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CNOOC UGANDA LIMITED

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE KINGFISHER FIELD DEVELOPMENT AREA, IN KIKUUBE & HOIMA DISTRICTS, UGANDA

Submitted to:
The Executive Director National Environment Management Authority
NEMA House, Plot 17/19/21 Jinja Road, P. O. Box 22255 Kampala, Uganda

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REPORT – VOLUME 1

List of Acronyms and Abbreviations

Acronym	Description
3LPP	3 Layer Polypropylene
BLPD	Barrels of Liquid per Day
BOPD	Barrels of Oil per Day
BS&W	Basic sediment and water content of crude oil. Part of quality specifications.
BVS	Block Valve Station
BWPD	Barrels of Water per Day
CCR	Central Control Room
CCTV	Closed Circuit Television
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLOs	Community Liaison Officers
CNOOC	China National Offshore Oil Corporation
CPF	Central Processing Facility
CR	Critically Endangered
CUL	CNOOC Uganda Limited
CV	Curriculum Vitae
DEO	The District Environment Officer
DRC	Democratic Republic of Congo
DWRM	Directorate of Water Resources Management
EA	Exploration Areas
EBS	Environmental Baseline Study
EFOs	Environmental Field Officers
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ESIA	Environmental and Social Impact Assessment
ESIS	Environmental and Social Impact Statement
ESMP	Environmental and Social Management Plan

Acronym	Description
ESP	Electric Submersible Pump
ICSS	Integrated Control and Safety Systems
IFC	International Finance Corporation
IPIECA	International Petroleum Industry Environment and Conservation Association
IT	information technology
IUCN	International Union for Conservation of Nature
KFDA	Kingfisher Field Development Area
LC	Least Concern
LC	Local Council
LP	Liquefied Petroleum
LPG	Liquefied Petroleum Gas
LSA	Local Study Area
MEMD	Ministry of Energy and Mineral Development
MGLSD	Department of Occupational Safety and Health, Ministry of Gender Labour and Social Development
MMS	Machine Monitoring System
MPFM	Multiphase Flow Meter
MTWH	Department of Museums and Monuments, Ministry of Tourism, Wildlife and Heritage
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NGO	Non-governmental Organisations
NPSH	Net Positive Suction Head
NSRs	Noise Sensitive Receptors
OGP	International Association of Oil and Gas Producers
PEPD	Petroleum Exploration and Production Department
PLDS	Pipeline Leak detection System
PLMS	Pipeline Leak Monitoring System
PM	Particulate Matter
PPE	Personal Protective Equipment

Acronym	Description
PS	Performance Standards
PSAs	Production Sharing Agreements
Ptb	Pounds per Thousand Barrel
RAP	Resettlement Action Plan
RSA	Regional Study Area
RTU	Remote Terminal Unit
RVP	Reid vapour pressure (RVP) is a common measure of the volatility of gasoline.
SCADA	Supervisory Control and Data Acquisition
SEHT	Skin-effect Heat Tracing System
SoCs	Species of Conservation Status
SOW	Scope of Work
SPT	sewage treatment plant
UCPs	Unit Control Panels
UNRA	Uganda National Roads Authority
UWA	Uganda Wildlife Authority
VOC	Volatile Organic Compounds
VOIP	Voice over Internet Protocol
WAT	Wax Appearance Temperature
WHCP	Hydraulic Wellhead Control Panel
WMD	Wetlands Management Department
WRMD	Water Resource Management Directorate

List of Terms

Acronym	Description
Artificial Lift	Is a process used in oil wells to increase pressure within the reservoir and encourage oil to the surface. When the natural drive energy of the reservoir is not strong enough to push the oil to the surface, artificial lift is employed to recover more oil.
Appraisal Well	A well that is being drilled into a discovered hydrocarbon accumulation to further understand the extent and size of the accumulation
Barg	'Barg' pressure is the pressure, in units of bars, above or below atmospheric pressure. The "g" at the end of the word indicates that the measurement is not absolute pressure, sometimes indicated by 'bara'
Blowdown	When water evaporates from a cooling tower, dissolved solids (such as calcium, magnesium, chloride, and silica) remain in the recirculating water. As more water evaporates, the concentration of dissolved solids increases. If the concentration gets too high, the solids can cause scale to form within the system. The dissolved solids can also lead to corrosion problems. The concentration of dissolved solids is controlled by removing a portion of the highly concentrated water and replacing it with fresh make-up water.
Development Well	A well that is being drilled into a reasonably well defined hydrocarbon accumulation. The well usually has a chance of success greater than an Appraisal Well.
Exploration Well	A well drilled in order to establish the existence of a possible petroleum deposit or to acquire information in order to delimit an established deposit.
Geohazard	A geohazard is a geological state that may lead to widespread damage or risk. Geohazards are geological and environmental conditions and involve long-term or short-term geological processes.
Kingfisher Field Development Area (KFDA)	This is the area within which CNOOC is licensed to operate.
Maximum Allowable Operating Pressure (MAOP)	Is the maximum pressure at which a pipeline is allowed to operate.
Maximum Operating Pressure (MOP)	Is the maximum pressure that the pipeline will be subjected to under operating conditions.
Polymer Flooding	An enhanced oil recovery technique using water viscosified with soluble polymers. Viscosity is increased until the mobility of the injectant is less than that of the oil phase in place, so the mobility ratio is less than unity. This condition maximizes oil-recovery sweep efficiency, creating a smooth flood front without viscous fingering.
Pour Point	The pour point of a liquid is the temperature at which it becomes semi solid and loses its flow characteristics.

Acronym	Description
Production Well	A well that produces hydrocarbons. It is often a development well that has been converted (completed), which is the process of making the well ready for production. This may include a range of tasks involving the preparation of the bottom of the hole to the required specifications, running in the production tubing and its associated down hole tools as well as perforating and stimulating as required. Sometimes, the process of running in and cementing the casing is also included.
Reservoir Souring	The phenomenon when there is an increase of mass of hydrogen sulphide (H_2S) per unit mass of total produced fluids due to activities of sulphate reducing bacteria (SRB) as a result of water injection. Hydrogen sulphide is extremely toxic and corrosive.
Soil Liquefaction	Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading. Liquefaction and related phenomena have been responsible for tremendous amounts of damage in historical earthquakes around the world. Liquefaction occurs in saturated soils, that is, soils in which the space between individual particles is completely filled with water. This water exerts a pressure on the soil particles that influences how tightly the particles themselves are pressed together. Prior to an earthquake, the water pressure is relatively low. However, earthquake shaking can cause the water pressure to increase to the point where the soil particles can readily move with respect to each other.

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1.0 INTRODUCTION AND OVERVIEW

1.1 Project Background

CNOOC Uganda Limited (CUL), Tullow Uganda Operations Pty Ltd (Tullow) and Total E&P Uganda Ltd (Total) are planning to develop oilfields in the Albertine Basin in western Uganda. The companies pursue a joint venture with equal interests in three government-designated license areas, with CUL operating in the Kingfisher Field Development Area (KFDA), Tullow operating in the Kaiso-Tonya Development Area and Total operating in the Tilenga License Area. Each of the three partners holds a 33.33% interest in each area. The Government of Uganda (GoU) at award of the production licences exercised its right to participate in these joint ventures at a 15% interest through its private subsidiary Uganda National Oil Company (UNOC). With this back in interest by the GoU, the partners each hold 28.3% with GoU holding 15%. The oil fields lie along the eastern border of Lake Albert, a 160 km long, 35 km wide, natural lake forming the border between Uganda and the Democratic Republic of the Congo. The KFDA is in the former Exploration Area 3A, where drilling of the Kingfisher-1 well discovered oil in 2006.The field is approximately 15 km long by 3.0 km wide (Figure 1-1 and Figure 1-2).

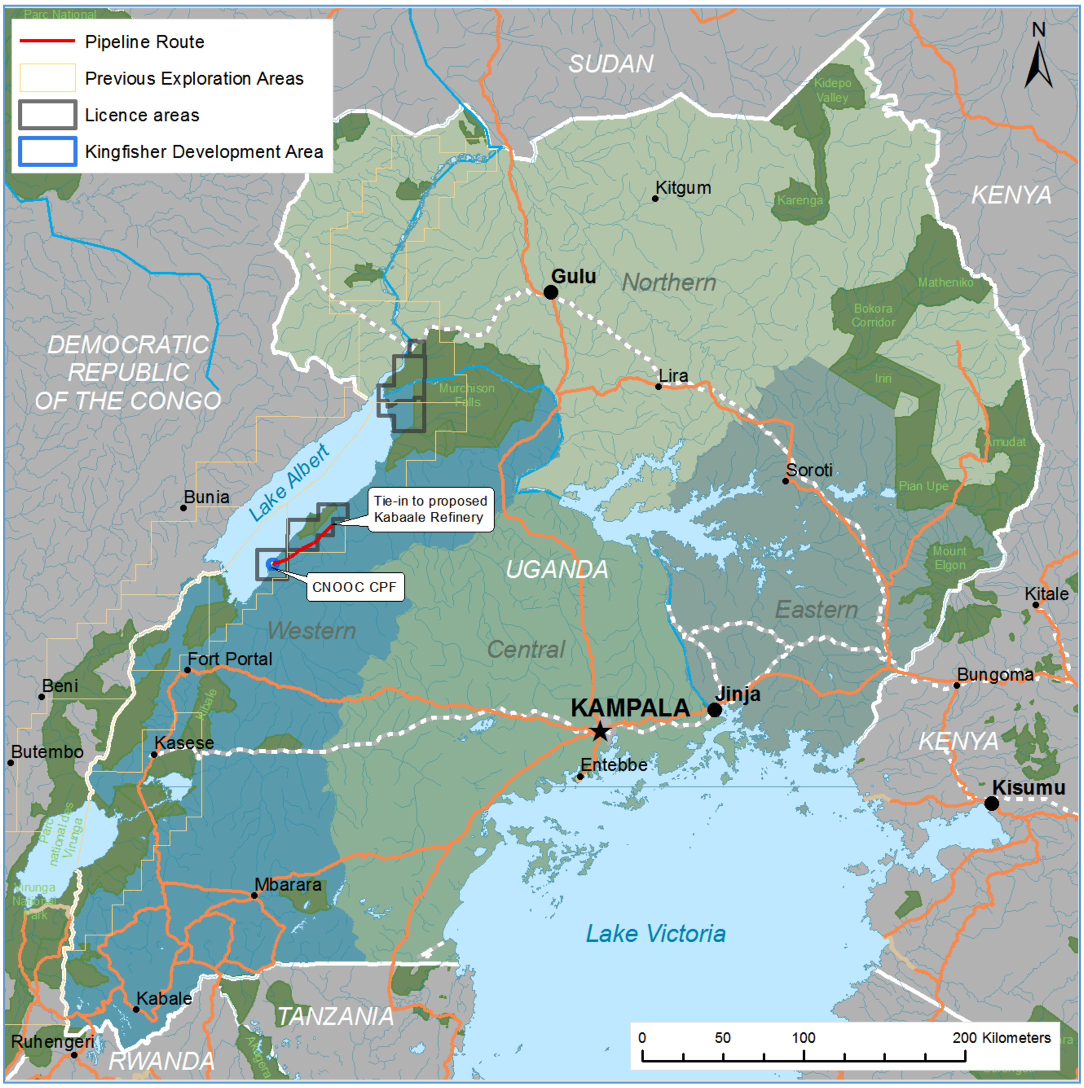

Figure 1-1: Regional Overview of the Kingfisher Field Development Area (KFDA), Kaiso-Tonya and the Tilenga Areas

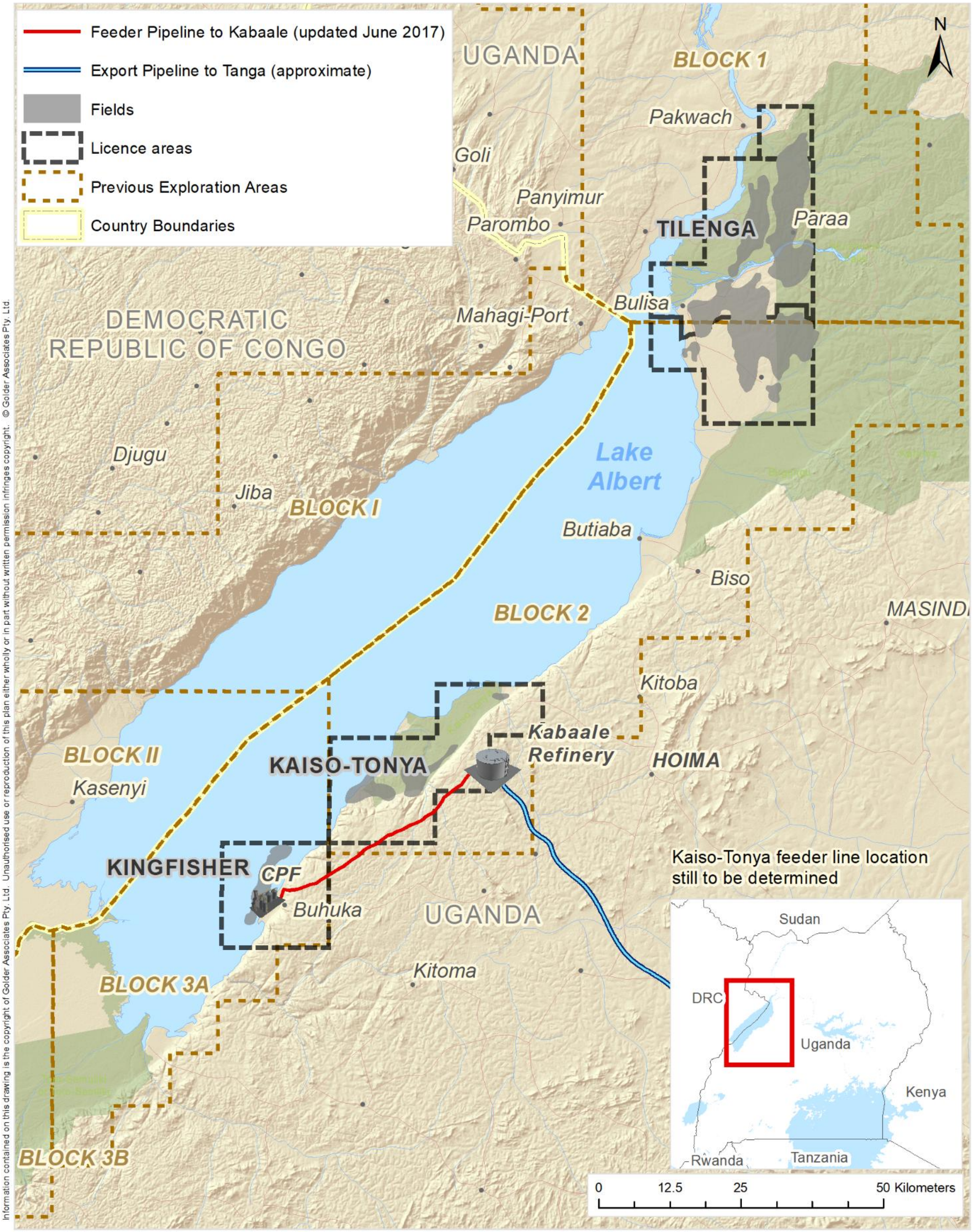

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Figure 1-2: Location of the Kingfisher Field Development Area in Uganda

CNOOC Uganda Limited (CUL) is the Ugandan subsidiary of the China National Offshore Oil Corporation (CNOOC), which is the largest offshore oil and gas producer in China. In this report, ‘CUL’ is generally referred to as ‘CNOOC’ (except where a legal distinction is required), as stakeholders, lead agencies and communities are familiar with the latter name.

The development of the KFDA for oil production, together with a feeder pipeline transporting oil to the proposed Kabaale Refinery, roughly 46 km to the north-east, is referred to as 'the Project'. More specifically, the Project will comprise the following components:

- Twenty (20) production wells and eleven (11) water injection wells on four onshore well pads situated along the eastern shoreline of Lake Albert;
- A 40,000 bopd Central processing Facility (CPF) to be constructed on the Lake Albert Buhuka Flats;
- A lake water abstraction station;
- Production flowlines and water injection flowlines linking the wells to the CPF;
- Supporting facilities including a permanent camp, a materials yard, a jetty and internal roads; and
- A feeder pipeline to transport the stabilised crude from the CPF to a delivery point at Kabaale.

From the delivery point, the oil will be processed in a refinery built at Kabaale and/or exported directly to international markets via a proposed feeder pipeline (the East African Crude Oil Pipeline, or 'EACOP'), which will be routed south of Lake Victoria to an oil export terminal on the coast of Tanzania, near the Kenyan border. Neither of these aspects of the overall Project are part of CNOOC's responsibility and are excluded from this ESIA, except with respect to the evaluation of cumulative impacts.

1.2 Report Background

This report comprises an Environmental and Social Impact Assessment (ESIA) for the Project, prepared in terms of Section 19 of the National Environment Act, Cap 153 and Regulation 3 of the Environmental Impact Assessment Regulations, 1998. The purpose of the ESIA is to provide the National Environmental Management Authority (NEMA) with sufficient information to make an informed decision about the Project and (if satisfied that the Project should proceed), to issue a Certificate of Approval.

1.2.1 The Proponent

The Project proponent is CNOOC Uganda Limited (CUL). CNOOC Uganda Limited was established in 2010, and employs around 130 permanent staff, of whom approximately 70% are Ugandan.

Table 1-1: Details of the proponent

Item	Description
Proponent (Operator)	CNOOC Uganda Limited (CUL)
Name of Proposed Project	Kingfisher Field Development Area
Address	CNOOC Uganda Limited Simba Towers, Plot 22 Acacia Avenue, P.O. Box 7862, Kololo, Kampala, Uganda
Contact Person	Mr Andrew Otuba
Contact Email	Andrew.OTUBA@cnoocuganda.com

1.2.2 The Environmental Assessment Practitioner

CNOOC Uganda Limited has appointed an independent Consultant, to undertake the Environmental and Social Impact Assessment (ESIA) for the Project. "The Consultant" is a consortium of both international and Ugandan Consultants with Specialists in different fields that contributed to the development of this ESIA report. The rest of the report to refer to "the Consultant" as a representation of the Project Management Team, the ESIA Project Team and the contributing specialists.

1.2.3 Project Team (Consultant)

The Project team, including specialists, are listed in the Tables 1-2, 1-3 and 1-4 below. The ESIA was suspended for more than a year before resuming again and consequently there have been a number of changes forced on the ESIA team to respond to the loss of team members. In all instances the Consultant is confident that new entrants to the team were of equal experience and capability or were more experienced.

1.2.4 Road Map for the ESIA

The ESIA comprises 5 volumes. The structure of the report is intended to:

- avoid stakeholder confusion and fatigue as public participation would be all inclusive compared to multiple consultations as a result of multiple ESIAs;
- enable NEMA and the various lead agencies to navigate to sections most applicable to their agency; and
- organised such that it will remain comprehensive without compromising on the required detail of all Project components.

This strategy was presented to and accepted by CNOOC. At the request of NEMA, the ESIA divides the Project into two main components - the production facility and associated infrastructure, most of which is situated on the Buhuka Flats, and the feeder pipeline, which transports oil from the production facility to the delivery point at Kabaale. Since this was not a part of the original commission, and the baseline for the specialist studies was already completed and written up, the division between these areas is not as complete as in the baseline.

Table 1-2: Project management team

Name	Qualification	Role
Robin S. Hounsome	MSc Environ. Geochemistry; BSc Environ. Geology; B.Sc Geology & Applied Geology **CC/EIA/143/15**	Project Director
Nelius Scheepers	M.Sc Environ. Management, B.Sc. Hons Wildlife Management, B. Sc. Ecology.	Project Manager

Table 1-3: ESIA project team

Name	Qualification	Role
George Nyundo Armitage	B.A. Environmental Management **CC/EIA/144/15**	ESIA Specialist, Project Manager
Tisha Greyling	M.A Linguistics; B.A Lang **CC/EIA/145/15**	Socio-economic & Community Specialist, scoping
Mervyn Mason	Msc. Zoology; Bsc. Zoology; PGD in Environment, Natural resources **CC/EIA/146/15**	ESIA Specialist Biodiversity Specialist
Dr Jennifer Pretorius	PhD Geohydrology; Msc. Geohydrology; Bsc. Geohydrology **CC/EIA/147/15**	ESIA Specialist Groundwater Specialist
Eddie Luyima	M.Sc. Environment Management B.A Environment Management, Dip- Environment Management, IEMA- Certified **CC/EIA/026/18**	In-country ESIA Team Lead
Francis Lugemwa	M.A. Land Use Planning, M.A Sociology (Cand), B.A Geography Postgraduate Dip. ESIA, IAP2-Cerfied, IEMA-Certified **CC/EIA/027/18**	Lead, Stakeholder Engagement, Socio-economist
Peter Isamat	BA Social Sciences Dip Project Management **CC/EIA/040/18**	Lead Socio-economic group
Nakalanzi Diana	Msc Limnology and wetland Ecosystems UNESCO – IHE (Holland) 2012; **CC/EIA/028/18**	Wetland Ecologist/ Limnologist
Amos Mafigiri	Cert Fundamentals of Oil and Gas, IBC Global Academy, UK (2012); B.A. in Envt Mgt, Mak(2005) **CC/EIA/029/18**	ESIA Specialist

Table 1-4: Associated specialists

Name	Qualification	Role
Dr Brent Baxter	Ph.D. (Botany), B.Sc Hons, B.Sc. Uni. Natal Prof. Natural Scientist, Registered ESIA Professional	Project Manager, Senior Review (ESIA Phase)
Celestino F. Mausse	M.Sc. Engineering (Chem. Eng); B.Sc. Engineering (Chem. Eng), CC/EIA/149/15	Oil and gas specialist
Erik Petrus Gouws	M.A. Research Psychology; B.Soc.Sci (Psychology); B.Sc. Human Physiology Genetics & Psychology, CC/EIA/148/15	Social specialist
Mark Wood	B.Sc Geography, BA Psychology	ESIA Specialist, ESIA Lead Author
Dr Ruth Golombok	PhD Uni. Cambridge, B.Sc Hons., Uni. Glasgow	Environmental Scientist
Robin Hounsome	M.Sc Environmental Geochemistry; B.Sc Environmental Geology; B.SC Geology & Applied Geology CC/EIA/143/15	Project Director
Adam Bennett	B.Sc Hons Environmental Sciences/Geography Uni. of Witwatersrand, B.Sc Environmental Sciences	Air quality specialist
Lance Coetzee	NHD.Chemistry, ND.Chemistry	Air quality specialist
Candice Allan	M.Sc Geographic Sci., B.Sc.Hons. Environ & Geographic Sci, B.Sc Geo Scio.	GIS and air quality specialist
Aisling Dower	M.Sc Applied Environ. Science, B.Sc Zoology	Biodiversity specialist
Gerhard van der Linde	B.Sc (Hons) Geohydrology; National Higher Diploma – Geotechnology	Groundwater specialist
Chris Viljoen	M.Sc Soil Science, Uni. of Potchefstroom	Soil specialist
Trevor Coleman	M.Sc.Eng, B.Sc.Civ.Eng.	Principle water specialist
Lee Boyd	M.Sc Water Utilization, B.Sc. Hons, B.Sc	Hydrology, Water specialist
Priyal Dama-Fakir	B.Sc.Eng Hons, Water utilization, B.Sc.Eng.Chem.	Surface water, process water specialist
Theunis Dumminy	B.Civ.Eng, Stellenbosch	Water treatment & management specialist
Johan Bothma	M.LArch. Landscape Architecture, BLArch.	Visual assessment Specialist
Michael van Nierkerk	M.Sc Geography, Environmental Sciences	Waste specialist, EMS Specialist
Natalie Kohler	B.Sc (Hon) Science Honors,; HDE Mathematics and Biology, B.Sc Environmental and Cell Biology	Waste specialist
Stuart McGowan	Chemical and Process Engineering BEng Hons; Environmental Management Systems PG Diploma	Noise specialist
Simon Waddell	B.Sc (Hons) MIOA, Postgraduate Diploma in Acoustics and Noise Control	Noise specialist
Dr. David de Waal	D.Litt et Phil, MA Development Administrator, BA.Hons Dev.Admin., BA Law	Social and development specialist
Antoinette Pietersen	BA Hons, Psychology, BA Psychology,	Stakeholder engagement specialist
Geraldine Schoeman	MA Environmental and Community Psychology	Social specialist, ESIA

Name	Qualification	Role
Serge Kayembe	BA. International Relations	Social and community engagement specialist
Dr Elizabeth Kyazike	M.A (History) Makerere Uni.; PhD (Archaeology) Uni. of Dar es salaam	Cultural Heritage Specialist
Paul Wheelhouse	BA (Hons) Ancient History and Archaeology	Cultural Heritage Specialist
Hobson Alice	MA Cultural Heritage, BA Hons Archaeology, Geography. MCIfA	Cultural Heritage Specialist (Scoping & ESIA Phase)
Dr Robert Kityo	B.Sc. (Hon) 1987, M. Sc., PhD in Zoology	Terrestrial Ecologist
Dr James Kalema	Ph.D. "Diversity and distribution of vascular plants in wetland and savanna Important Bird Areas of Uganda	Vegetation and Flora Specialist
Dr Behangana Mathias	Ph.D. (Environment and Natural Resources), Makerere Uni. Kampala,	Terrestrial Ecologist
Dr. Perpetra Akite	Doctor of Philosophy, Makerere Uni./Uni. of Bergen	Invertebrate Ecologist
Prof. Derek Pomeroy	PhD (Animal Ecology), Supervisor Professor H G Andrewartha, FAA Uni. of Adelaide	Ornithologist
Dr. Timothy Twongo	Ph. D. Zoology with focus on fisheries biology and Ecology	Lead Aquatic Ecology group
Dr William Okello	PhD in Natural Sciences;	Water Quality Specialist
Hannington Ochieng	M.Sc Environmental Science - Limnology & Wetland Ecosystems, UNESCO-IHE, Delft,	Water Quality Bio-assessment Specialist
Vincent Kiggundu	M.Sc Environ. Science, B.Sc Fisheries and Aquaculture,	Zooplankton Specialist
Robert Naguyo	Professional Master degree in Water Resources Surveys, Groundwater	Geology/Hydrogeology
Syliver Wadamba	PGD in Groundwater Exploration,	Hydrologist
Sammy Ratemo	M.Sc Environment & Natural Resources,	Air & Noise Specialist
Dr Dauda Batega	PhD Sociology	Sociologist, Stakeholder engagement
Dr Mark Divall	M.B.Ch.B., DA, DTMH, DOHM, Cert TM, Cert HIA, Cert Env Med	Health Impact Specialist
Dr Milka Owuror	M.B.Ch.B., MSc ETH	Public Health Specialist and Epidemiologist
Dr Izak Olivier	M.B.Ch.B. ADOH, CIME, Cert TM.	Community and Occupational Health Specialist

The volumes are made up as follows:

VOLUME 1A: Comprehensive Summary

The report summary is prepared to provide lead agencies with sufficient information about the findings of the main report to make a decision about the Project.

VOLUME 1B: Environmental and Social Impact Assessment (ESIA) Main Report

The main ESIA report is divided into three parts. Part 1 includes general Project information, the legal framework and the ESIA and public participation process. Part 2, sets out the Project baseline for the receiving environment. Part 3 covers all aspects of Project impact, mitigation and monitoring. It includes a Cumulative Impact Assessment of the Project taking into consideration impacts which may potentially result from other developments in the sub-region, including the Kabaale Refinery, regional road infrastructure and the oil industry developments of CNOOCs partners.

VOLUMES 2 and 3: Environmental and Social Management Plans (ESMPs)

The Environmental and Social Management Plans (ESMPs) for the CPF, Wells, Flowlines and Ancillary Infrastructure (Volume 2) are separate from the ESMPs for the feeder pipeline (Volume 3). Each ESMP is divided into construction, operation and decommissioning phases. Specific sub-plans dealing with environmental aspects and components are included in each plan.

VOLUME 4: Specialist Studies

Twelve specialist studies are included, which have been used to inform the environmental impact assessment.

2.0 PROJECT DESCRIPTION

2.1 Introduction

CNOOC's Kingfisher development will consist of the following components:

- **The wells, flowlines, central processing facility (CPF) and supporting infrastructure (**Figure 2-1**).** All production and supporting infrastructure will essentially be situated on the Buhuka Flats in the Kingfisher Field Development Area (KFDA), along the south-eastern side of Lake Albert. The subsurface engineering will entail drilling of wells from four onshore well pads: three well pads for Kingfisher Main (Pad 1-KF, Pad 2-KF, and Pad 3-KF) and one well pad (Pad 4A-KF[1]) for Kingfisher North. A total of 31 wells will be drilled, 20 of which will be production wells and 11water injection wells. The produced well fluids will be conveyed to the CPF through the infield flowlines from the respective production wells. All flowlines will be buried.

  The CPF will process the fluids by separation / removal of the produced water, sand, salts and associated gas (together with small quantities of associated material) to produce crude oil that meets the crude oil export standard. The components of the CPF will include oil separators, water treatment facilities, a water injection unit, a gas processing unit, an LPG unit, oil storage tanks and power generation. Produced water will be returned to the well pads for reinjection via separate flowlines. The CPF will convert part of the associated gas into LPG that will be sold into the local market. No gas flaring is contemplated except in cases of emergency. The CPF will also generate electricity by utilizing the remaining part of the associated gas to power the upstream facility. During the first part of the production facility's lifespan, the CPF will generate excess power above what is required by the project operations, the excess generated power will be evacuated and exported to the national grid.

  The Supporting infrastructure associated with the production facility will include in-field access roads and flowlines, an upgraded jetty and a water abstraction station on the shoreline of Lake Albert, a permanent camp, a material yard (or 'supply base'), truck buffer yard, drilling storage yard, airfield / helipad and a safety check station at the top of the escarpment in Ikamiro village;

- **The feeder pipeline** (see Figure 1-2). This pipeline will be buried along its full length and will transport the stabilised crude oil from the CPF to a delivery point in Kabaale, roughly 46 km to the northeast of the Kingfisher Field Development Area. At Kabaale, the Government of Uganda is planning an industrial park which, among other facilities, will include a refinery, associated petrochemical processing factories, an airport and related supporting infrastructure. At the delivery point, there will be fiscal metering of the crude oil, which will be piped either to the industrial park to feed the refinery and associated petrochemical industry or exported through the East African Crude Oil Pipeline (EACOP), planned from Kabaale to Tanga sea port in Tanzania. The EACOP will be a public - private partnership between the governments of Uganda, Tanzania and the pipeline company.

CNOOC's production licence mandate ends at the delivery point in Kabaale. The industrial park and the EACOP are independent projects from the Kingfisher Field Development Area (KFDA) project and as such will be planned, licenced and operated independently. Apart from their inclusion in the Cumulative Impact Assessment of the KFD project ESIA, they are outside of the scope of this study..

Project - Associated facilities

There are several associated facilities that will be operated independently of the KFDA. These are also outside of the general scope of the ESIA although they will be considered in the Cumulative Impact Assessment (CIA). The following fall under the category of associated facilities :

- Petroleum Waste management facilities that shall store, transport, treat and dispose petroleum wastes. By law, the oil companies (licensees) that operate the oil fields are not permitted to engage in business

[1] *For the purposes of this ESIA, the 'KF' (meaning Kingfisher) is left of the well descriptor in subsequent discussion, i.e: well pads 1, 3 and 4A.*

related to management of their produced petroleum waste including transportation, treatment and disposal;

- Transmission lines and substation infrastructure to evacuate excess generated power / import power to the field. It is projected that in the first 10 years of production, excess electricity will be generated by the CPF in excess of the energy demand of the upstream field operations. The excess electricity will be evacuated and sold to the Ugandan Government through a connection to the National Grid. After 10 years of production, the associated gas volumes are projected to fall, and the power generated at the CPF will consequently no longer meet the project's energy needs. At this point, the power lines will be used in the reverse direction to import power from the national grid to the KFDA. The establishment, construction and operation of the power line infrastructure will be the responsibility of Government;
- The pipeline (tie back) linking the Kaiso - Tonya (KT) field to the CPF (refer to Figure 2-1 for the location of the field). Due to the proximity of KT to Kingfisher, KT crude oil will be processed in the Kingfisher CPF. The development and tie back of the KT field to the KF CPF will only be undertaken at a point in the future.

Box 2-1: Note Concerning the Accuracy of Information in the Project Description

This chapter summarises the latest information available from the CNOOC Basis of Design, which informs the Front End Engineering and Design (FEED) studies. While this chapter provides an accurate account of the project, the nature of engineering is that the design develops over time. A number of refinements were made to the project description by CNOOC in September 2018. These have been indicated in the project description and are commented on specifically in the ESIA chapters where necessary.

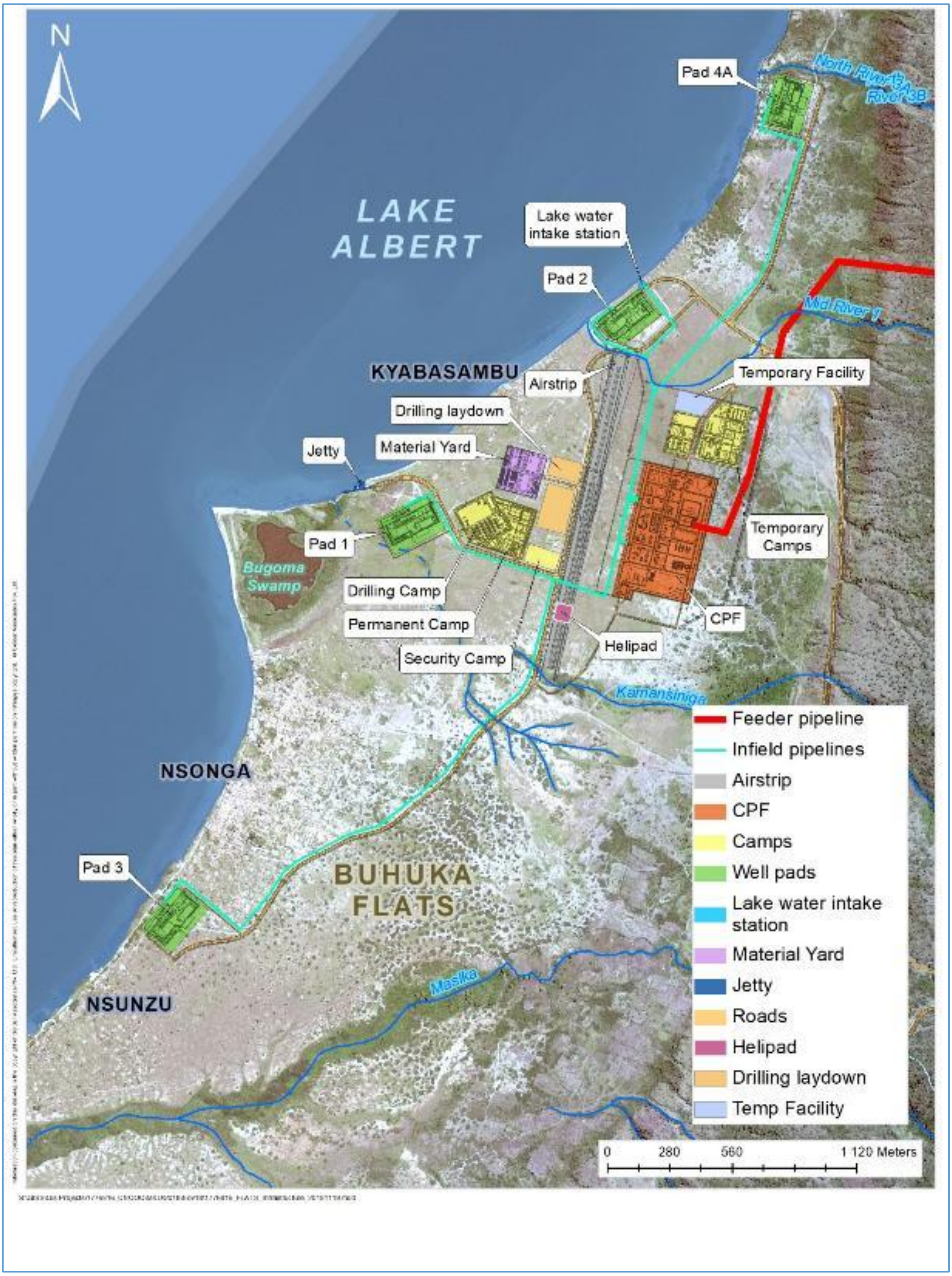


Figure 2-1: Layout of the project on the Buhuka Flats

2.2 Existing Infrastructure

Some of the project infrastructure has already been licensed and built (Figure 2-2). This includes:

a) A 6.9km tarred main road down the escarpment into the project area. Construction started in 2014 and was completed in 2016.

b) A 2.5km extension of infield access roads connecting the main escarpment road to the northern end of the proposed CPF boundary, the drilling camp and well pads 1, 2 and 3. Construction started in 2015 and was completed in 2016. There is an existing access road to well pad 3 which is also used by the local community. This was built by Heritage Oil and will be upgraded when well construction starts.

c) Well pads 1, 2 and 3, designed and developed to a standard fit for exploration drilling, with each pad measuring 100 m x 100 m and hosting a single exploration well. On completion, the wells were suspended and the well pads partially restored. In 2014, pad 2 was upgraded to a production well pad standard to allow for drilling of the Kingfisher 4 appraisal well[2].

d) A drilling camp, built in 2014 to replace the old camp used for the exploration drilling.

e) A supply base, built in 2013 to support the appraisal drilling but will be upgraded as a support facility for the planned field development. It is approximately 200m x 185m, and includes an assembly area, contractors' materials area, warehouse, material inspection and preparation area, casings area, chemical shed, parking and other minor use areas.

f) An airstrip suitable for light aircraft, established in 2006 by Heritage Oil and Gas Limited to support exploration drilling in KFDA. The facility was upgraded from grass to gravel in 2013 to facilitate landing of light fixed wing planes used for crew change and delivery of light weight supplies during drilling. Due to safety considerations during operation of the plant (a hazardous installation) the airfield will be converted into a material lay down area once construction is complete.

g) A jetty on Lake Albert, constructed in 2006 as a key access point to the KFDA during exploration drilling. The facility was upgraded in 2014 to accommodate docking of the barge and project boats that were the sole means of delivery of heavy construction and drilling supplies to the project area at the time. The jetty will continue to be used in the field development but its role will be limited to supporting marine security boats, emergency response such as oil spill response and proving an alternate evacuation to the existing escarpment road. Essentially all the supplies and equipment are planned to be brought in by road using the newly completed escarpment road to the KFDA.

[2] *Not to be confused with the Pad 4A well pad which has not been developed and is to be licensed as a part of the present ESIA.*

Figure 2-2: Overview of the existing main project infrastructure

2.3 Kingfisher Crude Oil Characteristics

Key characteristics of the Kingfisher Field Development Area crude include:

- Formation of stable emulsions;
- High pour point: 42-45°C;
- High wax content: 31.2%; and
- High wax appearance temperature: 63ºC (by DSC method).

Waxy crude needs viscosity correction to make it flow. When cooled, crude with higher wax content thickens more than paraffinic oils of comparable viscosity. Cooled to the pour point, the entire body of waxy crude congeals. Agitation has little effect on fluidity, unless the temperature is raised.

Because of the high wax content and high pour point of the Kingfisher crude, it will be necessary to keep it at least 5°C above the wax appearance temperature (WAT) i.e: 63°C +5°C. This will apply to the entire oil extraction and processing chain, from the well heads through the flowlines to the CPF, the processing facility and storage tanks at the CPF and the feeder pipeline to Kabaale. Where it is necessary to melt any precipitated wax, an even higher temperature of around 80°C will be required.

2.3.1 Crude oil Assay

A crude assay analysis was carried out on a dead oil sample recovered during testing operations on Kingfisher-1A. The analysis was performed by Oilfield Chemical Technology in Aberdeen (Laboratory Test Report No. 09-001421-0-ABDN). The results indicate that the Kingfisher oil is a low sulphur, high wax and medium viscosity crude with an API gravity of 31.5°.

Note: benzene has an overall weight percent of less than 0.1% and mole percent of less than 0.2% which makes its effect on environment practically negligible.

2.4 Production Targets

The estimated annual oil production and water injection volumes over 25 years are illustrated in Figure 2-3. The 40,000 BOPD plateau can be sustained for almost 6 years, before increasing water in the well fluids makes the target oil production rates unachievable, and from then on to the end-of-life of the field in year 25, there will be a gradual reduction in oil production. Total water reinjection is projected to stabilize at around 806 m^3/h in the tenth year, although make up water decreases after year 9 due to the increasing volumes of produced water.

'Producers' are production wells that are designed to extract oil from the oil field. These wells will be drilled from one of 4 well pads on the eastern lake shore to an approximate depth of 1700 m below the bottom of the lake. Details are provided in Section 2.7.

'Injectors' are wells that are designed to dispose of produced water removed from the well fluids, and to maintain reservoir pressures by injection of water into the oil field strata. Injection water is made up of water stripped from the well fluids, potentially oil contaminated (POC) water from the CPF and make up water extracted from Lake Albert. Details are provided in Section 2.7.

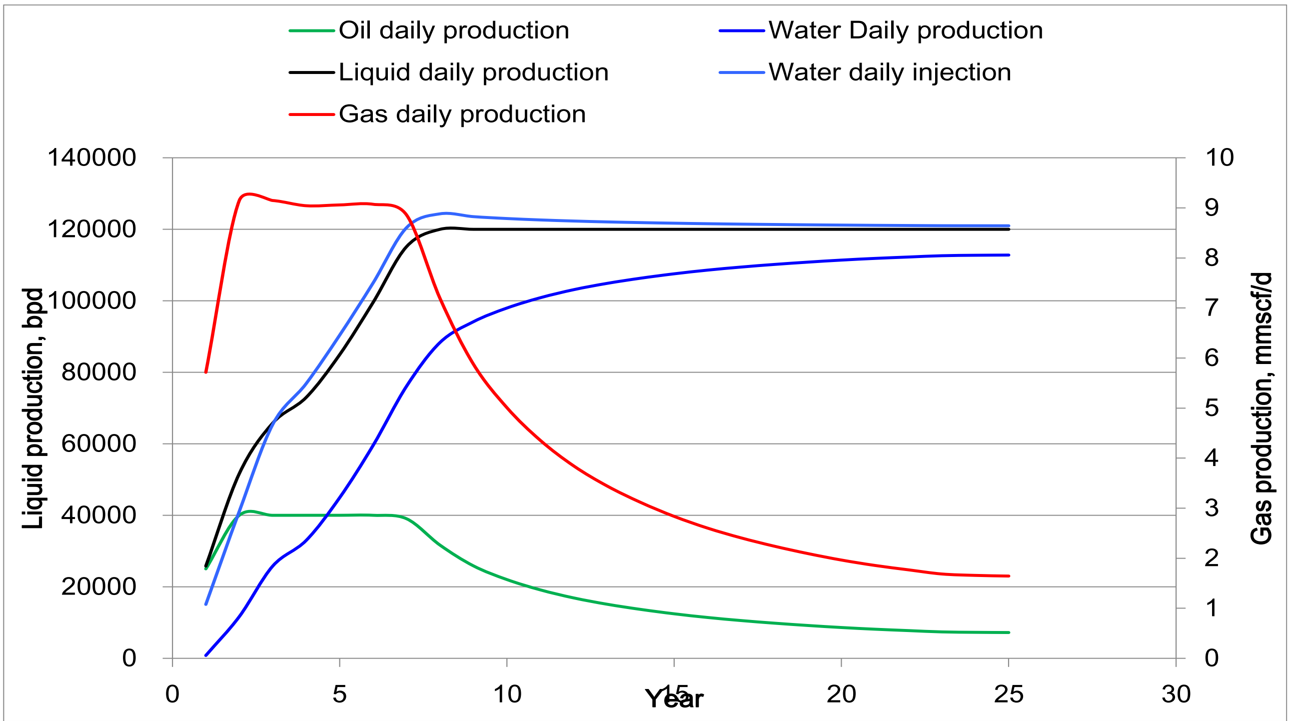


Figure 2-3: The Kingfisher field production profile for the whole field

2.5 Phasing of Project Implementation

The project will involve three main phases: a preparation (design) phase, a construction and drilling phase and an operational phase. During the design phase a range of geoengineering surveys, site preparation, planning and design work will be done. In the construction and drilling phases, well pads, wells, pipelines, the Central Processing Facility, camps, roads, the jetty upgrade, safety check station, the water intake works and other infrastructural support facilities will be built.

The first production will mark the start of the operational phase. This will overlap with continued construction and drilling of wells for the first 7 years. This overlap increased as a result of optimization studies for the FEED in which there was emphasis on the delay of initial CAPEX. Figure 2-4 shows the general sequence of project implementation. Production is intended to start at least two years after taking the Final Investment

Decision (FID) on project. Fourteen production wells and 14 injectors will be completed by the time production starts. The construction of well pad 4A and associated road and flowline infrastructure, and the drilling of the wells on this well pad, is planned at least four years after production of the first oil. After 5-7 years of production, well 4C (one of the wells on well pad 2) will be converted to an injection well. The drilling sequence is indicated in Table 2.1.

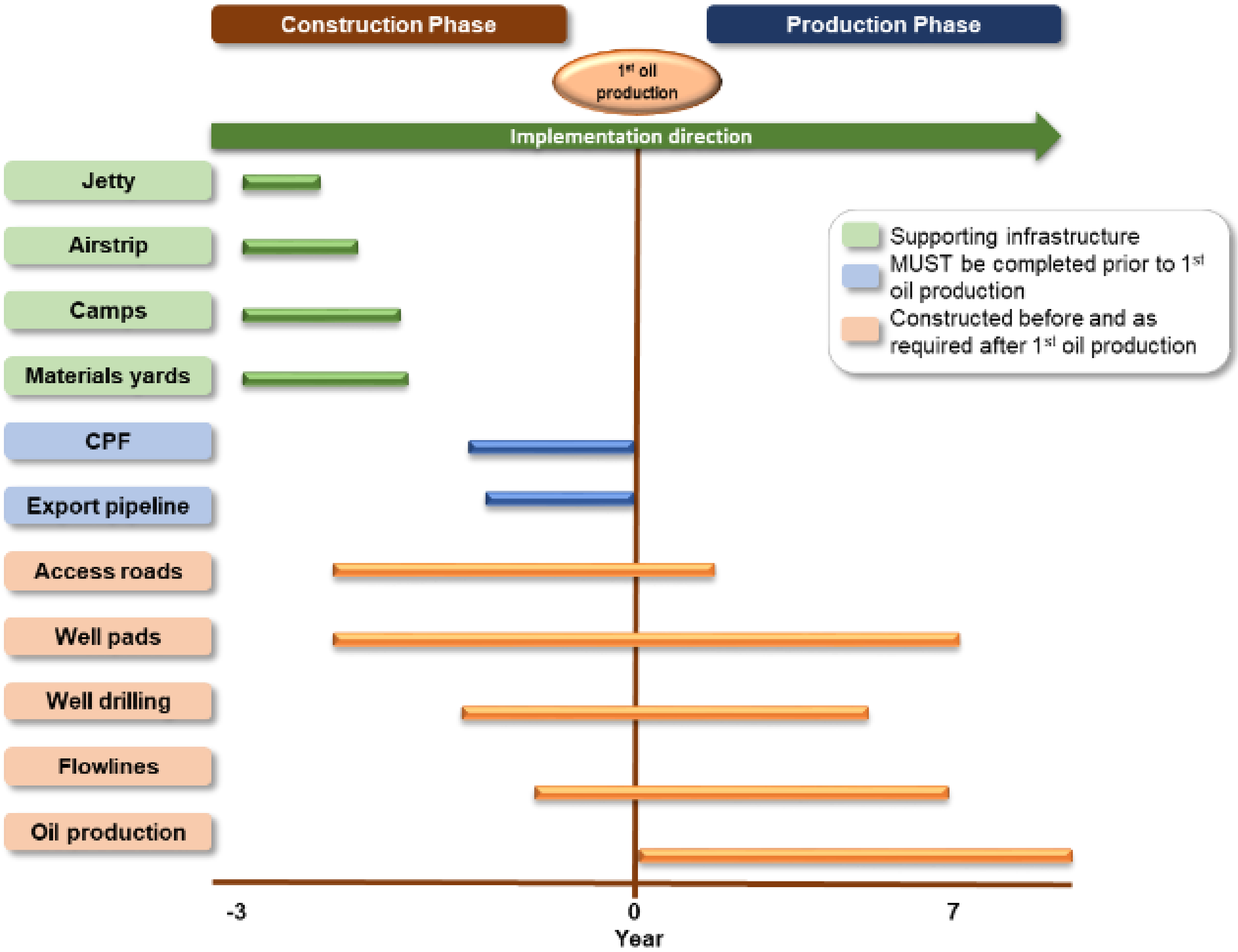


Figure 2-4: General sequence of construction and production activities

Table 2.1: Schedule of drilling of producer and injector wells, as of September 2018[3]

Well	Pad	Est. Duration (days)	Well	Pad	Est. Duration (days)
Rig mob			KF25	2	118
KF17	2	73	KF14	2	118
KF7	2	77	Move rig		15
KF16	2	55	KF27	1	68
KF2	2	15	KF33	1	114
KF4C	2	16	Move rig		15
Move rig		15	KF29	3	118

[3] The project has an overall program of scheduled activities as presented in figure 2-53

Well	Pad	Est. Duration (days)	Well	Pad	Est. Duration (days)
KF21	3	43	KF11	3	68
KF9	3	43	KF34	3	114
KF30	3	68	KF35	3	63
KF10	3	68	KF36	3	114
KF3A	3	15	Move rig		15
Move rig		15	KF38	2	114
KF19	1	41	KF32	2	114
KF8	1	43	Move rig		15
KF18	1	43	KF13	4	118
KF20	1	43	KF-N1	4	161
KF1A	1	15	KF-N2	4	196
Move rig		15	KF-N3	4	196
KF15	2	64			

The project has an expected lifespan of 25 years.

2.6 Production Wells and Associated Infrastructure

All development and production wells in the Kingfisher Field Development Area will be drilled from four well pads on the eastern shores of Lake Albert. Three of these well pads currently exist and will be upgraded to meet requirements for oil production. The well-fluids will be transported to a Central Processing Facility (CPF) via separate flowlines from each of the four well pads.

Section 2.6.1 describes the design and operational phase of the production wells and associated infrastructure, including the injection wells. Section 2.6.2 presents construction and drilling-related information, applicable to the construction phase of the wells.

2.6.1 Design and Operational Phase

2.6.1.1 Well Locations

The full Project development is expected to consist of 20 production wells (producers) and 11 water injection wells (injectors) totalling to 31 wells. **This number may change in the FEED, detailed design, and during the operating life of the project, depending on oil field conditions at the time.**[4] All of the wells will be situated on four onshore well pads, three of which are existing exploration / appraisal wells (Kingfisher-1A, Kingfisher-2 and Kingfisher-3A), that will be upgraded to accommodate development wells and completed as production wells. One of existing exploration / appraisal wells (Kingfisher-4C, well pad 2) is initially going to be a production well, but will be converted from a production well to an injection well after several years.

Figure 2-5 shows the location of the well pads and the drilling direction and approximate end point of the drilled wells, at the time of the start of the ESIA (LHS) and the slight directional refinement that was provided in September 2018 (RHS). Table 2.2 below provides the coordinates of each well pad and the number of production and injection wells on each pad. The well depth will be approximately 2200 m - 2800 m below the floor of Lake Albert. Horizontal departure of the well from the well pad location will typically be around 3800 m.

Table 2.2: Location of well pads and number of production and injection wells

[4] *Some changes to the number and configuration of production and injection wells on the well pads is not expected to alter the findings of this ESIA and should not require re-assessment*

Pad ID	North* (degrees)	East* (degrees)	Production Wells	Injection Wells	Size (ha)
Pad 1 (Existing)	1.24639	30.74120	5	2	7.10
Pad 2 (Existing)	1.25478	30.74998	6	4#	7.36
Pad 3 (Existing)	1.23038	30.73165	6	4#	8.19
Pad 4A (Future)	1.26344	30.75638	3	1	9.88

* *Centre point coordinates*

early production wells on these pads may be converted to injection wells as their production drops off

Three wells (Kingfisher 4C, KF 17 and 21, shown in Table 2.2, will be converted from production wells to injection wells. This is likely to happen within the first five years of production, depending on the production situation.

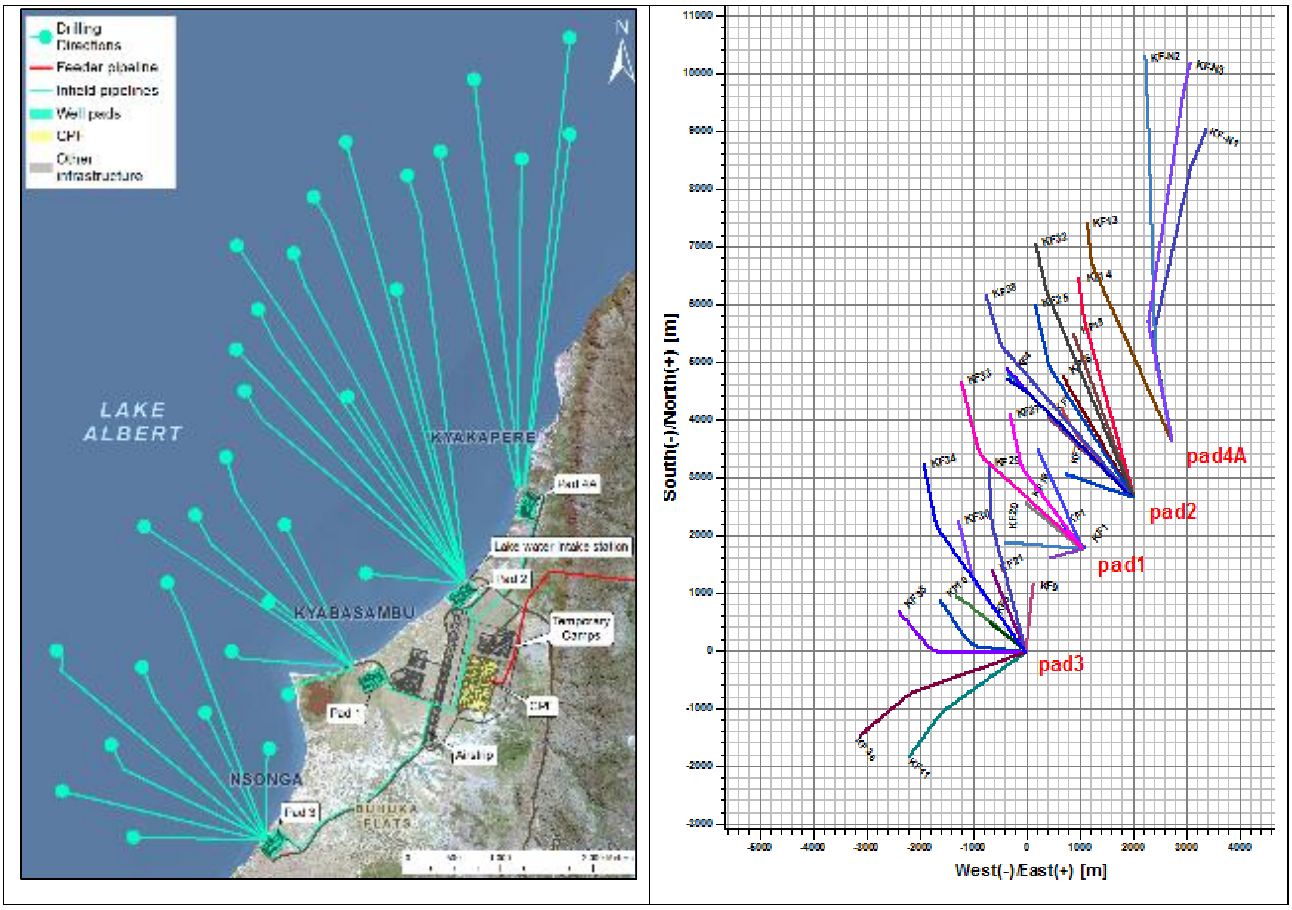


Figure 2-5: Approximate subsurface extent of the wells and well bores (left side), with the latest extent indicated on the right as of September 2018.

2.6.1.2 Consideration of Geohazards

The Kingfisher Field Development Area is seismically active and is susceptible to geological hazards (see more detailed discussion in Section 4 (Baseline Environment). A geohazard investigation has shown that well pad 4-2-KF is unsuitable for development, due to liquefaction potential of soils during earthquakes, and has been replaced by well pad 4A which has low geotechnical hazard.

Offshore geotechnical data are limited to shallow subsurface information. Risks associated with earthquake impact on well bores and the potential escape of produced water along fault zones will be investigated in more detail engineering design subsequently considered at a later stage of the project.

2.6.1.3 Infrastructure on the Well Pad

After well completion, the rig and the auxiliary facilities will be moved to the next drilling location and the completed well will be joined to all the wells on the well pad to feed into a single flowline to the CPF. Each production well pad is expected to comprise:

- Production well heads;
- Water injection well heads;
- Utility Systems;
- Production, water injection and flow metering;
- Pig Launcher/Receiver;
- Chemical injection system;
- Closed drain system; and
- Equipment room to accommodate instrumentation, telecom, and electrical equipment etc.

The well pads will be security fenced and will not be manned. All normal monitoring and operational requirements will be managed from the CPF control room.

Simultaneous production and drilling on the well pads will occur for the first 5 years. The design will allow for the drilling rig to move between different slots (well points) without shutting down production on the well pad. Only one drilling rig will operate on site at all-time moving from one well to the subsequent one to be drilled.

2.6.1.4 Well Bore Temperature

The crude temperatures in the reservoir will be between 85ºC and 104ºC, which will facilitate its flow up the well bore. Additional heating to provide the required flow will not be required.

2.6.1.5 Artificial Lift to Extract Reservoir Fluids

Artificial lift will be required to provide the desired flow and to meet the required Flowing Wellhead Pressure. This will be achieved by electrical submersible pumps (ESP).

2.6.1.6 Gathering of Well Fluids

The well fluids from the production choke valves on each Christmas tree (well head) will be gathered for delivery to the CPF via the flowline from the well.

2.6.1.7 Production of Sand

The wells will produce sand. Sand screens will be installed in each well although some will still escape to the surface, necessitating further sand screening at the CPF to remove unscreened sand from the well (refer to Section 2.8).

2.6.1.8 Overpressure Protection

A fully rated design has been opted for, for the Kingfisher well pads. There will be no flaring or venting at the well pads, except during emergency well conditions prior to commissioning. Overpressure protection will not be provided on the well pads, which will avoid the need for burn pits and emergency flares during production.

2.6.1.9 Produced Water Injection

A total of 11 water injection wells are planned on the well pads. Water injection is intended to meet two objectives - disposal of large quantities of produced water, removed from the well fluids at the CPF, in a safe and environmentally responsible manner; and assisting to maintain reservoir pressures throughout the life of the project. Injection water will consist of a combination of produced water, water from POC areas at the CPF and make up water from Lake Albert. All injection water will be treated to meet the injection water specification (see Table 2.10 for details). Relative quantities from the sources will change through the life of the project, with the proportion of lake water being a significant component of the total at start up and in the early years, but steadily reducing in later years, as illustrated in Figure 2-5 above. The average quantity of injected water over the 25-year lifespan of the project, the maximum injection rates during the 25-year period and the design capacity of the injection system is shown in Table 2.3. The design is based on maximum required injection rates plus 20 percent.

Table 2.3: Average and maximum water injection rates, based on the 25-year project lifespan

1	2	3	4	5
Average Produced Water Injected (m^3/hr)	Maximum Produced Water Injected (m^3/hr)	Average Make-up Water Injected (m^3/hr)	Max Make-up Water injected (m^3/hr)	Design Capacity of Injection System (m^3/hr)
577	747	144	301	990

1. 25-year average2. Year 253:.25-year average4.Year 6 5. Year 8 + 20%

Maximum water injection pressure will be 199.8 bar (a typical car tyre is pressurised to around 2.5 bar). Pressure will be provided by pumps located at the CPF.

Water injection temperature at the well head will be 75ºC. Make up water will be mixed with produced water at the CPF and heated prior to injection. The heated injection water will be transmitted along the injection flowlines to the injector wells. The thermal energy to heat the injection water will be mainly waste heat recovered from the electricity generation process at the CPF. Backup heating systems are proposed, to be used in cases when the power generation process from associated gas is shut down or when the generators are operating below the level necessary to provide power and thermal energy to heat the injection water. A wide variety of additives will be required but these will be injected in different areas of the produced water circuit at the CPF, prior to delivery to the wells (refer to Section 2.9). CNOOC proposes to pilot test polymer flooding in the first year of production. Polymer flooding is a method of adding a polymer to the injection water that increases its viscosity for Enhanced Oil Recovery (EOR) from the reservoir (see definition of terms).

2.6.1.10 Production Waste Generated on the Well Pad

In order to handle oily drainage from pipelines and equipment, each well pad will be provided with an underground closed drain system leading to a sump with a submersible pump. The levels will be monitored and the sump periodically emptied into a mobile tanker for handling at the CPF.

Only small quantities of solid waste will be generated, once drilling is completed. The wells are unmanned and will be remotely operated from the CPF over extended periods, without intervention on the well pad. During maintenance, small quantities of potentially oil contaminated and non-hazardous waste will be generated. These will be separated into non-hazardous and hazardous components, delivered to the CPF for temporary storage and then recycled, where possible, or earmarked for disposal by a NEMA certified hazardous waste contractor. From the studies conducted and earlier exploration and appraisal drilling, CNOOC indicates that NORM is not expected in the crude oil and resultantly in the pigging wastes. Estimated quantities of potentially hazardous waste are less than 0.5 t/well/year.

2.6.1.11 Polymer use

The potential produced fluid treatment strategy for KFDA is the combination of efficient equipment and appropriate water treatment agent in order to meet the requirement of rapid and efficient development.

The recommended suggestions are adding appropriate water treatment agents (demulsifier and water clarifier) and increasing settling time. The suggested strategy is to run a pilot before full field implementation which will help us clearly define the potential impacts on the environment.

Polymer flooding is applicable to Kingfisher, but the long well space and High reservoir temperature are the two main challenges. A polymer has not been selected, pending further studies on the reservoir chemistry, therefore an environmental assessment will be undertaken as more information becomes available.

2.6.1.11.1 Implementation Strategy

Overall implementation strategy is shown in the figure below.

After feasibility study, Kingfisher EOR further study still needs to be carried out before implementation, including de-risking, surface design, assessment for back produced water, and so on.

After first oil, there are 6 steps of work that need to be done.

Step 1, some time for water flooding performance understanding.

Step 2, Pilot is necessary to ascertain polymer injectivity behavior, reduce uncertainty, polymer parameters gathering from the flow back and desired result evaluation etc.

Step 3, Facility upgrade after the success of pilot result.

Step 4, full field implementation.

Step 5, Replacement technology shall be considered after some duration of polymer flooding, like polymer-surfactant binary combination drive.

Step 6, Subsequent water flooding may need to be implemented after some period of polymer flooding.

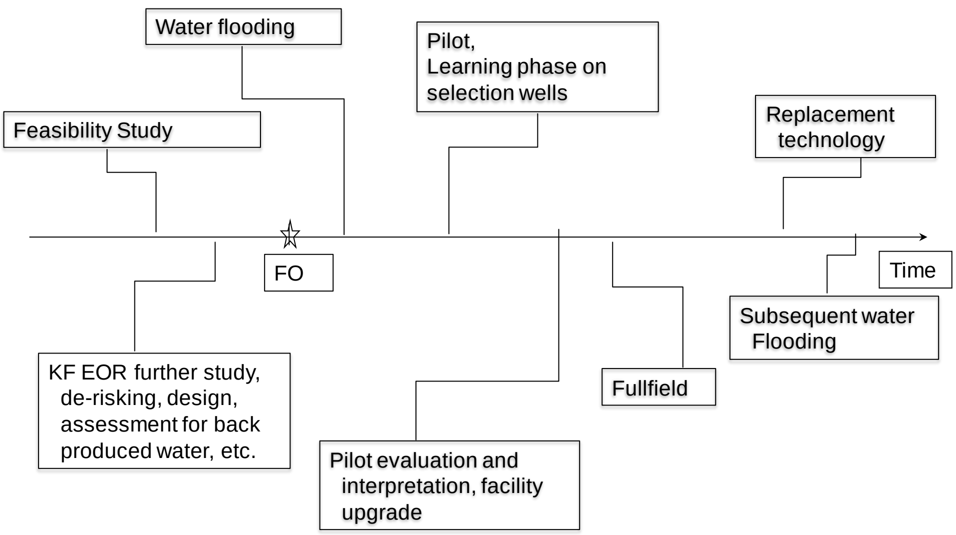


Figure 2-6: Overall implementation strategy

2.6.1.11.2 Treatment Technology Study for Produced Water

The typical treatment technologies for polymer flooding produced liquid were further investigated. The primary screening and evaluation of water treatment agents was carried out in lab. Finally, potential produced fluid treatment strategy for KFDA was provided.

2.6.1.11.3 Primary Evaluation of Water Treatment Agents

In this part, primary screening and evaluation of water treatment agents, including demulsifier for oil system and water clarifier for water system, was carried out in lab.

The aim of demulsifier and water clarifier incorporation is not reducing the viscosity or consuming the polymer, but reducing the oil concentration, suspended solids (SS) and median particle size in order to reach the reinjection water quality standard.

2.6.1.11.4 Potential Produced Fluid Treatment Strategy for KFDA

The treatment strategy for onshore oilfield can be summarized as “exchanging time and space for efficiency”. Basing on the experience of offshore oilfield, the produced liquid could be efficiently treated via the combination of efficient equipment and water treatment agent in a much shorter time. According to the current field application results, the incorporation of demulsifier and water clarifier is helpful for the efficient treatment of polymer flooding produced liquid. After treatment, the produced water successfully meets the quality standard of the reject water.

Learning from the experience of onshore and offshore oilfields, it was believed that the potential produced fluid treatment strategy for KFDA might be the combination of efficient equipment and appropriate water treatment agent in order to meet the requirement of rapid and efficient development. To be specific, the recommended suggestions may be adding appropriate water treatment agents (demulsifier and water clarifier) and increasing settling time (oil system: three-phase separator capacity increases by 100% and electric dehydration capacity increases by 50%, water system: CPI and Air Flotation capacity increases by 100%) .

2.6.1.11.5 Field Implementation Requirement

1. Guarantee the polymer viscosity and stability requirements.
2. To reduce equipment and construction influence on shear of the polymer solution.
3. When calculating the polymer injection amount, there is need to consider the polymer content effectively, to ensure that it meets the design of polymer injection.
4. Water flooding is needed before polymer flooding for effect evaluation.
5. Profile control implementation before polymer injection.
6. Tracer test will be needed before polymer flooding for calculating the profile control agent amount and evaluation of polymer flooding effect.
7. Suggestions for perforation with big density and deep penetration in order to ensure the maximization of the polymer solution viscosity retention rate and injection capacity.

2.6.1.12 Well Maintenance

During the operational life of a producing or water injection well, it is necessary to re-enter and recondition the well for well maintenance purposes from time to time. This typically occurs on an annual or bi-annual maintenance schedule (every 1-2 years), or in cases when the well ceases to perform as predicted and well performance deteriorates. Routine well maintenance activities may take a few days while more complex repairs may take a few weeks.

CNOOC currently plans to make use of the same drill rig which will be brought to site for drilling the development wells. During maintenance, a variety of well maintenance tools, processes and additives may be used that are similar to those that are used during the initial drilling operations. Typically, well maintenance ensure that the well remains in good working condition. A number of activities to achieve this goal are thus undertaken to include removing corrosion, repainting, functional testing, pressure testing, replacement of any torn and worn out parts of the well associated infrastructure, , and cleaning the wellbore and its contact into the formation..

Any support infrastructure required during this process is planned for within the infrastructure layout of the facility. Thus, any waste generated shall be handled in the similar manner as the rest of the petroleum wastes to be generated during drilling and production.

2.6.1.13 Lake Flies

The project area seasonally experiences swarms of lake flies that are attracted by flood lights lighting that is necessary for night operations. These swarms of lake flies not only constitute a nuisance to the operating personnel but are also pose an operational challenge as these insects are sucked into the equipment through the air intakes. This causes equipment malfunctioning which reduces both the operating efficiency and lifespan of the equipment. Preventative measures shall therefore be incorporated in the design of lights and equipment air intakes to minimise this challenge.

2.6.2 Construction Phase (Civil Works and Drilling)

2.6.2.1 Layout on the Well Pad

All the existing exploration pads will be upgraded to a standard that can accommodate multiple production wells on a single pad. These well pads will be expanded to their full extent during the construction phase. The proposed sizes of each production pad are set out in Table 2.2. All well pads will only be upgraded from their current existing exploration footprint apart from Well pad 4A that will be fully constructed from a non-existent footprint. The pads will be designed to permit concurrent drilling, development and production from wells within and between the well pads. This concurrence of the various well development activity will occur during the first 5 years of production.

Facilities on the well pad associated with drilling will include the drilling rig, drilling waste pits for well control emergency and temporary waste storage (covered to prevent rain ingress), fuel tank storage area, drilling fluids preparation area and mud tank, flare pits for emergency use, storage facilities for chemical additives, diesel generators to drive the rig and ancillary power requirements., and offices and other infrastructure for drilling contractor and CNOOC staff. Accommodation on the well pads will only be for the critical drilling personnel. Typical layout of a well pad during the drilling phase (well pad 1) is illustrated in Figure 2-7.

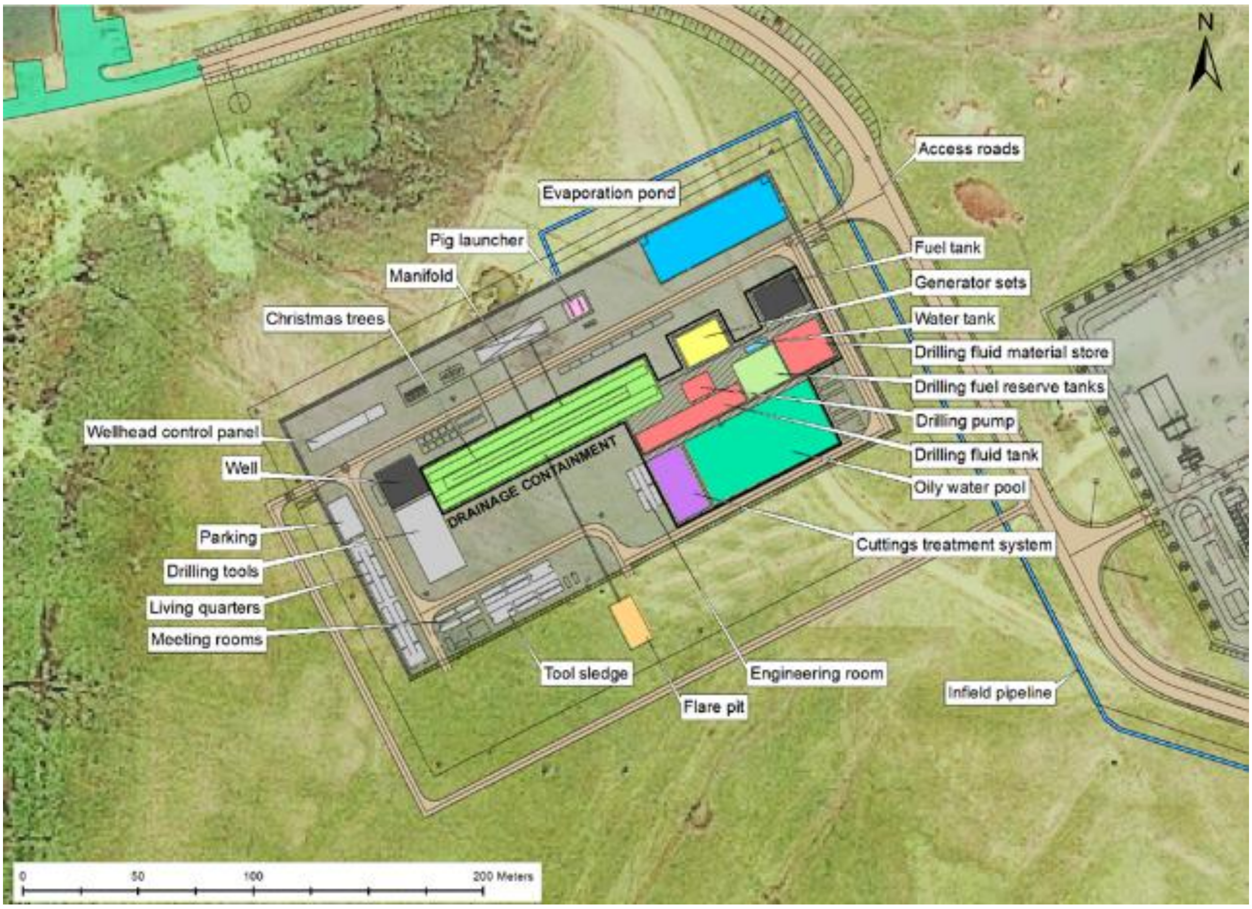


Figure 2-7: Provisional layout of Pad 1 during the development phase

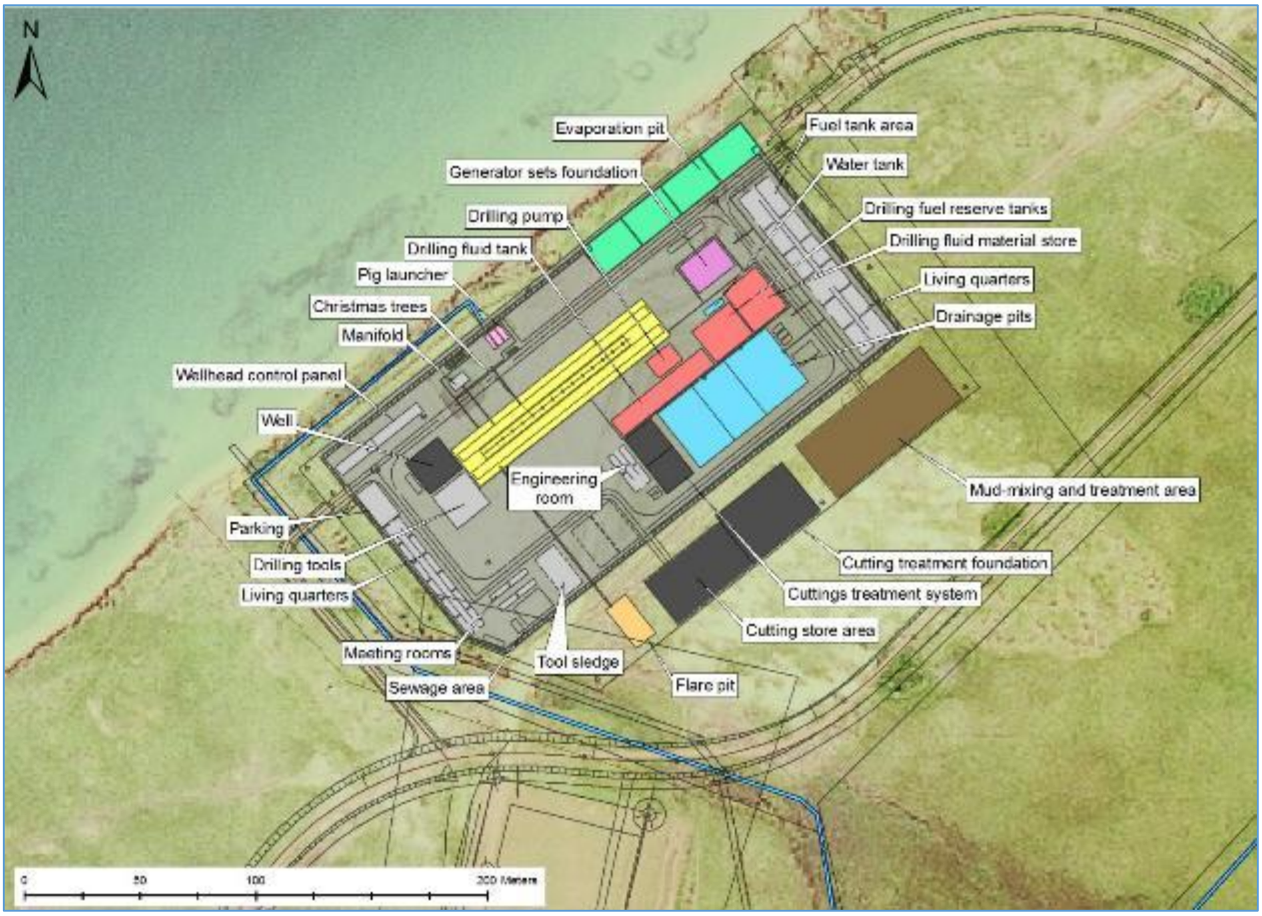


Figure 2-8: Provisional Layout of Pad 2 during the development phase

Specific to Pad 2 is an area reserved for a plant to process raw drill cuttings straight from the well borehole and recondition the spent drilling and completion fluids.

2.6.2.2 Directional Drilling

The wells will be vertically drilled from the well pads to the kick-off point (depth) and then directed towards the oil reservoir (Figure 2-9) A typical well in the KFDA will take 2 to 4 months to drill depending on the vertical depth and the horizontal departure to the Total Depth (TD) of the well (Roughly, a well on average will have a vertical depth of about 2700m below the Lake bed and horizontal departure will on average be about 3,800 m). Subject to satisfactory results, the development wells will be considered as 'completed', when it can produce oil (for producer wells) and / or it delivers the injected fluid (for injector wells) to the target formation. The well completion process will involve a number of tasks, including the preparation of the bottom of the hole to the required specifications, as well as perforating and stimulating the well, as required (refer to definition of terms).

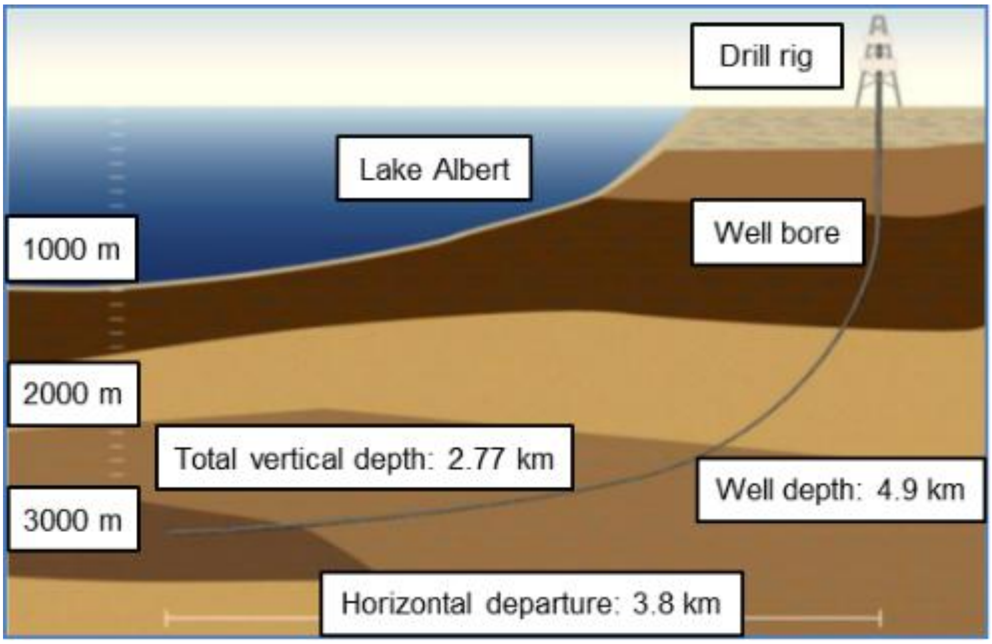


Figure 2-9: An illustration of directional drilling under Lake Albert

2.6.2.3 Drilling Rig Specifications

The expected specifications for a drilling rig are described below, together with a description of the different components of the rig, with emphasis on aspects of environmental interest.

Table 2.4: Aspects of a drilling rig

Aspect	Specification	Description
Mast	48 m	The structure used to support the crown block and the drill string. Masts are usually rectangular or trapezoidal in shape and offer a very good stiffness.
Draw works	2000 KW, mechanical and electrical breaking systems with regenerative breaking	The machine on the drilling rig consisting of a large-diameter steel spool, brakes, a power source and assorted auxiliary devices. The primary function of the draw works is to reel out and reel in the drilling line, a large diameter wire rope, in a controlled fashion. The drilling line is reeled over the crown block and traveling block to gain mechanical advantage in a "block and tackle" or "pulley" fashion. This reeling out and in of the drilling line causes the traveling block, and whatever may be hanging underneath it, to be lowered into or raised out of the wellbore. The reeling out of the drilling line is powered by gravity and reeling in by an electric motor or diesel engine.
Top Drive	69kNm120 RPM and will be update to 75kNm120 RPM	A device that turns the drill string. It consists of one or more motors (electric or hydraulic) connected with appropriate gearing to a short section of pipe called a quill, that in turn may be screwed into a saver sub or the drill string itself. The Top Drive is suspended from the hook, so the rotary mechanism is free to travel up and down the derrick.
Mud Pumps	3 x 1,600 HP 7500psi, and will be upgraded for 4x 1600 HP 7500 psi	Pumps that provide the motive power to circulate the drilling muds through the drill bit and back up the casing into the mud conditioning pits for make-up and recycling. Power will be supplied by diesel generators on the well pad.
Tank System	Pumpable volume of 600 m^3 in total.	The tank system that stores the mud which pumped down the drill string. Kill-weight mud has a density high enough to

Aspect	Specification	Description
		produce a hydrostatic pressure at the point of influx in a wellbore that is sufficient to shut off flow into the well. Kill-weight mud, when needed, must be available quickly to avoid loss of control of the well or a blowout. Thus, it is usually made by weighting up some of the mud in the system or in storage by adding barite or hematite.
Pressure Control	Minimum 5,000 psi BOP with 5,000 psi annular, mud gas separator	The BOP (blowout preventer) is a large valve at the top of a well that may be closed if the drilling crew loses control of formation fluids. By closing this valve (usually operated remotely via hydraulic actuators), control of the reservoir can be regained and procedures can then be initiated to increase the mud density until the BOP can safely be opened again and pressure control of the formation regained. Typically, two or more BOPs are used in a stack, one of which is an annular BOP which resembles a large rubber doughnut, which is mechanically squeezed inward to seal on either pipe.
Power Plant	Diesel generators: 6,000 KW	An assembly of components and controls necessary to provide a hydraulic power supply. In modern oilfield activities, many systems are hydraulically powered, including the majority of mobile systems such as slick line units, coiled tubing units and snubbing units. The diesel engine is used to power generators, providing an independent power supply that is harnessed to the necessary hydraulic pump and control systems.

2.6.2.4 The Drilling Process

Once drilling commences, drilling fluid (otherwise known as ‘mud’) is continuously circulated down the drill pipe and back to the surface equipment (Figure 2-10). The main functions of drilling mud are to remove rock cuttings to the surface, generated by the drill bit, maintain wellbore stability, cool and lubricate the drill bit, balance permeable formations and transmit hydraulic energy to the drilling tools and bit. The risk of uncontrolled flow from the reservoir to the surface is further reduced by using blowout preventers, a series of hydraulically actuated steel rams that can close around the drill string or casing to quickly seal off a well. Steel casing is run into completed sections of the borehole and cemented into place. The casing and cement provide structural support to maintain the integrity of the borehole, isolate underground formations and protect useable underground sources of groundwater.

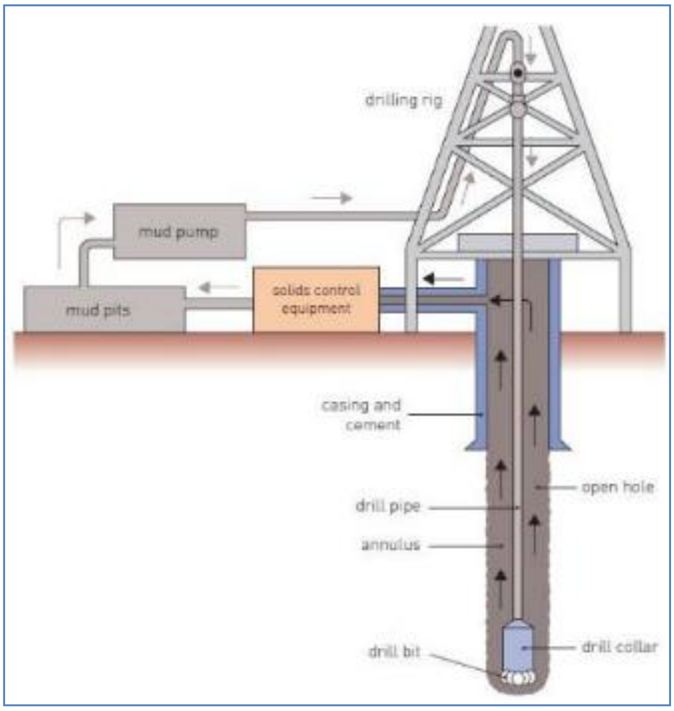


Figure 2-10: Drilling fluid circulation through a typical drilling system (Source: IOGP, 2016:9)

Photograph 2-1: A drilling rig at Lake Albert

2.6.2.5 Drilling Fluids (Aqueous)

Aqueous (water based) drilling fluids will be used for the upper sections of the KFDA wells. Synthetic drilling fluids will be used for the deeper sections. The main components of water based drilling fluids are described in Figure 2-11. Calcium carbonate and barite are the principle additives, used as a weighting material to help minimise the risk of well instability during drilling. Clay/polymers are also used to thicken (viscosify) the mud. The 4% ‘other’ category may be a wide range of additives, used in small quantities, including weighting materials, filtrate reducers, pH control chemicals (such as soda ash), shale control (soluble salts, glycol, amines), lost circulation materials (such as mica, cellulose fibres, calcium carbonate), lubricants, emulsifiers, surfactants, thinners, flocculants, bactericides, pipe freeing agents, defoamers, calcium reducers, corrosion inhibitors and temperature stability agents (details provided in the Specialist Waste study for the ESIA).

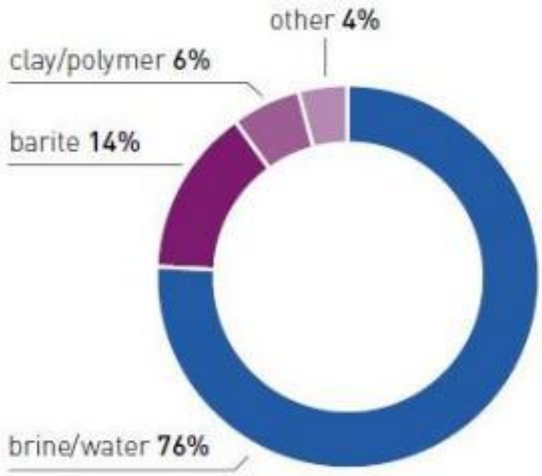


Figure 2-11: Makeup of a water-based mud

Generally, only a few of these are used for any one well. The composition of the water-based drilling fluids may also vary during drilling of a single well because different additives may be required to drill different well sections through varying geologic formations.

2.6.2.6 Drilling Fluids (Synthetic)

Synthetic drilling fluids are better suited to the drilling of highly deviated, extended reach, and horizontal wells than water-based drilling fluids. They will typically be used in the lower sections of the KFDA wells. Synthetic drilling fluids are typically formulated using, or low-toxicity olefins, paraffins and esters (IOGP, 2016). The olefins, paraffins and esters are often referred to as 'synthetics'. As with water-based drilling fluids, chemicals are added to synthetic drilling fluids to provide the same or similar functions. As Figure 2-12 shows, the synthetic drilling fluids comprise mostly non-aqueous fluid (46%), a weighting material such as barite or calcium carbonate, brine and emulsifiers.

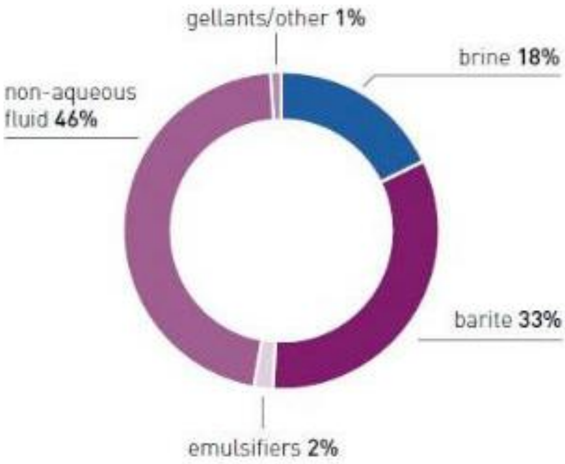


Figure 2-12: Makeup of a synthetic mud

The IOGP (2016) classifies synthetic drilling fluids into 3 groups, based on their toxicity, which is determined by the content of aromatic hydrocarbons they contain (high aromatic content, medium aromatic content and low aromatic content). CNOOC proposes to use low aromatic content (Seraline 185V) in the KFDA drilling fluids.

Further detail about the chemistry of drilling fluids is provided in the specialist Waste impact study for the ESIA.

2.6.2.7 Other Additives

During drilling the geological formation(s) nearest to the well bore may become damaged and the natural permeability of the target formation(s) may be reduced by the fine particles created during drilling, along with some of the drilling muds. The fine particles and drilling muds block, or blind, the natural pore spaces in the rock. An acid wash (typically hydrochloric acid) may be used to clean the well out during the completion phase of the drilling in order to return the natural porosity and permeability of the damaged formation.

2.6.2.8 Drilling Wastes

CNOOC will meet the requirements of the Ugandan National Environment (Waste Management) Regulations and Petroleum (Waste Management) Regulation, 2019. The GoU is in the process of drafting regulations for petroleum waste management which will become applicable on promulgation. Where the specific Ugandan environmental standards are not applicable, international guidelines will apply. In particular, CNOOC waste management practices will be aligned with current government legislation, the International Association of Oil and Gas Producers (OGP; 2008), *Guidelines for Waste Management with Special Focus on Areas with Limited Infrastructure*, Report 413, Rev. 1.1; and with IFC (2017), *Health and Safety Guidelines for Onshore Oil and Gas Development.*

Based on experience of the previous drilling operation in KF oil field, the formation in this area contains minerals as clays which are very sensitive to water-based mud (WBM). Therefore, with the exception of the First-Spud hole section, where WBM will be used for drilling, solvent-based mud (SBM) which do not react with the clays will be used to limit potential drilling risk (Figure 2-13).

The base fluid of WBM includes water and bentonite, while the base fluid of SBM selected for the proposed KF wells has a trade name Shell Saraline 185V. The synthetic based mud for drilling of the KF oil field was authorized and approved by NEMA on 13 March 2013.

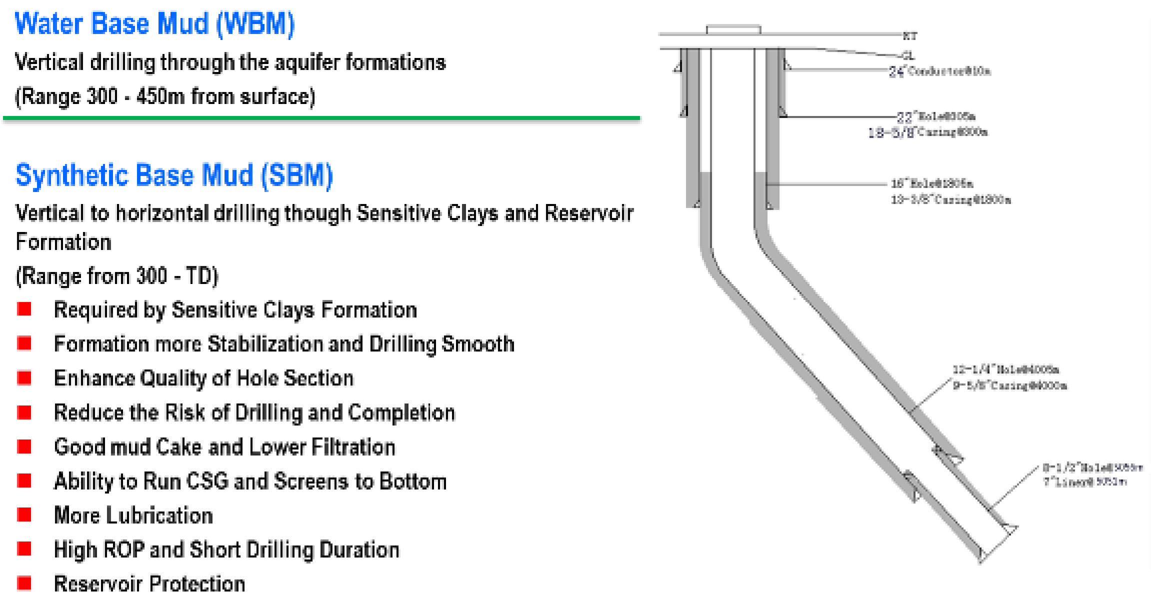


Figure 2-13: Mud type planned for use in the wells in KFDA

Three types of drilling and completion waste will be generated and managed during drilling, namely:

- Non-Oily Waste (WBM, Cement Mixture, Completion, Flush);
- Oily Waste (SBM, Return Fluids, Oily Contaminations); and
- Storm Water on Site (Rain).

Drilling waste types and quantities anticipated during drilling of the KFDA wells are indicated in Table 2.5 and Table 2.6 respectively.

Table 2.5: Drilling waste types anticipated during drilling of the KFDA Wells (project lifetime)

Waste Source	Waste Type	Nature of waste (Liquid/Solid)
WBM	Cuttings and Fine Sand	Solid
	Pure WBM Mud	Liquid
SBM	Cuttings and Fine Sand	Oily Solid
	Pure SBM Mud	Oily Liquid
Cementing Mixture	Cement and Mud Solid Mixture	Solid
	Cement and Mud Liquid	Liquid
Completion	Completion Fluid	Liquid
	Flush Fluid	Liquid
	Return Fluid from Formation	Liquid
	Fine Sand	Solid
Rain	Contamination Fluid	Liquid

Waste Source	Waste Type	Nature of waste (Liquid/Solid)
Larger solid waste	Sand, Soil and Larger size	Oily Solid/Solid

Table 2.6: Drilling waste quantities anticipated during drilling of the KFDA Wells

WBM Waste	SBM Waste	Other Liquids	Solids
1,926 m^3	8,124 m^3	25,841 m^3	20,338 m^3
35,892 m^3			41,580 Ton
22,000 m^3 as an estimate of rain water falling within contained areas of drill pads			

Note: The above data reflect waste volumes prior to cleaning and recovery of reusable drilling fluids on site

CNOOC will manage drilling waste in two phases. The primary intention of these phases will be to clean and process the raw wet waste streams to recover as much of the spent drilling fluids for reuse but also enable the safe onsite handling and offsite transportation of the residual waste to the third party treatment and disposal facility.

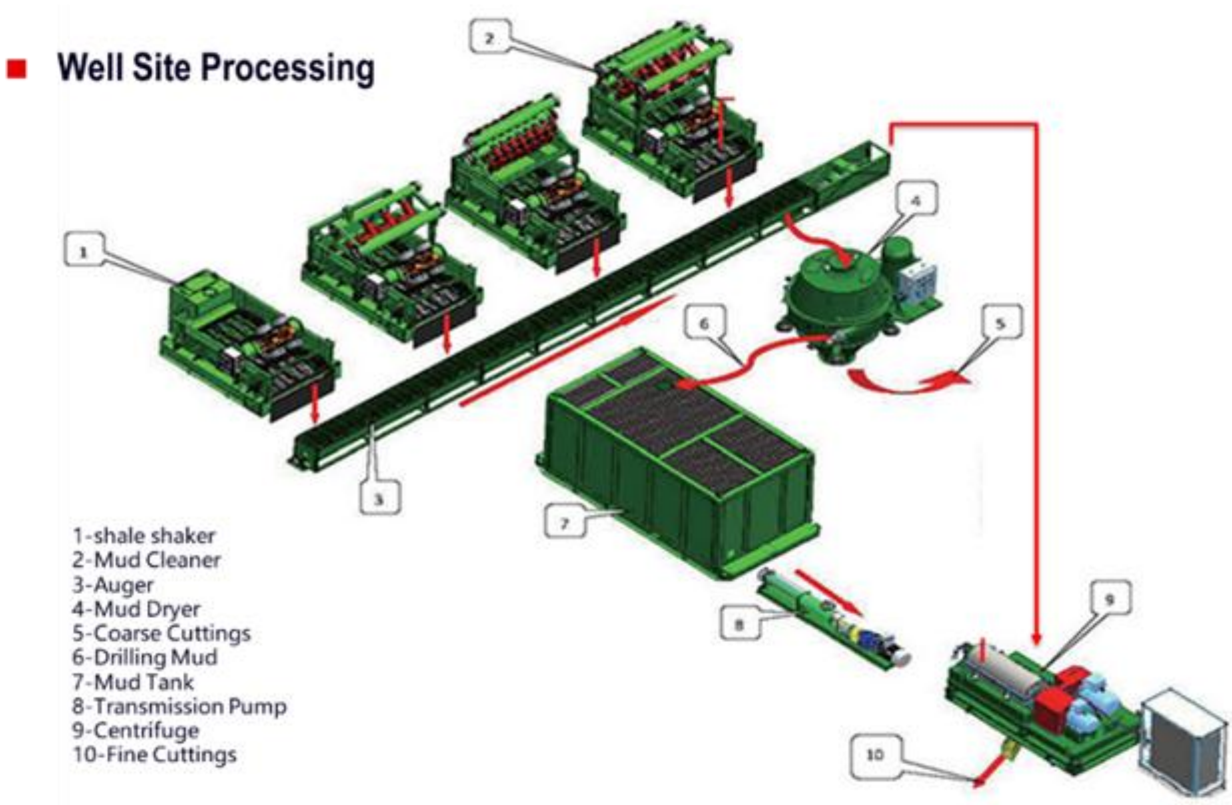
There will be initial (Phase 1) preliminary solid-liquid separation which will take place at the drill rig site. Final (Phase 2) solid/liquid separation of drilling wastes will take place at a dedicated drill waste processing facility to be that is planned to be adjacent to Pad 2 Phase 2 will be accomplished by a thermal desorption plant that will be installed within the dedicated waste processing zone adjacent to pad 2 as indicated in the Figure 2-14 below.

Figure 2-14: The location of the drill waste processing facility that will be constructed adjacent to Pad 2

2.6.2.8.1 Onsite drilling waste processing

Phase 1: Preliminary Solid/Liquid Separation of the drilling waste products is described below in detail:

- In this phase, the purpose of drilling wastes process and management on the rig site is to recover reusable drilling fluids at the well site. It also helps to condition the remnant waste to such a state that can safely be transported to the thermal desorption plant within the dedicated waste processing facility. . The drill rig site facility will separate liquid (water/oil) from solid and seek to control the liquid content in cuttings to 5%-8% this is based on best practices and the best available technology and will be subject to applicable laws and further guidance by Authorities. The dried solid cuttings (no-oily solids) will be transported to landfill. The oily solids will be transported to the Processing Plant at Pad 2 for final separation, prior to being transported to a licensed third party waste treatment and disposal facility.
- The drilling waste management system on the rig site will achieve step-wise removal of contaminants of the waste from drilling and completion operations operating on a “Zero Discharge” principle.
- Facilities will always be available to deal with discharge requirements and react quickly to changes in conditions. The main principle of drilling waste management on the rig site is solid-water separation and solid-mud separation processing.
- Based on operational experience gained during KF-4 cuttings handling, there is a risk of cuttings blinding the screen of the cuttings dryer and undermining the phase 1 waste processing at the rig site. CNOOC plans to use a filter press facility as a back-up on rig site tool for WBM waste processing on the rig site. Thus, even if the screen of the cuttings dryer were to be blinded during drilling, as the case during KF-4 well drilling, the filter press will be available as a contingency back up plan to address this failure and allow a smooth progress of the drilling operations.



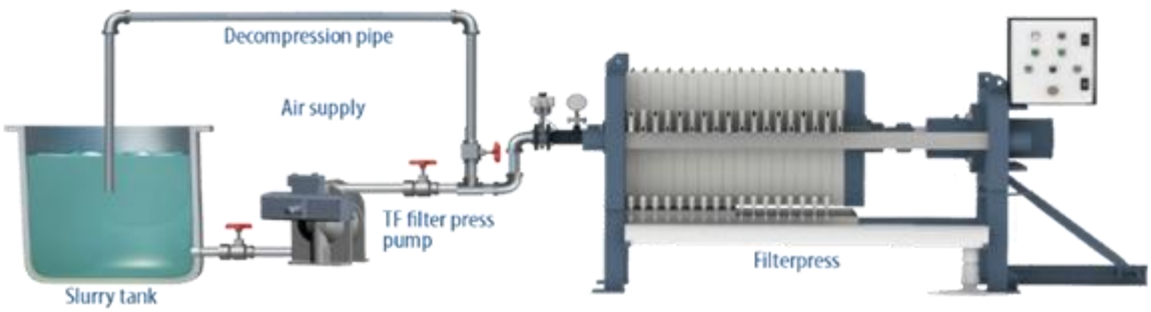


Figure 2-15: Well site waste processing flow diagram and components (as provided by CNOOC September 2018)

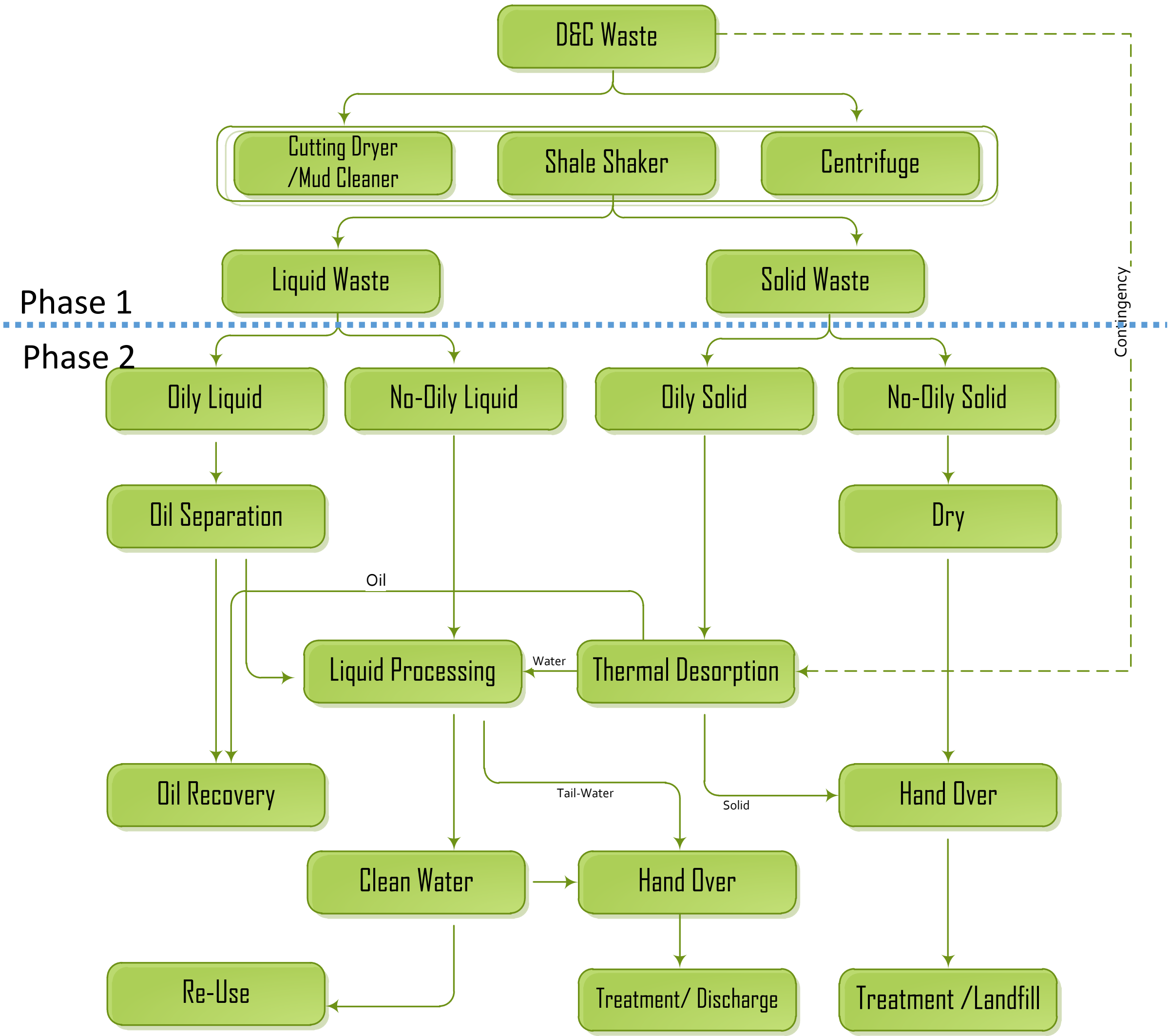


Figure 2-16: Flow diagram indicating the normal process for handling drilling and cutting's waste (CNOOC, September 2018)

Phase 2: Final solid/liquid separation by thermal facilities and liquid processing on the processing plant (thermal desorption processing)

- The remnant waste from phase 1 will be transported to the waste Processing Plant at pad 2, where an onsite CNOOC Contractor will establish a thermal desorption plant f to facilitate phase 2 (final) onsite waste processing.
- The Thermal desorption is intended to reduce the oil content in the cuttings to less than 5% based on the best available technology and will be subject to be applicable laws and further guidance by Authorities.
- Thermal desorption is a high tech and trusted waste processing method and a standard practice used for processing waste with such oily content prior to disposal. . It utilizes heat to increase the volatility of contaminants so that they can be removed (separated) from the solid matrix. The volatilized contaminants are then either collected or thermally destroyed. A thermal desorption system therefore has two major components; the desorber itself and the off-gas processing system.

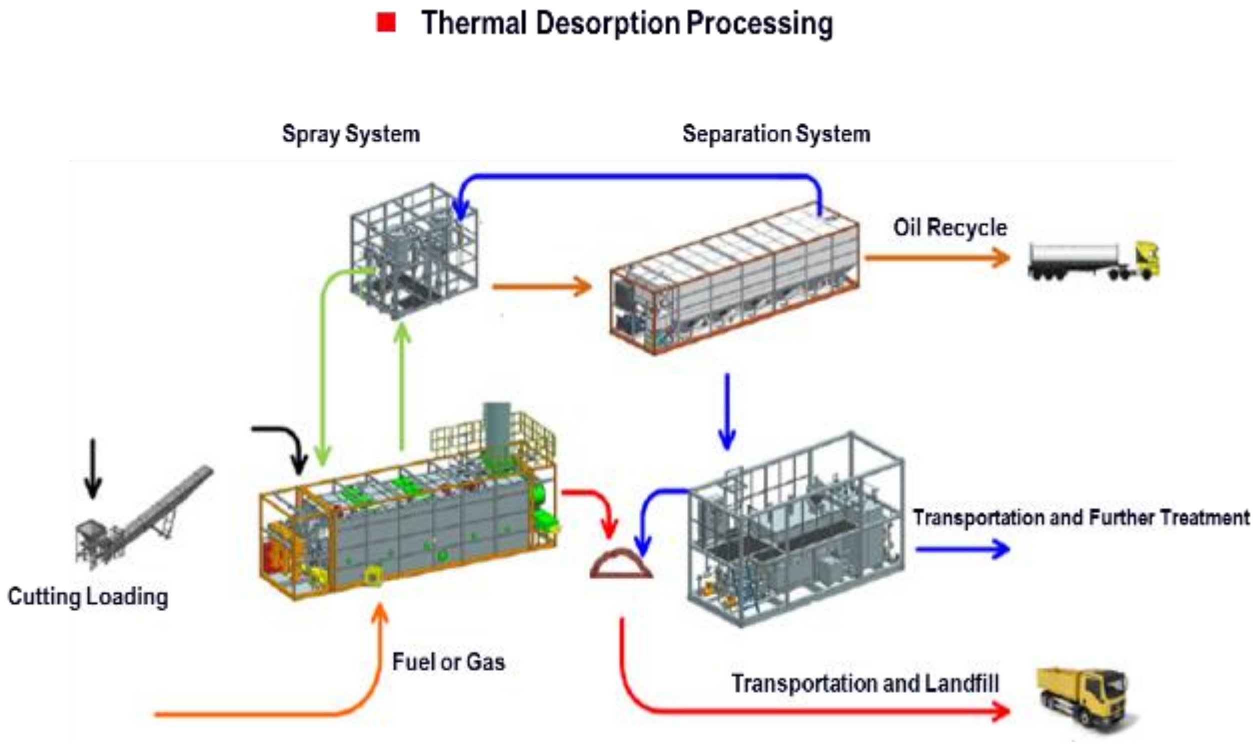


Figure 2-17: Key components and flow of materials through the thermal desorption processing plant that will be constructed for Phase 2 processing of drilling waste streams at pad 2 (CNOOC, September 2018).

The mixture of the liquid (SBM, WBM, FLUIDS) and drilling waste water will be processed at the pad 2 processing plant. All the reusable fluids recovered (such as SBM, pure oil) will be collected and recycled in the system. The waste liquids will be treated to a quality that will meet the National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations of Uganda. Notwithstanding that this is the treatment standard “for discharge of effluent”, this material will not be discharged to the environment. Between 80 - 100% of the liquid effluent stream is expected to exit the liquid processing facility meeting the target water quality requirement. This treated water will be reused. Liquid waste which will not meet the specification for reuse will be retained within the liquid processing circuit for further processing together with new incoming material being added into the circuit. The liquid waste that will remain in circuit at the end of the drilling operation and which does not meet the treatment specification, will be disposed offsite by an authorized company at a licensed waste facility. Similarly, if for any reason during the operation, liquid wastes fails to meet the permissible discharge specification will be disposed of at an appropriately licensed facility by a licensed waste contractor.

CNOOC will observe the Petroleum (Waste Management) regulations and partially ensure that the petroleum waste contractor is neither a subsidiary nor an affiliate of CNOOC.

Liquid Processing Facility

The liquids processing facility includes the following possible components, with choice of specific processing steps to be made by CNOOC to ensure that the liquid wastes meet the treatment specifications which are based on the National Environment (Standards for Discharge of Effluent into water or on Land) Regulations of Uganda and the requirement of NEMA:

- Emulsification;
- Demineralization;
- Flocculation;
- Separation Process;

- Oxidizing reaction;
- pH Adjustment;
- Filtration;
- High pressure Reverse Osmosis;
- Biological Processing (Optional);
- Membrane Processing;
- Filter Pressing; and
- Thermal Desorption.

Treatment of the liquid waste stream through the water processing facility produces oil, water, fine solids, and tail-water. The oil will be collected and recycled by CNOOC. Water will be reused or handed over to the authorized and licensed waste disposal company for offsite licensed disposal. Fine solids will be disposed of off-site by the licensed waste contractor while tail water will be recirculated into the water treatment process for further treatment to meet the required specification.

Should, for any reason, the liquid processing facilities of the processing plant fail or encounter some challenge that will impact drilling and completion operations (which are 24-hour operations), the liquid waste will be transported by the authorized and licensed waste disposal company to their site for treatment and/or disposal. This remains a backup option in the event that the liquid waste stream cannot be treated on site at any point during the drilling and completion period.

Stormwater

Stormwater management on the well pads will be separated into potentially oil contaminated (POC) areas and uncontaminated areas. Stormwater from the latter areas will be released from the site. POC stormwater will be collected, passed through an oil trap and temporarily stored on site for testing. Stormwater that meets the National permissible discharge standard will be released to the environment. Stormwater that does not meet the standard will be routed to the Phase 1 and Phase 2 processing facilities at the rig site and well pad 2.

2.6.2.8.2 Waste Treatment

Processed waste from all project activities will not be treated onsite. A NEMA certified waste transporter will remove processed waste from the site and transfer to a NEMA certified waste treatment plant and disposal facility for final treatment and disposal.

2.7 In-Field Flowlines

The KFDA well fluids, consisting of a mixture of crude, gas and water, will be delivered to the CPF via buried flowlines from each of the four well pads. The location of the flowlines is shown in Figure 2-1.

2.7.1 Design and Operational Phase

2.7.1.1 Arrangement of the Flowlines

The wells on each well pad will be connected to a single underground flowline to the CPF (four flowlines entering the CPF, one from each well pad). Provision will be made for the tie in of the Kaiso-Tonya flowline as well, although this is not a part of the present ESIA.

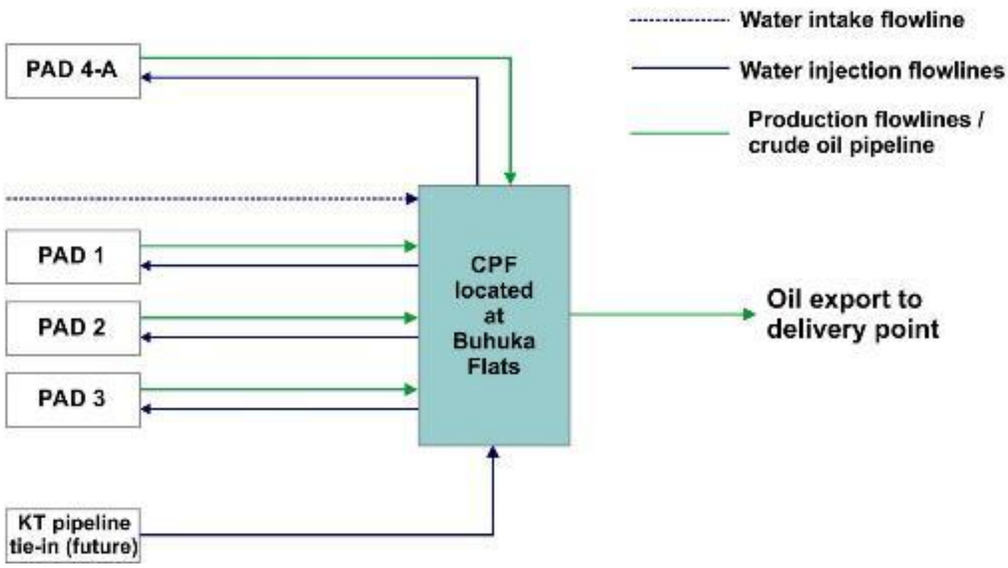


Figure 2-18: Schematic of production and water injection flowlines

2.7.1.2 Flowline Dimensions, Length and Depth of Burial

The flowline lengths and dimensions are set out in Table 2.7.

Table 2.7: Flowline length and diameter

Flowline	Length (km)	Diameter (Millimetres)
Pad 1 to CPF	1.63	254
Pad 2 to CPF	1.64	304.8
Pad 3 to CPF	3.5	304.8
Pad 4A to CPF	2.58	203.2

Flowlines will be buried 1 m below ground to top-of-pipe. This may be less in constrained locations but this is rarely if ever the case in the study area. Depth of burial is based on the ISO 13623 standard and is intended to minimise the risk of pipeline exposure due to erosion gulleys or accidental excavation. The flowlines will probably be heat traced. The pipeline will probably be heat traced and insulated for heat conservation (Figure 2-19). The normal flowing temperature for the production infield flowlines must be at least 5ºC above the pour point. Final decisions about heat tracing will be taken during the detailed design.

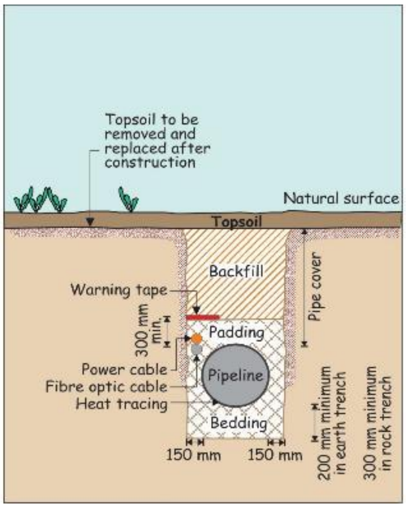


Figure 2-19: Typical cross section of a Kingfisher flowline and ancillary installations in the trench

2.7.1.3 Typical Trench Detail

The pipeline will be buried with a
surrounding cushion of frictionless material, typically a well-graded sand without rocks or large stones in it, to prevent damage to the pipe coating during the process of pipe laying or during operation (Figure 2-19).

2.7.1.4 Crossing of Drainage Lines

The flowlines will cross minor drainage lines from the escarpment near Pad 2 and south of the airstrip en route to Pad 3. The flowlines will be buried beneath the maximum scour depth of the river course. Figure 2-20 provides a cross sectional view of a crossing.

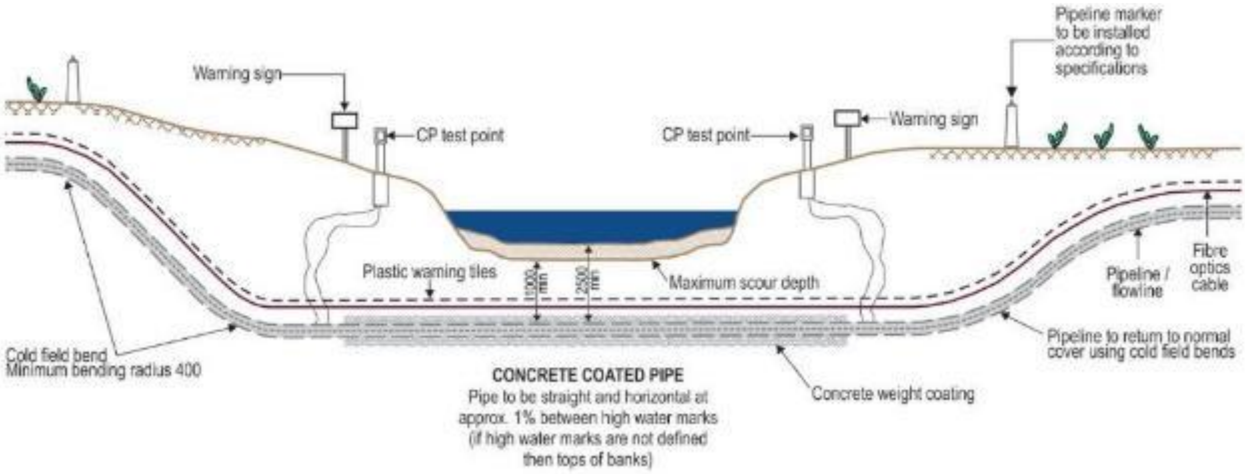


Figure 2-20: Cross section of a flowline crossing of a drainage line (typical detail)

2.7.1.5 Design for Overpressure

The flowlines will be rated to cater for overpressure conditions. The normal operating pressure in the flowlines is specified as 19 barg. This pressure can be controlled at the well heads which regulate the flow from the formations below. The well head shut in pressure (WHSIP), which is the highest pressure that could be expected in a flowline, is 228 barg.

2.7.1.6 Power and Telecommunications

A power cable and fibre optic cable will be bundled into a single umbilical (with redundancy for both services), and laid in the trench.

2.7.1.7 Corrosion Protection

Soil tests in the Buhuka Flats show moderate to high corrosivity. The outer surface of the flowlines is planned to be encased in an FBE coating in order to inhibit corrosion. Welded joints will be protected using a heat shrink wrap sleeve, applied after the weld is completed.

An impressed current Cathodic Protection System will be used to apply a small electrical current to the metal surface of the pipeline. Combined with a sacrificial anode, this will minimise the external corrosion of the pipe. The system will have no safety or health risk to humans or animals c. Taking into account the latest manufacture specifications and design of the pipeline proposed for the project as well as the construction and maintenance program and cathodic protection that will be installed the service life of a pipeline is projected to be over 30 years.

Photograph 2-2: CP instrumentation. The instruments provide information to maintenance teams which demonstrate that the cathodic protection is working properly.

Photograph 2-3: CP Post along a pipeline route

2.7.1.8 Land Requirements and Community Access

The total permanent right of way, inclusive of the adjoining access road, will be 20 m wide. Most of the access roads from the CPF to the well pads already exist, and are parallel to the proposed location of the flowlines (refer to Figure 2-1).

No constraints will apply to community access across the flowlines during the operational phase of the project. The flowlines will be buried and the right of way will not be fenced, allowing free access to communities. Natural indigenous grass cover will be replanted over the flowlines to prevent erosion.

The normal operating pressures of the flowlines are 19 barg. The safety zone along the flowline within which settlement and other sensitive permanent community infrastructure is prohibited is not expected to extend beyond the permanent right of way. Grazing of stock will be permitted but cultivation and settlement will be prohibited.

2.7.1.9 Maintenance and Leak Detection

Once the contractor’s obligations have been met with respect to the reinstatement of topsoil, and the warranty period has expired, the responsibility for rehabilitation and maintenance along the flowlines will revert to CNOOC.

The flowlines will require little maintenance on a day to day basis. The right of way will be monitored regularly for any signs of human activity (for example, excavation) that could create a risk, and for any potential leaks. Leaks are rare but should they happen, a major flowline failure would be registered on real time by a pressure drop in the line, recorded in the control room at the CPF. Minor leaks would typically manifest as a small patch of dying vegetation at the surface. In some instances, leaks can be observed and are reported by third parties.

2.7.1.10 Lifespan

The flowlines will be designed to have a lifespan of 25 years.

2.7.2 Construction Phase

2.7.2.1 Construction RoW and Community Access

The construction right of way will be 20 m wide for the flow lines and 30m for the feeder line. Provision will be made for pedestrian access across the trench during construction in any areas where there is pedestrian traffic and where the section of open trench is too long to walk around.

2.7.2.2 Method of Pipelaying

The trench for the flowlines is typically excavated using large tractor loader backactors (TLBs). In the study area, where deep sandy soils exist, blasting is unlikely to be necessary to excavate the trench to full depths. Trench construction is undertaken by stripping the topsoil and placing it in a windrow along the side of the trench opposite to the construction vehicles. Trench spoil is then removed and windrowed on the same side of the trench. The pipe is brought onto site by low loaders and is lifted by mobile cranes and placed on blocks, in rows, next to the trench. The pipe ends are then reamed, butted together and welded. Welding is done by highly skilled certified welders. The integrity of each weld is checked using X-ray methods, which are capable of detecting very fine faults. The shrink wrap sleeve is then applied and heated, in order to seal the welded joint.

The pipe coating is checked for defects using a handheld device which is capable of detecting pinhole-sized flaws when moved over the pipe. These are marked and repaired. The pipe is then lifted into the trench by side booms using slings, typically in 100 m welded sections. The pipe insulation system is then installed around the pipe. The graded material is placed around the pipe, following which the remainder of the excavated material is replaced. The backfill is not compacted and is left slightly mounded over the trench to allow for settlement.

2.7.2.3 Installation of Cathodic Protection

The Cathodic Protection System is connected to the pipeline and the trench is closed.

2.7.2.4 Disposal of hydrotest water

The pre-commissioning of the flowlines will involve pressure testing with water (hydrotesting), which is a way of checking the pipeline integrity and make certain that all of the pipes and welds can withstand the pressures under which they will be operating. The water will be sourced from Lake Albert. Current best practice is to minimize the residence time of the water in the pipe in order to avoid the need for corrosion inhibitors and biocides to prevent corrosion. After hydrotesting, the water will be treated and tested to confirm it complies with the Ugandan effluent standards and World Bank Effluent Standards, and disposed back into Lake Albert. Treatment typically involves sand filtration on sand bed screens to remove scale and other solids. It is not expected that biocides and corrosion inhibitors will be added to the hydrotest water in the flowlines but, in case that any additives are used, the hydro test water will be subjected to a neutralizing treatment process typically by neutralizer dozing and bio-inoculation at the end of the hydro test exercise. The treated water will then be tested to demonstrate that the additives have fully be neutralized to acceptable prior to discharge into the environment. The solids will be filtered and disposed to a certified waste disposal site.

2.7.2.5 Reinstatement and Rehabilitation of the Right of Way

After the trench is back filled, topsoil is recovered from the windrowed stockpile and replaced over the surface of the trench and surrounding disturbed area. Rehabilitation may be from the natural seed beds in the soil and by colonisation from the surrounding area or by re-seeding using locally indigenous grasses.

2.8 Central Processing Facility

The well-fluids from the wells will be sent to a Central Processing Facility (CPF) located on the Buhuka flats. Nearly three quarters of the total volume of fluids from the wells over the 25-year period will be formation water. The well-fluids will be processed in the CPF to separate formation water and associated gas from the oil phase. The oil will be stabilized, desalted and dehydrated to meet the export specification. Associated gas will be separated and utilized as fuel gas for power generation, the heating system and other utilities. Combined power generation with LPG recovery is proposed to utilize excess associated gas.

Produced water from the separators will be treated to achieve the injection water specification. Produced water, along with treated lake water from the CPF, will be injected into the reservoir. Lake water will be pumped to the CPF via a dedicated flow line running from the Lake Albert intake facilities.

2.8.1 Design and Operational Phase

2.8.1.1 Location

The CPF is located on the Buhuka Flats (Figure 2-1). The centre of the CPF is at coordinates 1.246325° N and 30.751756° E. A full list of coordinates for the production facility, and associated infrastructure is included in Volume 1, Appendix 1.

The basis of site selection of the CPF location was premised on the following considerations:

- to be far enough from the lake to protect the facility from the 1:100 year water levels plus wave action (design maximum water level is 624.6 amsl.);
- to minimize the risk of rock fall damage from the nearby escarpment;
- to use the gradual slope to suit the location of the process units; and
- to avoid, proximity to communities.

2.8.1.2 Footprint and Layout

The layout of the plant is presented in Figure 2-21. The area covered by the CPF has been optimised to 38 % less than the initial estimates in the feasibility study. In general, the CPF will comprise the following activities and areas:

- Oil treatment facilities;
- Gas Compression facilities;
- Produced Water Treatment & Injection facilities;
- Oil Storage & Export facilities;
- Enclosed ground flare;
- Power Generation plant;
- LPG production and loadout;
- Electrical substation;
- Water treatment facilities;
- Waste heat recovery units;
- Fire water and pumps;
- Plant Utilities area;
- Control room and administrative buildings;
- Maintenance workshop;
- Gatehouse; and
- Perimeter fencing, lighting and internal access road system.

Figure 2-21: Footprint and typical layout of the CPF, showing the context of the well pads and associated infrastructure

2.8.1.3 Design for Geohazards

The KFDA is seismically active and is susceptible to geohazards. Three earthquakes of magnitude greater than M_w 7.0 have been recorded in the region. The largest event was the 1990 Mw 7.6 earthquake in the northern part of the model region. Seismic and other geohazard information is presented in the baseline of the ESIA and is considered in the assessment of impact. Subject to detailed verification during the FEED / detailed design, the initial geohazard assessment (rock fall, landslide, mudslide, surface collapse, surface fault rupture and ground subsidence hazards) shows generally low overall hazard at the CPF site. Earthquake activity could pose substantial risk of soil liquefaction under parts of the CPF, which may require the design of structures to resist mass movement of soil. This consideration will be dully addressed in the structural engineering design to ensure that the facilities withstand the maximum experienced geohazard.

2.8.1.4 CPF Capacity

The CPF is designed for a throughput of 120,000 barrels of well fluid per day. This will be separated to produce:

- 40,000 barrels of oil per day;
- 9.1 MM Standard cubic feet of gas per day; and
- 112,808 barrels of produced water per day.

The design throughput for oil and water do not coincide, with the maximum oil production in years 2-6, while the maximum water production is in year 25 (refer to Figure 2-3 which shows the relationship between oil production and produced water over time).

2.8.1.5 Oil Production Process Overview

The process overview for the KFDA CPF is illustrated in Figure 2-22, showing crude oil, gas and produced water treatment.

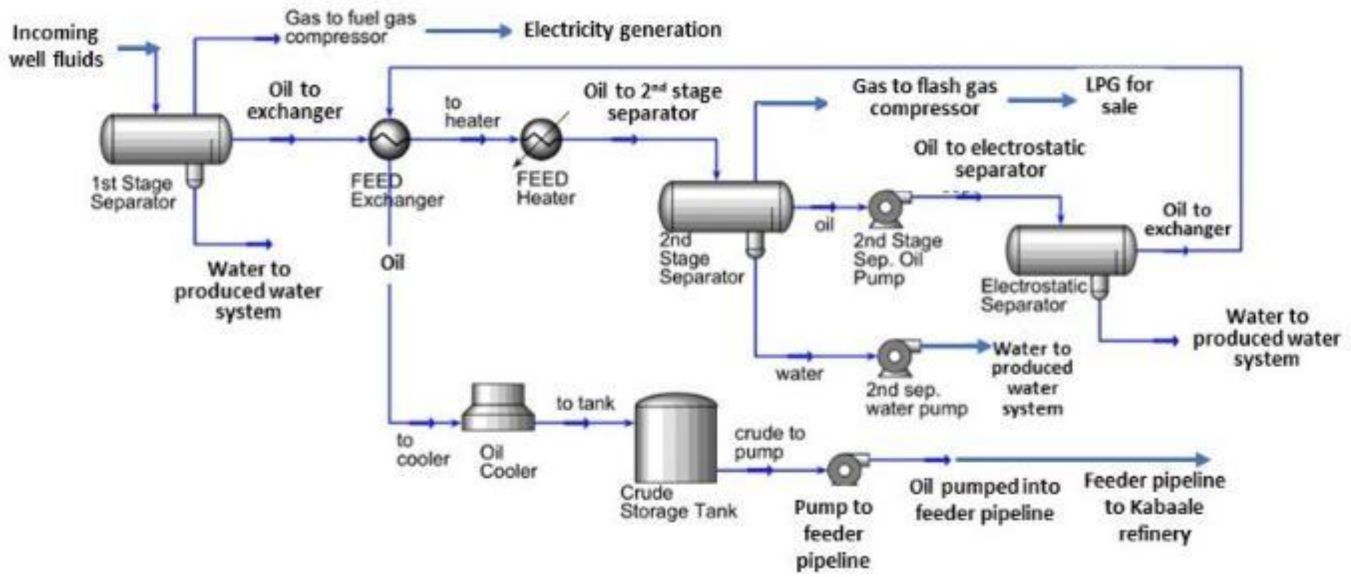


Figure 2-22: Oil production process overview for the KFDA CPF

The flowlines from the 4 well pads will terminate in a common inlet multi-port valves that deliver the well fluids to the 1st stage separator. This is a 3-phase separator (oil, water, gas) designed to reduce the water content in the oil phase to a maximum of 25% water. The separated produced water will be sent to the produced water treatment unit. Vapour from the separator will be mixed with the flash gas compressor discharge.

The crude from the 1st stage separator will be heated to 92°C in two exchangers and will then sent to the 3-phase 2nd stage separator, which will stabilise the crude for storage and export. Oil from the 2nd stage separator will be pumped to the electrostatic separator. Water will then be sent to the produced water treatment unit. Flash gas on the other hand will be sent to the flash gas compressor inlet cooler.

The electrostatic separator is a liquid-filled vessel operating at 92°C and provided with electrostatic terminals. The electrostatic separator shall be designed to achieve the crude oil specification of basic sediment and water (BS&W) content of less than 0.5% by volume and salt content of 60mg/l. The stabilised crude from the electrostatic separator will be cooled by 2nd stage separator feed in a 2nd stage separator feed/oil exchanger and then by air in the oil cooler to 68°C, which is above the pour point and wax appearance temperature. On-spec stabilised crude will thereafter be sent to the on-spec storage tank. It shall be monitored by analysers and automatically diverted to the off-spec crude tank if the Reid Vapour Pressure (RVP) and BS&W specifications are not met.

All three separators will be fitted with sand removal screens that include water jetting de-sanding nozzles. Depending on the extent of sand, the sand jetting may be continuous or periodic. Produced sand will be dewatered and temporarily stored at the CPF for disposal with drilling cutting waste.

2.8.1.6 Produced Gas Process Overview

Flash gas from the 2nd stage separator will be cooled in the flash gas compressor inlet cooler and sent to the flash gas compressor suction drum where the condensate is knocked out. Vapour will be sent to the flash gas compressor.

Flash gas from the 1st stage separator will be mixed with the flash gas compressor discharge, upstream of the flash gas compressor discharge cooler. Recycle condensate from the fuel gas compression system will also join the flash gas compressor discharge and then fed to the Flash Gas Compressor Discharge Cooler where it will cooled and sent to the flash gas compressor discharge drum to separate any condensate, which will be sent to the crude oil / oil exchanger.

Compressed gas from the flash gas compressor discharge drum will be sent to:

- the HP (high pressure) fuel gas super heater to meet the superheat requirements of 30°C before sending HP fuel gas (LPG) to main power generators;
- the fuel gas compression system where the gas is compressed to 36 bars for use in the power generation gas turbines. Should there be excess power during the initial years will be exported to the National Grid; and
- LP (low pressure) fuel gas users (normally no flow) which is the excess gas utilisation package, if any gas remains.

The condensate from the fuel gas system will be routed to the three phase separator in the LPG system. After removing the water and flash gas, the liquids flows to the deethaniser and the water to produced water treatment. The LPG tower will be a fractionation column. The LPG top tower output shall be used as reflux liquid after condensating and boosting. The bottom gas LPG in two. LPG quality can be adjusted to meet Ugandan standards.

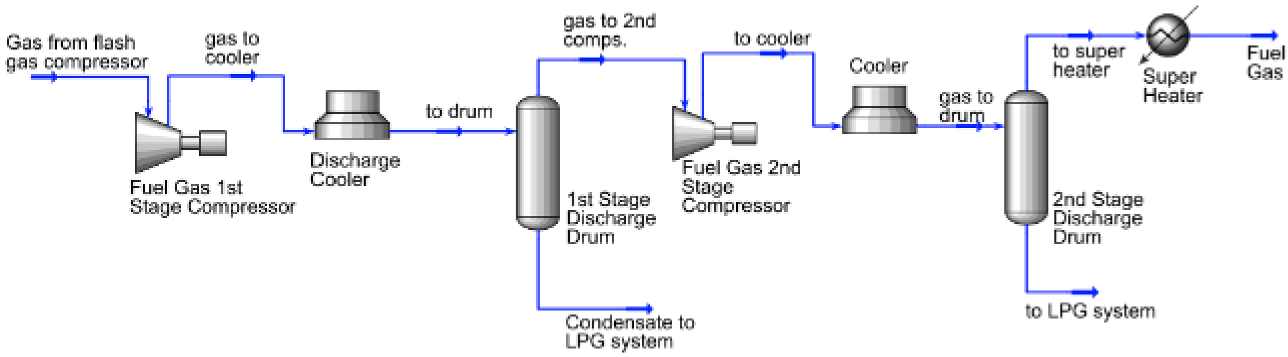


Figure 2-23: Fuel gas system

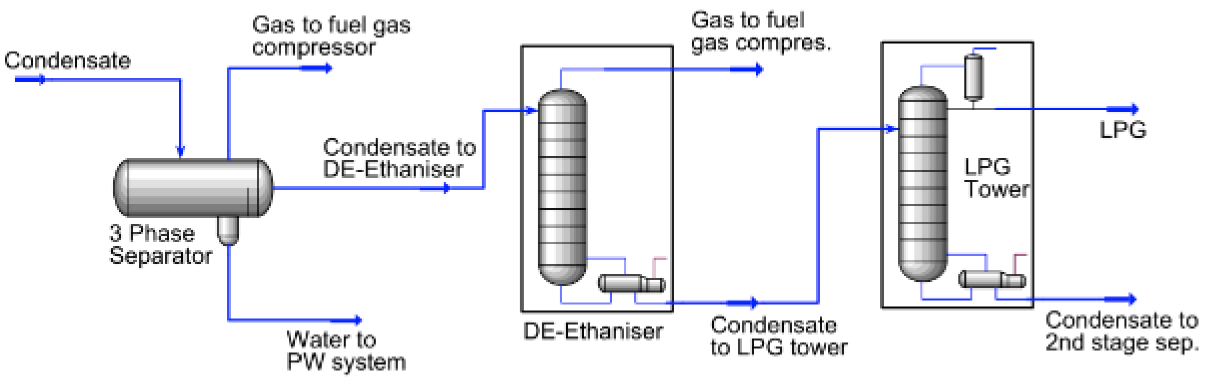


Figure 2-24: LPG system

2.8.1.7 Flaring and Venting

A ground flare is proposed at the CPF. There will be no continuous flaring under normal operations. Flaring will occur only occasionally, during purge (when fuel gas is being used, due to emergencies, mal-operation, start-up, shutdown or maintenance of the plant. There will be no continuous venting of hydrocarbons, but there may be occasional, low volume, venting during maintenance.

2.8.1.8 Crude Oil and LPG Storage

A 10,000 m^3 floating roof tank oil storage tank will be provided, making provision for 30 hours of storage. Heat loss from the oil storage tanks will be recuperated by means of heating medium coils inside the tanks. The temperature in the tanks will be maintained at 68ºCby means of internal heating medium coils.

Off-spec oil storage will be stored in a 3,000 m^3 fixed dome roofed tank with 10 hours storage time and nitrogen gas blanketing. Off-spec crude oil will be recycled to the 2nd Stage Separator with tank low level override. Heat loss from the tanks will be recuperated by heating coils inside the tanks. The temperature in the tank will be maintained at 68ºC. The off-spec tank may be used for on spec storage of crude during inspection and maintenance of the on-spec tank.

LPG will be stored in two 135 m^3 bullets. A loading facility will be built for LPG bulk road transport to the local market.

2.8.1.9 Electricity Generation and Distribution

Figure 2-25 provides a schematic overview of electricity generation at the CPF.

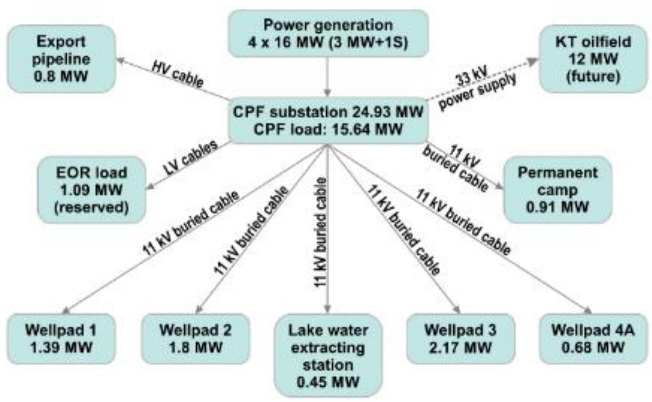


Figure 2-25: Power demand for the KFDA Project

Photograph 2-4: Typical stabilised oil floating roof storage tanks

Electricity will be generated at the CPF by four 16 MW gas turbine-driven generators (3 operational, 1 standby), powered by fuel gas from the CPF process. Medium Voltage (MV) switchgear and High Voltage (HV) switchgear will be provided for different processes.

The electricity distribution system will comprise:

- Transformers and switchgear at the CPF to power CPF requirements and the pump station for the feeder pipeline to Kabaale;
- Cables from the CPF to each of the well pads, and transformers and switchgear at each well pad;
- A cable from the CPF to the Lake Water Extraction Station, and a transformer and switchgear at the pump station;
- Construction of a power supply system to power pipeline heating stations and block valve stations along the crude feeder pipeline. The power supply system will be suitable for the SEHT requirements for the feeder pipeline (refer to Section 2.9); and
- A cable from the CPF to the permanent operators' accommodation camp and a transformer, switchgear and distribution system at the camp.

In addition, capacity will be reserved for Enhanced Oil Recovery (EOR) in the later stages of the project's life and for the KT oilfield. Backup power will be provided by one Genset located at the CPF. The Genset will consist of 1,000 Kw low voltage diesel unit for powering essential services during power failures.

In the first 10 years of the project it is likely that there may be an excess of power generated, followed by a deficit of power (Figure 2-26). Final decisions about the export and import of power to and from the Uganda national grid will be made later in the project. Development of the infrastructure will be the responsibility of Government and no power line infrastructure from the CPF to link to the national grid is presently provided for in the current project. In the event that the infrastructure for evacuation of excess power is not completed in time for the start of production, it will be necessary to flare the excess gas.

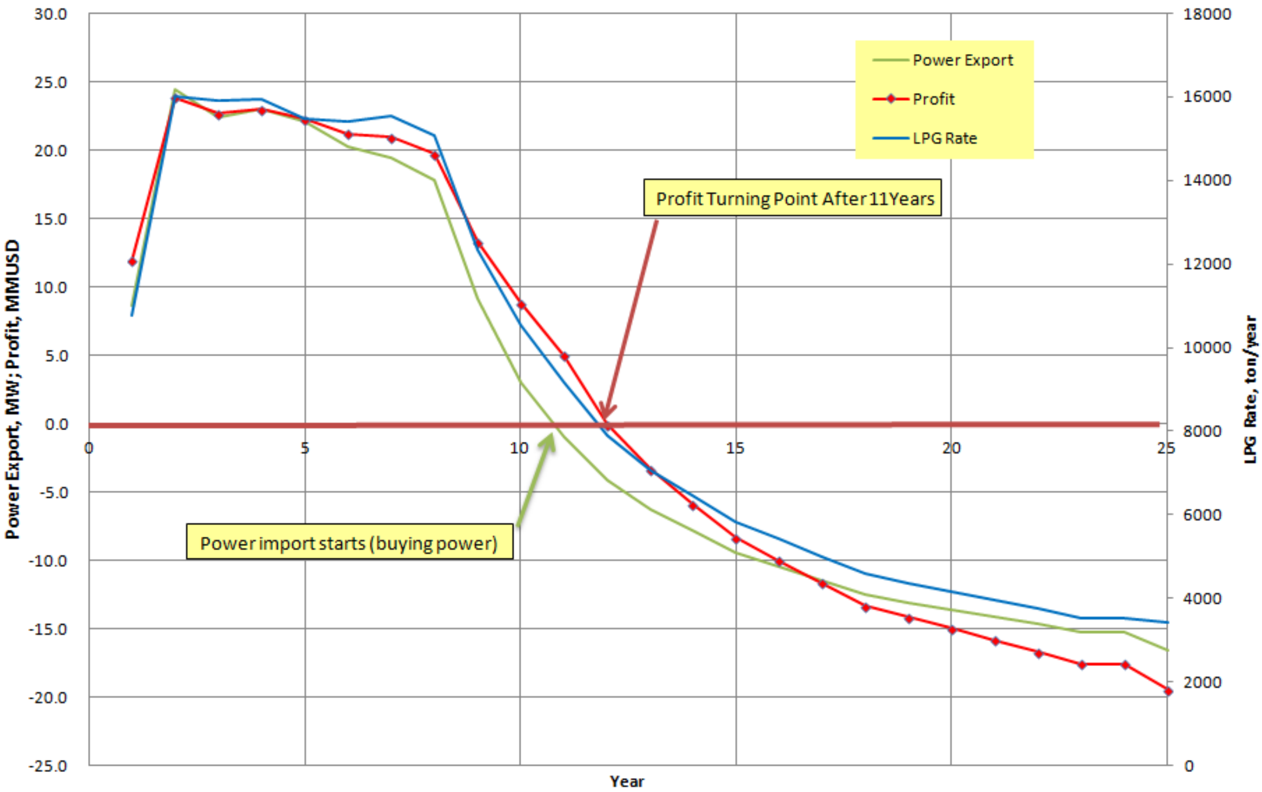


Figure 2-26: Power export vs import during the project lifespan

2.8.1.10 Heating System

The thermal energy requirements of the CPF will be supported by three waste heat recovery units (WHRUs) and one fired heater. Under normal operating conditions, the WHRUs will provide sufficient heat to meet operational requirements. The following are the main services that will require heating at the CPF:

- 2nd Stage Separator Feed Heater to heat the crude-water mixture to the required stabilization temperature;
- Make-up Water Heater to heat the make-up water to meet the injection water temperature of 75°C in the first 5 years and 50°C in later years;
- Fuel Gas Superheater to provide the required level of superheat to fuel gas;
- De-Etherizer reboiler to provide the energy for the bottom of the tower;
- LPG tower reboiler; and
- Storage Tank Heater to maintain stabilized crude at WAT+5ºC.

Of the above, the Make-up Water Heater will be the major consumer, comprising about 60% of the total heating load of the CPF.

2.8.1.11 Instrumentation and Control System

The KFDA instrumentation and control is segregated into **onsite** requirements, which include the Central Processing Facility (CPF), pumping station & delivery point facility; and **offsite** requirements, which include well pads, multi-port valve and pigging stations, block valve station, flowlines and crude oil transmission pipeline.

The primary source of process information will be provided by field instruments capable of measuring all of the physical process parameters necessary for the project's control and safety functions to be carried out. Field instruments will be linked to an Integrated Control & Safety System (ICSS), which will be operated from the Central Control Room (CCR) at the CPF. The ICSS will provide seamless integration of all instrument systems to serve plant monitoring, control, safety and operations of the facilities, including those off-site. It will comprise the following:

- Process Control System (PCS);
- Emergency Shutdown system (ESD);
- Fire and Gas Detection system (FGS);
- Supervisory Control and Data Acquisition system (SCADA); and
- Human Machine Interface (HMI).

Operator Work Stations in the Central Control Room will monitor and control the CPF and associated well pads, flowlines and multi-port valves. A subset of the ICSS will be located in the feeder pipeline delivery point tie-in to facilitate exchange of monitoring & control signals to the CPF CCR. The Operator Work Stations will also display Emergency Shutdown and Fire and Gas Detection system data and alarms, and provide access to the safety functions of these systems.

An Instrument Equipment Room adjacent to the Central Control Room will house all the system and marshalling cabinets and some mechanical package Unit Control Panels (UCP), such as the Compressor UCP.

2.8.1.12 Water Supply

All project water requirements will be supplied from a water intake station on Lake Albert, roughly 1 km northwest of the CPF (Figure 2-4). A reinforced concrete chamber will be sunk close to the shore edge comprising a pump basin, a silt collection basin and a trash screen section. The depth of the structure will be set to cover the range of design lake water levels and the pump basin depth set to ensure pump performance at the minimum lake level.

Most of the planned intake capacity will be for make-up of produced water injection requirements (further detail on produced water make up is included below). Even in 25th year of the licence, when produced water generation is high and make up water requirements are at their lowest (56 m^3/hr), this demand will still comprise about 89% of the total project water use. Table 2.8 shows the water supply requirements for the project. A graph showing the changing demand for make-up water over the life of the project is presented in Figure 2-5.

The planned capacity of the intake station is 390 m^3/hr, which includes provision for the maximum make-up injection water demand (~301m^3/hr in year 5), potable water demand of 6 m^3/hr and incidental (unaccounted) water demand, estimated to be in the order of 48 m^3/hr, which takes into account water requirements for makeover of wells during operations which is an intermittent activity. The average daily water demand at the CPF, excluding domestic requirements is expected to be approximately 100 m^3/day.

Table 2.8: Water supply for the project

Water Demand	Design Rate
Injection water make up	301 m^3/hr
Domestic Water	6 m^3/hour
Utility/Unaccounted Water	48 m^3/hr

The exact number, type and configuration of pumps to suit the water intake profile and maintenance requirements is subject to refinement in the field detailed design along with arrangement of piping and valves. Water pumped from the intake will be delivered to a 2,000 m^3 tank at the CPF. Provision will be made for addition of chemicals to the intake water to limit the risk of Sulphate Reducing Bacteria (SRB) in the make-up water, which could cause reservoir souring. The lake water is rich in the fatty acids required for SRB growth and salinity, pH and temperature are all within range for SRB growth. Hypochlorite (NaOCl) will be added together with a flocculent. This will be injected close to the intake water pump station in order to minimize the risk of build-up in the pipeline to the CPF.

To ensure independent control over potable water treatment for domestic use, a separate $30m^3$ tank at the CPF will be provided from which potable water will be drawn.

2.8.1.13 Wastewater

The following wastewater streams will be generated at the CPF:

- Produced water - removed from the well fluids and delivered to the water treatment plant before injection down one of 11 injection wells on the well pads;
- Process effluent routed to the Closed Drain system;
- Drainage (mainly stormwater) routed to the Open Drain system;
- Domestic effluent - treated in a sewage treatment plant at the permanent camp; and

Figure 2-26 shows the produced water / wastewater circuit at the CPF.

2.8.1.13.1 Produced Water

Overview

Discharge of produced water outside the boundary of the production facilities will not be considered owing to the sensitivity of the receiving environment. Produced water will be treated to meet the injection water specification, combined with lake water to make up the required quantity, and injected back into the oil reservoir to maintain reservoir pressures. Produced water will increase sharply in the first few years of the project while ramping up to full production in year 6 (2,610.35 barrels/h). The steep annual increase continues until around year 11 (4,270.91 barrels/h) after which the curve flattens, and from year 17 onward annual increases in produced water generation are slight. At year 25 end-of-life of the field, produced water reaches a peak of 4,755.24 barrels/h.

Produced Water Chemistry

Table 2.9 shows expected produced water chemistry.

Table 2.9: Properties of CNOOC produced water

Physical Parameters		Anionic Parameters	Concentration (mg/l)	Cationic Parameters	Concentration (mg/l)
pH@25ºC (pH units)	7.32	Chloride	3969	Lithium	0.2
Resistivity @25ºC ohm.m	0.805	Sulphate	105	Barium	2.3
Density@20ºC (kg/l)	1.004	Bromide	49.8	Strontium	4.7
Elements	Concen-tration (mg/l)	Nitrate	0.15	Calcium	268
		Phosphate	<1	Magnesium	5.8
		Bicarbonate	257	Sodium	1724
		Carbonate	0	Potassium	1760
		Hydroxide	0	Iron	<0.5
Total Iron	4.2	Formate	5.2	Copper	<0.5
Phosphorous	<2	Acetate	697	Zinc	2.2
Silicon	27	Propanoate	51	Manganese	0.6
Sulphur	38	Butyrate	20	Aluminium	<1

Physical Parameters		Anionic Parameters	Concentration (mg/l)	Cationic Parameters	Concentration (mg/l)
Total Cl equivalent (mg/l)	4676	Iso-Valerate	5.7		
Total Na equivalent (mg/l)	3083	Boron	<3		
Total NaCl equivalent (mg/l)	7758	Cl:Br	80		
Cation/Anion Balance %	101.67				
Cation/Anion Bias (%)	1.67				

Disposal Standard

The stringent requirement to remove oil from the produced water (Table 2.10) is mainly to prevent clogging of the injection system. The produced water stripped from the oil in the primary, secondary and electrostatic separators will be delivered to the water treatment plant for further cleaning.

Table 2.10: Specification for injection of produced water

Specification Unit Value	Unit	Value
Suspended Solids	mg/l	< 5.0
Particle Size	mm	< 3.0
Oil cut	mg/l	< 15.0
Average corrosion rate	mm/a	<0.076
Dissolved Oxygen	mg/l	0.1
Sulphate Reducing Bacteria	unit/ml	25
Ferrobacteria	unit/ml	< n X 10^3(1<n<10)
Metatrophic bacteria	unit/ml	< n X 10^3(1<n<10)

Produced Water Treatment Plant

The produced water treatment plant will consist of three treatment stages: primary, secondary and tertiary. The specification for produced water quality is stringent, and the basis of design requires a multi staged produced water treatment plant, comprising primary, secondary and tertiary treatment. A number of options have been considered for each stage with the following being selected based on the FEED:

- Skim tanks (Primary treatment). This provides a surge capacity of 4 hours for any upsets in the downstream systems. Skim tanks also ensure coarse separation of oil from water to less than 100mg/l and TSS to less than 30mg/l, which is sufficient for secondary and polishing stages of separation;
- Spray-induced gas flotation (Secondary treatment). This treatment system has the advantage of light weight, reduced power consumption, low cost and reliability. Oil in water will be reduced to less than 30mg/l and TSS to less than 20 mg/l;
- Walnut shell filtration (Tertiary treatment). This technology is capable of polishing the water to reliably meeting the 15mg/l oil specification (typically achieve less than 10 mg/l for oil in water and TSS. Five 250 m^3/hr filters will be provided, supported by two backwash pumps;

- Provision for an on line oil concentration monitor at the water injection point buffer tank outlet. Provision for other sampling points in the circuit will also be made to monitor oil in water through the treatment system;

Filter aids, reverse demulsifiers and biocides may be added at various points in this treatment process.

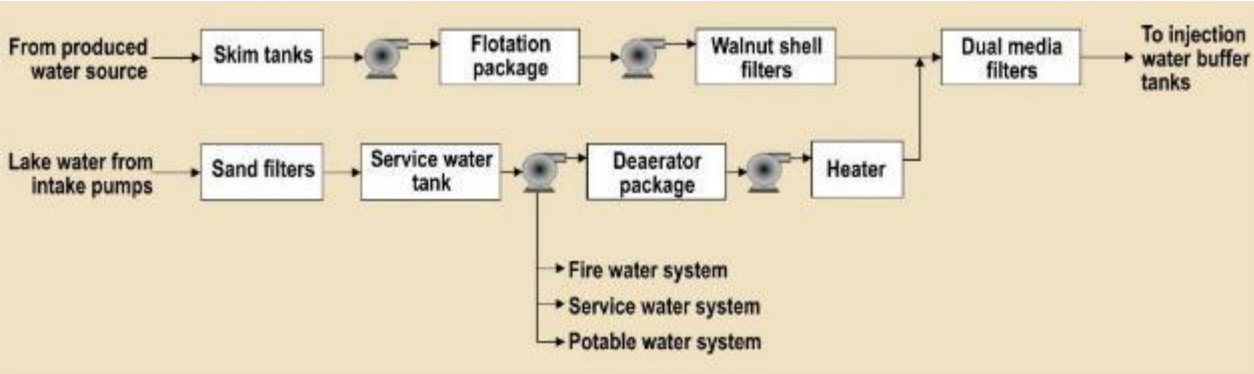


Figure 2-27: Produced water injection (including make-up water)

Addition of Make-Up Water

The produced water from the CPF will be combined with lake make-up water to meet water injection requirements in the KFDA (Figure 2-27). Lake water will be pumped to the CPF via a dedicated flowline running from the Lake Albert intake facilities. The demand for make-up water will increase sharply up to year 3, to meet the initial shortfall for water injection, after which demand will level off, staying more or less constant until year 9, and then gradually declining. After year 6, the amount of make-up water will be outstripped by produced water generation and by year 25, the usage will only be 34% of the earlier peak requirement, and 7% of the total water injected (Figure 2-5).

At the CPF, the make-up water will be deoxidized by a vacuum deaerator and heated to 87°C. It will then be mixed with the produced water from the walnut shell filters and routed to the dual media filters for fine filtration to reduce TSS to less than 5mg/l, with a particle size average diameter of less than 5 microns.

Backwash Water / Oil Recovery / Sludge Disposal

Large quantities of filter backwash water will be generated at the produced water and lake make up water treatment plant.

- The backwash water for the lake water sand filters will be supplied from the service water tank. Dirty backwash water will be discharged into a water recycle tank which is cylindrical, carbon steel tank, designed with a conical bottom to trap sediment. Solids trapped in the bottom will flow into a sludge settling drum for further separation of solids and water. Clarified water will be returned to the inlet of the sand filters. Solids will be collected and removed by a third party contractor for offsite disposal;
- The backwash water for walnut shell filters and dual media filters will be supplied from the water injection buffer tank by backwash pumps. Dirty backwash water will be discharged into a foul water tank. Foul water will be pumped back into the inlet header of the skim tanks;
- Oil skimmed from the skim tanks, flotation vessels, surge tank, walnut shell filters and water injection buffer tanks will be contained in a foul oil recovery drum which will be pumped back to the oil treatment system;
- One sludge settling drum will be provided for the produced water and lake water settled solids. The sludge settle drum will be a vertical cylindrical tank fabricated in lined carbon steel and designed with a conical bottom into which slurry will be discharged from the following sources:
  - water recycle tank conical bottom
  - drain from skim tanks

- drain from flotation vessels
- drain from surge tank
- drain from foul water tank
- Drain from buffer tanks

The foul oil will be discharged from the sludge settling drum to the sludge dewatering package via a bucket type weir on the side of the drum. Solids will settle in the conical bottom and be discharged by sludge transfer pumps to the sludge dewatering package for further dehydration. Clarified water will be pumped back into the inlet header of the skim tanks by water transfer pumps.

The sludge dewatering package will use a spiral sludge dehydrator which will be fully automatic for easier operation and maintenance, with lower energy consumption and low noise. The effluent through the spiral sludge dehydrator will be pumped back into the inlet header of the skim tanks, while the dewatered sludge will be transferred to the waste disposal areas for disposal by a third party waste contractor.

Storage and Delivery to the Injection Wells

The produced water and make up water will be stored in two 2,000 m^3 buffer tanks at the CPF, at a temperature of 80ºC. The tanks will have a retention time of 4 hours of storage. Produced water from the tanks will be pressurized by booster pumps (to 199.8 bar) and delivered by flowline to the injectors on the well pads. Provision will be made for dosing with corrosion inhibitor, scale inhibitor, oxygen scavenger and biocide on delivery into the pressurized flowlines to the well pads.

2.8.1.13.2 Process Effluent (routed to the Closed Drain System)

This process effluent will be generated by equipment operated under pressure, equipment containing toxic fluids and equipment containing highly volatile hydrocarbon liquids which may need to be drained for maintenance or inspection. All of the effluent will be routed through fully contained closed drains and shall either be pumped back to the oil processing plant or to the produced water plant.

2.8.1.13.3 Potentially Oil Contaminated (POC) Water

- Potentially oil contaminated (POC) water will be removed in the open drain system. POC water will be managed in three ways (Figure 2-29):

    - Open Drain system 1 (OD1): are waste water open drains from areas that are exposed to oil and hydrocarbon liquids during routine operations. Consequently these areas are anticipated to be oil contaminated and the drainage design allows for interception of these hydrocarbons liquids (crude oils and gas condensate). The open drain 1 shall be constructed in the crude oil production, process and storage areas. These areas are typically exposed to storm water and wash water that is collected underneath oil processing equipment and such water is potentially contaminated with oil from spills and drippings from pumps, compressors, separators, vessels etc during routine operations); All OD1 effluent will be routed through buried pipes to a first flush sump, connected to an oil-water interceptor for primary treatment (Figure 2-30) and then shall be pumped to the produced water treatment plant for produced water disposal. All storm water from this area will be delivered to the reinjection water system. There shall be no open discharge to the surface environment;

    - Open Drain system 2 (OD2): are waste water open drains that drain areas which can be foreseen to be largely clear of oil contamination but which may from time to time be contaminated by small volumes of hydrocarbons. These areas include stormwater collected from paved areas near process units, from bunded areas designed to collect accidental spillages, and from areas where water may be contaminated with oils and greases as part of normal equipment operation. OD2 water shall not be directly discharged to the environment. As a minimum floating oil shall be recovered in an observation basin; and

    - Open Drain system 3 (OD3): from oil-free areas of the plant where the risk of contamination with hydrocarbons or other oily products is negligible and can be disregarded. These areas include undeveloped areas, building roofs and green spaces. OD3 storm water is planned to be discharged directly to the environment through a pipe or ditch without testing.

2.8.1.13.4 Laboratory Water

Effluent released into the laboratory sinks will be separately handled due to possible chemical contamination. It will be contained for testing and, where necessary, treated before being delivered to the reinjection circuit or released to the OD2 drainage system.

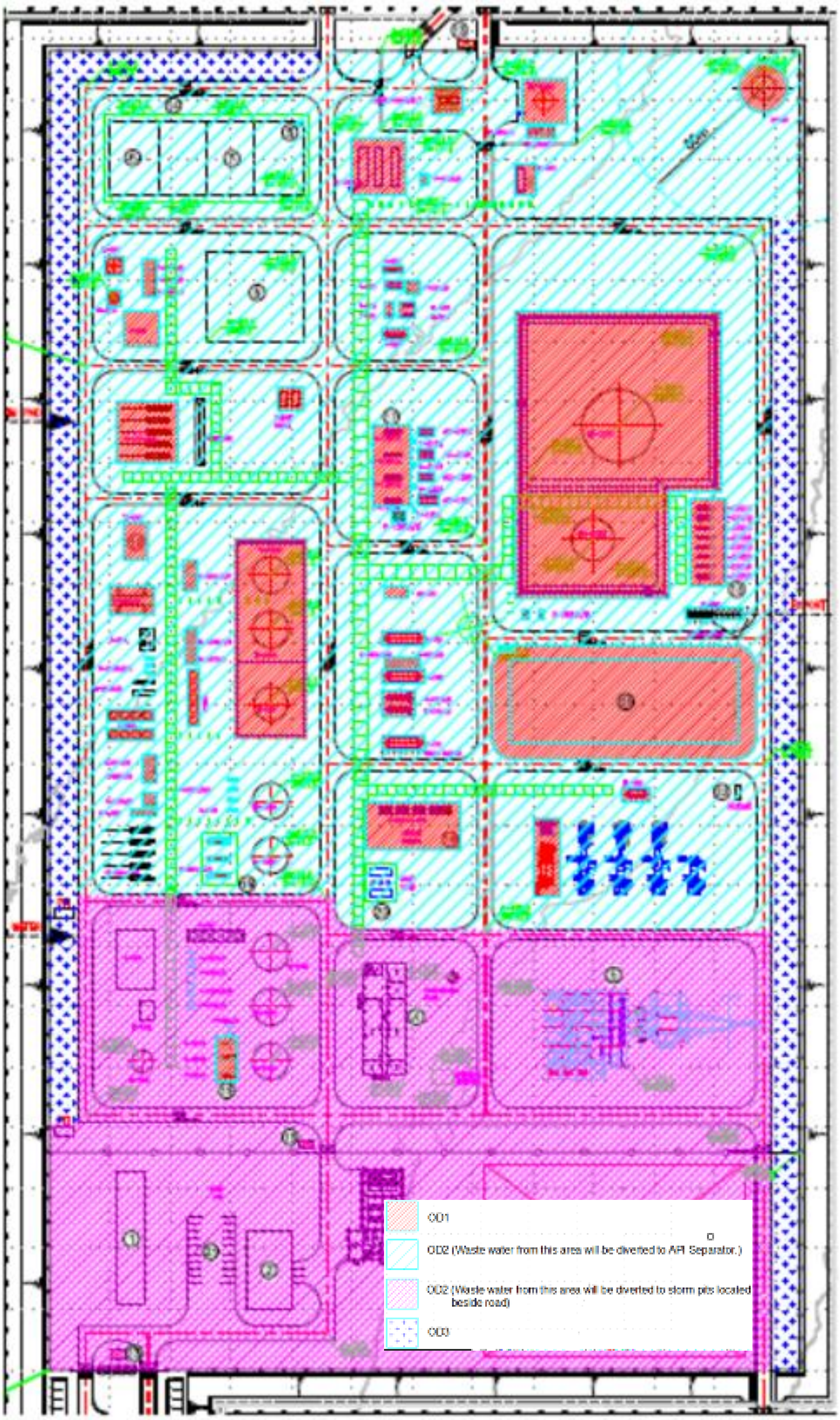


Figure 2-28: Handling of clean and POC water at the CPF (CNOOC, September 2018)

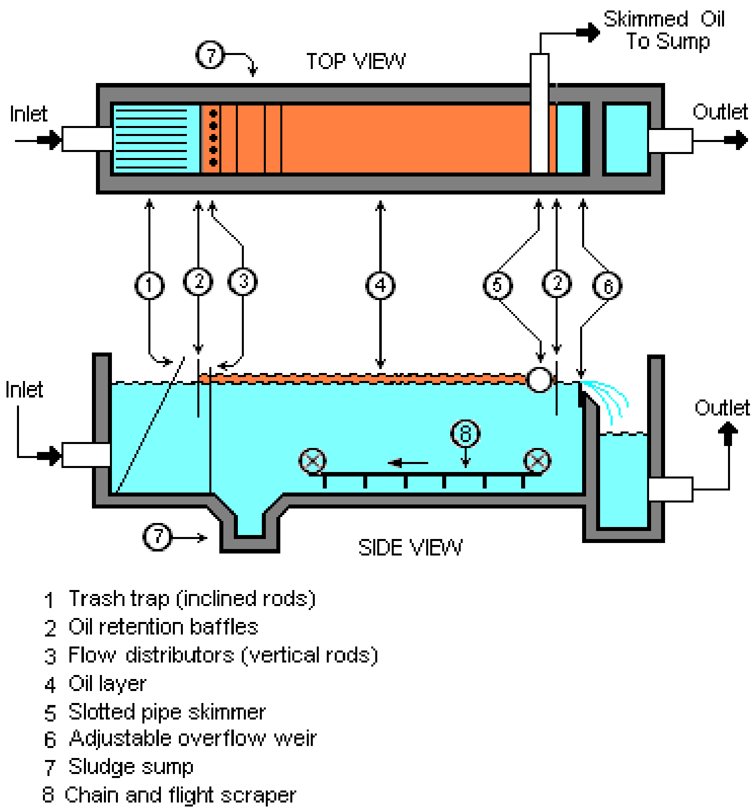


Figure 2-29: Typical API oil separator (Source: API, 1990)

2.8.1.13.5 Domestic Wastewater

The planned capacity of the domestic sewage treatment plant is 45 m^3/day, making provision for an estimated 120 personnel plus contingency. Treated sewage effluent will meet the more stringent of the Ugandan and IFC treated sewage effluent requirements (Appendix 1). The sewage treatment plant will be located at the permanent camp. Backup sewage treatment capability will be provided by the sewage treatment plant built to supply the drilling camp, which has spare capacity for an additional 130 people. The two sewage plants will be linked to allow for maintenance shutdowns of either plant. After drilling is completed in year 6, the drilling sewage plant will be maintained as a backup.

Sewage from the CPF will be routed via conservancy tanks to a regulating tank at the permanent camp from where it will be treated in a Membrane Bioreactor sewage treatment works. The sewerage that was generated in the safety check station and the well pads will be transported by vehicle from the site to the STP at the permanent camp or drilling.

The primary option for final disposal of treated sewage effluent will be by irrigation of the green spaces around the facilities (camp, CPF), on un-tarred roads to suppress dust and also the wider community grazing areas in the Flats. This will be done using 5m^3 water trucks fitted with spray / irrigation jets. The backup option will be discharge of the treated domestic waste water into the channel leading to the L. Albert. Injection with produced water is not considered due to the risk of bacterial contamination in the reinjection wells.

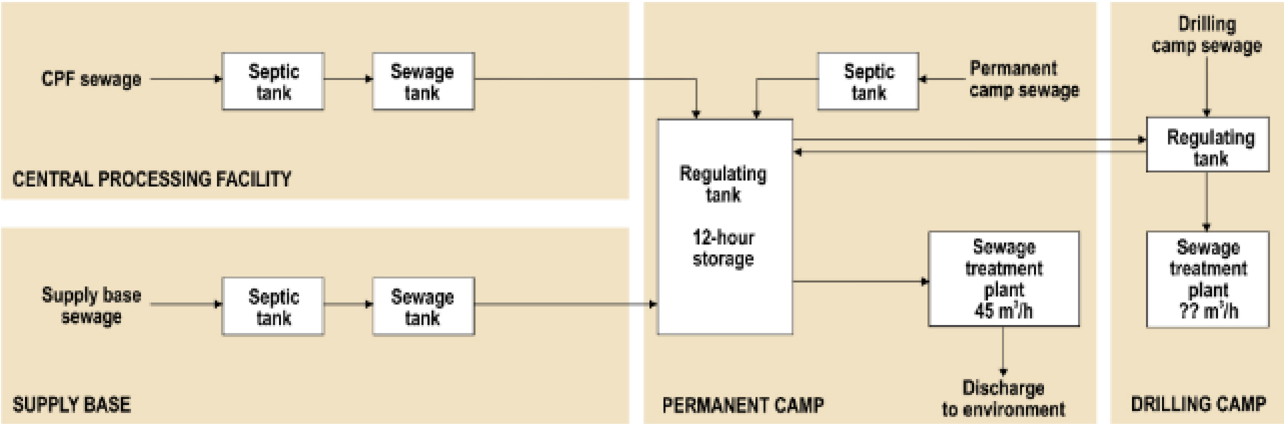


Figure 2-30: Schematic of sewage treatment capacity for the CPF, supply base and permanent camp

2.8.1.13.6 Accidental Releases

The design will provide for secondary containment around storage tanks of hazardous liquids, so as to minimize the risk of spillages due to accidents or leaks. Secondary containment shall consist of berms, dykes or walls capable of containing the larger of 110% of the largest tank or 25% of the combined tank volumes in areas with above-ground tanks with a total storage volume equal to or greater than 1,000 litres and will be made of impervious, chemically resistant material.

2.8.1.14 Air Emissions

There are a number of emission sources to air from the new project facilities. These comprise flue gas emissions from gas fired power plant, various process pumps, blowers, heaters, compressors, gas turbines, process vents, emissions from storage tanks and truck-loading activities, other fugitive emissions and emissions from the flare during upset or emergency conditions (or in the event that the excess power evacuation infrastructure is not in place at the start of production).

There are no applicable Ugandan air emission standards and the project will use the IFC/World Bank guidelines as the basis of design. These include maximum SO_2, NO_2 and PM_{10} and H_2S emission limits for reciprocating engines, gas turbines and boilers (equivalent to fired heaters). Details are provided in the IFC Project Emission Standards and Ambient Standards and Guidelines. Low NOx burners will be used on all combustion equipment.

Design requirements will also be influenced by recognised ambient air quality guidelines. Ugandan air quality standards are presently in Draft form and the project proposes to use IFC/World Bank guidelines instead, which are based on WHO guidelines to minimise health risks. Modelling of compliance with ambient air quality guidelines will be undertaken as part of the ESIA and is expected to inform design requirements for stack heights of the various discharges to air, among other requirements.

2.8.1.15 Solid Waste

The Project will comply with the Ugandan National Environment (Waste Management) Regulations, S.I. No 52/1999. Reference will also be made the OGP (International Association of Oil & Gas Producers), Guidelines for Waste Management with special focus on areas with limited infrastructure (updated March 2009) as a best practice reference.

The management of solid wastes generated at the CPF is described below. Further details of solid waste management are provided in the CNOOC Waste Management Philosophy (KF-FS-RPT-CPF-SA-0002) and in the Waste Management specialist study undertaken as a part of the ESIA.

The Ugandan Petroleum Waste Management Regulations prohibit the 'treatment' of petroleum waste by the operator. Refer to Section 3 for a discussion about this issue.

2.8.1.15.1 Compliance with the Waste Hierarchy

CNOOC's Waste Management Design Philosophy (2017) commits the company to comply with the key principles underpinning the waste hierarchy, which are, wherever possible, to avoid or reduce the generation of waste (or waste toxicity) at source, and/or to re-use or recycle the waste, before considering disposal options. This philosophy is also enshrined in the Ugandan Waste Management Regulations and in most international waste management standards and guidelines, including those of the IFC/World Bank.

Figure 2-31: The solid waste management hierarchy (OGP, 2009)

2.8.1.15.2 Segregation and Storage

Wastes will be segregated and stored temporarily at designated Waste Collection Points (WCPs) which will operate at the CPF. The WCPs will typically comprise of concrete hardstands, storage containers, secondary containment for hazardous liquid wastes (oil etc.), and provisions to prevent ingress of rain and sunlight, as well as protection measures from fire. Space will be reserved for separate storage containers to store prime recyclables (paper, cardboard, scrap, metal), domestic waste and hazardous waste which require segregation. A Waste Storage Area (WSA) will be determined as the central collection area for all stored waste generated at the CPF and as the transit station for collection by waste contractors for disposal.

Waste streams will be divided into three broad groups:

- recyclable / recoverable;
- general (non-hazardous);
- hazardous (see section 2.8.1.15.3 concerning wastes defined as 'Petroleum Wastes'); and
- Waste will be segregated at source. Once the waste is segregated, the labelled containers will be stored in the WCP area with secondary containment, where necessary. The waste management area will be concrete floored, bunded and roofed to prevent rainfall ingress. The temporary storage area for hazardous wastes will be secured to prevent unauthorized access.

2.8.1.15.3 Petroleum Wastes

Uganda has published Petroleum (Waste Management) Regulations (2019) S.I. No.3 of 2019. . Most hazardous wastes that will be produced at CNOOCs production facility (refer to Table 2.14) will be classified as petroleum wastes and will therefore be subject to the requirements of the Regulations. Regulation 5 (1), (2), (3) requirement of these regulations stipulates the general responsibilities of the licensee and key in the stipulation is that a waste producer (licensee), CNOOC in this case must appoint a separate independent third party petroleum waste handler, which is to be a company licensed by the Ugandan regulator to transport, store, and treat or dispose of petroleum waste in accordance with the Regulations. While the responsibilities of the waste handler are important, they are outside of the scope of this ESIA, which is limited to the management of the waste on site up to the point of transfer of responsibility to the handler transporting the waste.

Table 2.11 is a concise summary of key aspects of the Petroleum (Waste Management) Regulations. Details are included in Specialist Study 5.

Table 2.11: Summary description of key elements of the Petroleum (Waste Management) Regulations

- The Regulations will apply to companies involved in the production, transport, treatment and disposal of petroleum wastes;
- Petroleum wastes include all wastes that are listed in Schedule 2 of the Regulations. The listed wastes include essentially all potentially hazardous wastes that would be generated during drilling and operation of the project including the CPF and on the well pads, including materials that might otherwise be non-hazardous but are potentially oil contaminated. Sewage wastes and non-hazardous wastes that are not contaminated with oil or other oil production contaminants are excluded and would be handled in accordance with the requirements of the *National Environment (Waste Management) Regulations;*
- The licensee must contract a separate entity to be licensed by the Authorities as a petroleum waste handler, to manage the transportation, storage, treatment or disposal of waste arising from petroleum activities or midstream operations. This separate entity may not include any affiliate or subsidiary of the licensee. It is noted that pre-treatment / onsite waste processing a part of the drilling or production process (such as dewatering) is not regarded as ‘treatment’ and will be done by CNOOC, in specific cases, to minimise waste, increase recycling, and reduce transport risks in fulfilment of the waste management hierarchy ,;
- The licensee has a duty of care to ensure that the waste management hierarchy is applied and that options that deliver the least impact to the environment and human health are implemented. Wherever practical, the use of hazardous substances must be avoided or alternative substances used that cause less risk to human health and the environment;
- The licensee shall ultimately remain responsible for petroleum waste managed by the petroleum waste handler
- The waste must be segregated at source (by waste stream classification) and stored for onward handling and transport by the waste transporter. Incompatible wastes may not be stored in the same container. All primary containers for petroleum waste containing hazardous chemicals and substances must be packaged with up-to-date material safety data sheets with directions for handling the waste, including safety precautions. Wastes may not be placed in containers that could in future be used for purposes that could cause health impacts to people or animals;
- Waste storage areas must be designed and built on the basis of a risk assessment and must be within controlled areas. All waste storage areas must be shown on site plans. The quantities temporarily stored may not exceed 1000 kg and logs of all wastes stored must be kept. Waste may be temporarily stored on site for a period of up to 3 months;
- Containers for transportation and storage of hazardous substances must be colour-coded and labelled in accordance with standards approved by the relevant authority and best petroleum industry practices to ensure easy identification;
- Warning signs must be displayed at appropriate distances from presence of hazardous substances in every area where hazardous substances are present or could cause a hazard to a person;
- Leakage or spillage of waste must be quickly and reliably detected and handled, and reported to the licensing authority;

- Records must be kept of all hazardous substances contained at the facility or during petroleum activity including information on physical, chemical and hazardous properties; preventive safety measures and first aid treatment;
- Records of all petroleum wastes must be kept including manifests of wastes delivered to the waste transporter;
- Conditions for reactive or catastrophic events related to liquid or gaseous substances, including fire and explosion, must be minimised. Automated warning and detection systems must be maintained in areas where there is a likelihood of exposure to a hazardous substance; and
- Continual improvement of waste management practices shall be demonstrated as technology advances.

2.8.1.16 Permanent Staff and Accommodation

The permanent accommodation camp for CPF operational staff will be situated west of the airstrip near the drilling camp (Figure 2-32). Utilities for the two camps will be rationalised. A total permanent staff compliment of 120 people will operate the CPF.

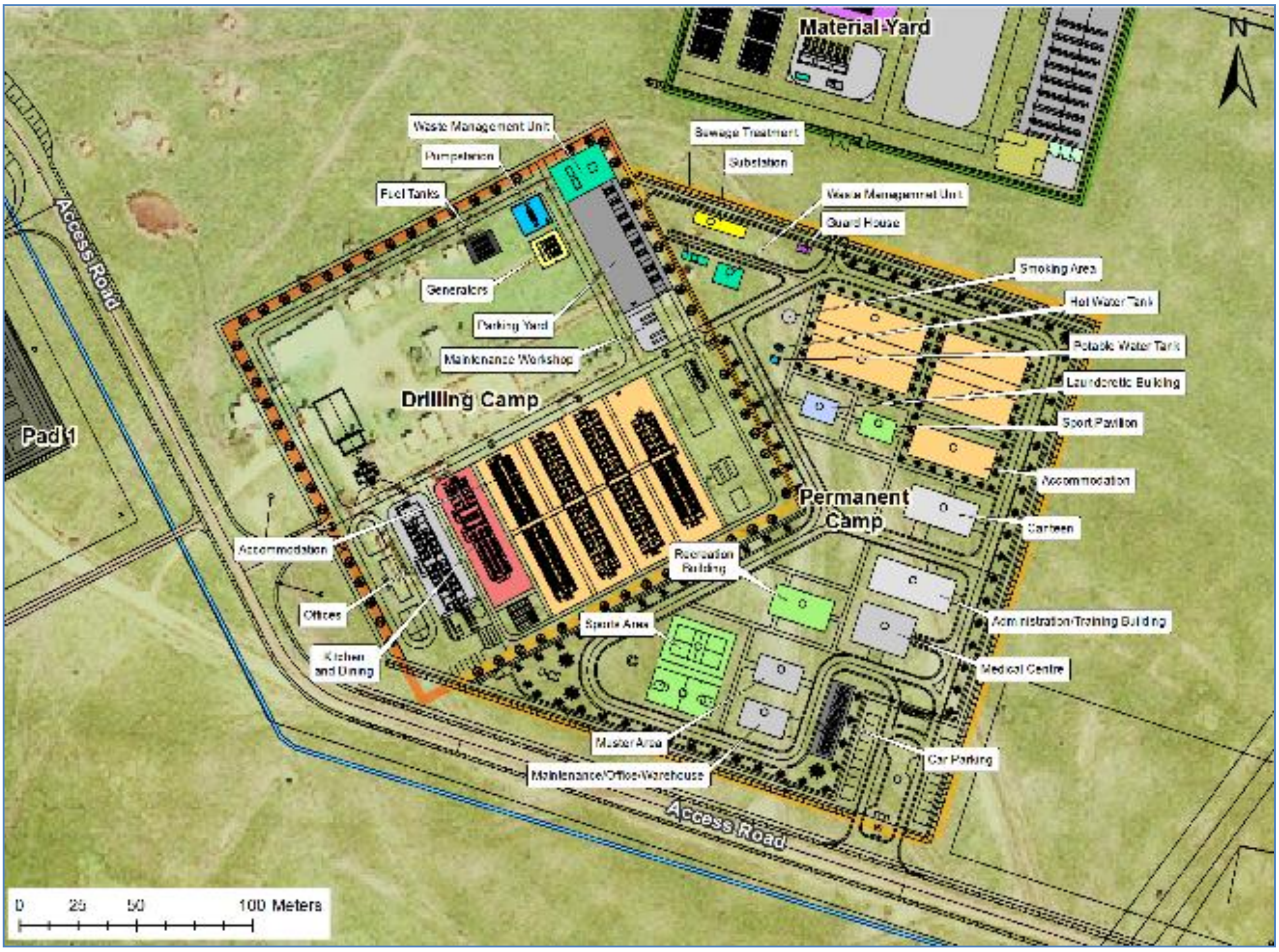


Figure 2-32: Permanent camp at the CPF

2.8.1.17 Supporting Facilities and Infrastructure

Facilities and infrastructure in support of the project include in-field access roads, a jetty, a helipad, a material yard (supply base) and a safety check station.

2.8.1.17.1 Access Roads

The location of project infield access roads is shown in Figure 2-1. Access to the project area will be from the recently constructed escarpment road, which is tarred. This road connects to the infield access roads to the drilling camp and to well pads 1 and 2, which were permitted and completed to support the appraisal drilling. An existing track built by Heritage Oil, which will be upgraded by CNOOC, leads to well pad 3. The road to well pad 4A will be built in advance of the first drilling on the well pad, estimated to start in 4 years after the production of the first oil from the field.

2.8.1.17.2 Jetty

The jetty was constructed in 2006 by Heritage Oil & Gas (Uganda) Limited to facilitate Kingfisher-1 exploration well drilling operations. It was located next to the Bugoma drilling camp in Kyabasumbu village. In 2014, it was rehabilitated to facilitate the movement of CNOOC personnel, materials and equipment during the appraisal drilling for the project (Figure 2-1). For the development and production phases, most equipment and supplies will be brought in by road, but the jetty will still be used to support marine security surveillance on the lake, emergency response such as oil spill response on the lake and as an alternative support evacuation route to the existing access road.   Helipad (and conversion of the airstrip to a materials lay down area)

An airstrip suitable for light air craft was established in 2006 by Heritage Oil and Gas Limited to support exploration drilling in KFDA. The facility was upgraded from grass to gravel in 2013 to facilitate landing of light fixed wing planes used for crew change and delivery of light weight supplies during drilling. It will be used during the construction phase. Due to safety considerations and the limited expected usage of the airstrip during the operational phase, it will be converted into a materials lay down area. The location of the helipad is still to be determined but will take into consideration access, security and to ensure that the final location is a safe distance from major project infrastructure.

2.8.1.17.3 Materials Yard (Supply Base)

The supply base was built in 2013 to support the appraisal drilling and it will be maintained as a permanent supply facility throughout the production phase. It is 3.7 ha in extent (200 m x 185 m), situated west of the airfield and north of the drilling camp. It includes an assembly area, contractors' materials area, warehouse, material inspection and preparation area, casings area, chemical shed, parking and other minor use areas. Topsoil and overburden has been stockpiled for future use during site restoration.

The layout of the materials yard is shown in Figure 2-33 below.

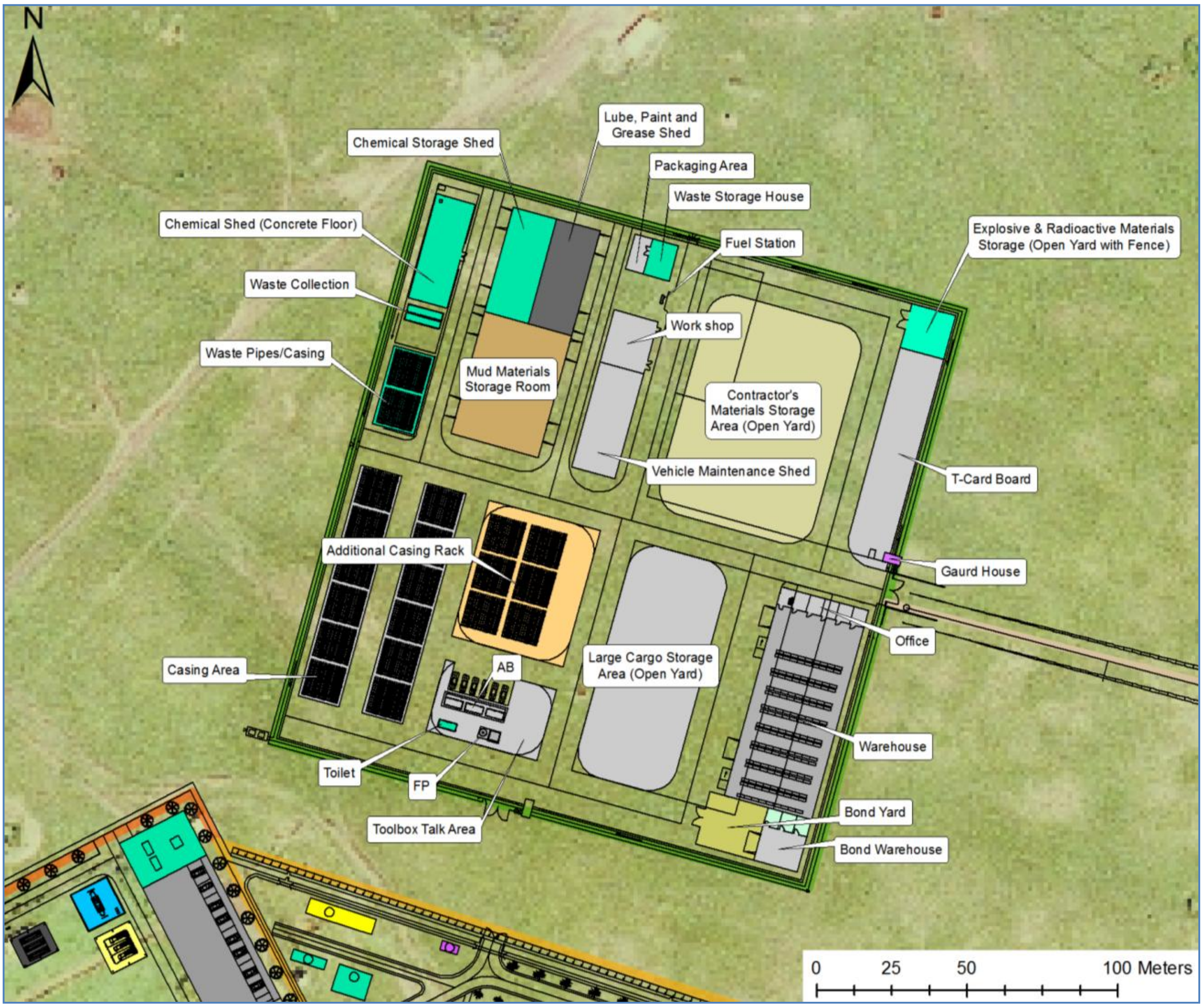


Figure 2-33: Layout of a typical materials yard (illustrative only)

2.8.1.17.4 Safety Check Station

This facility will enable safety and security checks for inbound and departing vehicles transporting equipment materials and passengers to and from the KFDA. Additionally, the safety check station will facilitate minor vehicle repairs and tyre changes. It will be built at the top of the existing escarpment road at the location of the former CCCC Camp (coordinates: X 251,494.3 and Y 135,619.4) approximately 2 km from the CPF (straight line distance).

The Safety Check Station will cover an area of 3,750m^2, and will include:

- parking area (10 long vehicle parking lots);
- flushing area (2 lots);
- guardhouse/duty room;
- diesel generator room;
- rest rooms (4 rooms)
- toilets (4 units)
- oil water pit;

- wastewater pit; and
- septic tank
- 2 main gates
- 3 pedestrian emergency gates
- perimeter drain
- perimeter fence

Electrical power for the safety check station shall be provided from the CPF via an 11 kV underground power cable. A 11/0.4 kV substation will be located in this area to provide power for via utilization at 400 V. As an alternative, a solar power system will be considered to provide power for safe check station. Air conditioning will be provided for the guardhouse.

The station will include the following communication systems:

- Closed Circuit Television System (CCTV)
- Telephone System
- Public Address and General Alarm system (PAGA)
- Access Control System

Utility water will supplied by truck from the CPF, and stored in a 2.5 m^3 overhead plastic tank. The tank is capable of providing 2 to 4 days' worth of water. Water for the flushing device, toilet and hand wash station will be supplied by gravity from the overhead water tank through a distributing piping network.

Flushing water will flow to the wastewater pit (2 m x 1 m x 1.3 m). The pit will have two sections to enable one section to be cleaned out while the other section is on-line. Each section of the pit will have a rectangular shape with the solid being introduced at one end, at the other end of the pit section will be a weir over which settled water will flow into the clean water sump. From here the water will be pumped to the 1 m^3/h flushing water treatment and recycle unit, and then reused for flushing vehicle tyres.

The effluent from septic tank will be taken to a 2m^3 holding tank, and then transferred by dung-cart to the drilling camp sewage treatment package for further treatment.

Portable and wheeled fire extinguishers shall be provided at strategic points to deal with small outbreaks of fire.

2.8.2 Construction Phase

2.8.2.1 General

The construction phase of the CPF and supporting infrastructure will involve the following general activities:

- Clearing, levelling and terracing;
- Foundations and civil construction works;
- Installation of Equipment;
- Electrical and other tie ins; and
- Commissioning and testing of plant and equipment.

The construction sites will involve a multitude of activities. Cranes, excavators, bulldozers, heavy vehicles, vibrating rollers, and a wide range of other mechanical and hand-operated equipment will be used. Most of the activity will be restricted within defined work areas, the principal of these being the CPF and permanent camp, as well as ancillary work areas which will include the temporary (EPC) camp, road construction sites (not already completed), the infield flowlines, the water intake station, the jetty (upgraded), the safety check station above the escarpment and the supply base. Materials laydown will, to the extent possible, take place within the construction footprint of the CPF and associated infrastructure. Should additional space be required for lay down areas, equipment parking et cetera this will take place within the buffer areas surrounding these facilities within land already acquired by CNOOC. The final and configuration of the site support areas during construction will be agreed between CNOOC and the EPC contractor, within the limits described above.

During the construction phase there will be three borrow pit areas which will be located to the south and north of the tar road onto the Buhuka flats at the point that the road turns onto the floor of the flats. The third borrow pit will be located at the foot slope of the escarpment on the southern side of the Kamansiniga River (coordinates and footprint shown in Table 2.12). This site and the borrow pit to the south of the tar road were both used during previous construction on the Buhuka Flats. The site to the north of the tar road is a new site. These areas will be used both for borrow of material for construction and road development and for the disposal of excess material that may result from preparation of the construction terrace for site infrastructure. These will be natural materials. No contaminated material or construction waste will be disposed of at these sites.

Table 2.12: Borrow pit locations

No.	Facility	Coordinates (WGS 84-36N)		Area (m^2)
		Easting	Northing	
1	Borrow and Disposal Area 1	250322	138407	15,000
		250463	138520	
2	Borrow and Disposal Area 2	250379	138643	22,500
		250585	138737	
3	Borrow and Disposal Area 3	249784	136493	75,000
		250158	136693	

2.8.2.2 Geotechnical investigations on site

A detailed geotechnical investigation will be performed on the site of the CPF, the well pads, the permanent camp, infield pipelines water intake station feeder line and other supportive infrastructure. This will be to provide final input for preconstruction design.

Field investigation work will include the following: site survey and positioning, core drilling and sampling, Pisa metric groundwater testing, in situ test pits et cetera

During these site tests fresh water or bentonite slurry may be used for drilling purposes. The contractor shall provide suitable containers to collect all the samples and soil materials. No contaminated soil will be stockpiled on site. After site tests have been completed any open pits or holes will be backfilled with native soil material or a cemented slurry.

2.8.2.3 Construction Personnel

From 1,000 up to 2,000 personnel (including 200 day workers) are expected be employed at peak times during the construction phase. Employment will be over a 34-month period. CNOOC has a local labour policy and currently employs as much unskilled labour from the local area. This practice is expected to persist. Personnel (casual workers) from the local area will live at home and will not be accommodated in the construction camp.

2.8.2.4 Temporary Camp

The temporary camp will accommodate the EPC personnel responsible for the construction of the CPF, well pads and supporting infrastructure. It will be located immediately north of the CPF, straddled across the access road (see Figure 2-1). An initial camp will be provided at the start of the project for the site enabling and early works, to be extended as construction progresses and the workforce increases.

The proposed camp layout is illustrated in Figure 2-34. The camp is designed to accommodate roughly 800 personnel although these numbers will only be finalised by the EPC contractor. The balance of employees will be day workers brought into site.

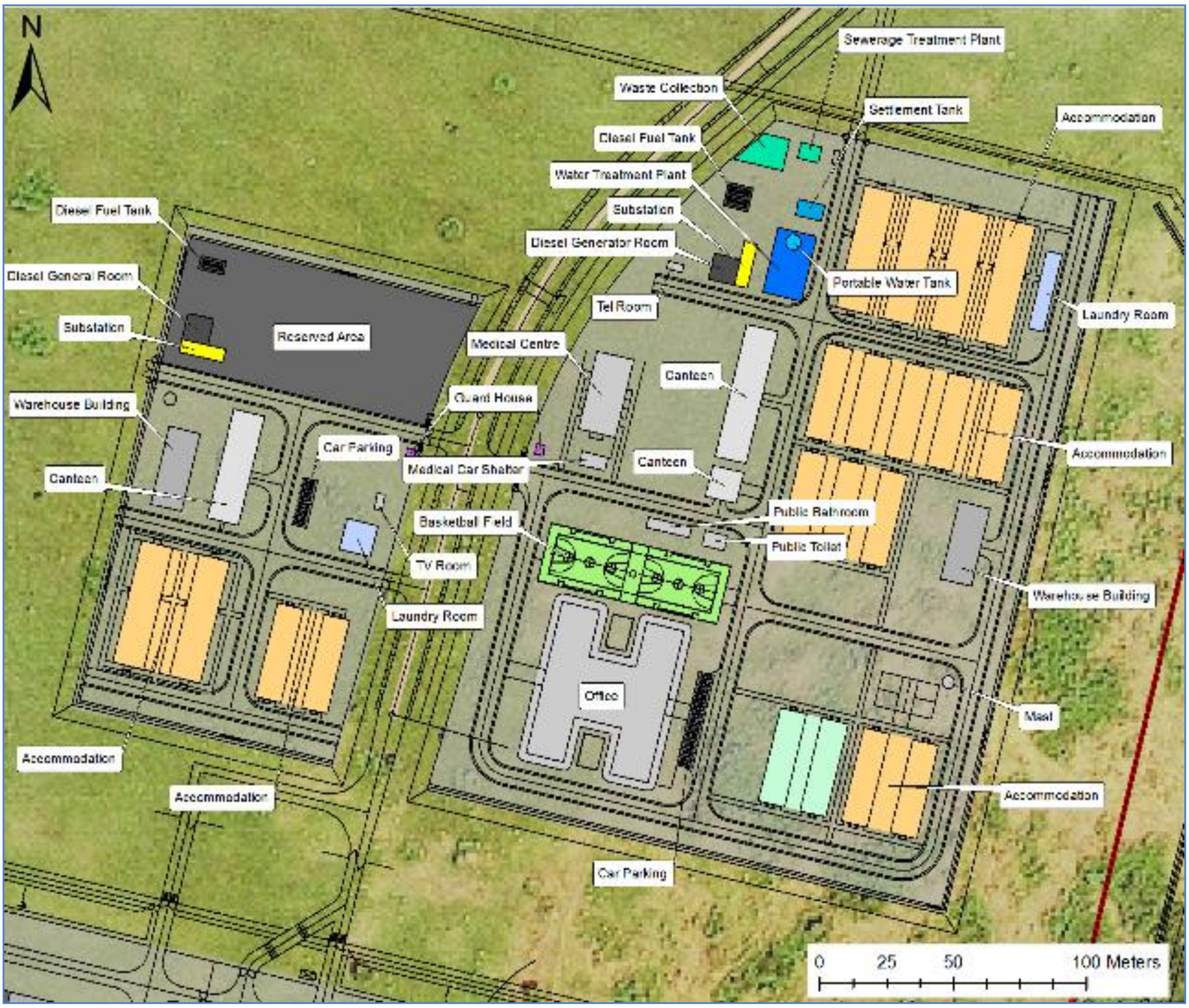


Figure 2-34: Temporary camp for accommodation of EPC Contractor

The temporary construction camp will provisionally include:

- Air-conditioned accommodation of varying grades with ablution facilities;
- Staff canteen facility (with food and drink storage facilities);
- Laundry facilities;
- Sick bay and first aid medical facility;
- Recreational & sports facilities (indoors and outdoors);
- Communication facilities;
- Area flood lighting;
- Camp office warehouse and maintenance facility;

- Diesel generator for electrical generation;
- Electrical transformer, switchgear, and distribution system;
- Stand-by emergency diesel powered electrical generation;
- Potable water production and storage facilities;
- Sewage treatment plant;
- Security gatehouse and fencing;
- Internal access roads, footpaths and parking areas;
- Fuel station;
- Vehicle maintenance workshop and wash bay;
- Fire station, fire detection and fire-fighting system;
- Waste storage and packing area;
- Emergency alarm system and PA system;
- Smoking area;
- Training room; and
- Personnel on Board (POB) and accommodation management system and access control system.

The temporary camp will be fully sewered, with a provisionally estimated treatment capacity of 300 $m^{3/}$day. Raw sewage will be delivered to a sewage treatment plant at the camp. The capacity of the plant will be sized to meet peak construction demands and to comply with the effluent discharge requirements of the Ugandan Government and IFC. Decisions about redundancy and modularization of the plant will be influenced by the ESIA.

2.8.2.5 Domestic Wastewater

The temporary camp will be fully sewered, with a provisionally estimated treatment capacity of 300 $m^{3/}$day. Raw sewage delivered to a sewage treatment plant at the camp. The capacity of the plant will be sized to meet peak construction demands and to comply with the effluent discharge requirements of the Ugandan Government and IFC. Decisions about redundancy and modularization of the plant will be influenced by the ESIA.

2.8.2.6 Solid Waste

The EPC contractor will be required to comply with Ugandan Waste Regulations and IFC waste management guidelines, which encompass the principles of the waste hierarchy, described in Section 2.8.1.15 above. Waste generation and waste disposed to landfill will be minimised. All re-usable and recyclable waste will be separated at source from waste destined for disposal to landfill. Waste will be labelled and stored in covered temporary storage areas, for collection by a third party contractor.

2.8.2.6.1 Non Hazardous Waste

Based on previous waste characterisations done in the CNOOC Kingfisher Field Development Area (KFDA), it is expected that the relative composition of the different non-hazardous solid wastes generated in the KFDA will approximately be as shown in Table 2.13.

Table 2.13: Expected non-hazardous solid waste generated during the construction phase of the CPF

Waste Type	Estimated Composition
Food and vegetable wastes	43%
Plastics	27%
Paper /packaging	20%
Metal	4%
Glass	1%
Rubber	1%

Waste Type	Estimated Composition
Wood	1%
Miscellaneous wastes **	3%

**e.g. insulation, used tyres, used parts, hoses, textile and leather, construction and demolition materials

No waste will be incinerated on site.

2.8.2.6.2 Waste generation per facility

Table 2.14– Table 2.22 shows the anticipated composition and quantity of waste generated during drilling, construction and operation of the CPF, Well pad, security check, temporary & permanent camp and that from the supply base. Details of hazard ratings will be provided in the specialist study on waste undertaken for the ESIA.

Table 2.14: Production wastes generated at the CPF during the Construction & Operational phase

Waste Type	Activity / Source	Potential Contaminants	Mass per year (t/y)	Mass per year (t/y)
Contaminated soil/hydrocarbon bearing soil	Spill/leaks	Hydrocarbons, heavy metals, salts, treating chemicals	5	-
Pigging sludge	Pipeline cleaning operations	Hydrocarbons, solids, production chemicals, phenols, aromatics	10	-
Waste oil sludge (from produced water treatment)	Produced water treatment system	Hydrocarbons	200	-
Produced sand	Removal from well fluids	Hydrocarbons	145	-
Pipe scale, hydrocarbon solids, hydrates, and other deposits	Cleaning piping and equipment	Hydrocarbons, heavy metals	20	-
Solid wastes generated by crude oil and tank bottom reclaimers	Separation tank sediments	Hydrocarbons, solids, production chemicals, phenols, aromatics	5	-
Empty chemical drums, drum rinsate and containers	Chemical injection, water treatment, cleaning agents	Heavy hydrocarbons, solvent	65	5.5
Cement slurries	Cement slurries	Heavy metals, thinners, viscosifiers, pH, salts	5	1300
Paint materials	Unused paints, used thinners	Heavy metals, solvent, hydrocarbons	0.5	1.5
Maintenance wastes	Sandblast (grits)，greases, fuel oils, filters, paint scale	Heavy metals, hydrocarbons, solids, solvents	5	1.2
Industrial waste	Batteries, transformers, Capacitors	Acid, alkali, heavy metals, PCBs	3	0.5

Scrap metals	Used piping, cables, drums, casing etc.	Heavy metals, scales	2	2.5
Sewage sludge	Domestic water treatment	Pathogens	8	0.5

Table 2.15: Non-hazardous waste generated at the CPF during the operational phase (including wastes from the permanent camp)

Waste Type	Activity (Source)	Mass per year (t/y)	Recycling / Disposal
Plastic	Bottles, waste packings		Mostly recycled
Paper / packaging	Packaging, office paper waste		Recycled
Wood	Packaging		Recycled
Rubber	Vehicle tyres		Recycled
Glass	Bottles		Recycled
Food and vegetable waste	Kitchens		Composted
Metal	Cold drink cans, processed food, other non-hazardous products, electrical metal scrap		Steel disposed to landfill. Aluminium recycled. Copper recycled
Miscellaneous	General office and personnel camp scrap		Disposed to landfill

Table 2.16: Wastes generated at the CPF during the decommission phase

Type of waste	Possible environmentally significant constituents	Quantity (average per year)**
Contaminated soil/hydro carbon bearing soil	Hydrocarbons, heavy metals, salts, treating chemicals	32450 tons
Pigging sludge	Hydrocarbons，solids, production chemicals, phenols, aromatics	5 tons
Waste oil sludge (from produced water treatment)	Hydrocarbons	12 tons
Produced sand	Hydrocarbons	-
Pipe scale, hydrocarbon solids, hydrates, and other deposits		15 tons
Solid wastes generated by crude oil and tank bottom reclaimers	Hydrocarbons，solids, production chemicals, phenols, aromatics	-
Emptied chemical drums	heavy hydrocarbon, solvent	10 tons
Cement slurries	Heavy metals, thinners, viscosifiers, pH, salts	139880 tons
Paint materials	Heavy metals, solvent, hydrocarbon	-
Maintenance wastes	Heavy metals, hydrocarbons, solids, solvents	-

Type of waste	Possible environmentally significant constituents	Quantity (average per year)**
Industrial waste	Acid, alkali, heavy metals, PCBs	-
Scrap metals	Heavy metals, scales	8230 tons
Drums, drum rinsate and containers		25 tons
Domestic sewage	BOD, solids, detergent, coliform bacteria	-

Table 2.17: Wastes estimate to be generated at the Supply base

Type of waste	Possible environmentally significant constituents	Quantity (per year)**
Cement slurries	Heavy metals, thinners, viscosifiers, pH, salts	390t/y
Paint materials	Heavy metals, solvent, hydrocarbon	0.8t/y
Maintenance wastes	Heavy metals, hydrocarbons, solids, solvents	7.0t/y
Industrial waste	Acid, alkali, heavy metals, PCBs	12t/y
Scrap metals	Heavy metals, scales	5.0t/y
Drums, drum rinsate and containers	-	2.5t/y
Domestic sewage	BOD, solids, detergent, coliform bacteria	1.5t/y

Table 2.18: Waste estimate to be generated during drilling (Well Pad 1, 2, 3, 4A)

Type of waste	Possible environmentally significant constituents	Quantity (per well)**
Drill Cuttings (aqueous)	Hydrocarbons, heavy metals, salts, treating chemicals	205 m^3
Drill Cuttings (Synthetic))	-	422 m^3

Table 2.19: Waste estimate to be generated during well pad construction & Operation

Type of waste	Possible environmentally significant constituents	Quantity (total per well) construction (t/y/well)	Quantity (total per well) operation (t/y/well)
Well Pad 1, 2, 3, 4A			
Contaminated soil/hydro carbon bearing soil	Hydrocarbons, heavy metals, salts,treating chemicals	-	0.1
Pipe scale, hydrocarbon solids, hydrates, and other deposits	-	-	0.02
Emptied chemical drums	heavy hydrocarbon, solvent	-	0.01
Cement slurries	Heavy metals, thinners, viscosifiers, pH, salts	4t/y/well	-
Paint materials	Heavy metals, solvent, hydrocarbon	0.02t/y/well	-
Maintenance wastes	Heavy metals, hydrocarbons, solids, solvents	0.025t/y/well	0.025
Industrial waste	Acid, alkali, heavy metals, PCBs	0.05t/y/well	0.05
Scrap metals	Heavy metals, scales	0.03t/y/well	0.03
Drums, drum rinsate and containers	-	0.05t/y/well	0.05
Produced sand	Hydrocarbons	-	0.02
Domestic sewage	BOD, solids, detergent, coliform bacteria	-	-

Table 2.20: Waste estimate to be generated at the temporary camp

Type of waste	Possible environmentally significant constituents	Quantity (Total Construction Phase)**
Cement slurries	Heavy metals, thinners, viscosifiers, pH, salts	910t/y
Paint materials	Heavy metals, solvent, hydrocarbon	1.0t/y
Maintenance wastes	Heavy metals, hydrocarbons, solids, solvents	4.5t/y

Type of waste	Possible environmentally significant constituents	Quantity (Total Construction Phase)**
Industrial waste	Acid, alkali, heavy metals, PCBs	10t/y
Scrap metals	Heavy metals, scales	25t/y
Drums, drum rinsate and containers	-	2.0 t/y
Domestic sewage	BOD, solids, detergent, coliform bacteria	350t/y

Table 2.21: Waste estimate to be generated at the permanent camp

Type of waste	Possible environmentally significant constituents	Quantity (per year)**
Cement slurries	Heavy metals, thinners, viscosifiers, pH, salts	550t/y
Paint materials	Heavy metals, solvent, hydrocarbon	0.6t/y
Maintenance wastes	Heavy metals, hydrocarbons, solids, solvents	0.5t/y
Industrial waste	Acid, alkali, heavy metals, PCBs	2t/y
Scrap metals	Heavy metals, scales	3.5t/y
Drums, drum rinsate and containers	-	1.5t/y
Domestic sewage	BOD, solids, detergent, coliform bacteria	8t/y

Table 2.22: Waste estimate to be generated at the Safety Check Station

Type of waste	Possible environmentally significant constituents	Quantity (per year)**
Cement slurries	Heavy metals, thinners, viscosifiers, pH, salts	10.0t/y
Paint materials	Heavy metals, solvent, hydrocarbon	0.2t/y

Type of waste	Possible environmentally significant constituents	Quantity (per year)**
Maintenance wastes	Heavy metals, hydrocarbons, solids, solvents	0.5t/y
Industrial waste	Acid, alkali, heavy metals, PCBs	1.0t/y
Scrap metals	Heavy metals, scales	0.6t/y
Drums, drum rinsate and containers	-	1.0t/y
Domestic sewage	BOD, solids, detergent, coliform bacteria	3.0t/y

2.8.2.7 Electricity Supply

Electricity will be supplied by diesel generator. The diesel generator in the temporary camp will be used as the backup generator once power is supplied from the CPF during the operational phase.

2.9 Feeder Pipeline to Kabaale[5]

2.9.1 Overview

Stabilised crude oil will be transported from the CPF storage tanks to a delivery point near Kabaale, via an underground pipeline. The Ugandan Government proposes to build a refinery at Kabaale which will serve as a hub for all of the oilfield developments along Lake Albert.

2.9.2 Design and Operational Phase

2.9.2.1 Location

Figure 2-35 shows the general location of the pipeline. It leaves the battery limits of the CPF on the east side of the plant, turning northward to the base of the escarpment at around KP1.5, where it turns directly east up the escarpment. The average gradient in this section of the route is 1:3 (Vertical: Horizontal), rising from roughly 650 amsl. to 1040 amsl. within a horizontal distance of 740 m. From this point, the pipeline is routed north eastward in gently undulating terrain, extensively cultivated and interspersed with rural settlement. The route passes south east of Hohwa and Kaseeta villages at KP 29 and KP 32 respectively. At KP 44, the route passes immediately north of the planned Kabaale Airport, and then turns eastward to the terminal point at the proposed Kabaale Refinery.

The total length of the pipeline is 46.2 km. Figure 2-34 to Figure 2-44 provide detailed mapping of the route, showing adjacent land use and settlement in proximity to the pipeline.

[5] During the course of the ESIA, the naming conventions have changed. What was previously referred to as the export pipeline is now called the feeder pipeline. This terminology has been corrected throughout the main ESIA report but has not been changed in the Specialist Reports

Figure 2-35: Location of the feeder pipeline

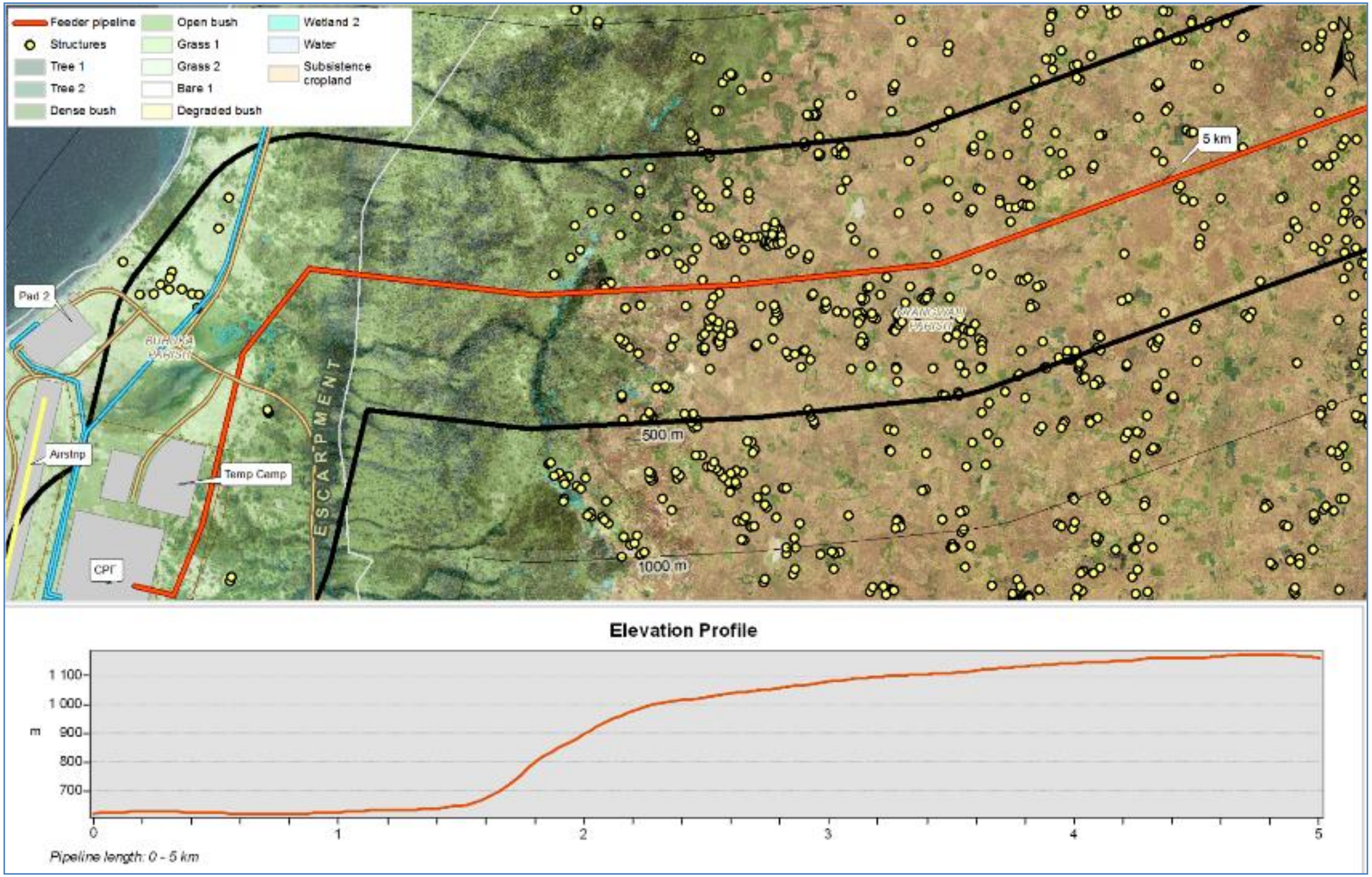


Figure 2-36: Pipeline route detail – 0 to 5 km

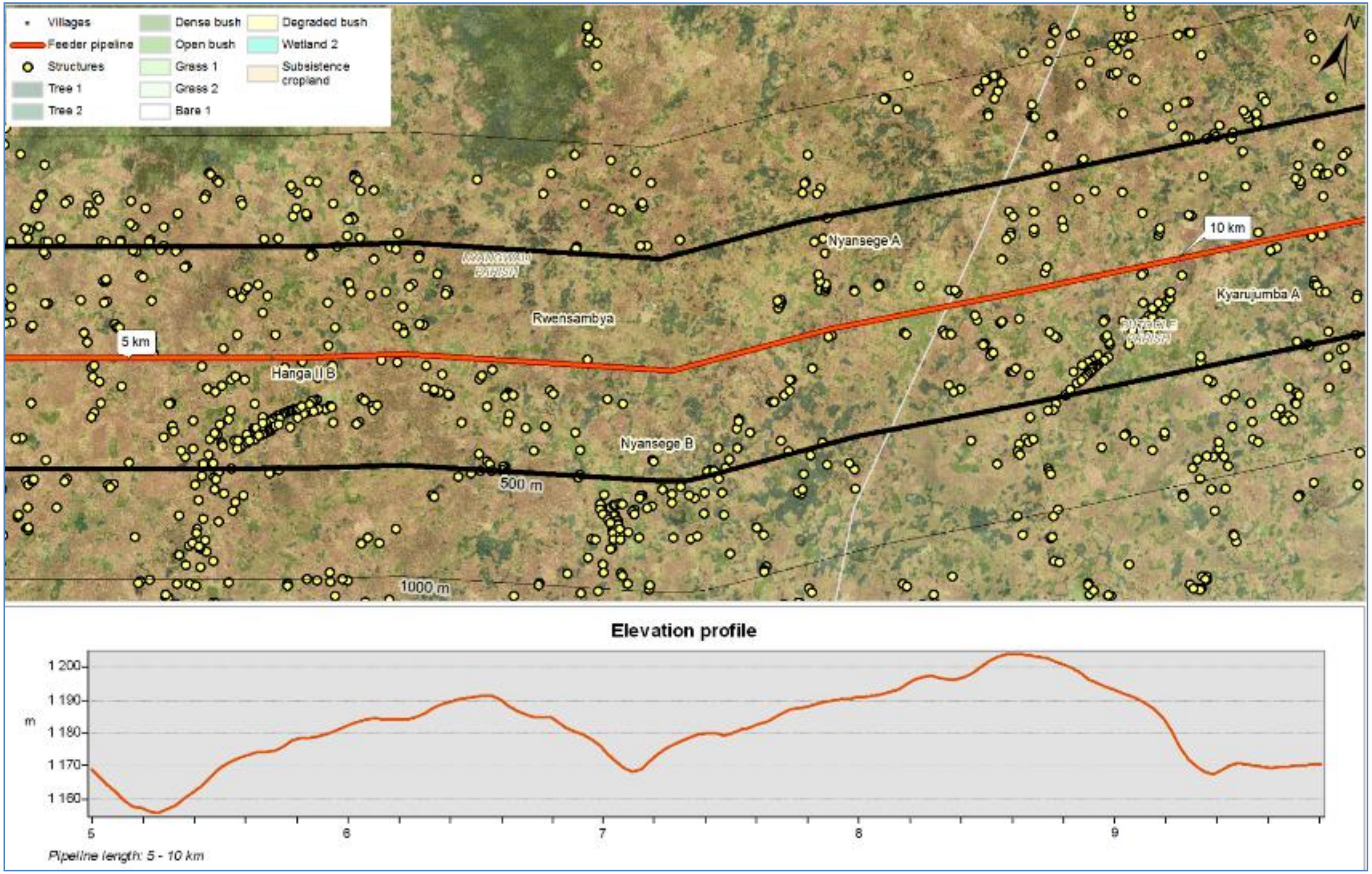


Figure 2-37: Pipeline route detail – 5 to 10 km

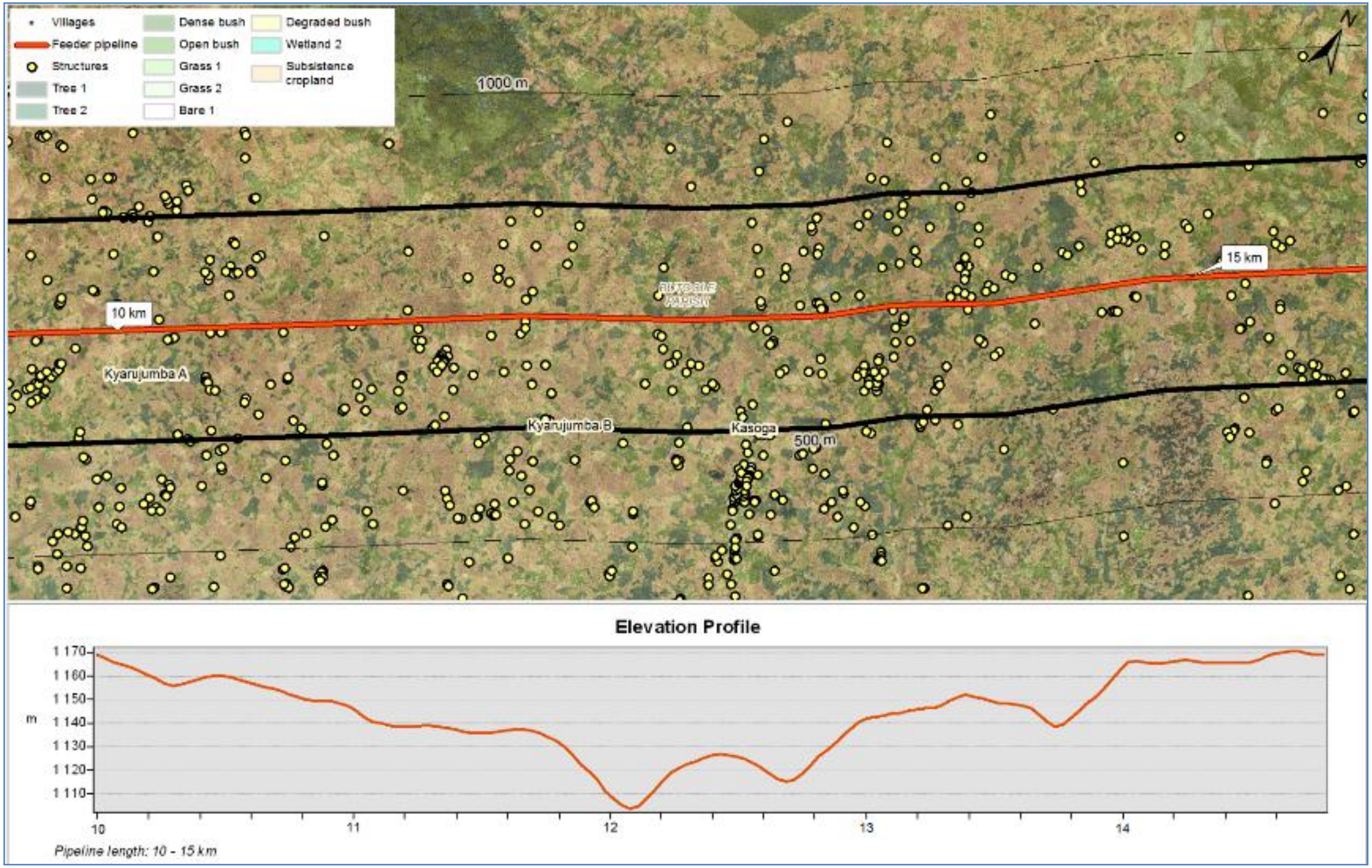


Figure 2-38: Pipeline route detail – 10 to 15 km

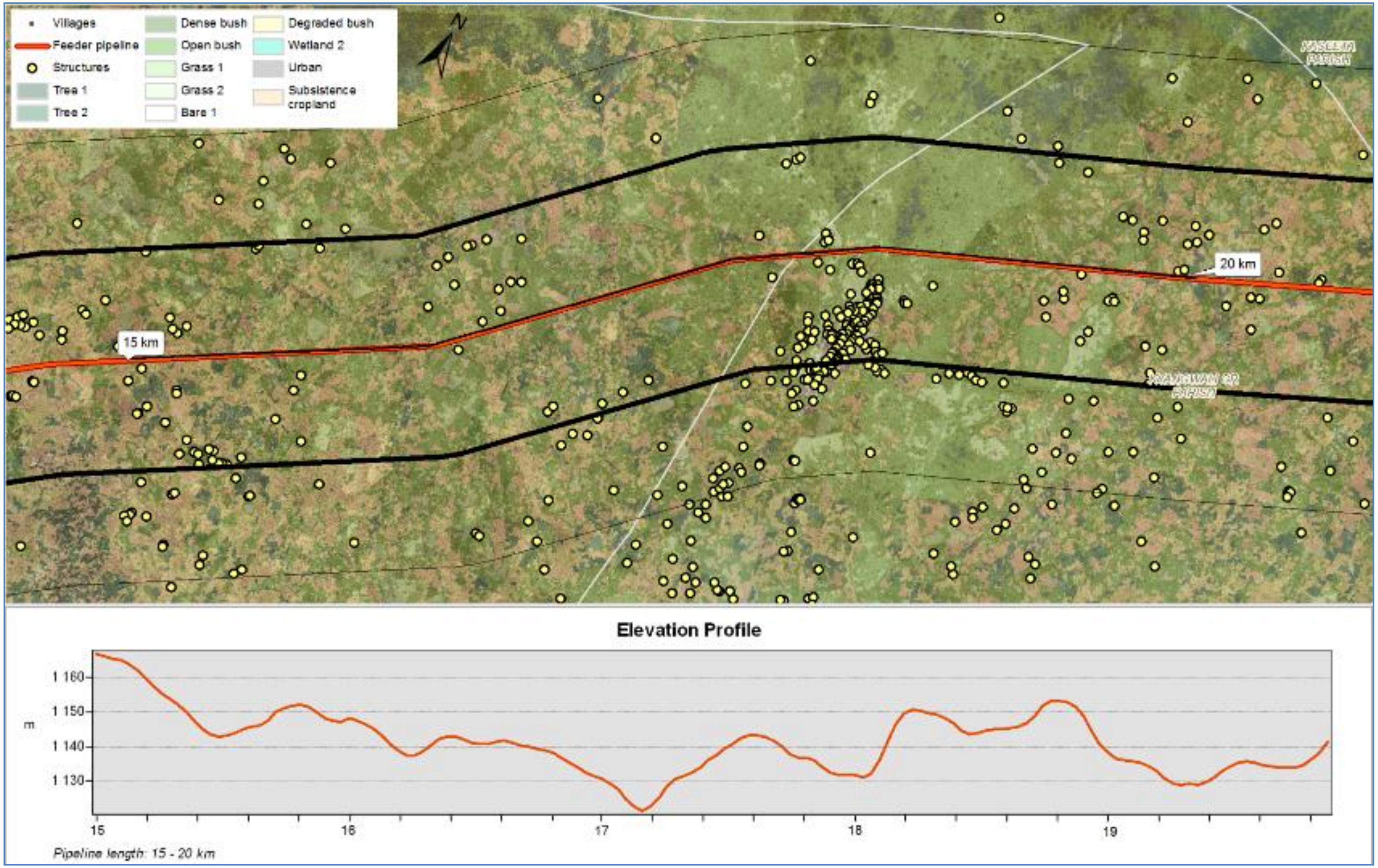


Figure 2-39: Pipeline route detail – 15 to 20 km

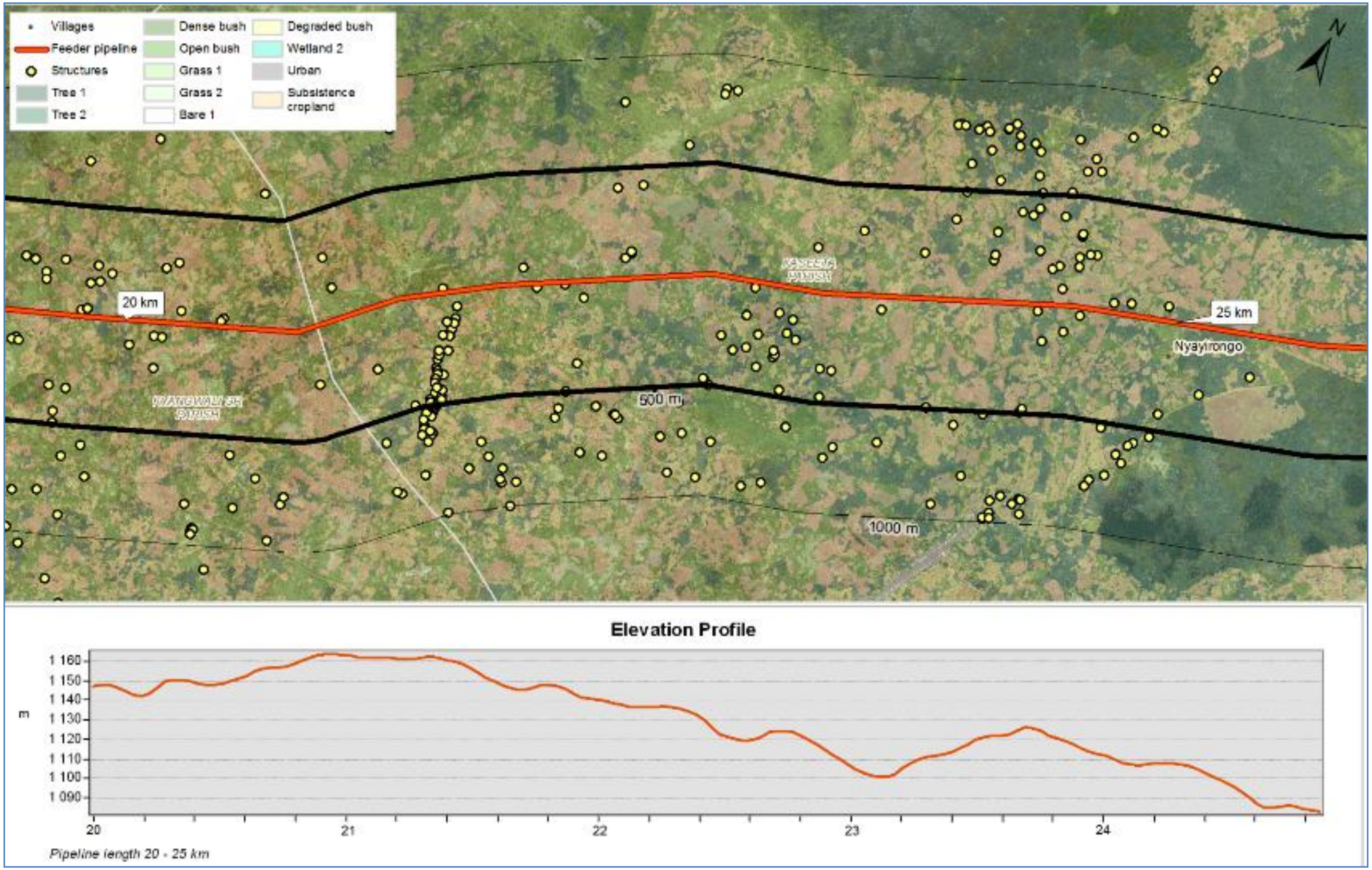


Figure 2-40: Pipeline route detail – 20 to 25 km

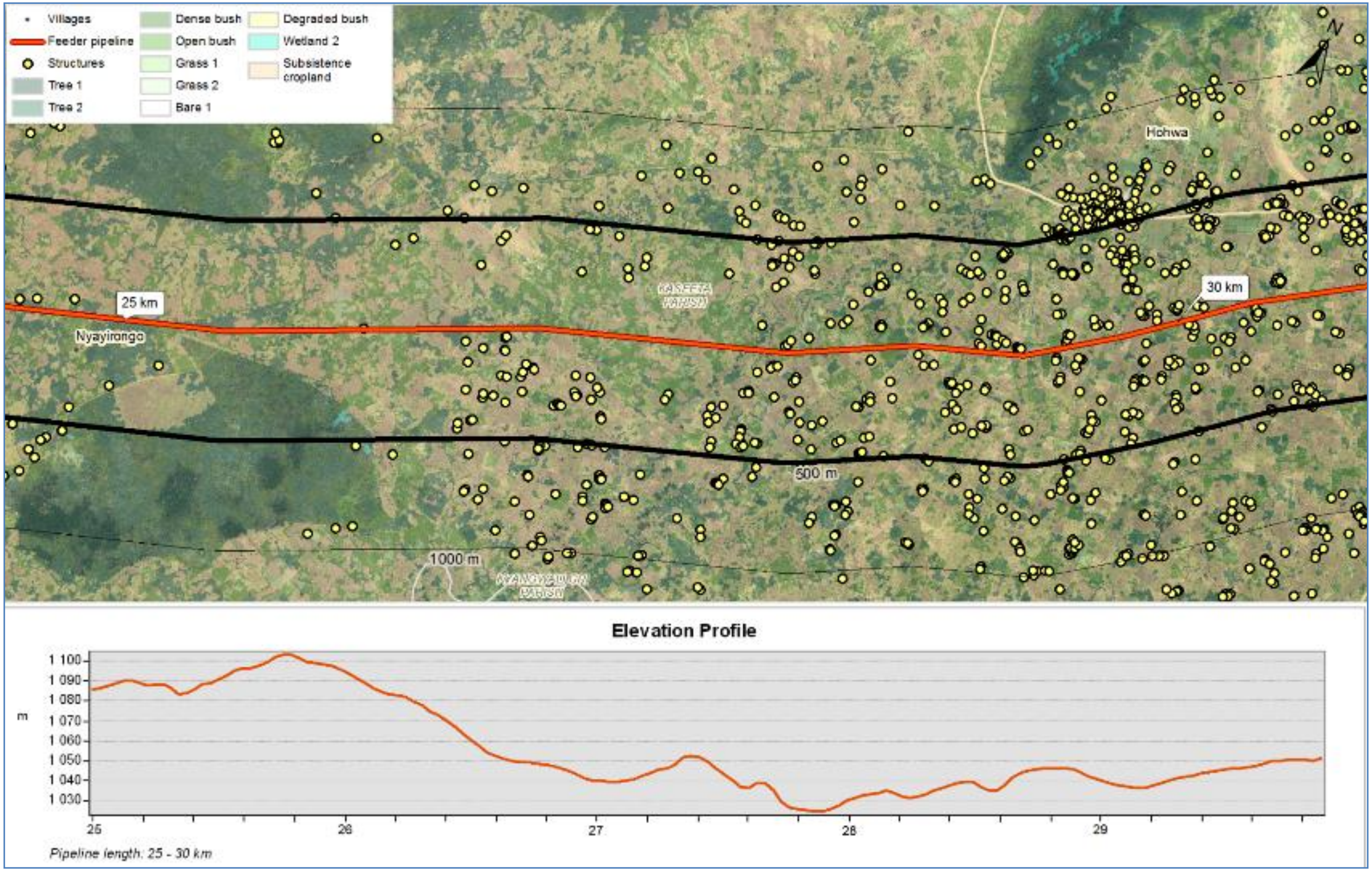


Figure 2-41: Pipeline route detail – 25 to 30 km

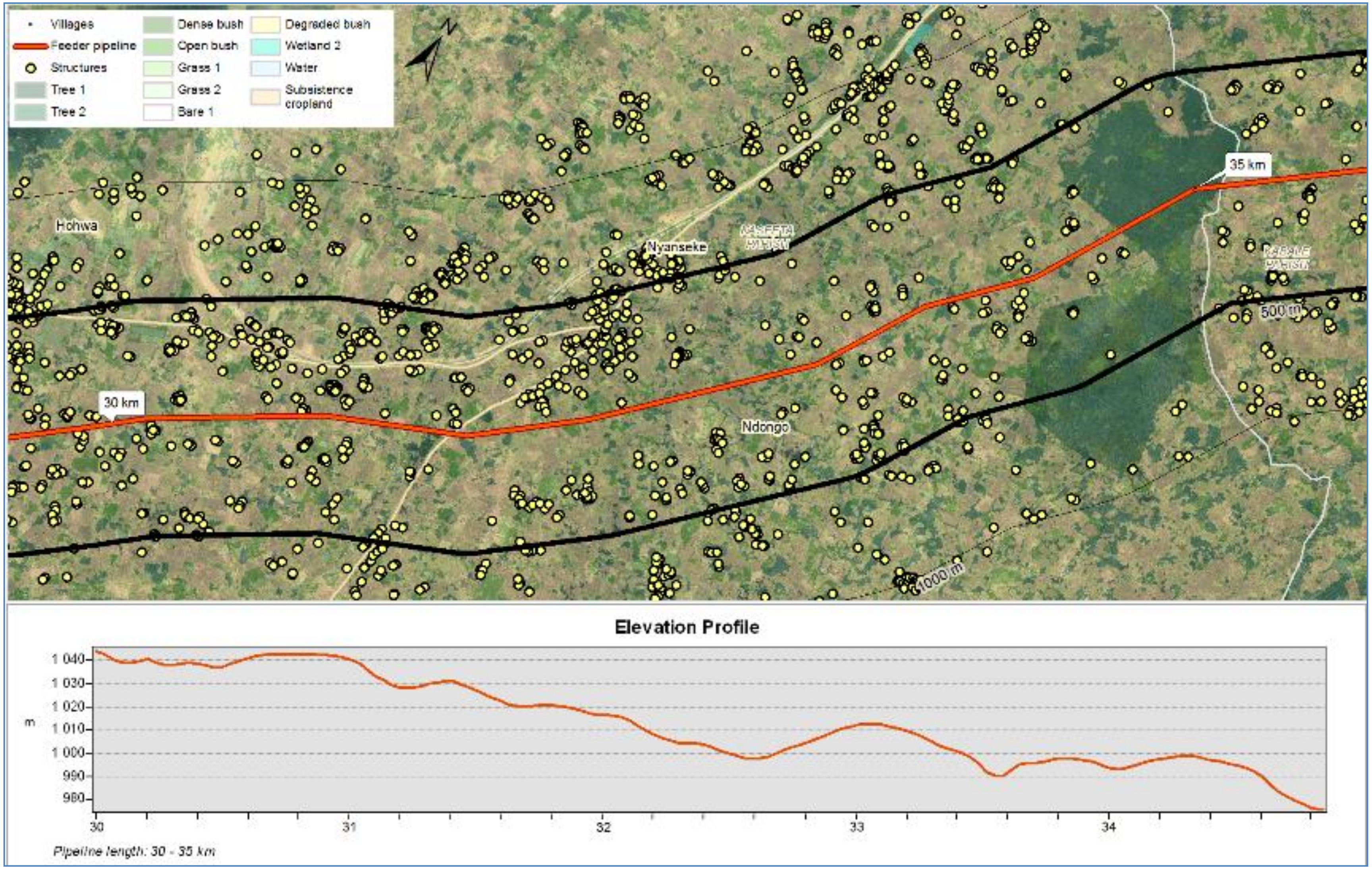


Figure 2-42: Pipeline route detail – 30 to 35 km

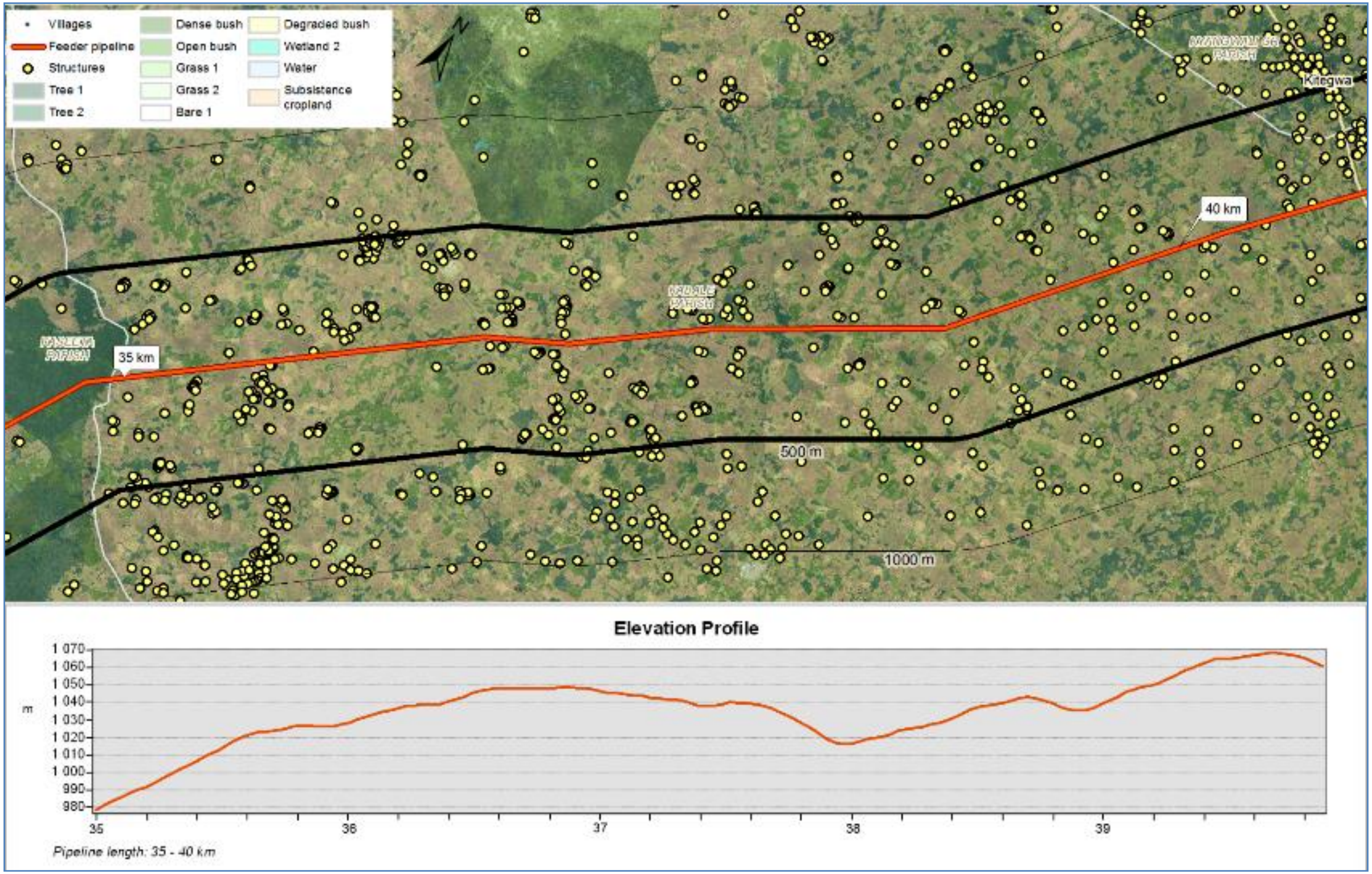


Figure 2-43: Pipeline route detail – 35 to 40 km

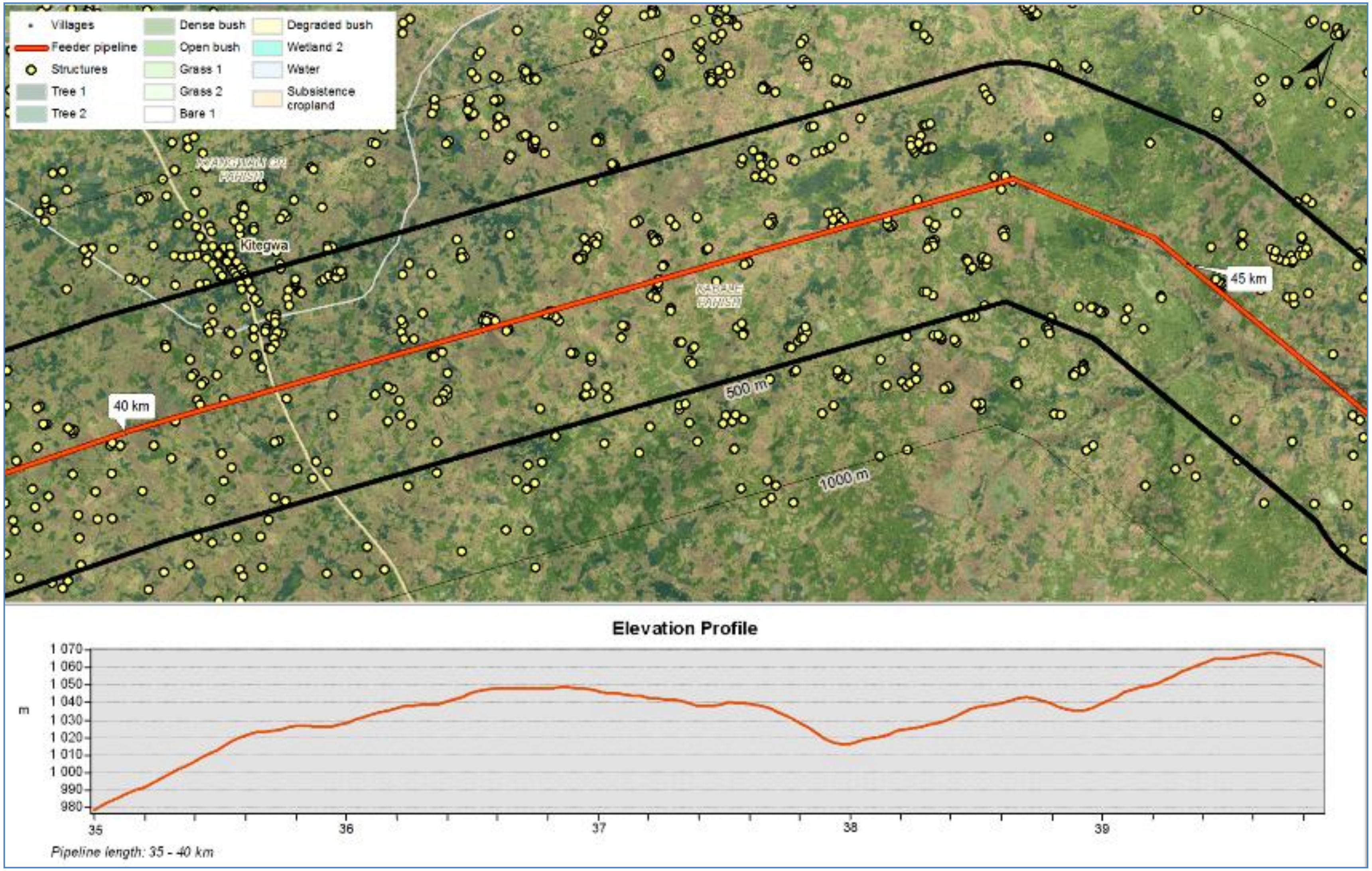


Figure 2-44: Pipeline route detail – 40 to 45 km

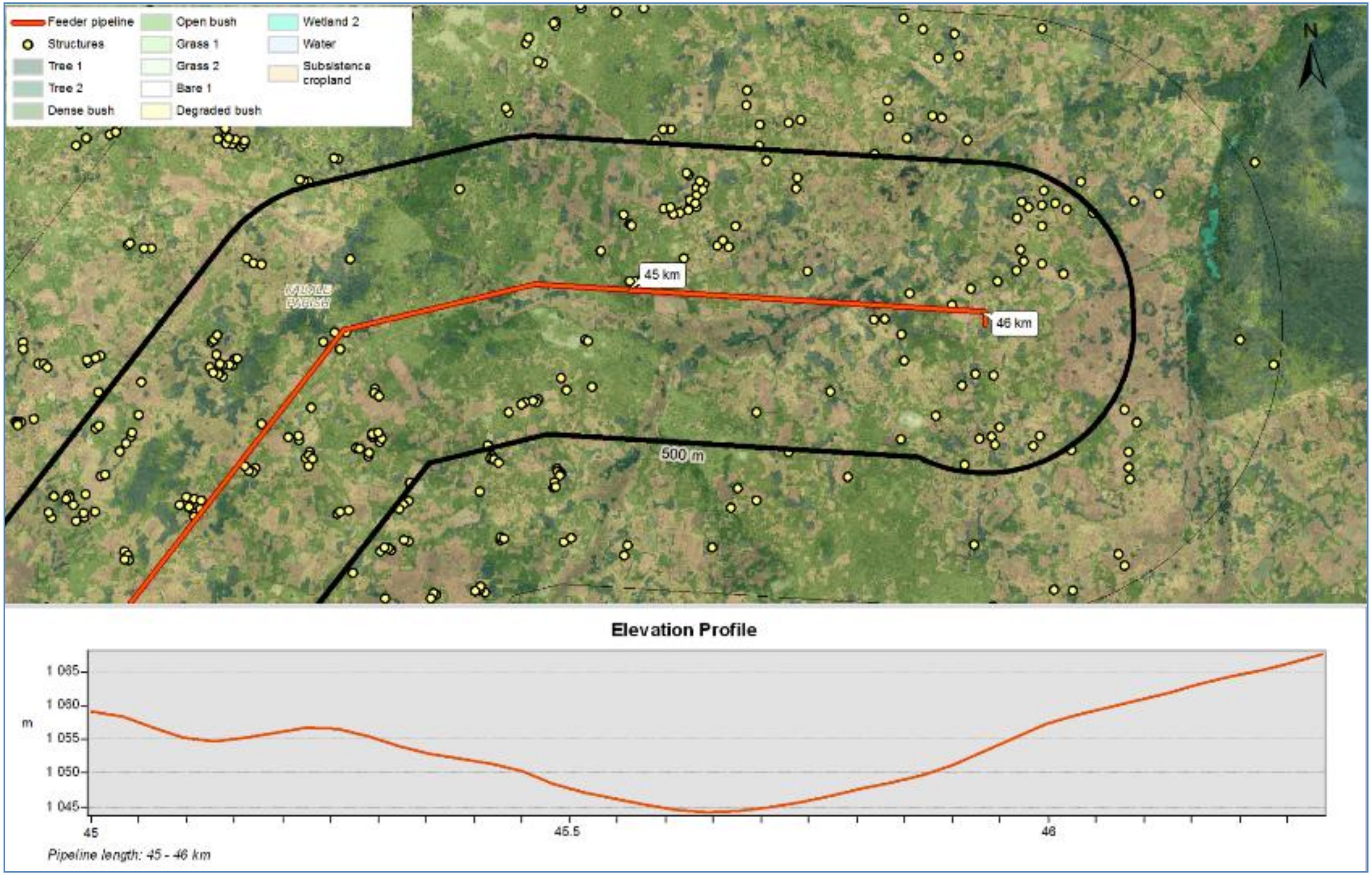


Figure 2-45: Pipeline route detail – 45 to 46 km

2.9.2.2 Pipeline Specifications

All pipeline specifications are preliminary and are subject to adjustment in the detailed design.

2.9.2.2.1 Operating Pressures

Maximum Operating Pressure (MOP) will be 94.6 barg. This is equivalent to the ASME B31.4 'Design Pressure'. Operating pressures will range from near zero to 94.6 barg. Max allowable surge pressure is 10% higher than MOP, which is 104.0 barg.

2.9.2.2.2 Pipe Wall Thickness

The wall thickness of the pipeline will be determined by the forecast pressures. The design pressure is the maximum pressure that the pipeline system can be exposed to. Once the pipe wall thickness required for pressure containment is determined, the specified corrosion allowance and mill tolerance is added and the finally selected wall thickness is derived from the next highest commercially available line pipe thickness defined in API 5L (Table 2.23).

Table 2.23: Pipe specifications for the feeder pipeline

Pipeline Section	Pipe Size (mm)	Outside Diameter (cm)	Design Temp. (°C)	Design Pressure (MPa)	Range in Wall Thickness plus Corrosion Allowance (mm)
CPF to top of escarpment	254	273.1	82	11.6	(6.4-8.7)+1.5
Top of escarpment to delivery point	254	273.1	82	7.32	(4.8-6.4)+1.5

1 MPa = 10 bar

2.9.2.2.3 Depth of Pipe Burial

The depth of burial to the top of the pipe will be at least 1 m below ground except in areas of rock, where 0.8 m of cover is acceptable. This may be less in constrained locations but is rarely the case in the study area, with the exception of the escarpment crossing. Depth of burial is intended to minimise the risk of pipeline exposure due to erosion gulleys or accidental excavation.

2.9.2.2.4 Typical Trench Detail

The pipeline will be buried with a surrounding cushion of frictionless material, typically a well-graded sand without rocks or large stones in it, to prevent damage to the pipe coating during the process of pipelaying or during operation (Figure 2-46).

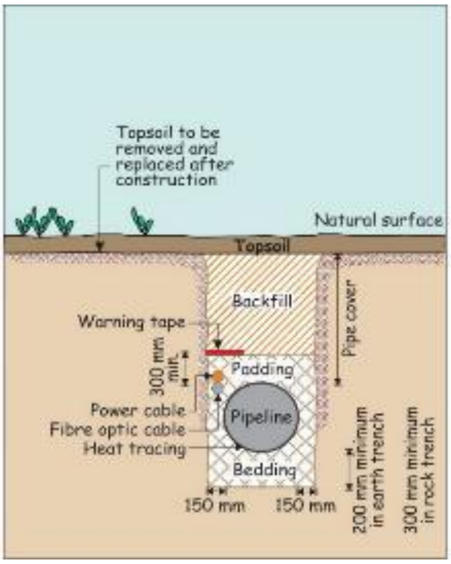


Figure 2-46: Cross section of the trench showing the feeder pipeline

2.9.2.2.5 Trench Breakers on Steep Slopes

In the steep sections of trench up the escarpment, between KP 1.5 and KP 2.3, trench breakers and water bars will be installed in order to prevent stormwater from undermining the pipe. Select material will be placed for padding under and around the pipe. Soil cement or bentonite sacks are proposed for trench breakers.

2.9.2.2.6 External Corrosion Protection

Soil tests along the pipeline route show moderate corrosion risk (Specialist Study 4). The corrosion protection system will be based on use of high integrity coating systems in combination with impressed current cathodic protection systems. Fusion bond epoxy (FBE) is recommended as the preferred coating. Welded joints will be protected using a heat shrink wrap sleeve, applied after the weld is completed.

2.9.2.2.7 Cathodic Protection System

The KFDA feeder line is a 10 inch diameter steel pipe. The main line pipe and field joints will be externally coated with fusion bonded epoxy (FBE). The FBE coated pipe will then be coated with external polyurethane thermal insulation covered by an HDPE jacket. Conventional cathodic protection systems will not be effective due to the HDPE jacket. The PUF material will not allow electrical current flow to protect wherever there is water ingress.
At bored crossings the pipeline may be installed inside a steel casing. The steel casing shall be considered for cathodic protection utilising sacrificial anodes.

2.9.2.2.8 Pipeline Heating

The pipeline will be heat traced, with a Skin Effect Heat Tracing (SEHT) or LLHT, and insulated for heat conservation (Figure 2-47). The normal flowing temperature for the feeder pipeline must be at least 5ºC above the pour point. The SEHT or LLHT design and power generation equipment size will be sufficient to ensure operation at Wax Appearance Temperature (WAT) plus 3ºC if required during operation.

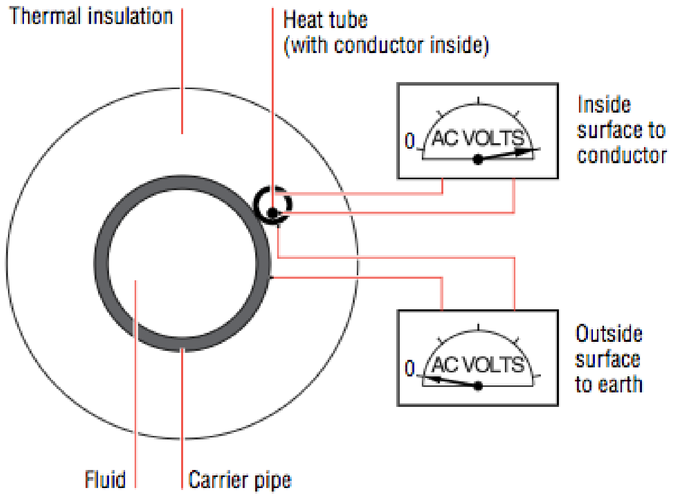


Figure 2-47: Typical skin effect heat tracing system

(Source: http://www.raychemrpg.com/ogd/pdf/pipeline/hts/long_line_heating.pdf)

2.9.2.2.9 Power and Communications

A fibre optic cable will be bundled into a single umbilical (with redundancy for both services), and laid in the trench. Power for the SEHT system will be provided by the CPF for the first half of the pipeline and from Kabaale for the second half.

2.9.2.2.10 Block Valves

Provisional studies show that there will be two mainline Block Valve stations - one at KP 1.3 and one at KP 25.4; or this could be optimized to one mainline block valve station located near KP 10. The valves will be contained in vaults. The dimensions of the fenced area around each vault will be 10 m x 28 m and will be within the 10 m wide permanent RoW. Both valves will be furnished with a gas over oil actuator with nitrogen bottles as a source of power gas. Both valves will be fully automated from the CPF. The design and location of the block valve(s) shall ensure that the any potential leaks at the bottom of the escarpment do not lead to backflow of the crude oil and pose a risk to the lake.

2.9.2.2.11 Leak Detection

The pipeline will require little maintenance on a day to day basis. The right of way will be monitored regularly for any signs of human activity (for example, excavation) that could create a risk, and for any leaks. A major pipeline failure would be picked up by a pressure drop in the line, recorded in the control room at the CPF by the SCADA system. Minor leaks that are not detected by the SCADA system would typically manifest as a small patch of dying vegetation at the surface. In some instances, due to the high pressures involved, leaks can be heard and are reported by local people. Leaks are very rare.

Two technologies are proposed for the pipeline leak detection. One technology is a Leak and Shock Detection System (LSDS) utilizing strands of the fibre optic communications cable. The system will provide continuous, real time monitoring along the entire length of the pipeline.

Ground movement will be monitored along certain segments of the pipeline that traverse geologically unstable areas. This function may be integrated with the LSDS but requires a separate, specialized fibre optic cable. The other technology is a Leak Detection System (LDS) utilizing a transient, on-line dynamic model. This system provides five functions that are important to pipeline operations:

- Leak detection;
- Look ahead;
- Predictive process model;
- Pipeline inventory management; and
- Threshold setting.

The LDS will be capable of detecting a leak which consists of 1% of the designed throughput in 10 minutes, and line rupture detection would take 5 to 20 seconds with a worst case scenario of up to 40 seconds.

2.9.2.3 Land Requirements

The permanent right of way will be 10 m wide. Surface features will include cathodic protection posts at intervals and the KP 1.3 and KP 25.4 block valve stations. The right of way will not be fenced and community access across the pipeline will not be affected in the operational phase. Natural indigenous grass cover will be encouraged over the pipeline to prevent erosion.

Grazing of stock over the right of way will be permitted, but cultivation and settlement will be prohibited. The safety zone along the pipeline within which settlement and other sensitive permanent community infrastructure is prohibited is still to be determined but is unlikely to extend beyond the boundaries of the permanent right of way.

2.9.2.4 Maintenance of the Right of Way

Once the contractor has reinstated the works in accordance with the specification and the warranty period has expired, the responsibility for rehabilitation maintenance along the feeder pipeline will revert to the operator. Monitoring of erosion and weed infestation along the right of way will be undertaken as a part of the overall pipeline maintenance programme. An access road along the right of way is not proposed at present. Block valves and CP posts are located at intersections with existing roads.

2.9.3 Construction Phase

The construction phase of the feeder pipeline is described below. At the end of the section, a series of photographs are presented (Photograph 2-5) which show typical construction activities along a pipeline construction right of way.

2.9.3.1.1 Construction Right of Way

The construction right of way will be 30 m wide. All construction vehicles and equipment will be restricted to this area. Access to the construction site will be along the pipeline right of way, entered and exited at points where existing roads cross the pipeline.

Generally, the temporary right of way will not be fenced. Ongoing communication with local communities will ensure that people who are curious about the construction do not encroach into the right of way and endanger their safety. The extent of the right of way will be demarcated by marker posts to provide guidance to the contractor and the local community. Provision will be made for pedestrian access across the trench during construction in any areas where there is pedestrian traffic (such as access to schools) and where the section of open trench is too long to walk around.

2.9.3.1.2 Method of Pipe Laying

Figure 2-48 provides a schematic of the stages of construction of the feeder pipeline, from bush clearing to final restoration.

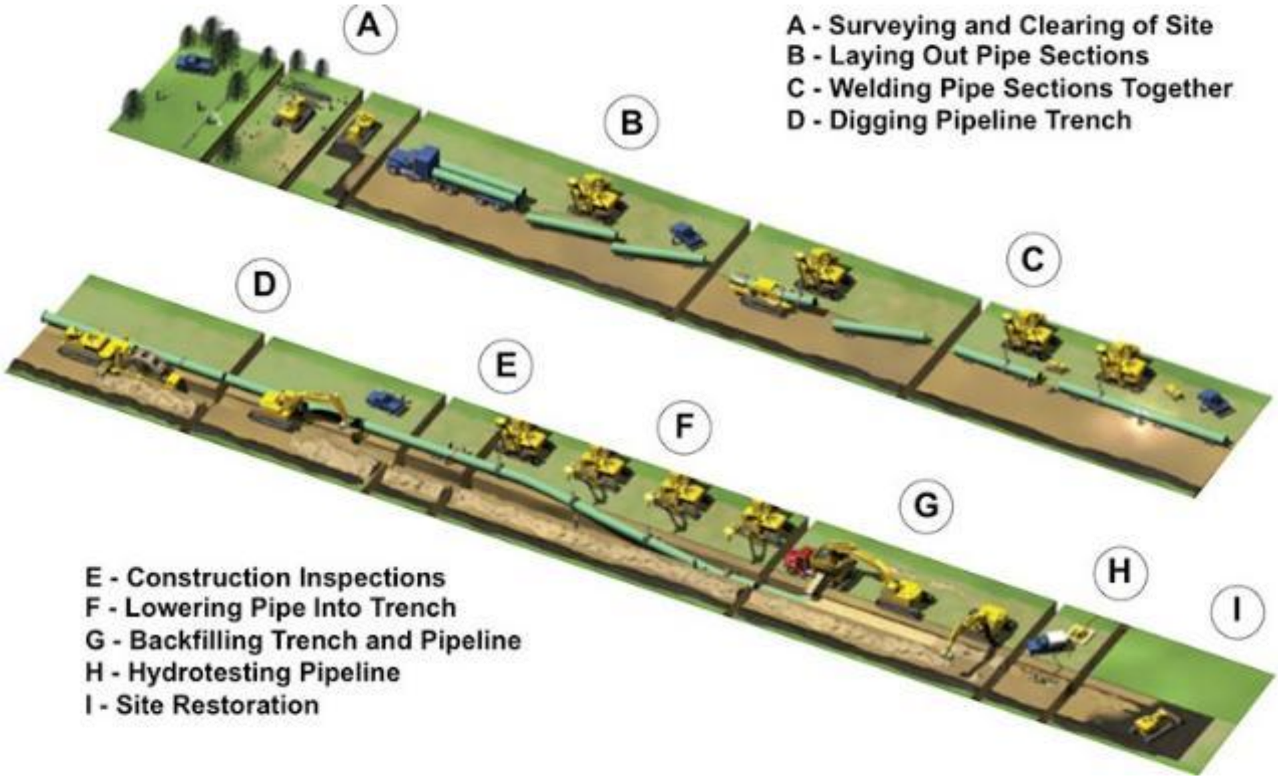


Figure 2-48: Construction stages of an feeder pipeline [Source: Association of Oil Pipelines (AOPL)]

In the first phase of construction, the site is surveyed and the centreline and perimeter of the construction right of way is pegged. Clearing is typically done using bulldozers working within the surveyed construction right of way.

The pipe is brought onto site by low loaders and is lifted by mobile cranes and strung on blocks, in rows, next to the future trench line. The pipe ends are then reamed, butted together and welded. Welding is done by highly skilled certified welders. The integrity of each weld is checked using X-ray methods, which are capable of detecting very small faults. A shrink wrap sleeve is then applied and heated, in order to seal the welded joint.

The pipe coating is checked for defects using a handheld device which is capable of detecting pinhole-sized flaws when moved over the pipe. These are marked and repaired.

The trench for the pipeline is excavated using large tractor loader backactors (TLBs) or a specialized trenching machine (see Photograph 2-5). In the study area, where deep soils exist, blasting is unlikely to be necessary to excavate the trench to full depth except in limited areas such as the escarpment. Trench construction is undertaken by stripping the topsoil and placing it in a windrow along the side of the trench opposite to the construction vehicles. Trench spoil is then removed and windrowed next to the topsoil (Figure 2-49).

The pipe is then lifted into the trench by side booms using slings, typically in 100 m welded sections. The thermal installation system (SEHT) is then installed around the pipe. The trench is then backfilled, using graded material placed around the pipe, following which the remainder of the excavated material is replaced. The backfill is not compacted and is left slightly mounded over the trench to allow for settlement.

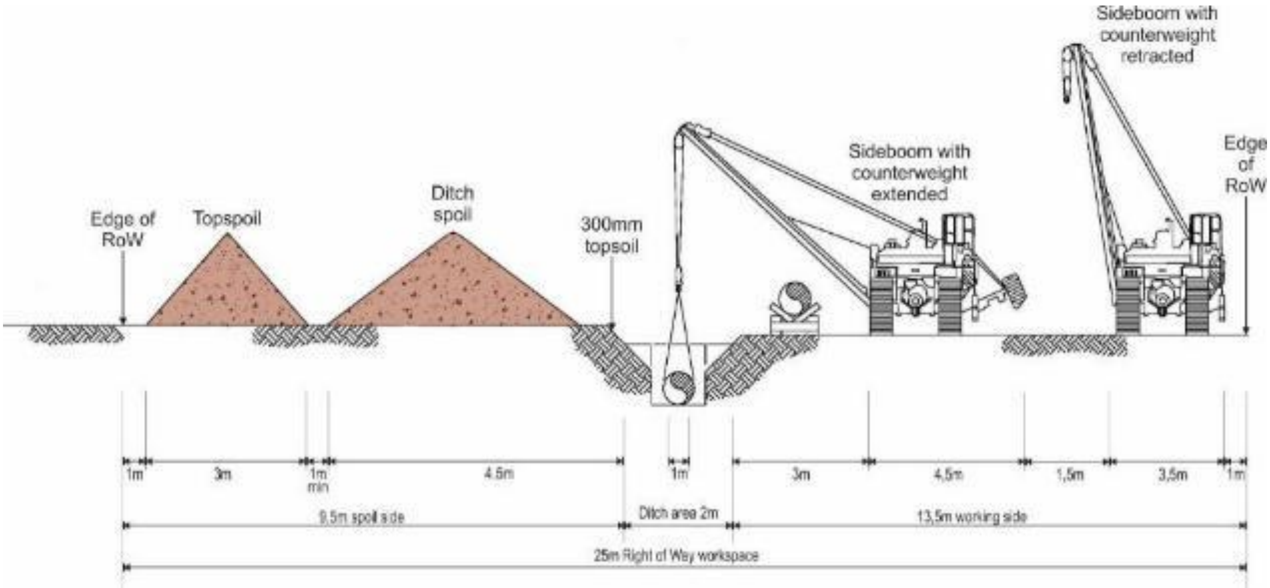


Figure 2-49: Schematic diagram showing the construction train for the feeder pipeline. The construction right of way width does not need to exceed 30 m.

2.9.3.2 Crossing the Escarpment

The 800m long section of pipeline between KP1.5 and KP2.3 is routed straight up a 76% (40º) slope. This section may be constructed conventionally, using only tracked equipment, supported by a temporary draw works anchored near the top of the slope at KP2.3. Alternatively, the pipe for this section may be strung and welded in sections up the hill past KP2.3 and then carried down to lower in after trenching.

The trench will probably need to be drilled and blasted to achieve the minimum 0.8m depth of cover for rocky ground. The pipe joints will need to be strung with tracked equipment and temporarily anchored with ‘dead men’ and strapping until they are lined up, clamped and welded.

2.9.3.3 Handling of Waste Rock

Waste rock is expected to be minimal other than in the escarpment section of the pipeline. In this area, some of the rock will be returned to the trench, where possible. Where not possible, the rockwill be removed to identified low-impact disposal areas along the RoW (or as specified in the ESIA).

2.9.3.4 Generation of Construction Waste

Hazardous waste generation is generally limited to waste oil and grease from vehicle maintenance, which will be undertaken at the Kingfisher camp site. Non-hazardous waste will be collected, bagged and transported back to the camp for sorting, recycling and disposal. Non-hazardous waste includes plastic, scrap metal, wood, lunch cartons, water bottles, packaging and other incidental waste. Sufficient provision for staff ablutions will be provided by ventilated chemical toilets.

2.9.3.5 River Crossings

Seasonal drainage lines occur at km 12.69[6], km 23.13, km 24.02, km 26.99, km 27.79, km 31.24, km 32.34, km 32.49, km 32.62, km 34.88, km 37.89, km 40.89, km 42.48 and km 45.48 (refer to Figure 2-38 to Figure 2-45). These small crossings will be in open cut. The method of construction typically involves the construction of temporary berms, made of soil or aqua bags, across the drainage line. Stream flow is maintained by steel or concrete flume pipes, as required (Figure 2-50).

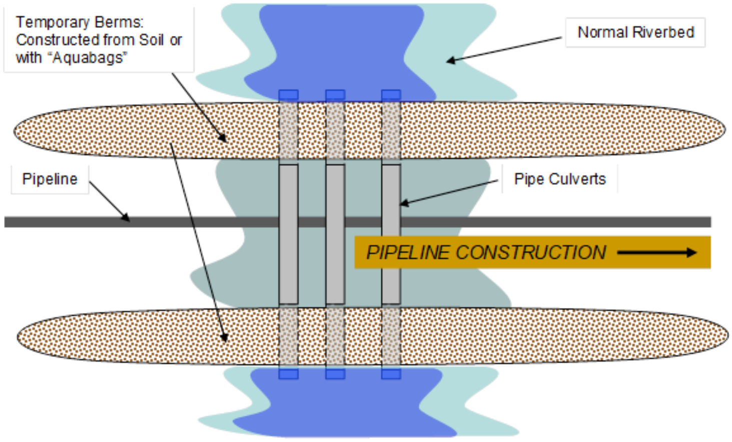


Figure 2-50: Typical method of pipeline construction across small drainage lines

2.9.3.6 Import of Bedding Material

Use will be made of materials excavated from the trench for pipeline bedding. Where necessary, excavated material will be screened and crushed. Additional bedding material may be required in places, which will be obtained from existing borrow sources along the route, wherever possible. If new borrow pits are required, these will be permitted in accordance with Ugandan legislation.

2.9.3.7 Hydrotesting

The pre-commissioning of the Kingfisher Feeder Line will involve pressure testing with water (hydrotesting), which is a way of checking that all of the pipes and welds can withstand the pressures under which they will be operated. The pipeline will be filled with approximately 2,400 m^3 of water, sourced from Lake Albert. The entire line can be tested in one section. Current best practice is to minimize the residence time of the water in the pipe in order to avoid the need for corrosion inhibitors and biocides to prevent corrosion. After hydrotesting, the water will be tested to confirm it complies with the Ugandan effluent standards and World Bank Standards, passed through sand filters in order to remove solids, and disposed back into Lake Albert. The solids, together with the filter sand, will be disposed to a certified waste disposal site.

2.9.3.8 Reinstatement of the Right of Way

After the trench is filled in, topsoil will be recovered from the windrowed stockpile and replaced over the surface of the trench and surrounding disturbed area. Rehabilitation may be from the natural seed beds in the soil and by colonisation from the surrounding area or by re-seeding using locally indigenous grasses.

2.9.3.9 Construction Camp and Personnel

A construction camp will be located roughly mid-way along the feeder pipeline route (Figure 2-52). It is assumed that some personnel will not be accommodated in the camp and will come to work daily from their homes along the pipeline route. The camp will be built in the latter half of 2019 (taking 3-5 months), to be

[6] *The engineering terminology for 'km' (kilometre) is 'KP'*

ready for the start of pipeline construction. A sketch showing the approximate layout of the camp is included as Figure 2-51. It will consist of the following:

- Accommodation for 200 personnel
- Diesel power generator
- Water supply from boreholes drilled in the camp
- Water treatment system to treat raw water to potable standards
- Sewage treatment system, with effluent discharged to a soakaway

The camp will be decommissioned once construction is complete, with all infrastructure being removed.

Table 2.24: Personnel camp requirements for the construction phase of the feeder pipeline

Personnel	Foreign	Ugandan Nationals
Skilled	20	-
Semi-skilled and unskilled	-	180
Total	20	180

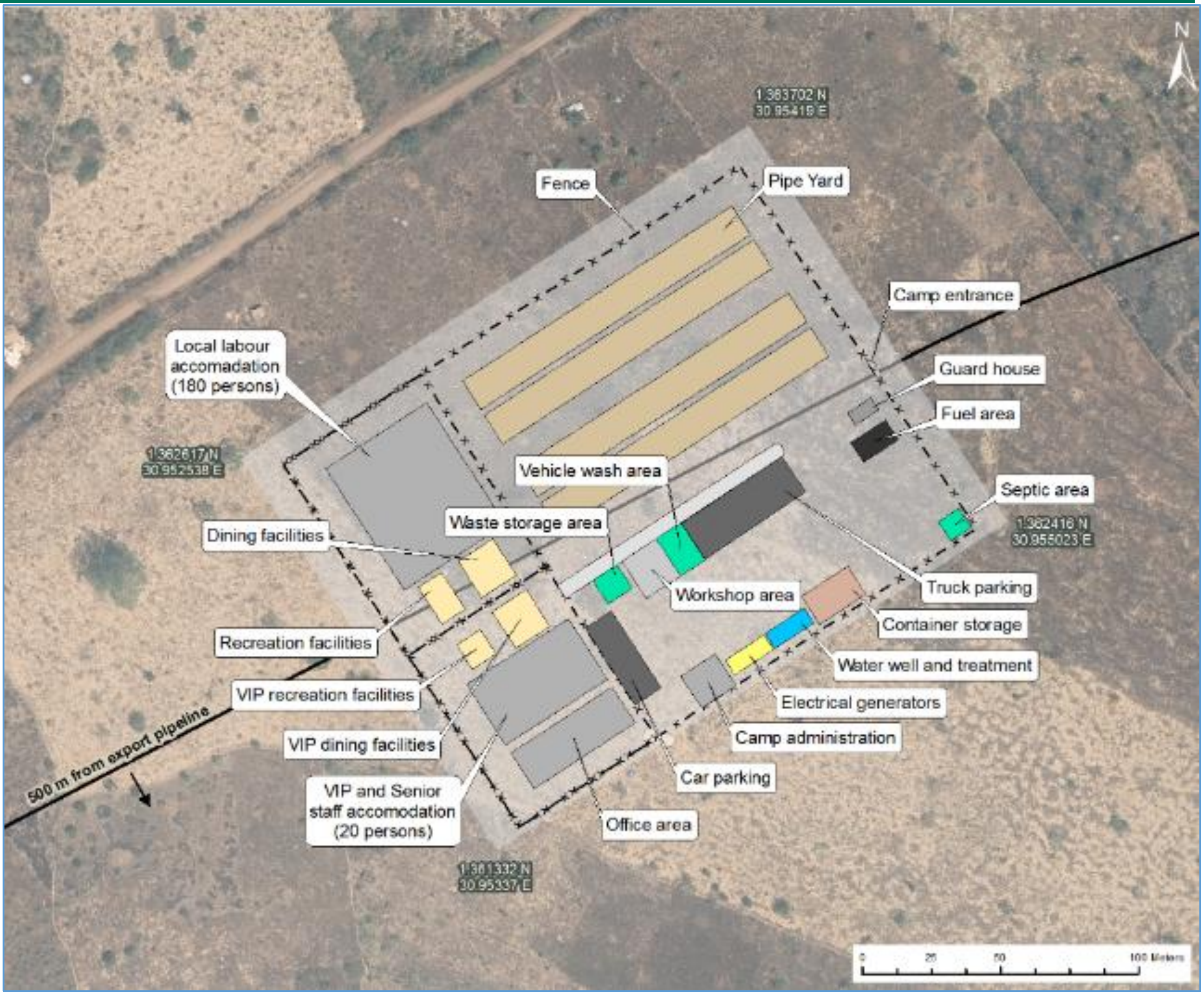


Figure 2-51: Approximate layout of the construction camp

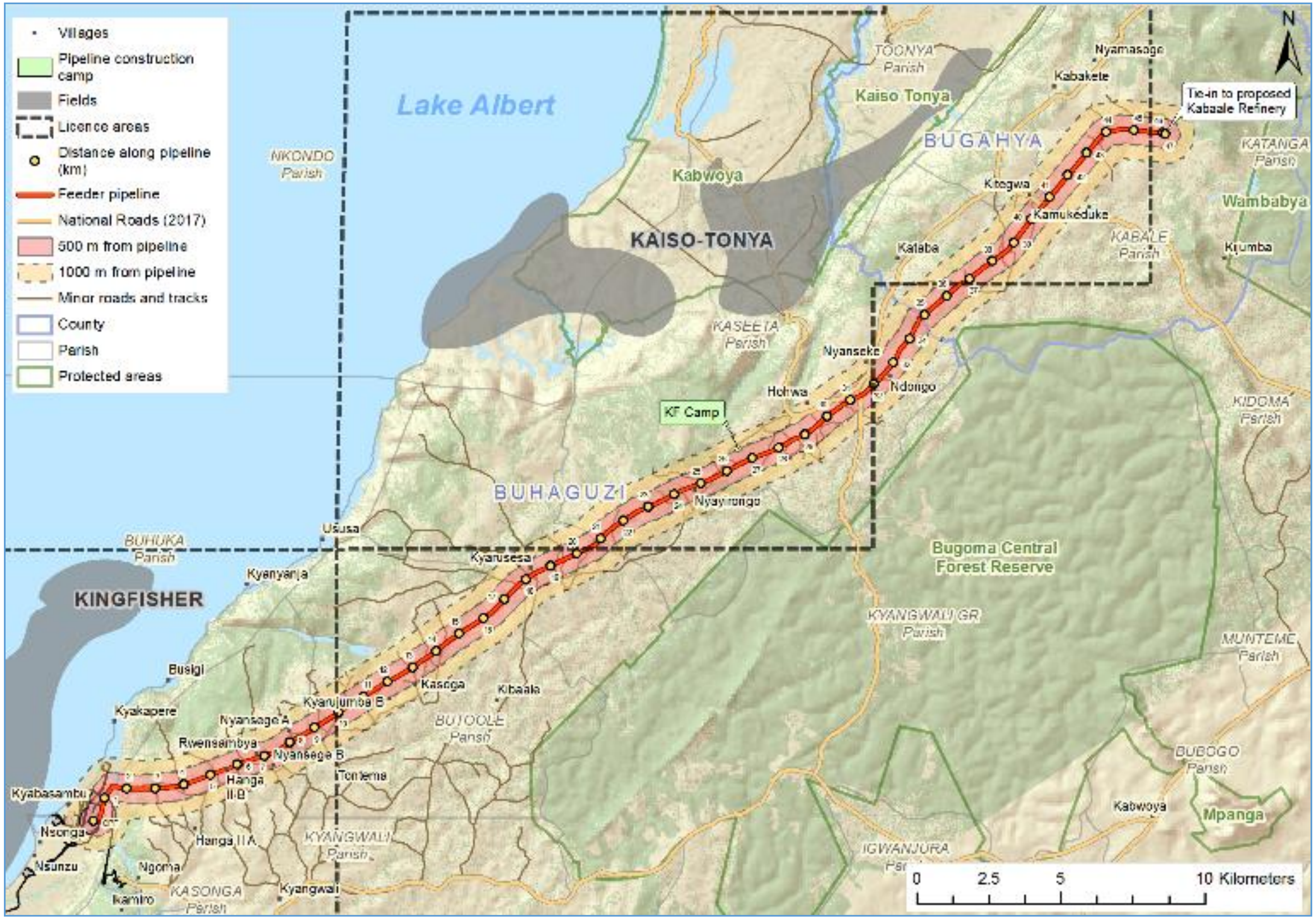


Figure 2-52: Location of the feeder pipeline construction camp

2.9.3.10 Construction Time Period

Construction will be completed within a period of 8 - 10 months.

Clearing and grubbing

Pipe string along the RoW

Conventional excavator

Cleveland excavator

Blasting in rocky areas

Bevelling machine for trimming pipe ends

	
Manual welding	Lowering in
	
River crossing (note flume pipes)	Trench breakers on steep slopes
	
Screening plant backfilling the trench	Closing up

	
Reinstated surface with drainage berms	Reinstated surface with pipeline centreline marker

Photograph 2-5: Typical illustrations of pipeline construction

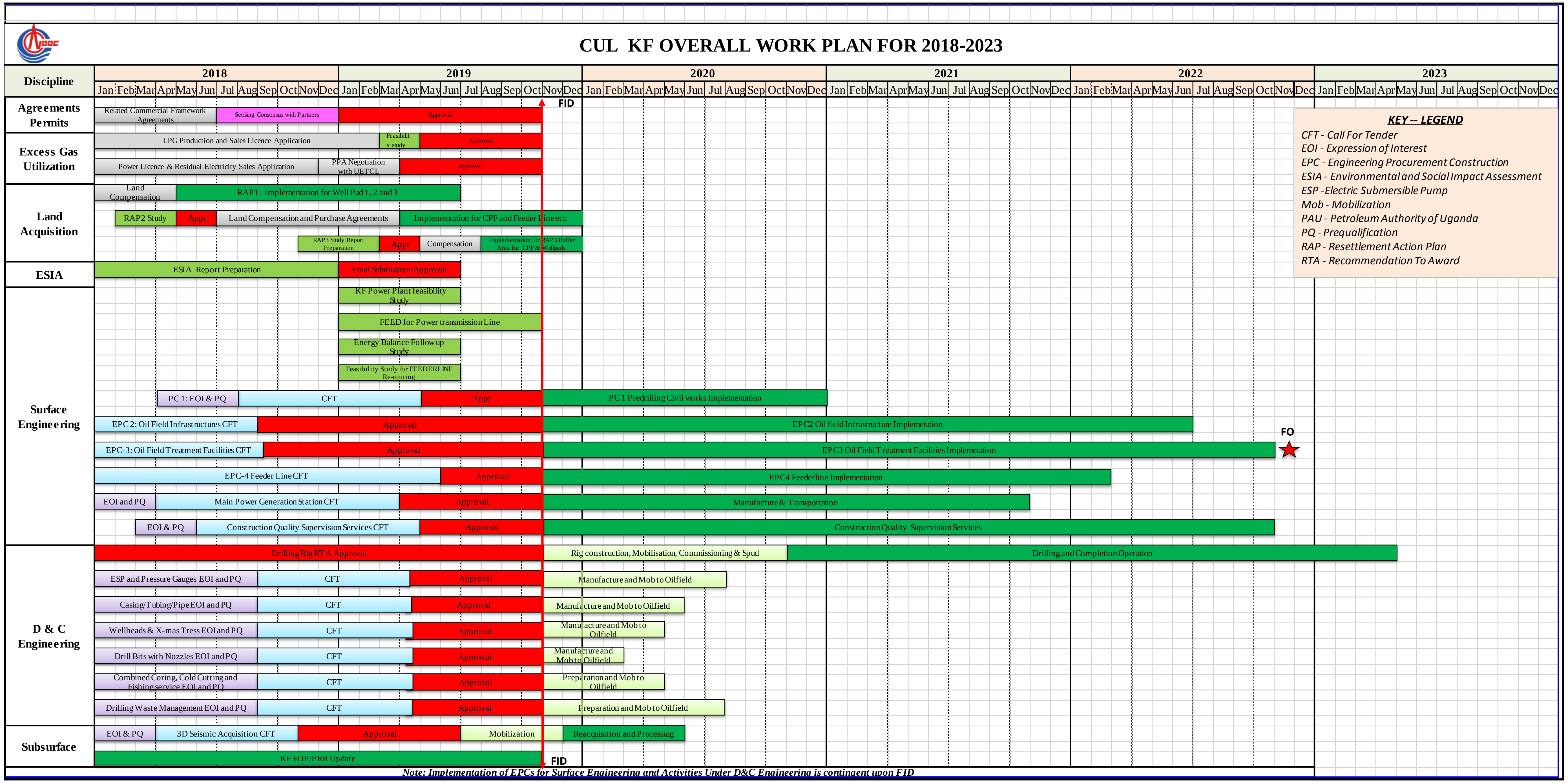


Figure 2-53: Project Schedule & timelines

REFERENCES

American Petroleum Institute (API) (February 1990). Management of Water Discharges: Design and Operations of Oil-Water Separators (1st ed.). American Petroleum Institute.

3.0 AREA OF INFLUENCE OF THE PROJECT

3.1 Biophysical Area of Influence

The spatial boundaries within which potential effects arising from the Project may have on biodiversity were set. For this assessment, and in order to satisfy IFC requirements, two areas of influence were considered in relation to assessing the potential effects on biodiversity:

- The Local Study Area or ‘LSA’; and
- The Regional Study Area or ‘RSA’. This area corresponded with an area defined as the ‘Critical Habitat Area of Analysis’ which was the area within which potential direct and indirect impacts on the biodiversity of potential Critical Habitats was assessed.

3.1.1 Local Study Area

For the assessment of local impacts, the defined area was large enough to analyse and mitigate efficiently the potential effects of the project on the receiving environment, but not too large as to dilute or confound the potential project-related effects with other human-induced and natural influences.

The spatial boundaries for the Local Study Area were determined as described below:

- The assessment of direct influence caused by the project within the local area, was based on the spatial extent of a project’s footprint and an associated buffer zone that includes potential immediate, direct, effects on the receiving environment. This area provides a focus for the development of a baseline case where potential direct effects are likely to occur;
- The LSA incorporates the production well pads 1, 2 and 3 and 4A and associated production and water reinjection wells, the Central Processing Facility (CPF); the temporary and permanent camps; the airstrip which is being converted to a laydown area; all in-field roads and flowlines; material yards for production and drilling; borrow pits for extraction of gravel; the jetty; the new water intake and pump station; materials yard and stockpile area on top of the escarpment; temporary camp on top of the escarpment; the safety check station at the top of the escarpment; and the feeder pipeline construction right of way plus buffer zone to Kabaale; and
- A 1 km buffer was incorporated around the infrastructure in order to capture all potential direct effects, including those from noise, dust, changes to surface water quality, and direct effects on habitats and species.

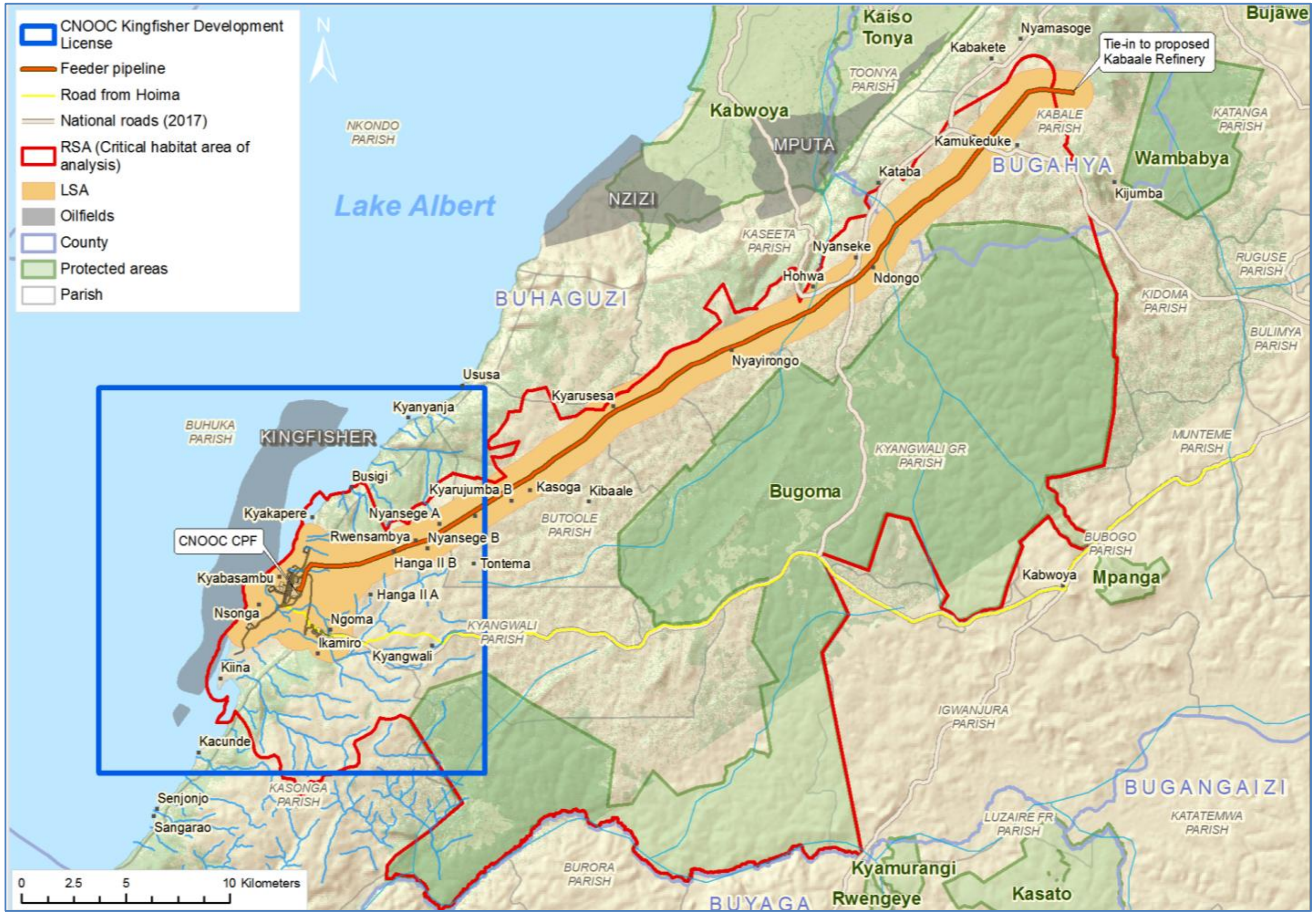


Figure 3-1: The Local and Regional Study Areas designated for Biodiversity

3.1.2 Regional Study Area

The spatial boundaries for the Regional Study were determined as described below. They correspond to the study area determined for the assessment of impacts on Critical Habitats, as defined by the IFC (2012):

- Critical habitat is only relevant to a development project where the project may affect that habitat (both directly and indirectly) (IFC 2012a);
- For the CNOOC project, a first step in defining critical habitat was to identify an ecologically-relevant area of analysis surrounding, and including, the anticipated extent of the Project's influence, including broader or regional effects from the Project, in association with other anthropogenic activities (such as other projects) and natural factors. These include indirect, induced and cumulative effects. The CHAA was defined as that area;
- The boundaries of the CHAA were devised cognisant of the need for an area where the ecological and land management issues have more in common with each other than they do with those in adjacent areas, and constitutes a sensible ecological and political boundary within which critical habitat can be defined;
- This area was also used as the geographical extent to screen biodiversity features to be assessed for critical habitat based on discrete management units (DMU). The screening was initially undertaken at a desktop level using the following attributes:
    - Presence, abundance, and distribution within, or relevance to, the area associated with the CHAA.
    - Potential for interaction with the area and proposed project development.
    - Conservation status or concern; in particular, IUCN-listed Critically Endangered and Endangered species, range restricted and endemic species, congregatory and migratory species, as well as, nationally listed threatened and priority species.
    - Ecological and/or socio-economic value.
    - Identified importance to interested public, government agencies, the scientific community, NGOs and/or CNOOC.
- Secondary data sources were also used, including SPOT 6 imagery, The Integrated Biodiversity Information Tool, catchments and hydrology, mapped soils and geology data, existing infrastructure and disturbance;
- A biodiversity constraints/sensitivity map of the wider area was then generated, which became the CHAA. This map also formed the basis to identify modified and natural habitats (as per IFC 2012b), focus the assessment of the valued components, and guide field surveys; and
- For the purposes of the assessment of biodiversity impacts, the CHAA (and RSA) encompass: the Buhuka Flats; the catchments of: the Masika River, the two unnamed watercourses to the south of the Masika River, the Kamansinig River, and the four unnamed watercourses to the north of the Kamansinig River; the pipeline corridor, extending to the eastern boundary of the natural vegetation on the escarpment (as derived from SPOT6 imagery); and the Bugoma Central Forest Reserve (CFR).

3.2 Social Area of Influence

For the assessment of local social impacts, the defined area was large enough to analyse and mitigate efficiently the potential effects of the project on the receiving environment, but not too large as to dilute or confound the potential project-related effects with other human-induced and natural influences.

The spatial boundaries for the Local Study Area (LSA) were determined as described below:

- The area of direct influence of the project where the most significance direct positive and negative socio-economic and sociocultural impacts will be felt, including jobs and training for local people and suppliers and improved social infrastructure, and the impact of the footprint of project activities on social infrastructure, subsistence agriculture and cultural heritage (negative impacts). This area may conveniently be defined as the same local area (LSA) as that for the biodiversity assessment (Figure 3-1 and
- Direct socio-economic effects will, however, extend outside of the license areas due to employment of semi-skilled and skilled people who are not from local districts and due to the appointment of local and international contractors. Much of the equipment and material necessary for drilling, construction of the CPF and building of roads, in-field flowlines and the feeder pipeline to Kabaale will be imported from other countries, and benefits will therefore extend internationally. Direct benefits to central Government in the form of taxes and royalties will also be paid, and Government expenditure, in turn, benefits all Ugandans.

The spatial boundaries for the Regional Study Area (RSA) were determined as described below:

- The boundaries correspond with an area defined as the indirect area of influence of the project and include the area where the most significant direct, indirect and cumulative impacts are likely to occur. Again, there is a convenient coincidence between this area and the area defined as the RSA for the biodiversity studies.
- As in the case of the social LSA, the boundaries in some instances are likely to extend well beyond the mapped areas. Indirect and induced effects may be felt at District, Provincial, National or even International level.

3.3 Unplanned Events

Unplanned events are unlikely to happen but in the event of their occurrence may influence areas that are remote from the location of the project infrastructure. The unplanned events that are considered in the present EIA are a major oil spill from the CPF (such as the failure of an oil storage tank), a failure along the feeder pipeline, a loss of well control during drilling (a so-called ‘blowout’), or a fire at the CPF. For the present study, the RSA provides sufficient spatial coverage to accommodate an assessment of the risks to any Valued Environmental Component caused by an accident.

4.0 ESIA PROCESS, PUBLIC PARTICIPATION AND SCOPED ISSUES

4.1 Stages in the ESIA process

Figure 4-1 describes the stages in the Ugandan ESIA process.

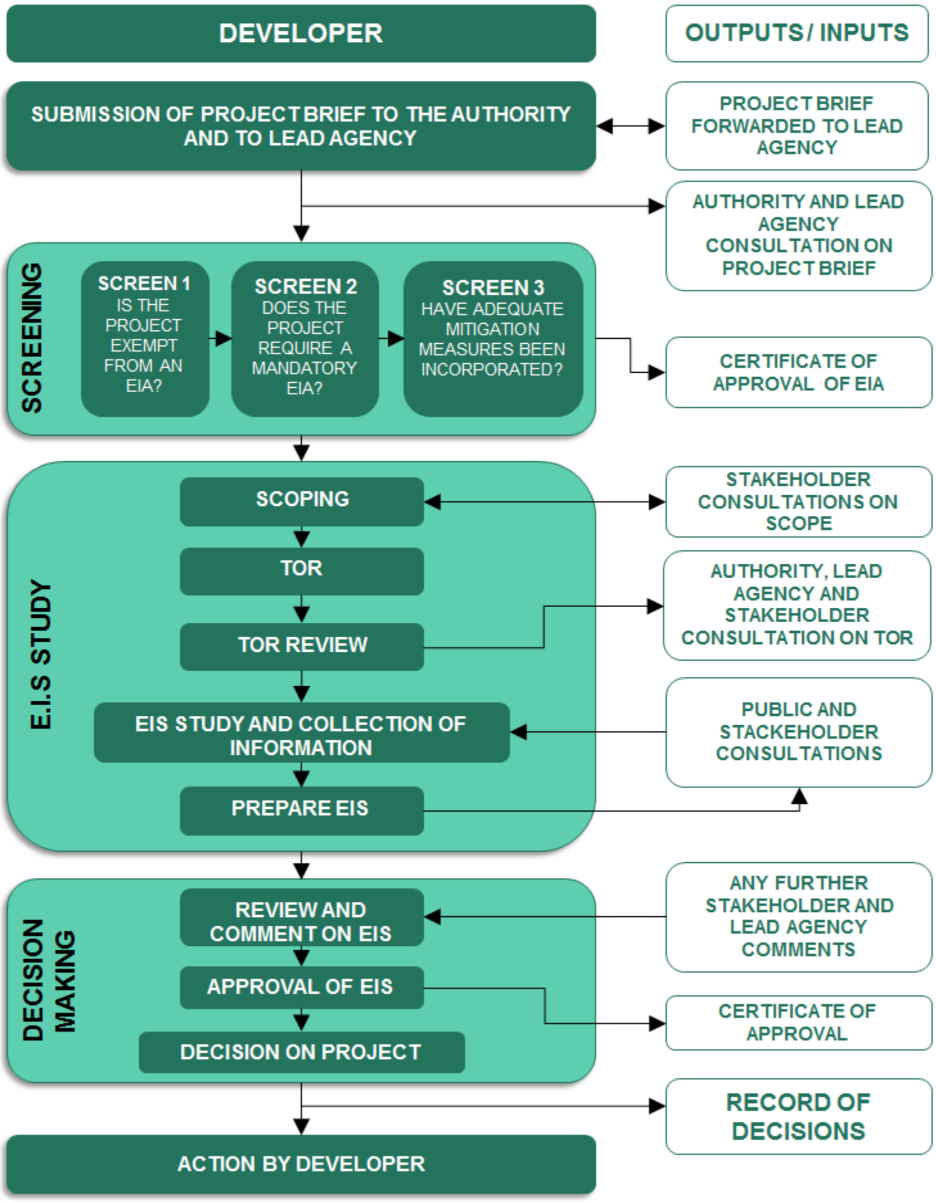


Figure 4-1: Uganda ESIA Process

4.2 Impact Assessment Criteria

The ESIA and associated technical studies have been undertaken in line with relevant Ugandan legislation, IFC standards and other applicable international standards.

4.2.1 Impact Prediction

An impact is essentially any change (positive or negative) to a resource or receptor brought about by the presence of the project component or by the execution of a project related activity. There are a number of ways that impacts may be described and evaluated (Figure 4-2). Generally, the assessment of impacts proceeds through an iterative process considering four key elements:

- Prediction of the magnitude of impacts (the consequences of the project on the natural and social environment);
- Evaluation of the importance (or significance) of impacts taking the magnitude, duration, scale and probability of occurrence into account;
- Development of mitigation measures to avoid, reduce or manage the impacts; and
- Assessment of residual significant impacts after the application of mitigation measures.

Where significant residual impacts remain, further options for mitigation may be considered and impacts re-assessed until they are as low as reasonably practicable (ALARP) for the Project and would be deemed to be within acceptable levels.

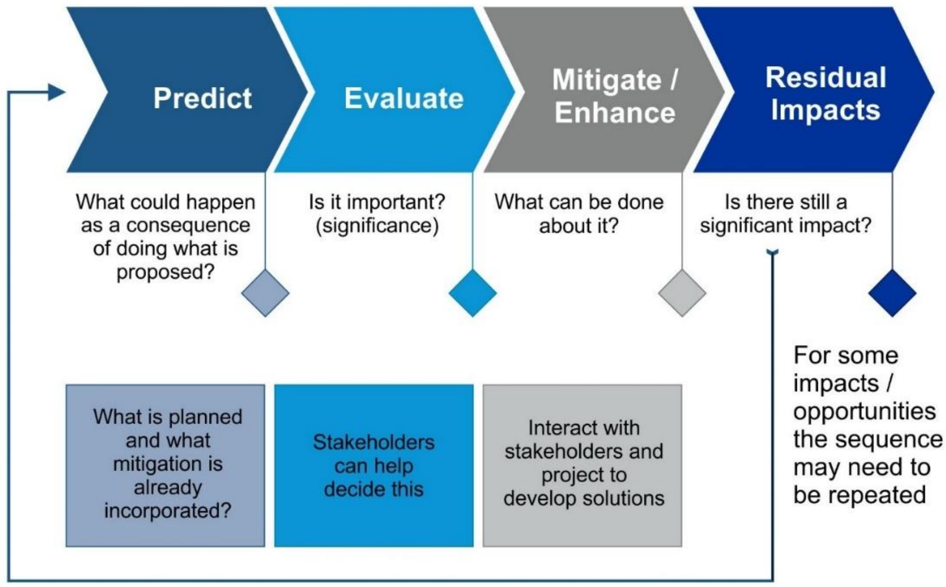


Figure 4-2: Prediction, evaluation and mitigation of impacts

The evaluation of baseline data gathered during desktop and field studies provides information for the process of evaluating and describing how the project could affect the biophysical and socio-economic environment. A clearly defined methodology is used in order to determine the significance of the predicted impact on, or benefit to, the surrounding natural and/or social environment. For this, the project must be considered in the context of the area and the people that will be affected.

4.2.2 Assessing Significance

There is no single accepted definition of 'significance'. An impact assessment is based on the professional judgment and experience of various specialists and EIA practitioners. The evaluation of significance is thus also contingent upon subject matter expertise, professional judgement and dependent upon the environmental and community context. Existing industry or national standards (e.g.: water quality standard or noise standards) will inform this judgement. In a number of cases where standards exist, the specialist must decide how this relates to the impact rating system, which may be a difficult task that requires judgement and explanation.

The following criteria were used to evaluate the significance of potential impacts identified in the ESIA:

Direction of an impact may be positive, neutral or negative with respect to the particular impact. A positive impact is one which is considered to represent an improvement on the baseline or introduces a positive change. A negative impact is an impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.

Magnitude is a measure of the degree of change in a measurement or analysis (e.g. the concentration of a metal in water compared to the water quality guideline value for the metal), and is classified as none, negligible, low, medium or high. The categorisation of the impact intensity may be based on a set of criteria (e.g. health risk levels, ecological concepts and/or professional judgment). The specialist study must attempt to quantify the intensity and outline the rationale used. Appropriate, widely-recognised standards are used as a measure of the level of impact.

The categories are slightly differently defined depending on whether they refer to biophysical or social impacts:

Biophysical Environment

Negligible:	the impact on the environment is not detectable.
Low:	the impact affects the environment in such a way that natural functions and processes are not materially affected
Medium:	where the affected environment is altered but natural functions and processes continue, albeit in a modified way
High:	where natural functions or processes are altered to the extent that it will temporarily or permanently cease

Socio-Economic Environment

Negligible:	there is no perceptible change to people's health, wellbeing or livelihood
Low:	people/communities are able to adapt to the impact with relative ease and maintain pre-impact livelihoods
Medium:	people/communities are able to adapt with some difficulty and maintain pre-impact health, wellbeing and livelihood status but only with a degree of support
High:	Those affected people/communities will not be able to adapt to changes while continuing to maintain pre-impact health, wellbeing or livelihood

Duration refers to the length of time over which an environmental impact may occur: i.e. transient (less than 1 year), short-term (1 to 5 years), medium term (6 to 15 years), long-term (greater than 15 years with impact ceasing after closure of the project) or permanent. It is noted that for some impacts in the construction phase, such as noise, a different scale is used to define duration.

Scale / Geographic extent refers to the physical area that could be affected by the impact and is classified as indicated below into site, local, regional, national, or international. Note that the reference is mainly to physical extent but may include extent in a more abstract sense, such as an impact with regional policy implications which occurs at local level.

Site:	impacts that are limited to the direct area of disturbance and immediate surrounds
Local:	impacts that affect an area in a radius of up to 10 km around the site
Regional:	impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ ecosystem impacts that are experienced at a regional scale e.g.: Provincial level

National:	impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences
International:	impacts that affect internationally important resources such as areas protected by international conventions

Probability of Occurrence is a measure of the likelihood of the change (or impact) actually occurring. This may be categorised as:

No chance of occurrence	0% chance of change;
Improbable	less than 5% chance;
Low probability	5% to 40% chance;
Medium probability	40 % to 60 % chance;
Highly probable	60% to 90% chance; or
Definite	impact will definitely occur.

A simple scoring system is applied in line with the example provided in Table 4-1 below.

Table 4-1: Scoring system

Magnitude	Duration	Scale	Probability
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence

The significance of the change (impact) is then be determined as:

SP (Significance Points) = (Magnitude + Duration + Extent) x Probability

where the relative significance of the change (or impact) is typically ranked as set out in Table 4-2 below.

Table 4-2: Ranking system

Value	Significance	Implications for the Project
SP ≥75	Indicates **high** environmental and/or social significance	The degree of change (or impact) that the Project may have upon the environment and/or the community(s) is unacceptably high. High residual impacts carry substantial weight for authority decision making about the project. The impact must be mitigated or avoided. If this impact cannot be mitigated or avoided, the Project is unlikely to be permitted for development.

Value	Significance	Implications for the Project
SP 30 - 75	Indicates **medium** environmental and/or social significance	The degree of change (or impact) that the Project may have upon the environment and/or the community(s) is medium. The Project may be compromised if this residual impact cannot be avoided or sufficiently mitigated
SP ≤30	Indicates **low** environmental and/or social significance	The degree of change (or impact) that the Project may have upon the environment and/or the community(s) is relatively low. Opportunities to avoid or mitigate the impact should still be considered, however this should not compromise the viability of the Project.
+	**Positive impact**	The changes will have a positive benefit upon the existing environment and/or the community(s).

4.2.3 Mitigation Measures

Mitigation measures for adverse environmental and social impacts are developed in the ESIA concentrating on feasible, realistic and enforceable alternatives in the context of the existing uses. A full range of possible mitigation measures has been considered.

Proposed mitigation measures in the ESIA have generally followed the recognised international approach shown in Box 4-1. This hierarchy is a cascading approach which ensures that the most effective desirable mitigation options are considered first. Avoidance is a critical element of this, which is typically the basis of an assessment of alternatives. The mitigation proposed in the ESIA has been discussed with CNOOC and binding commitments and recommendations for implementation will be identified and agreed.

Box 4-1: The mitigation hierarchy for planned project activities

Avoid at Source; Reduce at Source: Avoiding or reducing at source is essentially ‘designing’ the project so that a feature causing an impact is designed out (e.g. a waste stream is eliminated) or altered (e.g. reduced waste volume). Often related to alternatives assessment.

Abate on Site: This involves adding something to the basic design to abate the impact - pollution controls fall within this category. Often called ‘end-of-pipe’.

Abate at Receptor: If an impact cannot be abated on-site then measures can be implemented off-site - an example of this would be to use the stand-by vessel to help control the level of interference with fishing activity.

Repair or Remedy: Some impacts involve unavoidable damage to a resource, e.g. land disturbance. Repair essentially involves restoration and reinstatement type measures, such as base camp closure.

Compensate in Kind: Where other mitigation approaches are not possible or fully effective, then compensation, in some measure, for loss, damage, and general intrusion might be appropriate

4.2.4 Impact Type

In the designation of impact *type*, the definitions are universal (i.e. the same definitions apply to all resources/receptors and associated impacts). For these universally-defined designations, the definitions are provided in Table 4-3.

Table 4-3: Definition of impact types

Designation	Definition
Direct	Impacts that result from a direct interaction between the Project and a resource/receptor (e.g. between occupation of a plot of land and the habitats which are affected).
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g. viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g. influx of camp followers resulting from the importation of a large Project workforce).

4.2.5 Cumulative Impacts

Cumulative impacts occur when a Project activity acts together with other activities (other projects) to impact on the same environmental or social resources or receptor. Cumulative impacts have been defined as “the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted”. The study area for this project’s cumulative impacts takes into account CNOOC’s area of influence combined with the influence of other developments within that area.

4.3 Public participation process

The Consultant started with the scoping phase public participation process for the proposed Kingfisher project in late 2013.

Public participation requirements of the Environmental Impact Assessment (EIA) Regulations, S.I. No. 13/1998, in terms of section 107 of the National Environment Act Cap 153, 1998, and the Guidelines for Public Participation in the Energy Sector, 2004, are summarised in the ESIA Report. Both sets of regulations emphasise the requirement of providing sufficient information for stakeholders to understand the Kingfisher project and to contribute to the ESIA.

The 2013 public participation process focussed on consultation with communities living on the Buhuka Flats in the Kingfisher Development Area and in the surrounding area. The 2014 consultation process focussed on consultation with the communities who lived along the originally proposed pipeline route, who would be potentially directly affected by the construction activities of the pipeline (see Figure 4-3).

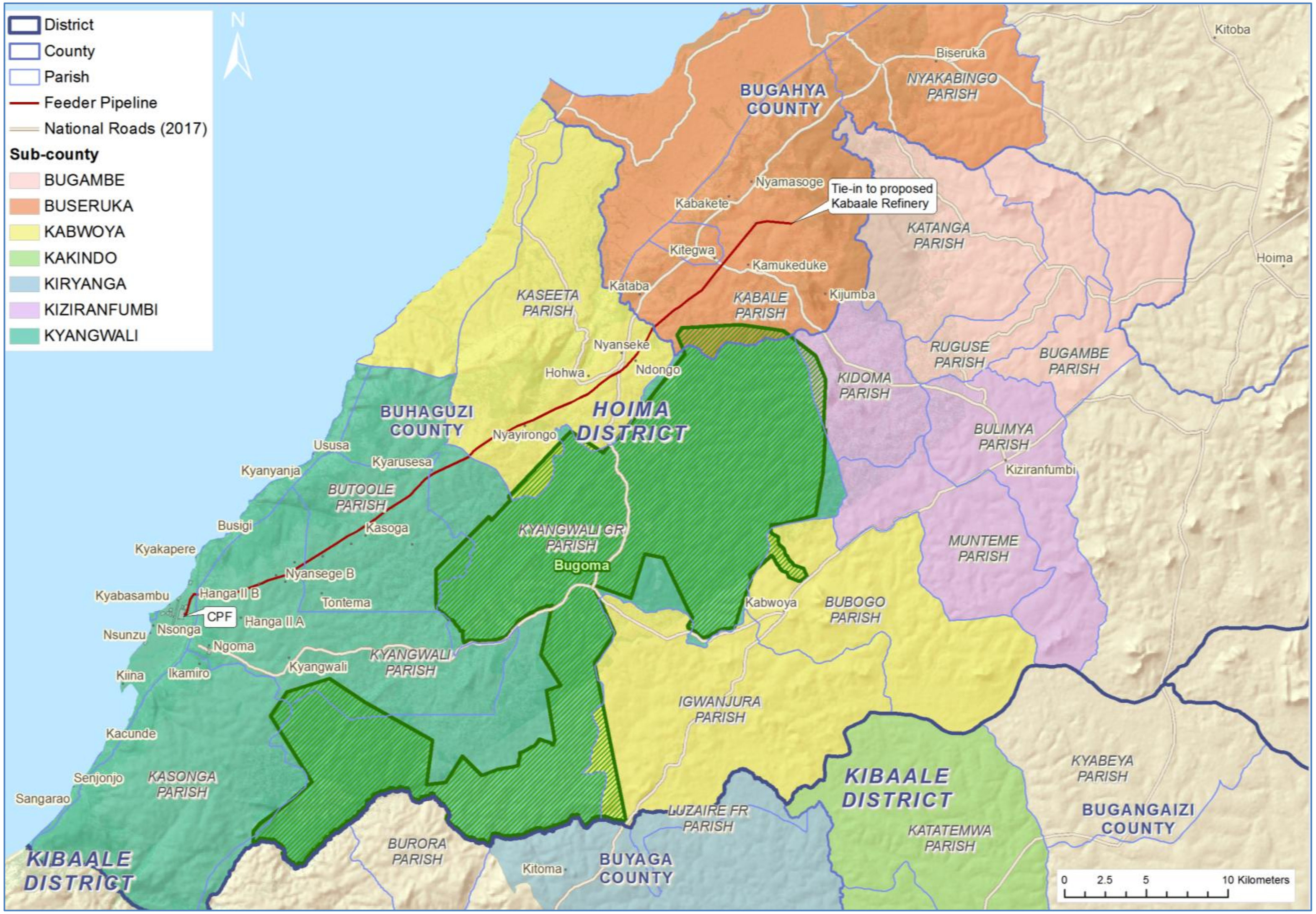


Figure 4-3: Previous map (2013) showing the original proposed pipeline route

Shortly after the completion of the public consultation process and the subsequent submission of the scoping report to the National Environment Management Authority (NEMA) in 2014, the ESIA was put on hold. In the subsequent period, CNOOC revised the feeder pipeline route, initially optimising it from a technical point of view and then further optimising it to minimise impacts on communities living in the area. These studies are reviewed as a part of the ESIA (Section 16). During this period, CNOOC also appointed consultants to develop a Relocation Action Plan (RAP) for project-affected people living on the Buhuka Flats and along the proposed pipeline route, the implementation of which was concluded in late 2017. Project-affected people were extensively involved in this process. Details of the RAP are separately reported and are not a component of this ESIA.

The ESIA process re-commenced in mid-2017 with some changes to the original scope of the project, of which the most significant was an evaluation of the impact of the optimised the feeder pipeline route (see Figure 4-4). The Consultant, in collaboration with CNOOC, made use of the opportunity provided by the updating of the Social Impact Assessment (Specialist Study 10) to create awareness among project affected people, the authorities and other stakeholders of the project optimisation and that fact that the ESIA was nearing completion. The main intent of this process was to provide people who had moved into the Kingfisher project area between 2014 and 2017 and who may not have been aware of the CNOOC Kingfisher project, with an opportunity to comment. The awareness creation process also served to inform stakeholders who had been consulted during 2013 and 2014 of the reason for updating the Social Impact Assessment, the optimised proposed pipeline route and proposed construction camp close to the pipeline route in Hohwa.

In addition to the focused consultation undertaken in 2017 as part of the social impact assessment baseline update and ESIA information sharing process, further engagements with project affected people were undertaken in 2018. The objectives of the 2018 consultation process were as follows:

- Share information with directly affected communities, leadership structures, authorities and NGOs about the key findings of the environmental specialist studies, the likely impacts and proposed measures to avoid, mitigate and manage the impacts; and
- To provide said stakeholders with an opportunity to comment on the findings and proposed measures to avoid, mitigate and manage the impacts.

4.3.1 Public participation: Scoping Phase 2013/2014 and ESIA 2017/18

The Public Participation Report, found in Volume 5, Appendix 2 of the ESIA, provides a detailed account of the public participation process, stakeholders identified, methodology followed, community, small group and focus group meetings as well as interviews convened, materials produced in 2013, 2014, 2017 and 2018. In summary, the public participation process comprised the following key activities:

i) Identification of project-affected people in the Kingfisher project area and along the proposed pipeline route, as well as administrative and regulatory institutions on local, regional and national level
ii) Announcement of the proposed project and invitation to stakeholders to contribute comments
iii) Consultation with project affected people, relevant authorities and institutions.

Consultation took place as follows and the number of meetings that took place are presented in the maps as indicated:

- 2013 – Buhuka Flats, Kikuube (see Figure 4-4);
- 2014 – Proposed pipeline route, Hoima (see Figure 4-4);
- 2017 – Buhuka Flats, Kikuube and optimised pipeline route (see Figure 4-5); and
- 2018 – Buhuka Flats in Kikuube, Pipeline in Hoima and Kampala (see Figure 4-6).

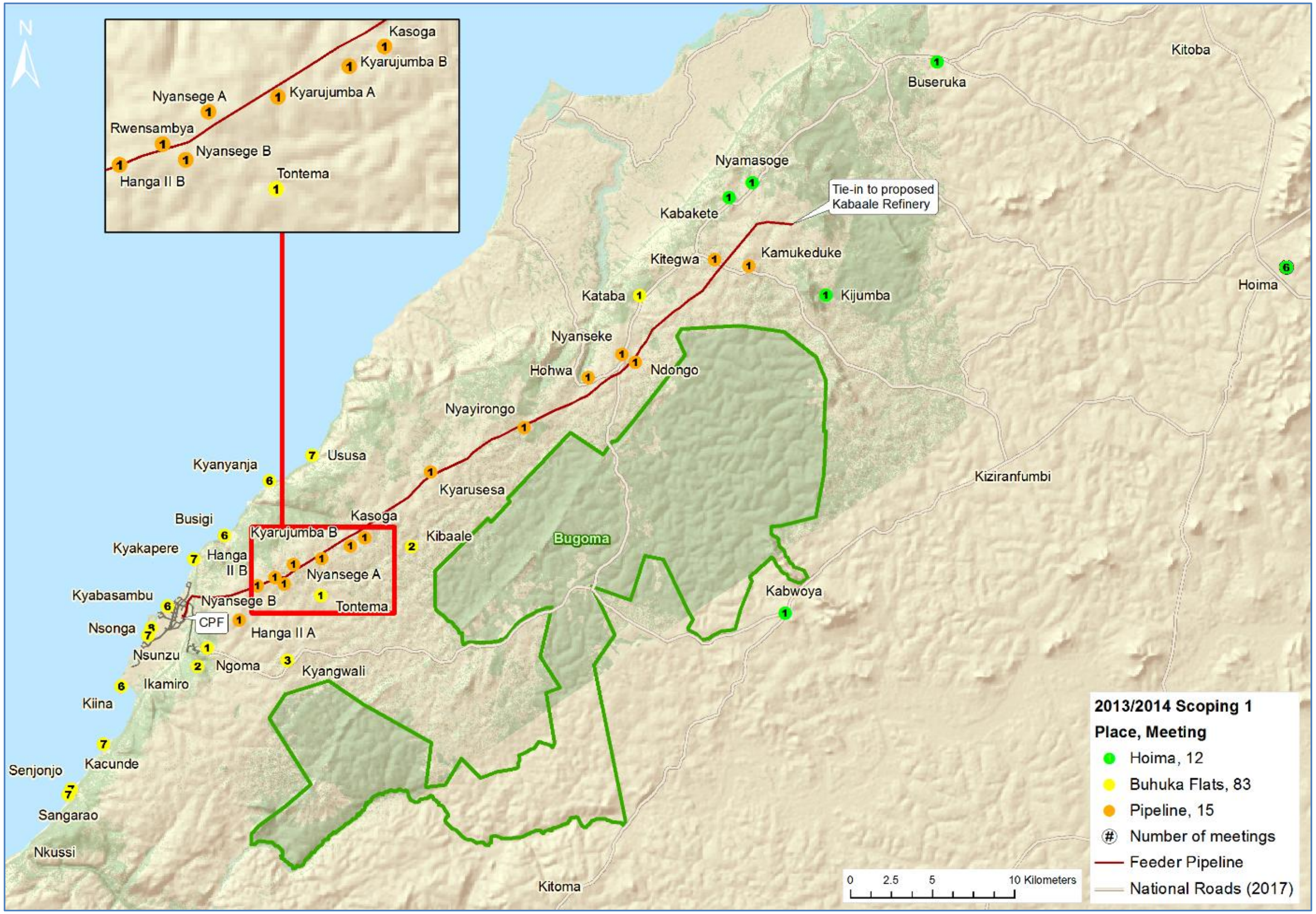


Figure 4-4: The Consultant convened 83 consultation meetings on the Buhuka Flats in Kikuube District in 2013, 15 along the proposed pipeline route in 2014 and 12 in Hoima between 2013/14.

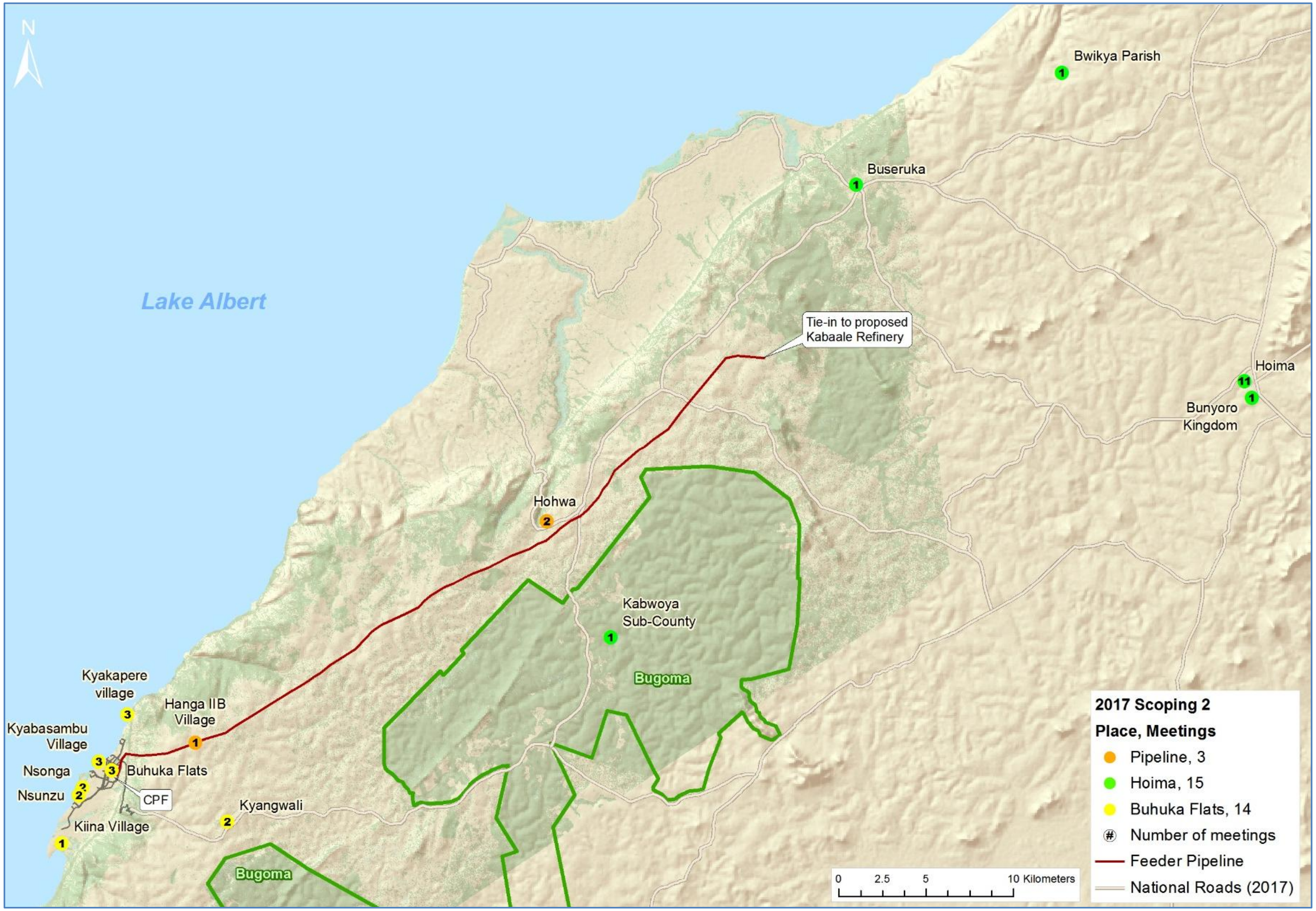


Figure 4-5: A total of 14 meetings were convened on the Buhuka Flats (Kikuube District), three along the proposed pipeline and 15 meetings in Hoima

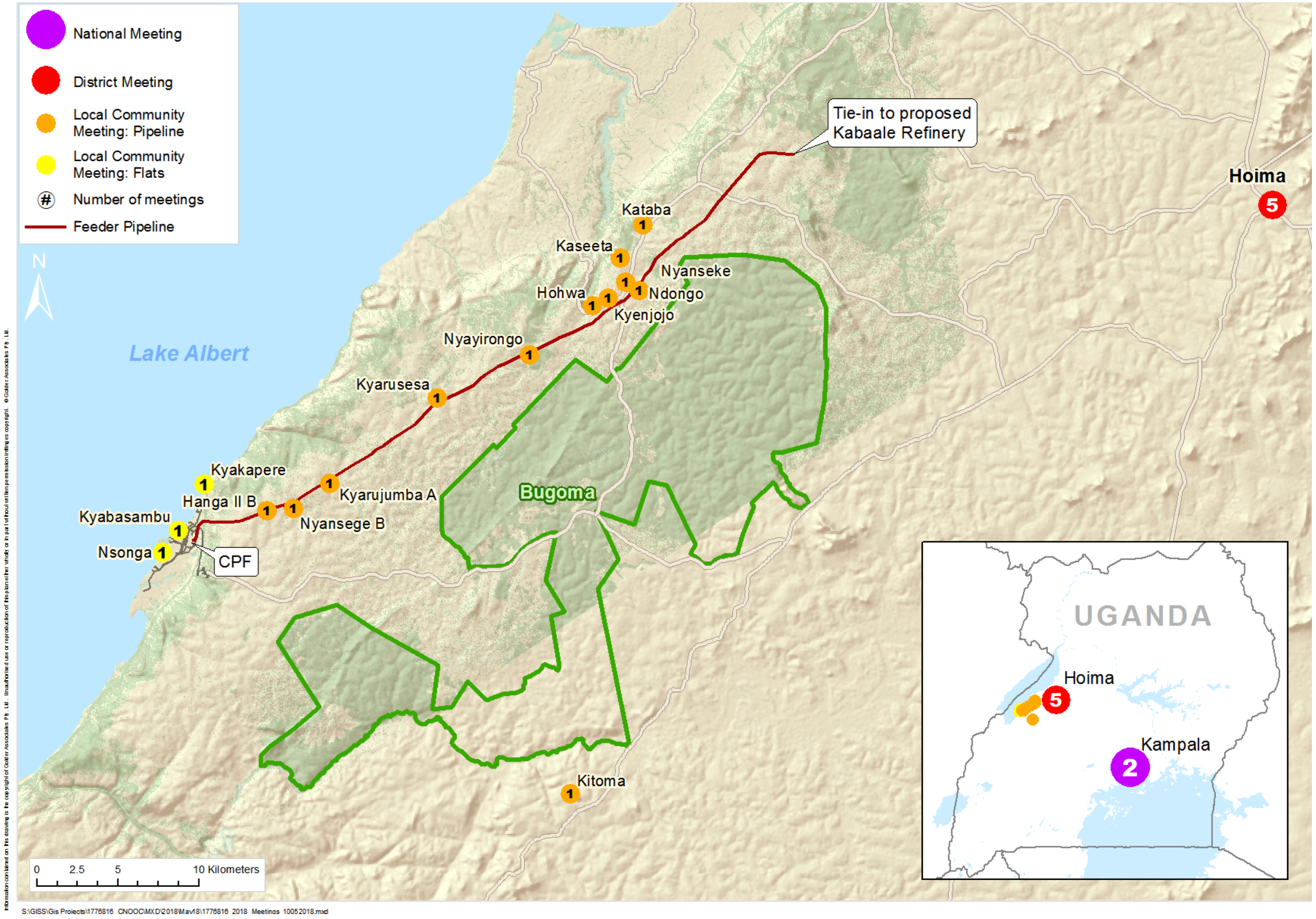


Figure 4-6: The 2018 consultation meetings took place on the Buhuka Flats (Kikuube), along the pipeline, in Hoima and Kampala

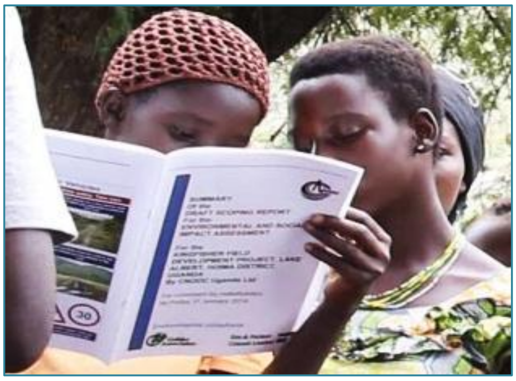
The photographs provide a broad presentation of the meetings that were convened in 2013/14 and 2017 (see Appendix 2 for details).

Posters were used to explain the proposed Kingfisher project and ESIA process

One of the village meetings, December 2013

Members of LCII contributed comments about the proposed project, 2014

Consultation meeting: Riugonjo, 2017



The booklets conveyed information in a way that everyone understood and were in high demand

Women of Kyabasambu contributed comments at the focus group meeting for women

4.3.2 Comments raised

Stakeholders actively participated during the 2013/14 and 2017/2018 consultation processes and attended the meetings out of their own free will. At all meetings, stakeholders expressed appreciation for the information and for listening to their comments.

Stakeholders contributed a total of approximately 790 issues during the 2013/14 public participation process and 1,004 during 2017/18. These comments have been captured in a Comment and Response Report and categorised according to different themes. The Comment and Response Report forms part of the detailed Public Participation Report, attached as Appendix 2

Key issues raised by the majority of stakeholders consulted in 2013/14 can be summarised as follows (see Figure 4-7):

- Expectations of community benefits as a result of the proposed project, in particular employment and community development support; health facilities, education and agricultural support were frequently mentioned;
- Concern over increase in HIV/AIDS and other sexually transmitted diseases;
- Potential impacts on Lake Albert water quality, fishing grounds and fish breeding areas;
- Land acquisition, resettlement and compensation;
- Concerns over air quality, especially gaseous emissions from the CPF;
- Concerns over noise in particular drilling rigs;
- Safety and security of the nearby population, including concerns over terrorism;
- Environmental quality and restoration – numerous requests for support with tree planning;
- Seismicity and the potential of pollution of Lake Albert should an earthquake damage drilling rigs, wells or flow lines; and
- Influx of work seekers and other opportunity seekers.

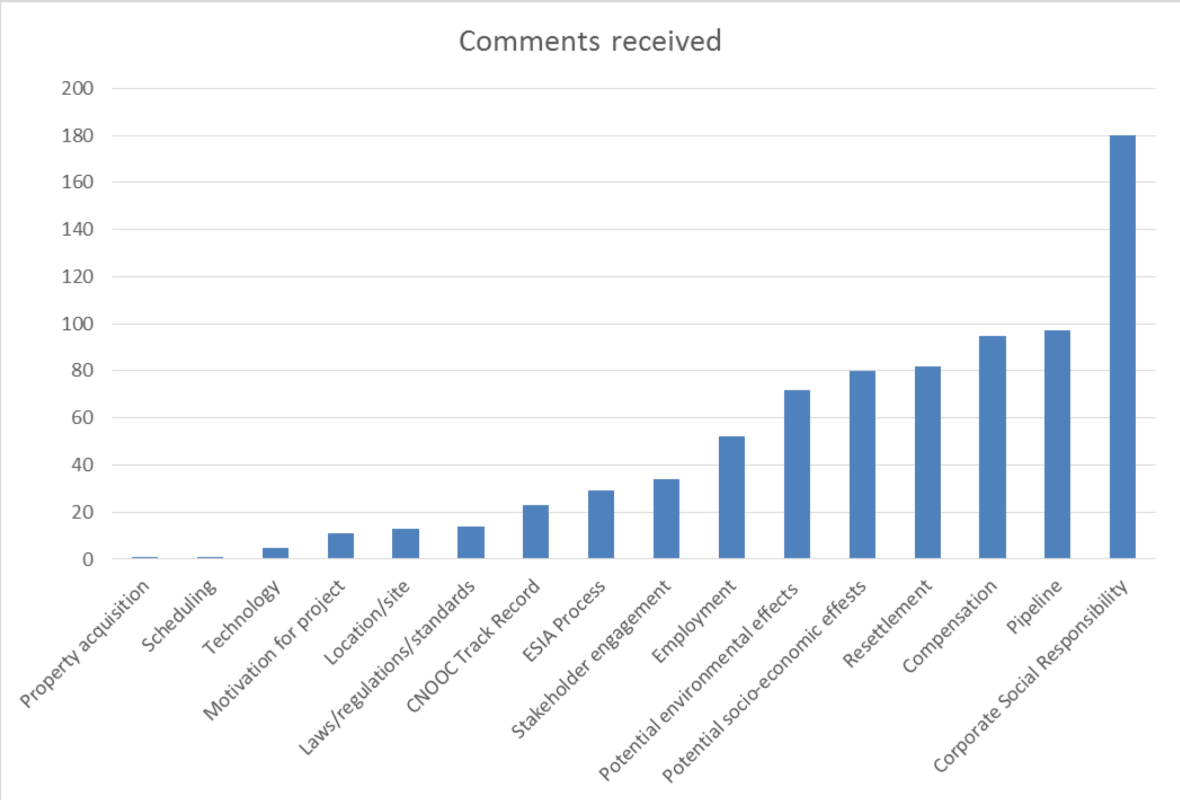


Figure 4-7: The bar chart represents the volume of issues raised per category in 2013/14

Key issues raised by the majority of stakeholders consulted in 2017/18 can be summarised as follows (see Figure 4-8):

- Concerns about increased demand that has resulted in a decrease in fish yield with particular reference to overfishing, use of illegal tackle and fishing of nursery areas;
- Reports of severe deforestation (collection of firewood and overgrazing);

- Locals are concerned about increased pests and diseases in crops;
- Perceived decrease in crop yield;
- Increased demand on land resulting in a shortage of grazing land;
- Influx of foreign population;
- Concerns about contamination of lake water as a result of sewage discharge and the impacts on the aquatic ecosystem;
- Concerns about increased social ills, e.g. rise in gambling, drug and alcohol consumption, prostitution, increased youth pregnancies, drop out of pupils from school, diseases including HIV/AIDS, increased domestic violence, decrease in marital security, increased theft such as loss of crops, poultry, cows and goats;
- Concerns about increased waste generation and terrestrial dumping and the lack of adequate waste management systems;
- Concerns that water pollution will cause waterborne diseases;
- Concern that construction of the pipeline may disrupt groundwater flow;
- Concerns about light and sound pollution from the drilling pads;
- Concern around the safety and environmental impacts should there be a pipeline failure;
- Concerns that CNOOC's recruitment process is focussing on non-local people and that it seems to be focused on the employment of males;
- The influx of people into the area, including refugees, places a burden on existing infrastructure, particularly school and health facilities;
- There is concern that the existing road infrastructure does not cater for the increased traffic into the area and causes fatal accidents;
- In general there is increased land related conflicts at all levels (e.g. between refugees, farmers and pastoralists);
- Concerns about overused communal latrines, poor maintenance and ultimate failure of sanitation facilities due to lack of services; and

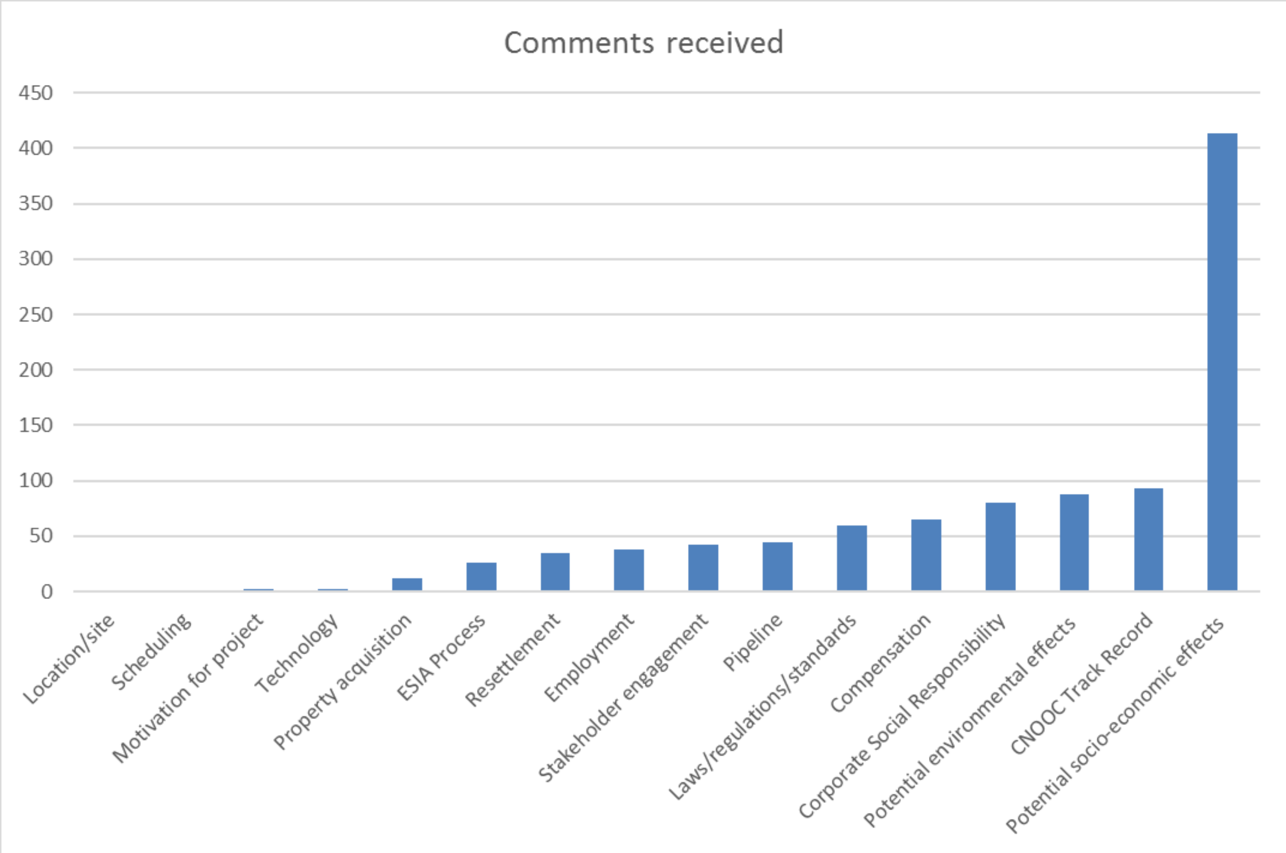


Figure 4-8: The bar chart represents the volume of issues raised per category in 2017/18.

- During the 2018 consultation process, the key issues of concern, listed in sequential order, related to:

  i) Compensation;

  ii) Corporate Social Responsibility;

  iii) Potential environmental effects;

  iv) Pipeline; and

  v) Socio-economic effects.

  It is interesting to note that compensation and corporate social responsibility (investment) remained at the heart of the concerns raised. Compensation most probably emerged now that stakeholders had a better understanding of the impacts of the proposed project and, linked to this is the need for corporate investment into the development of sustainable futures of those that will be impacted by CNOOCs presence and operations in the area. The issues raised by stakeholders during the 2017 consultation process do not reflect compensation as key, probably due to two key factors:

  - Compensation associated with the RAP had been paid out to directly affected stakeholders; and

  - The findings of the environmental impact studies and proposed measures to avoid, mitigate and/or manage impacts were not available at the time. The issues are a reflection of an extended awareness creation process that was undertaken to inform stakeholders of the proposed project optimisation and to update the 2014 social baseline study.

  The maintenance of ongoing stakeholder communications will be critical to secure CNOOCs continued social license to operate.

4.4 Terms of Reference for the ESIA

4.4.1 Specialist Study Scope and Methodology

In this section the terms of reference of each of the specialist studies recommended as a basis for the ESIA are briefly summarised. The following specialist studies were undertaken:

- Specialist Study 1: Air Quality and Greenhouse Gas
- Specialist Study 2: Surface Water
- Specialist Study 3: Groundwater
- Specialist Study 4: Soils
- Specialist Study 5: Waste
- Specialist Study 6: Noise
- Specialist Study 7: Visual Aesthetics
- Specialist Study 8: Biodiversity
- Specialist Study 9: Ecosystem Services
- Specialist Study 10: Social Impact Assessment
- Specialist Study 11: Influx Management Strategy & Framework Plan
- Specialist Study 12: Cultural Heritage

Some of these studies provide baseline information which supports impact assessment studies (soils, waste management). The subsections below describe each specialist study, providing a brief description of the objectives, methods and outputs. Most of the specialist studies involved baseline field research, which is described in the text. In some instances, such as the biological studies, seasonal baseline work was required, and the methodology included for repeated surveys.

4.4.2 Air Quality and Greenhouse Gas Assessment (Specialist Study 1)

Objectives	Project Phase	Methodology
To establish baseline ambient air quality; identify potential sources of air emissions associated with the proposed project and to quantify emission rates from each source; to predict emission concentrations of key pollutants, to assess the impacts on project affected people in terms of local and international standards and cumulative impacts and to make recommendations	Construction and Operation	<u>Baseline</u> ■ Verify available baseline air quality and meteorological information and analysis of site-specific or MM5 modelled meteorological data; ■ Identification of sensitive receptors, such as local communities, within the surrounding areas; ■ The development of a conceptual baseline air quality monitoring network system, which may be implemented in the second phase of the study. <u>Impact Assessment</u> ■ Identify sources of emission and compile emissions inventory. ■ Undertake dispersion modelling for Phases 1 & 2 (normal operations, emergency events, start up and shut down). Pollutant parameters to be modelled: NO_X, SO_2, H_2S, PM_{10} particulates and selected VOC's; ■ Analyse dispersion modelling results and associated air quality impact;

Objectives	Project Phase	Methodology
to mitigate and manage impacts		■ Comparison of the modelling results to the observed baseline data (If suitable baseline data is available); ■ Provide recommendations for mitigating / managing the impact of air emissions; ■ An air quality management planning section for inclusion into the facilities EMP; ■ Compilation of an Air Quality Impact Assessment Report; ■ Detail anticipated GHG emissions footprint for construction and operational phases; ■ Graphical representations of results; and ■ Recommend any necessary mitigation measures.

4.4.3 Surface Water Impact Assessment (Specialist Study 2)

Objectives	Project Phase	Methodology
To assess the impact of the project on the surface water regime	Construction and Operation	<u>Baseline</u> ■ Conduct a site visit; ■ Collect, update, review and analyse available daily rainfall data and use data as primary input to the site-wide water management model. ■ Collect and review available climate data to produce monthly potential evaporation and temperature statistics; ■ Review information from existing road ESIA (and/or updates) as well as the water quantity and quality required; ■ Undertake a regional hydrology assessment of the catchment; ■ Undertake once-off water sampling and analysis to determine baseline water quality at the site; and ■ Develop integrated site wide water management plan. <u>Impact Assessment to address:</u> ■ Changes to the catchment hydrology including decreased catchment area and increased surface water runoff due to the proposed development area; ■ Potential impact on surface water quality due to spills; discharges from containment structures and flooding, including discussion on existing water quality; ■ Potential impact of the rise in Lake Albert water level on the drillings pads and their associated infrastructures; ■ Potential impact of erosion on the quality and geomorphology of the various water systems; ■ Recommend mitigation measures; and

Objectives	Project Phase	Methodology
		■ Develop monitoring programme.

4.4.4 Groundwater Impact Assessment (Specialist Study 3)

Objectives	Project Phase	Methodology
To understand the baseline groundwater regime at the proposed facility from available information; To establish the baseline groundwater quality profile; and use the available groundwater information to predict potential groundwater impacts during construction, operation and decommissioning	Construction Operation Decommissioning	Baseline ■ Characterise existing baseline groundwater conditions through: ▪ review of existing secondary data; and / or ▪ collection of new primary data by both field sampling and interviews with local groundwater users. ■ Record water levels using an electronic dip-meter; ■ Developing a groundwater monitoring database; ■ Initial sampling of each groundwater point and completion of a chain of custody certificates for each sample; ■ Submission of samples to an accredited laboratory; ■ Analysis of samples: the following determinants will be analysed: pH, Dissolved Oxygen, Total Dissolved Solids, Total Suspended Solids, Total Hardness as Calcium Carbonate, Electric Conductivity, Nitrates, Ammonia, Phosphates, Fluoride, Sulphates, Chloride, Sodium, Magnesium, Calcium, Potassium, trace metal scan and hydrocarbons (including GRO, EPH, PAH, BTEX); and ■ Compile a baseline groundwater quality report. Impact Assessment ■ Assess the groundwater impact caused by the construction, operation and decommissioning of the CPF on groundwater quality and supply of the local and regional aquifer systems ■ Recommend mitigation and monitoring requirements, as required

4.4.5 Soil Impact Assessment (Specialist Study 4)

Objectives	Project Phase	Methodology
To assess the impact of the project on soils and agricultural potential	Construction Operation and Decommissioning	Baseline ■ Review current usage of the soils within the project area and along linear infrastructure ■ Sample soils on the plant site and at representative locations along the pipeline servitudes ■ Delineate wetlands ■ Provide land capability information Impact Assessment ■ Provide land capability information as input into the SIA specialist study on land loss and food security ■ Critically evaluate any changes in soil quality around the CPF (attributable to aerial deposition) and assess the potential impact of the CPF on this basis ■ Recommend any necessary mitigation and monitoring

4.4.6 Waste Management (Specialist Study 5)

Objectives	Project Phase	Methodology
To identify all waste streams associated with the Project, identify potential impacts of these waste streams and develop mitigation and management measures	Construction and Operation	Baseline ■ Collect and verify data from project and other relevant source material; ■ Obtain a good understanding of Ugandan legislative requirements, technical and procedural requirements for waste management, recycling and re-use opportunities, treatment and disposal facilities in the country; ■ Develop an inventory of the class and quantities of wastes to be generated at/by the project; and ■ Determine the amount and classification of the waste that will be generated over the operational life of the project. Impact Assessment ■ Waste will be assessed in terms of: ▪ Risks posed to the environment and human health and safety in order to identify the potential impacts; ▪ Based on the above, the significance of each impact will be identified; and ▪ Once the potential impacts have been assessed and their significance has been established, mitigation measures will be developed. In the development of mitigation measures, cognisance will be taken of the relevance and use of the waste management hierarchy.

Objectives	Project Phase	Methodology
		■ The cumulative impact will also be considered. ■ Recommend mitigation and monitoring measures, as required.

4.4.7 Noise Impact Assessment (Specialist Study 6)

Objectives	Project Phase	Methodology
To assess: noise impacts from construction works during the daytime and night-time period; noise impacts from projected typical operations at the CNOOC facility; operational noise based on 24 hours p/day, 7 days p/ week operations; transport infrastructure associated with the CNOOC facility during the operational phase; decommissioning phase noise impacts	Construction Operation Decommissioning	Baseline ■ Delineation of the study area; ■ Data collection inclusive of noise monitoring at selected monitoring locations, measuring of noise levels, mapping and photographing monitoring locations, description of prevailing noise environment; ■ Desktop review of relevant documentation; and ■ Prediction of noise levels. Impact Assessment ■ Model future noise environment based on data concerning future sources associated with the CPF ■ Assess impacts by comparing results with WHO guidelines for daytime and night-time sound levels ■ Recommend mitigation measures

4.4.8 Visual Aesthetics (Specialist Study 7)

Objectives	Project Phase	Methodology
To assess the potential visual impact of the proposed project	Construction and Operation	Baseline ■ Conduct desktop study using available published research and review available project information; ■ Conduct photographic assessment of local examples of night-time lighting, the CNOOC project site and surrounding study area; ■ Develop GIS-based view-shed analysis; ■ Determine the visual resource value of the study area; and ■ Compile a baseline report complete with baseline maps. ■ Impact Assessment ■ Determine the magnitude of the impact; ■ Assess the impact significance by relating the magnitude of the visual impact to its duration, severity and geographical extent;

		■ Compile visual impact assessment report; and ■ Recommend mitigation measures.

4.4.9 Biodiversity Impact Assessment (Specialist Study 8)

Objectives	Project Phase	Methodology
To assess the impact caused by the construction and operation of the project on the biodiversity of the study area, particularly aquatic, terrestrial and wetland ecosystems	Construction and Operation	<u>Baseline</u> ■ Desktop review of all available data (aquatic and terrestrial) ■ Map wetland areas in and beyond the project area ■ Identify range of ecosystem services supplied by project area ■ Identify SoCs, critical habitats and areas of focus ■ Identify suitable sampling sites (where relevant in wet and dry-season) ■ Establish fish habitat mapping and fish community inventory; assess fish habitat ■ Undertake a dry and wet season benthic community inventory of the rivers draining the escarpment, wetlands and near-shore of the lake ■ Establish drivers of change of aquatic and terrestrial ecosystems in project area ■ Identify, map and assess habitats and flora, mammals, avifauna and invertebrates ■ Prioritise ecosystem services as well as drivers of change and assess the project's effects to the supply of, and demand for ecosystem services. <u>Impact Assessment</u> ■ Assess the potential effect of the project on local river functioning, wetland functioning and near-shore functioning of Lake Albert, and the aquatic biota ■ Recommend any necessary mitigation and monitoring, rehabilitating disturbed or degraded areas and re-alignment of infrastructure, if necessary

4.4.10 Ecosystem Services Assessment (Specialist Study 9)

Objectives	Project Phase	Methodology
To assess predicted changes in ecosystems and ecosystem function, physical and aesthetic changes in the Lake Albert landscape, and changes in human population dynamics within the Project Area of Influence; and the concomitant effects that these changes will have on ecosystem service supply and demand within the same area	Construction and Operation	The aim of this Ecosystem Services Review and Impact Assessment is to: ■ Identify priority ecosystem services and goods currently supplied in the context of the area in which the Project will be located. ■ Qualify the relationship between ecosystem services, the ecosystems that provide them, and the condition of those systems, and the current drivers of change of those systems. ■ Identify beneficiaries of the services, that is, the Project and/or the people who benefit from the goods and services supplied, and their level of dependence on the ecosystem services. ■ Identify potential impacts on priority ecosystem services arising from the Project and propose mitigation measures. ■ Identify any necessary additional areas of investigation.

4.4.11 Social Impact Assessment (Specialist Study 10)

Objectives	Project Phase	Methodology
To assess the impact of the construction and operation of the project on the social and economic well-being of communities in the project area	Construction and Operation	<u>Baseline</u> ■ Secondary data collection through desktop research; ■ Primary data collection through field work; ■ Planning and consultation meetings with government and other stakeholders; and ■ Compile a socio-economic baseline report. <u>Impact Assessment</u> ■ Identify, predict and evaluate a range of potential positive and negative socio-economic impacts including trends, forecasting and scenario building; ■ Recommend measures to minimise negative and enhance positive impacts; and ■ Recommend monitoring requirements for the construction and operational phases of the project.

Health Impact Assessment (Specialist Study 10, Appendix B)

Objectives	Project Phase	Methodology
To assess the impact of the construction and operation of the project on the health and welfare of surrounding communities	Construction and Operation	<u>Baseline</u> ■ Review existing data concerning the health status of communities near the CPF site; ■ Review relevant health information from the Hoima & Kikuube District Services of Health, and Ugandan information; ■ Prepare and administer semi-structured key informant interviews (health sector personnel and local authorities) in the local communities affected by CNOOC's existing project infrastructure; ■ Prepare a structured analysis of the current health effects of the previous projects on the health status of the affected communities, taking into consideration the available research data, the opinions expressed by local stakeholders, Government and Health officials and NGO's; and ■ Compile a health baseline report. <u>Impact Assessment</u> ■ Evaluate the impacts of the proposed project on the health of affected communities; and ■ Recommend mitigation and monitoring strategies, as required.

4.4.12 Influx Management Strategy and Framework Plan (Specialist Study 11)

Objectives	Project Phase	Methodology
To assess the impact of migration into the study area and develop an influx management strategy and framework plan	Construction and Operation	<u>Baseline</u> ■ Conduct a desktop review of people migration trends in Uganda, with a specific focus on the study area; ■ Primary data collection through interviews with local residents, newcomers to the and relevant authorities; ■ Evaluate historical migration trends between 2008 and 2017. <u>Impact Assessment</u> ■ Evaluate the impacts of the in-migration; ■ Develop a management strategy and framework plan inclusive of recommendations.

4.4.13 Cultural Heritage Assessment (Specialist Study 12)

Objectives	Project Phase	Methodology
Characterise the physical cultural resources of the areas to be affected by the proposed project; Determine the archaeological/cultural significance from visible cultural remains in project area; and Identify and describe actions required to fill information gaps and mitigate possible potential significant impacts.	Construction	<u>Baseline</u> ■ Conduct desktop study, literature review, and site plotting exercise of readily available archaeological, paleontological and historical sites previously recorded within and adjacent to the local study area; ■ Field walkover survey and community consultation to record and document cultural heritage sites within the local study area; ■ Prepare a baseline report detailing the results of the fieldwork and providing professional judgment on the sensitivity and value of the identified cultural heritage resources. <u>Impact Assessment</u> ■ Prepare a cultural heritage impact assessment for inclusion in the ESIA, making recommendations for any agreed mitigation measures required in advance of, or during, development (e.g. a watching brief or chance finds procedure during construction).

5.0 LEGAL, POLICY AND OTHER REQUIREMENTS

This section presents the policy, legal, and administrative framework within which the ESIA and EBS has been carried out. It summarizes policies, laws, regulations, standards and guidelines relevant to the environmental management of the proposed project. It also identifies agencies, departments and institutions responsible for the monitoring and enforcement of legal requirements specified therein.

5.1 National Policies

The following policies provide the overarching framework for environmental legislation in Uganda.

5.1.1 The National Environment Management Policy, 1994 (*currently under review*)

The National Environment Management Policy was adopted by the Ugandan Cabinet in 1994. Its overall goal is to promote sustainable economic and social development that enhances environmental quality without compromising the ability of future generations to meet their own needs. One of the strategies identified to achieve this goal is ESIA. The policy states that an environmental assessment should be conducted for any project that is likely to have potential adverse impacts on the socio-cultural, physical, and biological environment.

5.1.2 The National Water Policy, 1999

The National Water Policy, 1999 promotes an integrated approach to manage the water resources in ways that are sustainable and most beneficial to the people of Uganda. It stipulates that the quality of drainage water will be such as not to pollute the receiving water or groundwater, and that all measures must be taken by the users to prevent increase in salinity levels in receiving waters, and to prevent the accumulation of dangerous or toxic compounds in the subsoil that may be capable of contaminating underground waters.

5.1.3 The National Oil and Gas Policy, 2008

The National Oil and Gas Policy, 2008 states that production of oil and gas will be done in a manner that protects biodiversity and conserves the environment. The strategies include:

- Ensure availability of the necessary institutional and regulatory framework to address environmental and biodiversity issues relevant to oil and gas activities;
- Ensure presence of the necessary capacity and facilities to monitor the impact of oil and gas activities on the environment and biodiversity;
- Require oil companies and their contractors/subcontractors to use self-regulation and best practices in ensuring environmental protection and biodiversity conservation; and
- Require oil companies and any other operators to make the necessary efforts to return all sites on which oil and gas activities are undertaken to their original condition as an environmental obligation.

5.1.4 The National Energy Policy, 2002

The goal of the energy sector in Uganda is to meet the energy needs of the Ugandan population for social and economic development in an environmentally sustainable manner. The National Energy Policy objectives include the following:

- To establish the availability, potential and demand of the various energy resources in the country;
- To increase access to modern and reliable energy services as a contribution to poverty eradication;
- To improve energy governance;
- To stimulate economic development; and
- To manage energy related environmental impacts.

In pursuit of these objectives, the Government of Uganda will ensure that environmental considerations are given priority by energy suppliers and users to protect the environment and will put in place a monitoring mechanism to evaluate compliance with established environmental protection guidelines.

5.1.5 The Uganda Wildlife Policy, 2014

The 2014 edition of the Policy (first formulated in 1994) updates the Policy of 1999. The Policy guides the conservation and development of wildlife resources in Uganda. The policy requires that new developments and interventions with potential to affect wildlife resources are subject to environmental impact assessments.

5.1.6 The National Fisheries Policy, 2004

The Policy provides strategies for sustainable management of fisheries though decentralisation and community involvement.

5.1.7 The National Policy for the Conservation and Management of Wetland Resources, 1995

Prepared in 1995 by the Ministry of Natural Resources, the policy aims at "promoting the conservation of Uganda's wetlands in order to sustain their ecological and socio-economic functions for the present and future well-being of the people." The policy also complements the Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat, and provides for the requirement of EIA for all planned wetland developments.

5.1.8 The Uganda National Culture Policy, 2006

The policy provides the framework for the promotion of culture. The core principle underlying this Policy is respect for all cultures. The policy is all inclusive and advocates the rights of indigenous groups in Uganda. The Culture Policy promotes social change and encourages new ideas and approaches within the laws of Uganda.

5.1.9 The Uganda Forestry Policy, 2001

The goal of the Uganda Forestry Policy is to have an integrated forest sector that achieves sustainable increases in the economic, social and environmental benefits from forests and trees by all the people of Uganda especially the poor and vulnerable. The three pillars of forest sector development are given as poverty eradication, socio-economic development and sustainable forest resource management. The National Forest Plan, 2013 is the means through which the National Forestry Policy is put into action.

5.1.10 The Museums and Monuments Policy (2015)

The main aim of the policy is to "create a framework for preservation and sustainable development of Uganda's Museums and Monuments for the benefit of the people of Uganda and posterity." The policy further provides guidance on collection, research and museum services.

5.1.11 The National Content Policy for the Petroleum Subsector in Uganda (2017)

The Policy aims to promote competitiveness of Ugandan labour and enterprises in the oil and gas industry and the overall economy. This goal is supported by the following objectives:

1) To build the capabilities of Uganda's human resources to effectively participate in the oil and gas subsector.
2) To promote employment of Ugandans in the oil and gas industry.
3) To develop the competitiveness of Ugandan enterprises as suppliers and joint venture partners.
4) To increase the use of locally produced or available goods and services by the oil and gas industry.
5) To promote research and development and technology transfer.

According to the Policy, licensed oil companies, their contractors and subcontractors are required to:

- publicly advertise all available positions;
- give priority to Ugandans in recruitment and training;
- establish operational bases in Uganda;
- put in place procurement and contracting procedures and practices to benefit Ugandan enterprises;
- locally available goods and services are to be exclusively tendered to Ugandan enterprises; and
- prepare and implement plans for the transfer of technology and knowhow to Ugandan institutions.

The Policy has been prepared by and is the responsibility of the Ministry of Energy and Mineral Development.

5.1.12 The Uganda Gender Policy, 2007

The Government of Uganda's first National Gender Policy (NGP) was approved in 1997. The policy provided a legitimate point of reference for addressing gender inequalities at all levels of government and by all stakeholders.

The policy places responsibilities on the private sector, such as incorporation of gender equality principles in corporate policies, broadening corporate social responsibility and interventions that promote gender equality.

5.1.13 The National Policy for Disaster Preparedness and Management, 2011

The National Policy for Disaster Preparedness and Management aims at reducing vulnerability levels, risk mitigation, disaster prevention, preparedness, effective response and recovery in a manner that integrates disaster risk with development planning and programming. The policy requires that socio-economic and environment impact assessments be undertaken to guide planning and budgeting for Disaster Preparedness and Management.

5.1.14 The Uganda National Land Policy, 2013

The Uganda National Land Policy provides a framework for having an efficient and effective land delivery system. The policy seeks to harmonise and streamline the complex tenure regimes in Uganda for equitable access to land, and to clarify the complex and ambiguous constitutional and legal framework for sustainable management and stewardship. It also aims to ensure sustainable utilisation, protection and management of environmental, natural and cultural resources on land for socio-economic development.

Paragraph 3.8 of the policy outlines government strategies for managing land resources with respect to minerals and petroleum development.

5.1.15 The National Health Policy, 2010

The National Health Policy II (2010) guides the development of Uganda’s health sector in line with the Government’s constitutional obligation to provide health services and promote healthy nutrition and lifestyles. Among other guiding principles, the policy emphasises the role of the community in decision making and planning for health services delivery, delivery of health services within the framework of decentralisation, the need for alternative, equitable and sustainable options for health financing partnerships with the private sector in increasing the geographical scope of health services and the scale of services provided.

The proposed project has the potential to impact (positively and negatively) community health and safety within the proposed project area and beyond.

5.1.16 The National Youth Policy, 2001

The Policy provides an operational framework to facilitate meaningful involvement of youth in national development efforts and to respond to their various needs. Section 8.8 highlights the significance of youth education and awareness in promoting the conservation of natural resources. The Policy aims to enhance the participation of youth in the development process.

The proposed project has the potential to impact (positively and negatively) youth. Concerns of youth were documented and addressed during the stakeholder engagement process.

5.1.17 The National Orphans and Other Vulnerable Children Policy, 2004

The Policy outlines the enabling framework for improvement of the quality of life of orphans and other vulnerable children. Its guiding principles include inclusion of orphans and other vulnerable children in the development process, particularly in affairs that affect them (s 2.9). Additionally, the Policy provides for effective advocacy at all levels to ensure that the concerns of orphans and other vulnerable children are appreciated (s 4.3).

Orphans and vulnerable children are likely to be more vulnerable to potential negative Project impacts and less likely to be able to benefit from positive impacts. It is therefore important to identify these groups as part of the ESIA and RAP processes.

5.1.18 The National Child Labour Policy, 2006

The Policy provides a framework for addressing child labour and actions that need to be taken to deal with child labour.

There is a potential risk of child labour in the Project supply chain that must be addressed by the Project Proponents in line with national policy.

5.1.19 The National Equal Opportunities Policy, 2006

The policy provides the framework for promoting equal opportunities for all people in Uganda in all activities, programmes, plans and policies of Government, private sector and Non-Governmental Organizations in all spheres of social, economic, political and civil life.

The proposed project will be a major employer. The Project Proponents shall undertake Project activities in compliance with supporting legislation.

5.1.20 The National Policy on Persons with Disability, 2006

The Policy seeks to promote equal opportunities, care and support for the protection of Persons with Disabilities.

Persons with disabilities are likely to be more vulnerable to potential negative Project impacts and less likely to be able to benefit from positive impacts. It is therefore important to identify these groups as part of the ESIA and RAP processes.

5.1.21 The National Industrial Policy, 2008

The Policy sets out the strategic direction for industrial development in Uganda. Policy objectives include the promotion of environmentally sustainable industrial development and participation of disadvantaged sections of society in industrial development (s 1.3).

5.1.22 The National Policy for Older Persons, 2009

The Policy provides for equal treatment, social inclusion and provision of livelihood support for older persons.

Older persons are likely to be more vulnerable to potential negative Project impacts and less able to benefit from positive impacts. They must therefore be identified as part of the ESIA and RAP processes.

5.1.23 The National Policy for Disaster Preparedness and Management, 2010

The Policy details the mechanisms and strategies for the effective and practical management of disasters, and presents the institutional framework under which partners (lead sectors, local governments, international development and humanitarian partners, the private sector and NGOs) can coordinate their operations.

Under section 1.1.4.8, the Policy states that socio-economic and environmental impact assessments shall be undertaken to guide planning and budgeting for disaster preparedness and management.

5.1.24 The National Employment Policy, 2011

The policy provides a framework for achieving the goal of decent and remunerative employment for all women and men seeking such work, in conditions of freedom, equity, security and human dignity.

Section 6.6 of the policy emphasises the need for employers to comply with Uganda's legal and regulatory framework to promote the rights of workers.

5.1.25 The National HIV/AIDs Policy, 2011

The policy provides a broad framework for delivering Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) services in the country. It stipulates policies and legal requirements that guide planning and action in social and economic sectors and at the various levels of the response to HIV and AIDS.

Under section 3.1 (Policy: Coordination and Management of the National Response), Government requires all stakeholders involved in development efforts to mainstream HIV and AIDS in their policies and plans.

5.1.26 The National Social Protection Policy, 2015

The Policy seeks to promote effective coordination and implementation of relevant social protection interventions to complement the efforts of the poor and vulnerable to cope with socioeconomic risks and shocks.

The proponent has elicited the views and concerns poor and vulnerable members of the affected communities as part of the stakeholder engagement process.

5.1.27 National Content Policy for the Petroleum Industry in Uganda, 2017

The Policy establishes a framework for significant national participation in the petroleum sector for the benefit of the Ugandan economy, the sector itself and society at large.

The proponent will implement requirements specified under Section 4.3 (role of the private sector) that include among others:

- preparation of plans for promotion of national content
- ensuring that national content is a criterion in the evaluation and award of bids and tenders
- utilizing locally available goods
- promoting best employment practices and industry standards.

5.1.28 The National Population Policy for Social Transformation and Sustainable Development, 2008

The Policy aims to improve the quality of life of the people of Uganda by achieving the following objectives:

- Monitoring of population data and integration of population variables into development policies, plans and programmes;
- Improvement of population health, family planning and social welfare;
- Development of skills and human capital;

- Improvement of nutrition and food security, increase in household incomes, protection of the environment and sustainable use of natural resources; and
- Planned urbanisation and human settlements development.

5.2 National Laws

5.2.1 The Constitution of the Republic of Uganda, 1995

The Constitution, as the supreme law, provides the legal and regulatory framework in the country and provides for all aspects pertaining to the environment and other related aspects. Articles 39 and 41 of the Constitution provide that everyone has a duty to maintain a sound environment. It also stipulates that every person in Uganda has a right to a healthy and clean environment and as such can bring action for any pollution or improper disposal of wastes. Chapter III, Section 245 stipulates that the Parliament shall by law provide measures intended to protect and preserve the environment from abuse, pollution and degradation.

5.2.1.1 Protection of natural resources Objective (XIII)

The State shall protect important natural resources, including land, water, wetlands, minerals, oil, fauna and flora on behalf of the people of Uganda.

5.2.1.2 Clean and safe water Objective (XXI)

The State shall take all practical measures to promote a good water management system at all levels.

5.2.1.3 Social and Economic Objective (XIV)

Under the general social and economic objective the State shall endeavour to fulfil the fundamental rights of all Ugandans to social justice and economic development and shall in particular ensure that all developmental efforts are directed at ensuring the maximum social and cultural well-being of the people.

5.2.1.4 Cultural Objective (XXIV)

Cultural and customary values which are consistent with fundamental rights and freedoms, human dignity, democracy and with the Constitution may be developed and incorporated in aspects of Ugandan life. The State shall promote and preserve those cultural values and practices which enhance the dignity and well-being of Ugandans.

5.2.1.5 Cultural Objective (XXV): Preservation of Public Property and Heritage

The State and citizens shall endeavour to preserve and protect and generally promote the culture of preservation of public property and Uganda’s heritage.

5.2.1.6 The Environment Objective (XXVII)

The state shall promote and implement energy policies that ensure that people’s basic needs and those of the environment are met.

5.2.2 The Historical Monuments Act, 1968, Cap. 46

The Act provides for the survey, collection, documentation, preservation, and protection of historical monuments and objects of archaeological, palaeontological, ethnographical, and traditional interest. Provisions are set out for the declaration and protection of ‘preserved’, ‘protected’ and ‘discovered’ objects. The Minister may, by statutory instrument, declare any object of archaeological, palaeontological, ethnographical, traditional or historical interest to be a preserved object for the purposes of this Act.

The National Environment Act, 2019Section 110 (1) The purpose of environmental and social assessments undertaken under this Act and regulations made under this Act is to evaluate environmental and social impacts, risks or other concerns of a given project or activity, taking into account the environmental principles set out in section 5(2).

Section 112 (1) A developer of a project set out in Schedule 4 to this Act shall undertake an environmental and social impact assessment by way of project brief.

5.2.3 The Petroleum (Exploration, Development and Production) Act, 2013

The Petroleum (Exploration, Development and Production) Act operationalises the National Oil and Gas Policy of Uganda. Among its other functions, the Act seeks to establish institutions to manage petroleum resources and regulate petroleum activities including licensing, exploration, development, production and decommissioning.

Section 3 outlines the environmental principles to which all licensees shall comply including the duty to comply with the principles of the National Environment Act, the duty to:

- Manage waste arising out of petroleum activities in accordance with the National Environment Act and all applicable legislation; and
- Contract a separate entity to manage the transportation, treatment and disposal of waste arising out of petroleum activities.

5.2.4 Petroleum (Refining, Conversion, Transmission and Midstream Storage) Act 4, 2013

The Act establishes the legal framework for sustainable management of the midstream oil and gas sector:

- Establishes a legal framework to ensure that midstream operations in Uganda are carried out in a sustainable manner. The objectives of the Act are to regulate, manage, coordinate and monitor midstream operations; to enable the construction, placement and ownership of facilities; and to provide for third-party access to facilities and to regulate tariffs for facilities;
- Outlines the duty of the licensee to comply with environmental principles under the National Environment Act, including management of transportation, storage, treatment and disposal of waste arising from midstream operations (same as Upstream Act requirements) (Section 3); and
- Promotes state participation and national content in midstream operations (Sections 52 – 55).

5.2.5 The Water Act, Cap 152

Objectives of the Act include, among others, i) the promotion of rational management and use of the waters of Uganda through the coordination of all public and private activities which may influence the quality, quantity, distribution, use or management of water resources; and ii) control of pollution and promotion of the safe storage, treatment, discharge and disposal of waste which may pollute the water or otherwise harm the environment and human health.

Section 6, subsection (2)(a) states that no person shall sink any well or use any water pursuant to section 31 of the Mining Act without a permit to undertake works or a water permit as may be required by the Minister or Regulations made under this Act.

Section 20, subsection (c) stipulates that the holder of a water permit issued under this Division 3 of the Act shall:

a) Not cause or allow any water to be polluted;

a) Prevent damage to the source from which water is taken or to which water is discharged after use;

b) Take precautions to ensure that no activities on the land where water is used result in the accumulation of any substance which may render water less fit for the purpose for which it may be reasonably used;

c) Observe conditions prescribed by regulations made under the Act; and

d) Observe any special condition that may be attached to the permit.

Section 28, subsection (2) states that a person who is responsible for the production, storage, discharge or deposit of any waste prescribed under subsection (1) shall not cause or permit any waste to be discharged directly or indirectly into any water, except in accordance with a waste discharge permit.

Section 31, subsection (1) further states that a person commits an offence if, unless authorized under this Part of the Act causes:

a) Waste to come into contact with any water;

b) Waste to be discharged directly into water; and

c) Water to be polluted.

5.2.6 The Uganda Wildlife Act, Cap 200 *(currently under review)*

Section 15, subsection (1) of the Act requires that any project which may have a significant effect on any wildlife species or community will be subject to environmental impact assessment in accordance with the National Environment Act. Subsection (2) further stipulates that the authority shall perform all the functions required of a lead agency for purposes of an environmental impact assessment under the National Environment Act, and any regulations made under the National Environment Act, unless the authority is the developer.

5.2.7 The Fish Act, Cap 197, 1951

The Act provides for the control of fishing and for the conservation, purchase, sale, marketing and processing of fish. Section 12 (4) of the Act stipulates that “except where otherwise expressly provided by any written law, no person shall divert the waters of any lake, river, stream, pond or private waters in which fish, their eggs or progeny have been introduced with the consent of the chief fisheries officer”.

5.2.8 The Historical Monuments Act, 1968, Cap. 46

The Act provides for the survey, collection, documentation, preservation, and protection of historical monuments and objects of archaeological, palaeontological, ethnographical and traditional interest. Provisions are set out for the declaration and protection of ‘preserved’, ‘protected’ and ‘discovered’ objects. The Minister may, by statutory instrument, declare any object of archaeological, palaeontological, ethnographical, traditional or historical interest to be a preserved object for the purposes of this Act.

5.2.9 The Local Governments Act, Cap 243

The Local Governments Act, Cap 243 establishes a form of government based on the District as the main unit of administration. The Districts are given legislative and planning powers under this Act. They also plan for the conservation of environment within their local area. District Environment Committees established under Section 15 of the National Environment Act, Cap 153 guide the district authorities in that regard. District authorities must therefore be involved at an early stage of project implementation since they have a stake in the project as overseers of environmental issues in their local areas of jurisdiction.

5.2.10 The Land Act, Cap. 227 as well as Land (Amendment) Act, 2010

The Land Act, Cap 227 provides for the ownership and management of land. It provides for four different types of land tenures (Customary, Leasehold, Mailo and Freehold) and the procedure for applying for grant of any of the tenures. The Act states that non-citizens of Uganda may only be granted leases not exceeding 99 years.

The developer of an energy project should seek to enter into mutual agreement with the occupier or owner of the land. The Act creates a series of land administration institutions consisting of the Uganda Land Commission (ULC), District Land Boards (DLB), Parish Land Committees (PLC) and land tribunals. Section 78 of the Act gives valuation principles for compensation. Section 40 requires the written consent from the spouse(s) and children before the household head transfers sells or enters into contract of land where the household derives its livelihood. District Land Tribunals have power to determine any disputes arising out of compensation for land.

Under the Land fund, there is a provision for resettling persons who have been rendered land-less by Government action. For energy development projects in general, the developer will have to source funds for resettlement or compensation.

The Land (Amendment) Act 2010 aims to enhance the security of occupancy of lawful and bona fide occupants on registered land in accordance with article 237 of the Constitution, and for related matters.

5.2.11 Land Acquisition Act, Cap 226, 1965

The Act provides for the compulsory acquisition of land for public purposes and for other matters incidental thereto and for adequate compensation to project affected persons in the event of compulsory acquisition.

5.2.12 The Physical Planning Act, 2010

The Act requires any person intending to undertake a development in a designated planning area to obtain development permission. It also stipulates that the Minister may, on the recommendation of the National Physical Planning Board, declare an area (such as the Albertine Graben) with unique development potential or problems as a special planning area and require the preparation of a physical development plan (PDP) [Section 24 (1)].

5.2.13 The Occupational Safety and Health Act, 2006

Section 13(1) (a) of the Occupational Health and Safety Act, 2006 states that "it is the responsibility of an employer to take as far as is reasonably practicable, all measures for protection of his or her workers and the general public from the dangerous aspects of the employer are undertaking at his or her own cost." It further stipulates [Section 13(1) (b)] that it is the responsibility of the employer "to ensure, as far as is reasonably practicable, that the working environment is kept free from any hazard due to pollution by:

- Employing technical measures applied to new plant or process in design or installation or added to existing plant or processes; or
- Employing supplementary organizational measures".

Section 13(2) (c) states that it is the employer's duty to ensure the provision of adequate and appropriate information, instructions, training and supervision necessary to ensure, as far as is reasonably practicable, the safety and health of the employees, and the application and use of occupational safety and health measures, taking into account the functions and capabilities of the different categories of workers in an undertaking. Section 25 (a) provides that it is the duty of the employer to display or provide safety precautions to any person who may be affected by the manner in which the employer conducts his undertaking, whether or not that person is his or her worker.

Section 27 stipulates that it is the duty of the person with control of premises to which section 26 applies to use the best practicable means to prevent the emission into the atmosphere from the premises, of toxic or offensive substances and to render and inoffensive any substances that may be emitted. Section 35 (a) makes it the duty of every worker to take reasonable care for the health and safety of himself or herself and of any other person who may be affected by his or her acts or omissions at work. Other sections relevant to this particular project include sections 61, 67, 83 (handling of hazardous materials), 91 (provision of personal protective gear), 97 (labelling of hazardous chemicals) and 102 (penalties in cases of fatal and non-fatal injuries).

5.2.14 The Public Health Act, Cap 281

The main objective of the Public Health Act is to safeguard and promote public health. Section 7 of the Act provides local authorities with administrative powers to take all lawful, necessary and reasonable measures for preventing the occurrence of, or for dealing with any outbreak or prevalence of any infectious communicable or preventable diseases. Local Authorities are mandated to exercise powers and perform the duties in respect of public health conferred or imposed by this act or any other law.

Section 105 of the Act imposes a duty on the Local Authority to take measures to prevent any pollution dangerous to the health of any water supply that the public has a right to use for drinking or domestic purposes. The Act also details the siting of waste disposal facilities such as solid waste skips in relation to settlements and food points.

5.2.15 The Plant Protection and Health Act, 2015

Section 10 outlines the duty of every owner or occupier of land, upon instruction from an Inspector authorised under the Act, to implement appropriate measures for eradication, reduction or prevention of the spread of any harmful organisms to plants.

This Act requires the proponent to manage any attendant spread of harmful organisms occurring within the project area.

5.2.16 The National Forestry and Tree Planting Act, 2003

The Act prohibits the destruction, damage or disturbance of natural forests and forest reserves except in the course of carrying out activities for their sustainable management, or in accordance with a licence issued under this Act.

Section 38 also requires any person tending to undertake a project or activity, which may, or is likely to have a significant impact on a forest to undertake an environmental impact assessment.

5.2.17 Access to Roads Act, Cap 350, 1969

The Act establishes the procedure by which a proponent may obtain access from a public highway. It stipulates that the proponent is to consult adjoining landowners before the construction of access roads to project facilities. The Act also provides for the establishment of a legal regime to limit damage to land adjoining the access road, for maintenance of the access road, and for payment of compensation by the applicant in respect of the use of land, the destruction of crops or trees and such other property.

5.2.18 The Roads Act, Cap 358

The Act provides for the establishment of road reserves and for maintenance of roads.

Road upgrades that shall be undertaken due to proposed project activities will be subject to this Act.

5.2.19 The Traffic and Road Safety Act, Cap 361, 1998

The Act establishes the overarching requirements for the use of road vehicles in Uganda, including registration of vehicles, issuance of driver permits, licensing of public service, omnibuses and goods vehicles. It also sets the enabling framework for related traffic and road safety regulations.

5.2.20 The Atomic Energy Act, 2008

Subject to section 33, no person shall acquire, own, possess, operate, import, export, hire, loan, receive, use, install, commission, decommission, transport, store, sell, distribute, dispose of, transfer, modify, upgrade, process, manufacture or undertake any practice related to the application of atomic energy and regulated by this Act unless permitted by an authorisation issued under this Act.

This legislation regulates the management of radioactive materials and substances including the transport thereof.

5.2.21 The Domestic Violence Act, 2010

The Act provides for the protection and relief of victims of domestic violence and for the punishment of perpetrators of domestic violence.

The proponent has identified measures to address domestic violence as an indirect outcome of project activities in local communities.

5.2.22 The Survey Act, Cap 232

The Act provides for and guides the survey of land in Uganda including aspects such as access to lands under survey, and compensation for injury caused during survey activities.

Requires the developer to undertake land acquisition activities in accordance with the requirements of the Act including provision of prior notice and compensation for injury done by clearance among others.

5.2.23 The Registration of Titles Act, Cap 230

The Act stipulates the requirements relevant to the registration and issuance of titles to land transfer of registered land.

The proponent is required to comply with the requirements of the Act during any acquisition of land for establishment of project components.

5.2.24 The Illiterates Protection Act, Cap 78

The Act provides for the protection of illiterate persons in relation to writing and signing of documents on behalf of such persons.

Requires the proponent to ensure adherence to this Act during any writing, signing or endorsement of documents pertaining to land acquisition or compensation related to the project.

5.2.25 The Public Finance Management Act, 2015

The Act sets out that the government will give 1% of royalties arising from petroleum production due to central government to a gazetted cultural or traditional institution.

The traditional authorities within the Project Area have stated that these royalties will constitute a key source of revenue for the cultural institutions and that they will contribute to various development projects on education, health, culture and infrastructure projects.

5.2.26 The Income Tax Act, Cap 340 and the Income Tax (Amendment Act), 2011

The Act consolidates and amends the law relating to income tax payable by persons or businesses in Uganda and for other connected purposes.

The developer shall pay taxes due on chargeable income as stipulated in Part IV of the Act.

5.2.27 The National Forestry and Tree Planting Act, No. 8 of 2003

A person intending to undertake a project or activity which may, or is likely to have a significant impact on a forest shall undertake an environment impact assessment.

An environment impact assessment stating the likely impacts on and proposed mitigation measures have been included in this report.

5.3 National Regulations

5.3.1 The Environmental Impact Assessment Regulations, 1998 *(currently under review)*

The EIA Regulations, 1998 specify the general requirements for good EIA practice in Uganda. These include requirements such as prior preparation of Terms of Reference for environmental impact studies, public involvement at various stages of the EIA process, production of non-technical (executive) summaries for EIA reports, and implementation of post-assessment audits.

5.3.2 The National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, 2000

The regulations (under regulation 5 (a)) stipulate that an environmental impact assessment under the National Environment Act, Cap 153 is mandatory for all activities in wetlands likely to have an adverse impact on the wetland.

Regulation 12, sub-regulation (1) further states that “subject to the provisions of the Regulations, a person shall not carry out any activity in a wetland without a permit issued by the Executive Director”. Regulation

5(c) states that special measures are essential for the protection of wetlands of international, national and local importance. Regulation 8(1) states that a wetland of national or international importance must be formally declared as such by the responsible Minister.

Regulation 8(3) states that a “fully protected” wetland is an area of international and national importance in which research, tourism and restoration or enhancement may be permitted. Regulation 8(6) states that the wetlands specified in the Third Schedule to the Regulations are declared to be wetlands of national and international importance. There is only one wetland listed in the Third Schedule: “wetlands on the shores of Lake George and associated in-flowing rivers”.

5.3.3 The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999 *(currently under review)*

The Regulations prescribe the requisite standards for effluent or waste water that may be discharged from industries and establishments into water or on land.

Regulation 4, Sub-regulation (1) stipulates that every industry or establishment shall install at its premises anti-pollution equipment, so that the operations of his/her business do not cause harm to the environment. Sub-regulation (2) states that anti-pollution equipment installed under regulation (1) shall be based on the best practicable means and environmentally sound practice or other guidelines as the Executive Director (of NEMA) may determine.

The Regulations also impose upon the lead agency a duty to maintain records on waste generated by the activity [Regulation 5 (1) (a)] and to submit the records to the Executive Director (NEMA).

5.3.4 The Water (Waste Discharge) Regulations, 1998

These regulations prescribe limits for the discharge of waste into water resources, specifying among others restricted activities for which waste discharge permits must be acquired. Regulation 4, sub-regulation (1) specifies that no person shall discharge effluent or waste on land or into the aquatic environment contrary to the given standards unless he or she has a permit in the format specified in the First Schedule issued by the Director. Sub-regulation (2) states that a person granted a permit under sub-regulation (1) shall ensure that the effluent or waste discharged conforms to the given maximum permissible limits.

Under Regulation 5, any person to whom a works approval has been issued, or who is or proposes to be responsible for producing, storing, discharging or disposing of any waste, or any waste containing a substance specified in the Second Schedule to the regulations, may apply to the Director for a waste discharge permit.

5.3.5 The Water (Water Resources) Regulations, 1998

The regulations outline requirements applicable to any person intending to construct, own, occupy or control works affecting water resources as defined by the regulations.

5.3.6 The National Environment (Waste Management) Regulations, 1999 *(currently under review)*

Under Regulation 11 (1), no person shall discharge any hazardous substances, chemical, oil or mixture containing oil in any water or any other segment of the environment except in accordance with guidelines prescribed by the Authority in consultation with the Lead Agency. Under subsection 4: the owner or operator of a production or storage facility, motor vehicle or vessel from which a discharge occurs shall mitigate the impacts of the discharge by giving immediate notice of the discharge to NEMA and other Government officials and immediately beginning clean–up operations using the best available methods.

5.3.7 The Petroleum (Waste Management) Regulations, 2019

The licensee and the petroleum waste handler shall, in compliance with the environmental principles set out in the National Environment Act, apply measures in the management of petroleum waste-

a. to prevent harm to human health and ensure safety of human beings;

b. to prevent pollution, harm to biological diversity and contamination of the wider environment by petroleum waste;
c. to use the best available technologies and best environmental practices; and
d. to ensure resource efficiency by –
    i. by the implementation of the waste management hierarchy and the control or minimisation of the generation of waste to the greatest extent possible, arising from petroleum activities and midstream operations;
    ii. by promoting proper cyclical use of petroleum commodities and petroleum products as circulative resources; and
    iii. by ensuring proper disposal of circulative resources not put into cyclical use.

The licensee shall contract a separate entity as a petroleum waste handler to manage the transportation, storage, treatment or disposal of petroleum waste.

5.3.8 The National Environment (Noise Standards and Control) Regulations, 2003 *(currently under review)*

These regulations prescribe the maximum permissible noise levels from a facility or activity to which a person may be exposed, and provisions for control of noise and for mitigating measures for the reduction of noise. Under regulation 8, it is the duty of the owner of a facility or premises to use the best practicable means to ensure that the emission of noise from his/her premises does not exceed the permissible noise levels.

5.3.9 The National Environment (Mountainous and Hilly Areas Management) Regulations, 2000

These provide for the sustainable management of mountainous and hilly areas, and prescribe rules for soil conservation. The regulations also prohibit the introduction of invasive alien species. The National Environment (Audit) Regulations, 2006 (currently under review).

The regulations stipulate specific requirements pertaining to the execution of environmental audits provided for in the National Environment Act, Cap 153 and the Environmental Impact Assessment Regulations, 1998.

5.3.10 The Petroleum (Exploration, Development and Production) Regulations 2016

These regulations highlight the responsibility of the license in regards to opening of new areas for petroleum activities. Part II of the regulation spells out the requirement for impact assessment prior to opening up any area for petroleum operations and establishing an impact assessment program. Regulations 22 – 24 spell out requirements for the operators to have a Field Development plan and prepare a petroleum reservoir report. CNOOC will be required to follow-through with all relavant requirements as stated in the regulations.

5.3.11 The Petroleum (Exploration, Development and Production) (Health, Safety and Environment) Regulations, 2016

The regulations outline the duty of a licensee ‘to ensure that occupational safety and health in all upstream and midstream operations is satisfactory for the health and safety of employees and the environment.’

The regulations establish a number of mandatory safety measures for upstream and midstream operations including, among others:

- Risk assessment;
- Preparation of emergency plans;
- Use of protective equipment;
- Use of safety signs;
- Weather protection (for outdoor work areas); and

- Protection from extreme temperatures.

5.3.12 National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001

The main purpose of the legislation is to:

- Establish and prescribe minimum soil quality standards to maintain, restore and enhance the inherent productivity of the soil in the long term;
- Establish minimum standards for the management of the quality of soil for specified agricultural practices;
- Establish criteria and procedures for the measurement and determination of soil quality; and
- Issue measures and guidelines for soil management.

5.3.13 The Atomic Energy Regulations, 2012

A person who intends to engage in a practice or possess a radiation source referred to in regulation 3 shall apply to the Council for an authorisation specified in Form 2A, 2B, 3, 4, 5, 6 and 7, Schedule 1 of these regulations.

A person who applies for an authorisation to import, export or transport any apparatus, article, plant, installation or other material or substance which is a source or intended to be used for the purposes of emission of radiation, shall submit to the Council information necessary to support his or her application as specified in Form 4 and Form 8, Schedule 1.

5.3.14 The National Content Regulations, 2016

The regulations prescribe the requirements for technology transfer of knowledge and skills relating to the petroleum industry to Ugandans to be employed by licensees.The developer shall implement and promote transfer of knowledge and skills to Ugandans during the project through a national content programme (s.7), including requirements such as employment and training of Ugandans, procurement of goods and services locally, and partnership with Ugandan companies, citizens and registered entities.

5.3.15 The National Forestry and Tree Planting Regulations, 2016

Under Regulation 27(6), on conclusion of the agreement, a certificate of registration in the form in Schedule 6, and in case of forest reserves, a license in the form in Schedule 7 shall be issued to the managing partner by the responsible body.

5.3.16 Upcoming legislation

In addition to the legislation under review at the time of this ESIA, the study anticipates that the following legislation could apply to the project upon enactment, and as such shall be reviewed and incorporated into the project's compliance mechanism.

- Air quality regulations and guidelines;
- Noise standards and control regulations; and
- Oil spill regulations and guidelines.

5.4 National Standards and Guidelines

5.4.1 National Standards

All relevant environmental standards prescribed in accordance with the National Environment Act Cap 153 and national regulations shall apply to the Project.

Standards currently in place include:

- Standards for Discharge of Effluent or Wastewater (National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999);
- Soil Quality Parameters – First Schedule to the National Environment (Minimum Standards For Management of Soil Quality) Regulations, 2001;
- Maximum Permissible Noise Levels – First Schedule to the National Environment (Noise Standards And Control) Regulations, 2003;
- Draft national air quality standards; and
- Uganda Standard for Drinking (Potable) Water (US EAS 12: 2014).

5.4.2 National Guidelines

In addition to national laws and regulations, further guidance on EIA practice in Uganda is provided through a number of general and sector-specific guidelines that include:

- Guidelines for Environmental Impact Assessment in Uganda (NEMA, 1997);
- Environmental and Social Impact Assessment Guidelines for the Energy Sector in Uganda (NEMA, 2014);
- Environmental Impact Assessment Guidelines for the Energy Sector (NEMA, 2004);
- Environmental Impact Assessment Guidelines for Water Resources Related Projects in Uganda (Ministry of Water and Environment, 2011);
- Environmental Impact Assessment Guidelines for Road Projects (Ministry of Works, Housing and Communications 2004);
- Water Source Protection Guidelines for Uganda (MWE 2013);
- National Physical Planning Standards and Guidelines, 2011; and
- Uganda Wildlife Authority Operational Guidelines for Oil and Gas Exploration and Production in Wildlife Protected Areas (2014).

5.5 Permits, Licences and Approvals

National laws and regulations provide for a number of permits, licences and approvals that could apply to the project or specific activities within its operational scope. Requirements within the legislation typically stipulate that these permits, licences and approvals shall be acquired before commencement of the activities to which they apply (Table 5-1).

Table 5-1: Permits, Licences and Approvals

TYPE OF PERMIT/APPROVAL	SUPPORTING LEGISLATION	REQUIREMENT	APPLIES TO	APPROVING AUTHORITY	TYPE OF APPLICATION SUBMITTED	STAGE AT WHICH APPROVAL IS REQUIRED
Groundwater Abstraction Permit/Surface Water Abstraction Permit	The Water Act, Cap 152	Section 18: Subsection (1): No person shall construct or operate any works unless authorized to do so under this Part of the Act. Section 18: Subsection (2): A person wishing to construct any works or to take and use water may apply to the director in the prescribed form for a permit to do so.	Any abstraction of water from natural surface waters (lake, river or stream) and groundwater (aquifer, spring, etc.).	Directorate of Water Resource Management (DWRM)	■ Form A: Application for a Surface Water Permit; and ■ Form B: Application for a Ground Water Permit.	Prior to any project-related surface or groundwater abstraction.
	The Water Resources Regulations, 1998	Regulation 3, sub-regulation (1): A person who, (a) occupies or intends to occupy any land; (b) wishes to construct, own, occupy or control any works on or adjacent to the land referred to in Regulation 10; may apply to the Director for a water permit.				
		Regulation 3, Sub-regulation (2): An application referred to under sub-regulation (1) shall, (a) be in the form specified in the First Schedule to these regulations except that, i) Form A shall be used for surface water permits; and ii) Form B shall be used for ground water permits.				
Construction Permit	The Water Act, Cap 152	Section 18: Subsection (1): No person shall construct or operate any works unless authorized to do so under this Part of the Act. Section 18: Subsection (2): A person wishing to construct any works or to take and use water may apply to the director in the prescribed form for a permit to do so.	■ Any works or structures constructed in or adjacent to natural waters (rivers or lakes) whether temporary or permanent; and ■ Any abstraction of groundwater requiring construction of a borehole.	DWRM	Form F1: Application for Construction Permit.	Prior to any project-related water abstraction construction of works or structures in or adjacent to natural waters.
	The Water Resources Regulations, 1998	Regulation 16, Sub-regulation (2): A person who wishes to engage a driller under sub-regulation (1) to construct a borehole on his or her land for the purpose of, (a) using water; (b) re-charging an aquifer; or (c) fitting a motorised pump to a borehole, may apply to the Director for a construction permit in Form F1 of the Sixth Schedule.				
Waste Water Discharge Permit	The Water (Waste Discharge) Regulations, 1998	Regulation 4, sub-regulation (1): No person shall discharge effluent or waste on land or into the aquatic environment contrary to the standards established under regulation 3 unless he or she has a permit in the format specified in the First Schedule issued by the Director.	Any project likely to result in the discharge of effluent or waste water (treated or untreated) onto land or into a water body.	DWRM	Form A: Application for a Waste Discharge Permit.	Prior to construction of project facilities (e.g. camps, well pads).
Licence to Emit Noise in Excess of Permissible Noise Levels	The National Environment (Noise Standards And Control) Regulations, 2003	Regulation 12, Sub-regulation (1): An owner or occupier of premises whose works or activities are likely to emit noise in excess of the permissible noise levels shall apply to the Executive Director in the form prescribed in Part I of the Second Schedule, for a Licence to Emit Noise in Excess of the Permissible Levels.	Projects in which it is highly likely that noise levels generated by the proposed activity will exceed permissible levels and cause a significant nuisance effect (e.g. flaring and quarrying).	NEMA	Form NEMA/NC: Application For A Licence to Emit Noise in Excess of Permissible Noise Levels.	Prior to commencement of activities likely to emit noise in excess of permissible levels.

TYPE OF PERMIT/APPROVAL	SUPPORTING LEGISLATION	REQUIREMENT	APPLIES TO	APPROVING AUTHORITY	TYPE OF APPLICATION SUBMITTED	STAGE AT WHICH APPROVAL IS REQUIRED
Permit to Carry Out a Regulated Activity in a Wetland/River Bank/Lake Shore	The National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, 2000	Regulation 12, Sub-regulation (1): Subject to the provisions of Regulations, a person shall not carry out any activity in a wetland without a permit issued by the Executive Director. Regulation 12, Sub-regulation (2): Any person intending to carry out an activity listed in the Second schedule to these Regulations shall apply to the Executive Director for a permit in Form A of the First Schedule.	Any regulated activity (listed in the Second Schedule to the Regulations) undertaken in a wetland, or within the protection zone of a riverbank: ■ 100 m from the highest watermark of a river listed in the Sixth Schedule; ■ 30 m for a non-listed river; ■ 200 m from the low watermark for a listed lake; ■ 100 m for a non-listed lake.	NEMA	Form A: Application for a Permit to Carry out a Regulated Activity in a Wetland/River Bank/Lake Shore.	Prior to undertaking any project activities within wetlands, riverbanks or lake shores.
		Regulation 23, Sub-regulation (1): A person who intends to carry out any of the following activities shall make an application to the executive Director in Form A set out in the First Schedule to these Regulations - (a) use, erect, reconstruct, place, alter, extend, remove or demolish any structure or part of any structure in, under, or over the river banks or lake shore; (b) excavate, drill, tunnel or otherwise disturb the river bank or lake shore; (c) introduce or plant any of a plant whether alien or indigenous on a river bank or lake shore; (d) introduce any animal or micro-organism, whether alien or indigenous in any river bank or lake shore; or (e) deposit any substance on a riverbank or lakeshore if that substance would or is likely to have adverse effects on the environment.				
Registration of a Workplace	The Occupational Safety and Health Act, 2006	Section 40, Subsection (2): a person shall not less than one month before he or she begins to occupy any premises as a workplace, serve on the Commissioner, a notice with the particulars prescribed in Schedule 3.	Any project requiring the establishment of a work place (e.g. drill site or camp).	■ Department of Occupational Safety and Health; and ■ Ministry of Gender, Labour and Social Development.	Particulars to be Submitted When Applying for the Registration of a Workplace or a Change in the Registered Occupier.	Immediately upon (not later than one month) prior to undertaking any site works (construction, operation, pre-construction surveys).
Development Permission	The Physical Planning Act, 2010	Section 33, Subsection (1): A person shall not carry out a development within a planning area without obtaining development permission from a physical planning committee.	Any development involving construction of permanent or semi-permanent structures or establishments such as base camps.	District Technical Planning Committee.	Form PPA 1: Application for Development Permission.	Before commencement of any project activities.
Licence for Storage of Hazardous /Non Hazardous Waste	The National Environment (Waste Management) Regulations, 1999	Regulation 6, Sub-regulation (1): A person intending to store waste on his or her premises shall apply to the Authority for a licence in Form III set out in the First Schedule.	Any project requiring construction or operation of a storage facility for hazardous or non-hazardous waste (e.g. drill cuttings).	NEMA.	Form III: Application for a Licence for Storage of Hazardous Waste.	Prior to commencement of any activity requiring temporary storage of hazardous waste.

TYPE OF PERMIT/APPROVAL	SUPPORTING LEGISLATION	REQUIREMENT	APPLIES TO	APPROVING AUTHORITY	TYPE OF APPLICATION SUBMITTED	STAGE AT WHICH APPROVAL IS REQUIRED
Authorisation to use radioactive sources	The Atomic Energy Act, (Cap 143)	Section 32, Subsection (1): Subject to section 33, no person shall acquire, own, possess, operate, import, export, hire, loan, receive, use, install, commission, decommission, transport, store, sell, distribute, dispose of, transfer, modify, upgrade, process, manufacture or undertake any practice related to the application of atomic energy and regulated by this Act unless permitted by an authorisation issued under this Act.	Projects requiring the use of radioactive materials e.g. oil well drilling.	Atomic Energy Council, Ministry of Energy and Mineral Development.	■ Notification of Council (requirements listed in Section 34 (2)); and ■ Application for an Authorisation (required information listed in Section 35 (1) of the Act.	Prior to commencement of project activities (specifically well drilling).
Licence to erect or carry on a magazine	The Explosives Act, (Cap 298)	Section 22, Subsection (1): Any person desiring to erect or carry on a magazine for the storage of explosives shall make application for a licence to erect or carry on a magazine.	Activities requiring the temporary storage of explosives.	Ministry of Internal Affairs.	Licence to erect or carry on a magazine.	Prior to procurement and/or use of explosives.
Lease Agreement	The Registration of Titles Act, (Cap 230)	Section 101: The proprietor of any freehold under the operation of this Act may, subject to any law or agreement for the time being in force, lease that land for any term exceeding three years by signing a lease of it in the form in the Eighth Schedule to this Act.	Access to or use of land for project activities.	District Land Board.	Application for Lease.	Prior to temporary use of or access to land for project activities.
	The Land Act, (Cap 227)	Section 73: Where it is necessary to execute public works on any land, an authorised undertaker shall enter into mutual agreement with the occupier or owner of the land in accordance with this Act; and where no agreement is reached, the Minister may, compulsorily acquire land in accordance with section 42.				
	The Land Acquisition Act, (Cap 226)	Section 19: Nothing in this Act shall prevent the Government from entering into an agreement with a person having an interest in land by which— ■ that person's interest in land is acquired by the Government; or ■ that person's claim to compensation for land under this Act is settled by the grant of other land or in any other way.				

5.6 Institutional Framework

The following are the key institutional stakeholders who have an interest in the project.

5.6.1 National Environment Management Authority

The National Environment Management Authority (NEMA) is the principal agency in Uganda for the management of the environment, mandated to coordinate, monitor and supervise all activities in the field of the environment. In accordance with its functions stipulated under section 6, subsection (1) of the National Environment Act Cap 153, the authority is mandated to ensure observance of proper safeguards in the planning and execution of all development projects, including those already in existence that have or are likely to have significant impact on the environment.

5.6.2 Petroleum Authority of Uganda

The Petroleum Authority of Uganda (PAU) is a statutory body established under the Petroleum (Exploration, Development and Production) Act 2013 with a mandate to monitor and regulate the exploration, development and production, together with the refining, gas conversion, transportation and storage of petroleum in Uganda. The authority is also responsible for implementing functions under the Petroleum (Refining, Conversion, Transmission and Midstream Storage) Act, 2013.

5.6.3 Petroleum Exploration, Development and Production Department

The Department (part of the Ministry of Energy and Mineral Development) implements the National Oil and Gas Policy for Uganda (2008), and is responsible for initiating policy and legislation on petroleum exploration and development. The PEDPD regulates licensees undertaking petroleum exploration and production in the country, and is responsible for building national capacity in the field of petroleum exploration and development.

5.6.4 Uganda Wildlife Authority

The Authority was established under the Uganda Wildlife Act, Cap 200, and is mandated to perform all the functions required of a lead agency for purposes of an EIA for any project that may have a significant effect on any wildlife species or community.

5.6.5 Uganda National Roads Authority

The UNRA develops and maintains the national roads network, advises Government on general roads policy and contributes to addressing transport concerns. Additionally, the authority collaborates with the private sector on issues relating to the development and maintenance of roads.

5.6.6 District Government

District Local Government is defined as one of the lead agencies under the National Environment Act and is mandated to establish a District Environment Committee that coordinates with NEMA on all issues relating to environment management. The District Environment Officer (DEO) in particular will play an active role in monitoring of environmental aspects, and liaise with the NEMA on all matters relating to the environment. The Act also provides for the establishment of Local Environment Committees that may be appointed to monitor all activities within their local jurisdiction to ensure that such activities do not have any significant impact on the environment, and to report any events or activities which have or are likely to have significant impacts on the environment to the District Environment Officer.

5.6.7 Directorate of Water Resources Management (DWRM)

The Directorate is responsible for managing, monitoring and the regulation of water resources through issuing water use, abstraction and wastewater discharge permits.

5.6.8 Wetlands Management Department (WMD)

The Wetlands Management Department is the agency responsible for the management of wetlands. Its functions include the evaluation of EIAs with a bearing on wetlands. The proposed project could impact a number of wetlands that are under the Department's control.

5.6.9 Department of Museums and Monuments, Ministry of Tourism, Wildlife and Heritage (MTWH)

The Department is mandated to protect, promote and present the cultural and natural heritage of Uganda. Its key functions include the conservation and maintenance of important physical cultural resources or heritage collections.

5.6.10 Department of Occupational Safety and Health, Ministry of Gender Labour and Social Development (MGLSD)

The Department is responsible for administering the Occupational Safety and Health Act, 2006, and carries out regular statutory inspections to ensure proper management of health and safety in the work place including in oil and gas activities.

5.6.11 The National Forest Authority

The National Forest Authority (NFA) responsible for implementation of the requirements of the National Forestry and Tree Planting Act (2003) which provides for the conservation and sustainable management and development of forest for the benefit of the peoples of Uganda.

5.7 Strategic Environmental Assessment

In 2015, the Cabinet approved the framework for implementation of Strategic Environmental Assessment (SEA) for the Albertine Graben, which was meant to ensure that oil and gas activities are undertaken in a manner that conserves the environment and biodiversity. The Ministry of Energy and Mineral Development and that of Water and Environment jointly undertook the SEA of oil and gas operations in the Albertine Graben from April 2010 to September 2013. The Assessment involved various stakeholders, who included Government institutions (at national, regional and district levels), civil society (non-governmental organizations, faith-based organizations, community-based organizations), business and industry players (private enterprises) and cultural institutions.

The SEA states that "if the Government decides to open up for petroleum activities in highly sensitive hotspot areas, both parties have a clear responsibility of doing whatever possible to minimize the impacts on the environment" to "take the opportunity to benefit biodiversity in and around project sites", "ensure maintenance of the status-quo of the ecosystem and the biodiversity or even improving it", "take a pro-active approach (...) strengthen creation and management of protected areas, support for scientific research/assessment, initiate and support campaigns to save endangered species (...), support capacity building in national/regional agencies, support for conservation easement and support to integrated conservation and development".

Key Issues were divided into groupings for ease of management:

- Group 1 – Petroleum Related Activities in Protected and Environmentally Sensitive Areas;
- Group 2 - Co-existence with Local Communities;
- Group 3 - Co-existence with Archaeology and Cultural Heritage;
- Group 4 - Co-existence with Other Industries and Service Providers (i.e. Local Content and training);
- Group 5 - Co-existence with Tourism;
- Group 6 - Co-existence with Fisheries;

- Group 7 – Sharing of Revenues and Wellbeing between the National and the Local / Regional level. Co-operation;
- Group 8 – Discharge and Emissions from the Petroleum Industry;
- Group 9 – Waste Management;
- Group 10 – Water Management;
- Group 11 – Oil Spill Preparedness on Land and Surface Waters;
- Group 12 – LABSG LOGISTICS: Infrastructure Development in the Region and Transportation of Crude, Products and Construction Materials;
- Group 17 – Trans-boundary and International Issues (i.e. surface water oil spill and fisheries);
- Group 18 – Establishment of Transparent Baseline data and Scientific Basis; and
- Annex 10 – Resettlement Policy Framework.

5.8 International Conventions and Agreements

Uganda has ratified and assented to a number of international conventions and agreements. The obligations specified within these conventions are supported by provisions of specific policies, acts, regulations and government agencies. These are outlined in Table 5-2.

Table 5-2: International Conventions and Agreements

TREATY, CONVENTION, AGREEMENT	SUBJECT	SIGNED/ ACCEPTED	RATIFIED	APPLICATION TO PROPOSED PROJECT
Bonn Convention, 1979	Convention on the Conservation of Migratory Species of Wild Animals	-	01/08/2000	The proponent should consider the potential impact of the project on globally vulnerable and migratory species.
Convention on Biological Diversity, 1992	Conservation, sustainable and equitable use of biodiversity	-	08/09/1993	Requires, under Principle 17, that EIA shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority. At the ninth meeting of the Conference of Parties (COP9) in 2008, one of the decisions of the Conference was to consider biodiversity offset mechanisms where relevant and appropriate while ensuring that they are not used to undermine unique components of biodiversity. The biodiversity offsets are designed to achieve no net loss (or a net gain) in the context of development projects (UNEP 2010).
Nile Basin Initiative, 1999	Agreement between riparian countries of the Nile to develop and manage water resources in a sustainable and equitable manner.	-	08/2002	NA
UNCCD, 1994	United Nations Convention to Combat Desertification.	21/11/1994	25/06/1997	The Convention is supported by the following Acts that shall apply to the project: the National Environment Act, Cap 153; the Environmental Impact Assessment Regulation, 1998; the Land Act, Cap. 227 as amended; the Local Governments Act, Cap 243; the Water Act, Cap 152; the Uganda Wildlife Act, Cap 200; the National Forestry and Tree Planting Act, 2003; the Prohibition of the Burning of Grass Act, Cap 33; and the Physical Planning Act, 2010.

TREATY, CONVENTION, AGREEMENT	SUBJECT	SIGNED/ ACCEPTED	RATIFIED	APPLICATION TO PROPOSED PROJECT
Kyoto Protocol, 1997	The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC), aimed at fighting global warming. The UNFCCC is an international environmental treaty with the goal of achieving the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."	25/03/2002 acceptance	16/02/2005 entered into force	The proponent must demonstrate they have explored all alternatives and identified the least polluting solution according to best available techniques and best practical environmental option.
Montreal Protocol, 1987	The Montreal Protocol on Substances that Deplete the Ozone Layer	-	15/09/1988	In accordance with supporting local legislation, resourcing of goods and materials should not be from a country that is not a signatory of the Montreal Protocol. Additionally, any imports of controlled substances should be licenced by the relevant authority, and free of listed materials.
POPS, 2001	Stockholm Convention on Persistent Organic Pollutants	20/07/2004 accession	-	The proponent should take appropriate steps to prevent the use of chemicals listed under this Convention.
Convention for the Safeguarding of the Intangible Cultural Heritage, 2003	Intangible Cultural Heritage	-	13/05/2009	The proponent should consider the potential impact of the project on intangible cultural heritage and implement measures to safeguard it where it exists.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973) (CITES)	Trade in endangered species of wild fauna and flora	18/07/1991 accession	16/10/1991 entered into force	The proponent should consider the potential impact of the project on endangered species of wild fauna and flora, directly or indirectly, within the project area of influence.

TREATY, CONVENTION, AGREEMENT	SUBJECT	SIGNED/ ACCEPTED	RATIFIED	APPLICATION TO PROPOSED PROJECT
Ramsar, 1971	Convention on Wetlands of International Importance especially as Waterfowl Habitat	-	04/03/1988	NA
Convention on the Elimination of All Forms of Discrimination against Women (CEDAW)	United Nations Convention on discrimination against women	30/07/1980	22/07/1985	The Project area likely includes many women whom are single parents and others who are constantly being cheated out of their rights to property or discriminated against by men. The responsibility for implementation of CEDAW in Uganda lies with the Uganda Human Rights Commission (UHRC) which was established by the Constitution of the Republic of Uganda (Article 51). The Ministry of Gender Labour and Social Development provides the national machinery for gender mainstreaming (CEDAW 2015). The MGLSD, the UHRC and relevant departments within the Ministry are to be engaged as part of the ESIA.
International Convention on the Elimination of All Forms of Racial Discrimination	United Nations Covenant on racial discrimination	21/10/1980	-	The Uganda Human Rights Commission (UHRC), established by the Constitution of the Republic of Uganda (Article 51), is responsible for combating the violation of human rights in Uganda and implementation of the international conventions. The Commission is to be engaged as one of the stakeholders of the ESIA. The Project proponent will engage in consultation with the UHRC as necessary.
International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families	United Nations Covenant on protection of migrant workers	14/10/1995	-	
Convention against Torture and Other Cruel		03/10/1986	-	

TREATY, CONVENTION, AGREEMENT	SUBJECT	SIGNED/ ACCEPTED	RATIFIED	APPLICATION TO PROPOSED PROJECT
Inhuman or Degrading Treatment or Punishment				
Convention on the Rights of Persons with Disabilities		30/03/2007	25/09/2008	
International Covenant on Economic, Social and Cultural Rights	United Nations Covenant on equal economic, social, cultural, civil and political rights within State Parties	21/01/1987	-	The Uganda Human Rights Commission (UHRC), established by the Constitution of the Republic of Uganda (Article 51), is responsible for combating the violation of human rights in Uganda and implementation of the international conventions. The Commission is to be engaged as one of the stakeholders of the ESIA with respect to issues related human rights violations.
International Covenant on Civil and Political Rights (including the First Optional Protocol on the ICCPR with reservations on Article 5)	United Nations Covenant on civil and political rights within State Parties	21/06/1995 (acceptance of Optional Protocol 14/11/1995)	-	

TREATY, CONVENTION, AGREEMENT	SUBJECT	SIGNED/ ACCEPTED	RATIFIED	APPLICATION TO PROPOSED PROJECT
Convention on the Rights of the Child. Optional Protocol to the Convention on the Rights of the Child on the involvement of children in armed conflict. Optional Protocol to the Convention on the Rights of the Child on the sale of children child prostitution and child pornography.	United Nations Convention on the rights of the child	17/08/1990 06/05/2002 30/11/2001	17/08/1990	
African Charter on Human and Peoples' Rights	International human rights instrument to promote and protect human rights and basic freedoms on the African continent	18/08/1986	10/05/1986	Chapter 4 of the 1995 Constitution of the Republic of Uganda fully domesticates the rights enshrined in the African Charter on Human and Peoples' Rights. The Constitution of the Republic of Uganda empowers the Uganda Human Rights Commission (UHRC) to carry out various human rights related functions including monitoring the Government's compliance with international treaties and conventions. The Commission shall be engaged as part of this ESIA with respect to issues related to human rights violations (ACHPR 2015).
African Charter on the Rights and Welfare of the Child	International human rights instrument on the rights and welfare of the child on the African continent	26/02/1992	17/08/1994	
Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa	International human rights instrument on human rights and the rights of women on the African continent	18/12/2003	22/07/2010	

TREATY, CONVENTION, AGREEMENT	SUBJECT	SIGNED/ ACCEPTED	RATIFIED	APPLICATION TO PROPOSED PROJECT
Labour Inspection Convention, 1947 (No. 81) (Excluding Part II)	ILO Convention concerning labour inspection in industry and commerce	-	04/06/1963	The Occupational Safety and Health Act, 2006 operationalises Uganda's commitments to the convention, the requirements of which shall apply to the project. The project shall also engage the Department of Occupational Safety and Health under the Ministry of Gender, Labour and Social Development – the lead Ministry responsible for labour administration.
Forced Labour Convention, 1930 (No. 29)	ILO Convention concerning forced or compulsory labour	-	04/07/1963	Local supporting legislation that shall apply to the project includes: the Employment Act, 2006; the Employment Regulations, 2011; the Employment (Employment of Children) Regulations, 2011; the Equal Opportunities Act, 2007; the Labour Disputes (Arbitration and Settlement) Act, 2006; the Labour Disputes (Arbitration and Settlement) (Mediation and Conciliation) Regulations, 2011; the Labour Unions Act, 2006; the Labour Unions (check - off) Regulations, 2011; the Labour Union (Access of Union Officials to a Workplace) Regulations, 2011; the Minimum Wages Boards and Wages Councils Act, 2000; Workers Compensation Act, 2000; and Workers' Compensation Regulations, 2011. The Project is going to be a labour intensive project with both local, foreign/ expatriate, skilled, semi-skilled and unskilled employees all of whose rights need to be effectively protected during the life of the project.
Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)	ILO Convention concerning freedom of association and protection of the right to establish workers' and employers' organisations	-	02/06/2005	
Right to Organise and Collective Bargaining	ILO Convention concerning the application of the principles of the	-	04/06/1963	

TREATY, CONVENTION, AGREEMENT	SUBJECT	SIGNED/ ACCEPTED	RATIFIED	APPLICATION TO PROPOSED PROJECT
Convention, 1949 (No. 98)	right to organise and to bargain collectively			
Equal Remuneration Convention, 1951 (No. 100)	ILO Convention concerning equal remuneration for men and women workers for work of equal value	-	02/06/2005	
Abolition of Forced Labour Convention, 1957 (No. 105)	ILO Convention concerning the abolition of forced labour	-	04/06/1963	Local supporting legislation that shall apply to the project includes: the Employment Act, 2006; the Employment Regulations, 2011; the Employment (Recruitment of Uganda Migrant Workers Abroad) Regulations, 2005; the Employment (Employment of Children) Regulations, 2011; the Equal Opportunities Act, 2007; the Labour Disputes (Arbitration and Settlement) Act, 2006; the Labour Disputes (Arbitration and Settlement) (Mediation and Conciliation) Regulations, 2011; the Labour Unions Act, 2006; the Labour Unions (check - off) Regulations, 2011; the Labour Union (Access of Union Officials to a Workplace) Regulations, 2011; the Minimum Wages Boards and Wages Councils Act, 2000; Workers Compensation Act, 2000; and Workers' Compensation Regulations, 2011.
Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	ILO Convention concerning discrimination in respect of employment and occupation	-	02/06/2005	
Minimum Age Convention, 1973 (No. 138)	ILO Convention concerning minimum age for admission to employment	-	25/03/2003	

TREATY, CONVENTION, AGREEMENT	SUBJECT	SIGNED/ ACCEPTED	RATIFIED	APPLICATION TO PROPOSED PROJECT
Worst Forms of Child Labour Convention, 1999 (No. 182)	ILO Convention concerning the prohibition and immediate action for the elimination of the worst forms of child labour	-	21/06/2001	
Migrant Workers (Supplementary Provisions) Convention, 1975 (No. 143)	ILO Convention concerning migrations in abusive conditions and the promotion of equality of opportunity and treatment of migrant workers	-	31/03/1978	
Bamako Convention, 1991	Bamako Convention on the Ban on the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa	-	01/10/1998	NA
Basel Convention, 1989	Transboundary Transportation and Disposal of Hazardous Wastes	11/03/1999	- [1]	NA[2]
Cartagena Protocol, 2000	Protocol on Bio-safety to the Convention on Biological Diversity	-	11/9/2003	NA
World Heritage Convention, 1972	World Heritage Sites	20/11/1987	-	NA
1951 Convention Relating to the Status of Refugees and the 1967 Protocol Relating to the Status of Refugees	United Nations Convention concerning the rights of international refugees	27/09/1976	27/09/1976	NA

TREATY, CONVENTION, AGREEMENT	SUBJECT	SIGNED/ ACCEPTED	RATIFIED	APPLICATION TO PROPOSED PROJECT
Paris Agreement 2016	Agreement to strengthen the global response to the threat of climate change; strengthen the ability of countries to deal with the impacts of climate change; and provide for enhanced transparency of action and support through a more robust transparency framework	22/04/2016	21/09/2016	The Climate Change Department – part of the Ministry of Water and Environment – is responsible for strengthening Uganda's implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and its related protocols and agreements. In accordance with Article 4 (4) of the Paris Agreement, the proponent has an obligation to reduce project related emissions to support national efforts towards 'economy-wide emissions reduction or limitations targets in light of national circumstances.'

[1] – No date specified

[2] – NA = Not applicable

5.8.1 The Convention for the Protection of the World's Cultural and Natural Heritage (1972)

Uganda is a signatory to the Convention on the Protection of the World Cultural and Natural Heritage (1972). To date Uganda has three sites on the list of the World heritage sites namely; Kasubi tombs, enlisted in 2001, Bwindi Impenetrable Forest National Park and Ruwenzori Mountains National Park. In 2005, UNESCO proclaimed the art of backcloth making in Uganda a masterpiece of the Oral and Intangible Heritage of Humanity. Currently five sites are on the World Heritage nomination list including the ancient salt making sites at Kibiro that lies within the Albertine Graben, approximately 45 km north east of the Kingfisher Field Development Area.

5.8.2 The Convention for the Safeguarding of the Intangible Cultural Heritage (2003)

Uganda has been a signatory to the United Nations Educational, Scientific and Cultural Organisation's (UNESCO's) Convention for the Safeguarding of Intangible Cultural Heritage since 2009. The Convention seeks to raise awareness of threats to intangible heritage and encourages member states in the identification, protection and management of such assets, ensuring respect for those individuals and communities concerned.

5.9 International Guidelines and Standards

This ESIA will been prepared in line with relevant standards and guidelines of the international oil and gas industry obtained from publications produced by the following organisations:

- International Finance Corporation (IFC; particularly the Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development);
- IUCN (Oil exploration in the tropics: guidelines for environmental protection);
- The Energy and Biodiversity Initiative (Integrating Biodiversity Conservation into Oil and Gas Development);
- International Association of Oil and Gas Producers (OGP); and
- International Petroleum Industry Environment and Conservation Association (IPIECA).

5.9.1 Equator Principles and the International Finance Corporation (IFC)

The World Bank Group published environmental and social guidelines and standards, updated 2012. These guidelines and standards are applicable to the Environmental and Social Impact Studies related to a proposed project and the operational phase of a project.

The Performance Standards (PS) are:

- PS1. Assessment and Management of Environmental and Social Risks and Impacts;
- PS2. Labour and Working Conditions;
- PS3. Resource Efficiency and Pollution Prevention;
- PS4. Community Health, Safety and Security;
- PS5. Land Acquisition and Involuntary Resettlement;
- PS6. Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PS7. Indigenous Peoples; and
- PS8. Cultural Heritage.

5.9.2 IFC Industry Specific EHS Guidelines

Industry specific EHS guidelines have been developed by the World Bank Group and the IFC. The following EHS Guidelines should still be considered.

The applicable industry sector guidelines for typical Oil and Gas projects:

- EHS Guideline Onshore Oil and Gas Development;
- EHS Guideline on Hazardous Materials Management; and
- EHS General Guidelines, including but not limited to:
  - Hazardous Materials Management;
  - Noise;
  - Waste Management;
  - Contaminated Land;
  - Occupational Health and Safety;
  - Community Health and Safety;
  - Water Conservation;
  - Wastewater and Ambient Water Quality; and
  - Energy Conservation.

5.9.3 IFC Standards in the Context of the Kingfisher Field Development Area

For the purpose of the proposed Kingfisher Field Development Area, the Performance Standards are listed in Table 5-3. This includes a brief summary of the important aspects of each standard as well as the implications and applicability to the KFDA.

Table 5-3: IFC Performance Standards Relevant to the Proposed Kingfisher Field Development Area ESIA Project

Performance Standard	Scope	Relevance to the Kingfisher Field Development Area	Remarks
1) Assessment and Management of Environmental and Social Risks and Impacts	Applies to projects with potential social or environmental risks and impacts that should be managed. The objectives of the standard are: ▪ To identify and evaluate environmental and social risks and impacts of the project; ▪ To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment; ▪ To promote improved environmental and social performance of clients through the effective use of management systems; ▪ To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately; and ▪ To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant	Yes	This ESIA identified and evaluated environmental and social risks and impacts. The ESMP provides mitigation measures and ways to avoid and/or minimise risk as well as relevant management programs. The Management System shall incorporate the following elements: i) Social and Environmental Assessment; ii) Management program; iii) Organizational capacity; iv) Training; v) Community engagement; vi) Monitoring; and vii) Reporting. CNOOC should be the owner of such a program and build upon material developed during the ESIA and prescribed in the ESMP. Although an ESIA is a tool for managing the social and environmental risks of the Project, the principles should be applied by CNOOC so that efficient social and environmental management processes are implemented in line with the requirements of IFC Performance Standard 1.

Performance Standard	Scope	Relevance to the Kingfisher Field Development Area	Remarks
	environmental and social information is disclosed and disseminated. This standard establishes the importance of: i) integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects; ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; establish an adequate grievance mechanism; and ongoing reporting to affected communities. iii) the client's management of social and environmental performance throughout the life of the project.		
2) Labour and Working Conditions	Projects which employ workers must ensure fair treatment and health and safety of all workers including those employed through contractors in the supply chain to the project. The objectives of this standard are: ■ To promote the fair treatment, non-discrimination, and equal opportunity of workers; ■ To establish, maintain, and improve the worker-management relationship;	Yes	CNOOC intends to make use of a mix of outsourced contractors for the Kingfisher Field Development Area. There are a number of organisational and management requirements in this standard which CNOOC should consider for the Kingfisher Field Development Area to be IFC compliant. CNOOC will consider local workforce and a supply chain to the Project during construction and operation. Requirements above would be addressed in the ESIA and ESMP.

Performance Standard	Scope	Relevance to the Kingfisher Field Development Area	Remarks
	▪ To promote compliance with national employment and labour laws; ▪ To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain; ▪ To promote safe and healthy working conditions, and the health of workers; and ▪ To avoid the use of forced labour.		
3) Resource Efficiency and Pollution Prevention	Any projects component must minimize pollution. This Performance Standard outlines a project approach to pollution prevention and abatement in line with these internationally disseminated technologies and practices. The objectives of the standard is: ▪ To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; ▪ To promote more sustainable use of resources, including energy and water; and ▪ To reduce project-related GHG emissions.	Yes	A range of emissions and waste streams will be produced during the life of the proposed Kingfisher Field Development Area. These will need to be proactively minimized through the design process. CNOOC should acknowledge that during the "design, construction, operation and decommissioning of the Project (the Project lifecycle), they should consider ambient conditions and apply pollution prevention and control technologies and practices (techniques) that are best suited to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective". CNOOC should also note that this standard requires the client to "promote the reduction of project-related greenhouse gas (GHG) emissions in a manner appropriate to the nature and scale of project operations and impacts".

Performance Standard	Scope	Relevance to the Kingfisher Field Development Area	Remarks
			The IFC Oil and Gas Industry Specific guidelines and related international standards and best practice would be applied in this ESIA. These guidelines referred to above, have been included in this ESIA and ESMP.
4) Community Health, Safety and Security	Projects which increase the potential for community exposure to risks and impacts must take measures to avoid or minimize potential risks or impacts. The objectives of this standard are: ▪ To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances; and ▪ To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.	Yes	There are existing settlements and social infrastructure around the Project area. This standard requires that the proponent evaluate the risks and impacts to the health and safety of the affected community during the design, construction, operation, and decommissioning of the Project and will establish preventive measures to address them in a manner commensurate with the identified risks and impacts. These measures favour the prevention or avoidance of risks and impacts over minimization and reduction. During the ESIA, the risk to neighbouring communities will be reviewed. Mitigation measures will be included in the ESMP applicable to this project.
5) Land Acquisition and Involuntary Resettlement	Projects which reduce communities' access to natural resources and land should minimize negative implications in this respect. The objectives of this standard are: ▪ To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs; ▪ To avoid forced eviction;	Yes	Land acquisition and resettlement will be required for the Kingfisher Field Development Area. The proposed project will however not have any involuntary resettlement and the affected persons (on less than 10% of the total project area) will have to give their voluntary consent to occupation within the project area. IFC PS 5 states that the performance standard does not apply to resettlement resulting from voluntary land transaction (i.e. if negotiations fail, market transactions do not oblige a

Performance Standard	Scope	Relevance to the Kingfisher Field Development Area	Remarks
	■ To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by: (i) providing compensation for loss of assets at replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. ■ To improve, or restore, the livelihoods and standards of living of displaced persons; and ■ To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.		seller to sell and the buyer can not resort to expropriation or other procedures outlined by the legal system of the host country). Furthermore, compliance to PS 5 is of specific importance to ensure that the social conditions of persons who stand to be displaced physically or economically are not worsened, but that they are better off following resettlement. As such, a “Phase 1 RAP” has been developed, which provides a general framework for the resettlement but has not been disclosed to the community.
6) Biodiversity Conservation and Sustainable Management of Living Natural Resources	This standard requires projects impacting natural environments must avoid or mitigate threats to biodiversity and sustainably manage natural resource use. The objectives of this standard are: ■ To protect and conserve biodiversity; ■ To maintain the benefits from ecosystem services; and	Yes	This will be addressed in this ESIA and ESMP.

Performance Standard	Scope	Relevance to the Kingfisher Field Development Area	Remarks
	■ To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.		

Performance Standard	Scope	Relevance to the Kingfisher Field Development Area	Remarks
7) Indigenous Peoples	Where indigenous people are potentially affected by project activities, the client must avoid, minimize, mitigate these impacts or compensate the people if this is not possible. The objectives of this standard are: ■ To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples; ■ To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts; ■ To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner; ■ To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle; ■ To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in	No	Uganda has "Indigenous Peoples" – Batwa (forest-dwelling hunter-gatherers, living in the high altitude forests around Lake Kivu and Lake Edward), Benet (Eastern Uganda in the vicinity of the Mount Elgon National Park), Karamojong ('herding people' from the North Eastern Uganda) and the Ik ('mountain people' from the far North Eastern region along the escarpment between Kidepo National Park and the Timu Forest). The project location however lies outside the margins of areas occupied by indigenous people and therefore the Project will not have any observable interaction with the Indigenous Peoples culturally and socially.

Performance Standard	Scope	Relevance to the Kingfisher Field Development Area	Remarks
	this Performance Standard are present; and ■ To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.		
8) Cultural Heritage	Where project activities have adverse effects on cultural heritage, measures must be taken for its protection. The objectives of this standard are: ■ To protect cultural heritage from the adverse impacts of project activities and support its preservation; and ■ To promote the equitable sharing of benefits from the use of cultural heritage.	Yes	The impacts to cultural heritage resources will be assessed as part of the socio-economic impacts in this ESIA. This will be included in the ESMP.

5.9.4 World Health Organisation (WHO)

WHO is the directing and coordinating authority for health within the United Nations system. It is responsible for providing leadership on global health matters, shaping the health research agenda, setting norms and standards, articulating evidence-based policy options, providing technical support to countries and monitoring and assessing health trends.

5.9.4.1 Guidelines for Drinking-Water Quality (2011)

The primary purpose of the *Guidelines for drinking-water quality* is the protection of public health. The Guidelines provide the recommendations of the WHO for managing the risk from hazards that may compromise the safety of drinking-water. The recommendations should be considered in the context of managing the risk from other sources of exposure to these hazards, such as waste, air, food and consumer products.

5.9.4.2 Guidelines for Community Noise (1999)

The *Guidelines for Community Noise* have been prepared as a practical response to the need for action on community noise at the local level, as well as the need for improved legislation, management and guidance at the national and regional levels.

5.10 CNOOC's policies and standards

5.10.1 Design codes and standards

The relevant design codes and standards applicable to this proposed Project are presented in Appendix E of the Report.

5.10.2 Environmental, Health and Safety Policies and Standards

CNOOC standards and local legislation on safety, health and environment will be used to guide the design and operational philosophy of the facility (see Appendix F of the Scoping Report).

5.10.3 Corporate Social Responsibilities

CNOOC Uganda engages in activities that benefit society. CNOOC is already involved in the following ventures in Uganda:

- Support to Education Best Performers' Award;
- Basic Skills Training;
- Buhuka School Donation;
- Promotion of culture and Talent;
- Support to Health Sector and Medicine donation for Ntoroko District Health Centres; and
- Disaster Relief Donation.

6.0 THE RECEIVING ENVIRONMENT

This chapter presents a description of the receiving environment potentially affected by the CNOOC production facility, which includes the CPF and ancillary supporting infrastructure and the production and injection wells and flowlines, and the feeder pipeline from the production facility to Kabaale.

This chapter is divided into the following subsections:

- Physical environment;
- Biological environment;
- Socio-economic environment; and
- Socio-cultural environment.

The chapter summarises more detailed information presented in the specialist reports. For additional information, refer to Volume 4.

6.1 Physical Environment

6.1.1 Climate

6.1.1.1 Regional Climate

Uganda is located on the East African Plateau, its climate is tropical, but is moderated by high altitude. Temperature varies little throughout the year, but the average temperatures increase in the south of the country as the elevation decreases towards the Sudanese plain. Average temperatures in the coolest regions of the south-west remain below 20°C, while reaching 25°C in the warmest, northernmost parts.

Seasonal rainfall in Uganda is driven mainly by the migration of the Inter-Tropical Convergence Zone (ITCZ), a relatively narrow belt of very low pressure and heavy precipitation that forms near the equator. The exact position of the ITCZ changes over the course of the year, migrating southwards through Uganda in October to December, and returning northwards in March, April and May. As a result, Uganda experiences two distinct wet periods – the ‘short’ rains in October and December and the ‘long’ rains in March, April and May. The amount of rainfall received in these seasons is generally 50-200mm per month but varies greatly, exceeding 300 mm per month in some localities.

The movements of the ITCZ are sensitive to variations in Indian Ocean sea-surface temperatures and vary from year to year; hence the onset and duration of rainfall varies considerably from year to year. One of the most well documented ocean influences on rainfall in this region is the El Niño Southern Oscillation (ENSO). El Niño episodes usually cause greater than average rainfall in the short rainfall season (OND), whilst cold phases (La Niña) bring a drier than average season (Mc Sweeny, New, Lizcano et al 2010).

6.1.1.2 Wind

Analysis of long term data from the East African Meteorological Department (1975) shows that for most of the year, the Buhuka Flats experience moderate to strong and gusty winds, increasing in the afternoon. Wind speeds exceeding 2 m/s are common - in the 2010 and 2011 measurement period, winds exceeded 2 m/sec for more than 54% of the time.

The available measured data are not based on continuous wind recordings and cover only two consecutive years (2010 - 2011). In such cases, the US EPA recommends against the use of the local data for atmospheric dispersion modelling, preferring the meso scale modelled data developed by Penn State University / National Centre for Atmospheric Research. The 5th generation model, released in 2014, is known as MM5, Data for the Buhuka Flats was selected from this model for the period 1 January 2011 to the 31 December 2013. The data correlate moderately well with the existing field data[1] but provide additional information, including winds at higher levels in the atmosphere.

[1] *A correlation coefficient of r=0.65, which falls within the category of ‘strong, high’ correlation.*

Figure 6-1 shows that ppredominant winds blow from the two sectors, SE to SW for 53% of the time, and NW for 10% of the time. The average wind speed during the 3-year period was 2.9 m/s with 10% calms.

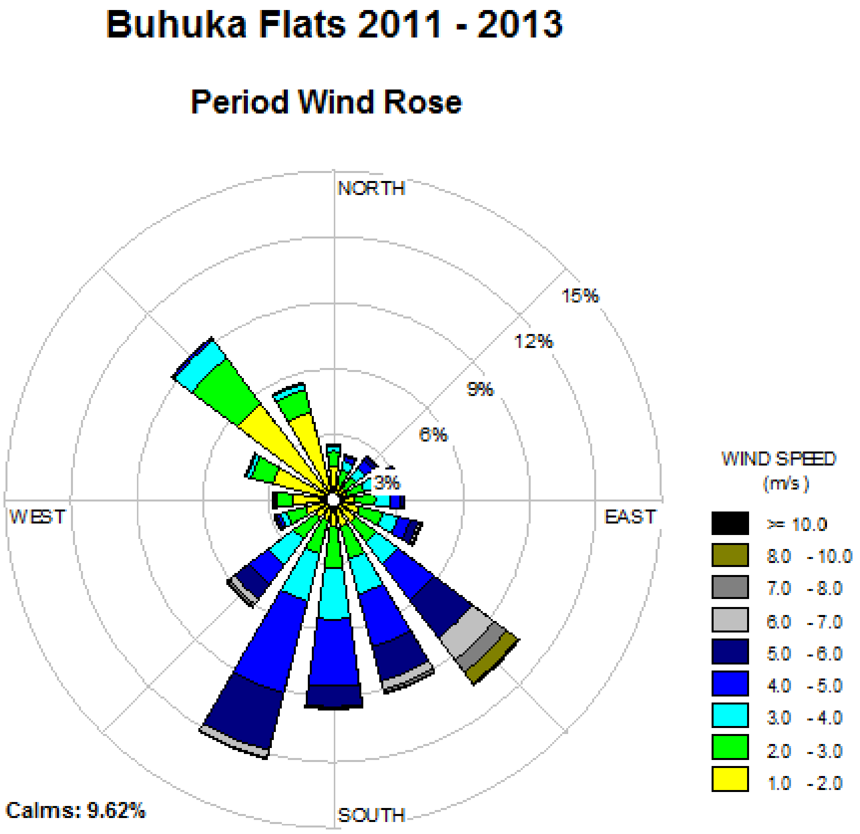


Figure 6-1: MM5 data wind rose for the Buhuka Plains for the period 1 January 2011 to 31 December 2013

The daily variation in wind is shown in Figure 6-2. Morning winds from midnight to 06h00 are predominantly southerlies, with the highest frequency of winds of >4 m/s occurring during this period. Very strong winds of >8 m/s also occur mainly during this period and to a lesser extent from 06h00 to midday, all blowing from the south east. Winds between midday and 18h00 are generally light, with a predominantly north westerly component. Night winds between 18h00 and midnight blow from all directions except the west and north-west, with speeds higher than the afternoon period.

Both wind speed and direction have important implications for oil exploration and production, particularly for the dispersion potential of air pollutants (NEMA 2010).

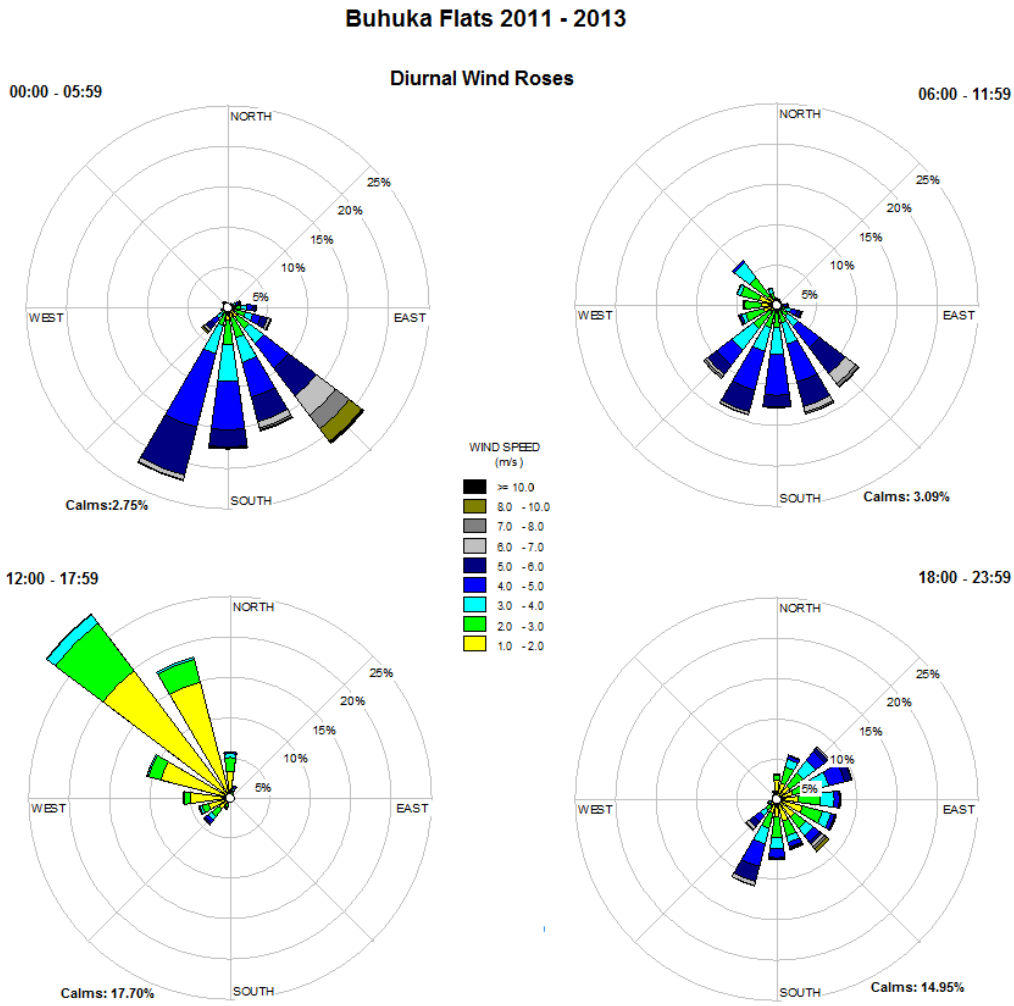


Figure 6-2: MM5 diurnal and nocturnal wind roses

Table 6-1: Diurnal Wind Roses - Buhuka Flats 2011 - 2013

Wind Rose	Major Wind Directions				Calms
	Sector	% of Wind	Sector	% of Wind	
00:00 - 05:59	SE - SSW	79%	-	-	2.75%
06:00 -11:59	SE - SW	67%	NW	7%	3.09%
12:00 - 17:59	W - N	84%	-	-	17.70%
18:00 - 23:59	NNE - SSW	86%	-	-	14.95%

6.1.1.3 Rainfall, Temperature and Humidity

At a regional level, Hoima[2] and Kikuube Districts rainfall varies sharply, mainly due to topographic differences between the rift valley floor, the rift escarpment and the raised topography to the east. The Rwenzori Mountains are the highest landscape in the region, towering to over 5,000m above mean sea level

[2] Kikuube District was recently carved out of Hoima District in 2015. Most of the literature reviewed therefore refers to Hoima District.

(amsl). The Rift Valley floor lies in a rain shadow of both the escarpment to the east and the mountains, and has the least amount of rainfall, much lower than rainfall in the highland area to the east.

The peak rainfall periods recognised by local people are between March and May and between September and December although rainfall patterns have become more erratic in recent years. In general, the second peak rainfall (August to November) is higher than the early peak. Western areas on the valley floor, such as the Buhuka Plain, are the driest and hottest, with annual average rainfall typically around 900 mm, increasing to 1,400 mm per annum on the escarpment. The higher rainfall over the escarpment is the result of the orographic effect of higher terrain, forcing moist air off the lake to rise.

There is no rainfall station on the Buhuka Flats and all rainfall is based on modelled projections. The nearest station with long term records (59 years with 647 days of missing data) is at Masindi, which is 87 km from the proposed CNOOC CPF. Figure 6-3 is an interpolation of rainfall across the Lake Albert basin, developed as a part of a Hydrometeorological Survey of Lake Victoria, Kyoga and Albert.

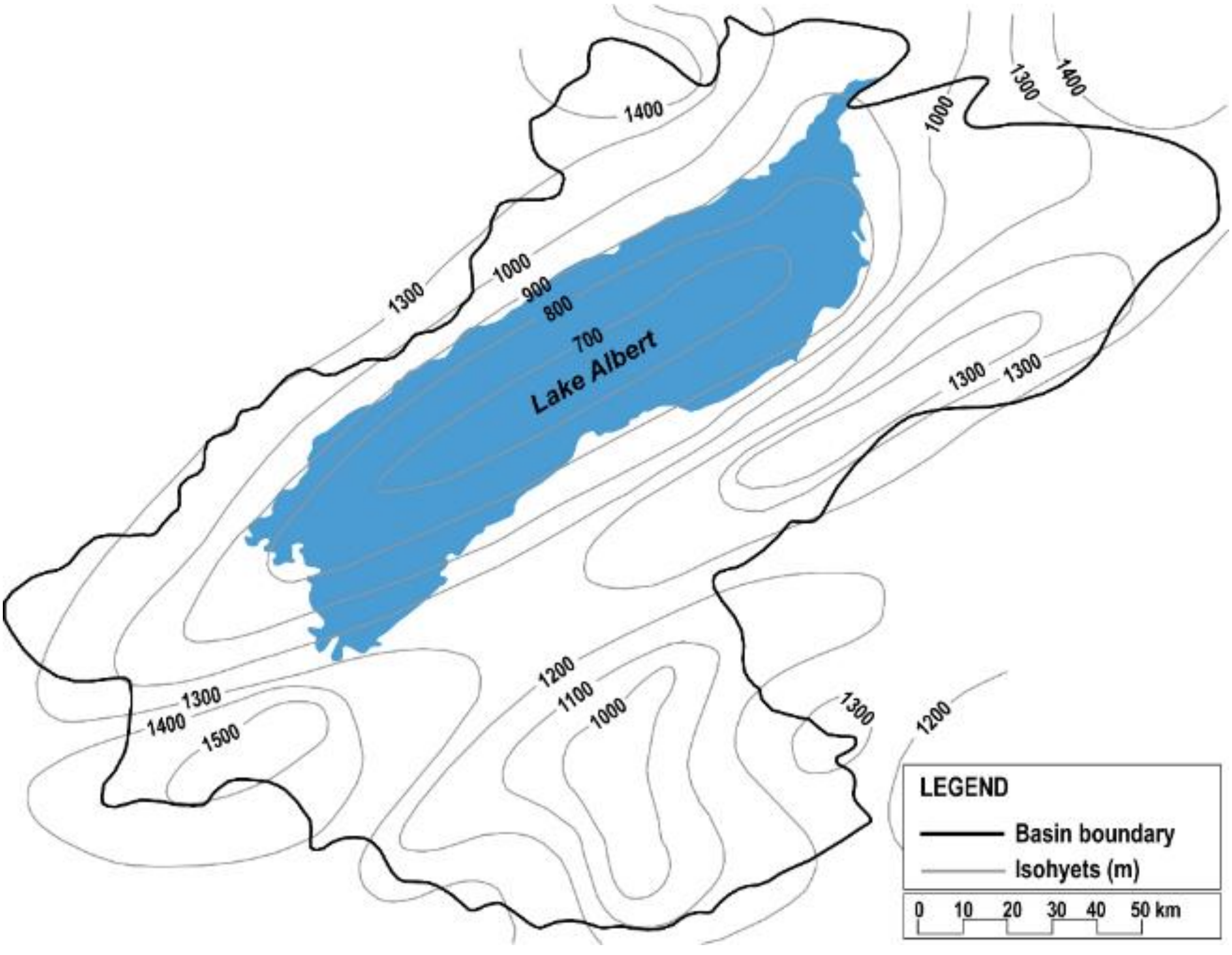


Figure 6-3: Annual rainfall distribution in the Lake Albert basin

MM5 modelled monthly average (2011-2013) precipitation for Buhuka Flats is shown in Figure 6-4. Predicted monthly rainfall was highest in 2011 while tending to peak in September, October, and November (>150mm). Lowest average precipitation occurred in January (<25mm).

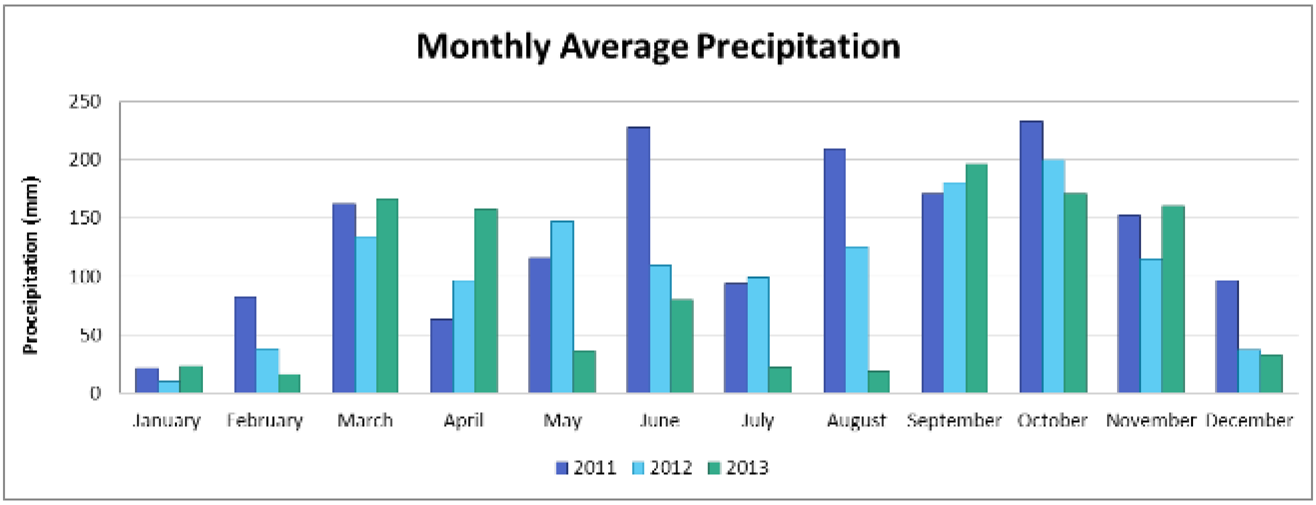


Figure 6-4: MM5 modelled monthly average precipitation between 2011 and 2013

MM5 modelled monthly average (2011-2013) temperature is shown in Figure 6-5. Temperatures were typically highest in March (>29ºC) and lowest in November (~27ºC). Temperatures may exceed 30ºC although peak temperature is moderated along the lake shore. The highest modelled temperature was in April in 2011 (>30.5ºC). Minimum monthly temperatures typically varied between 17.5 and 21.1ºC.

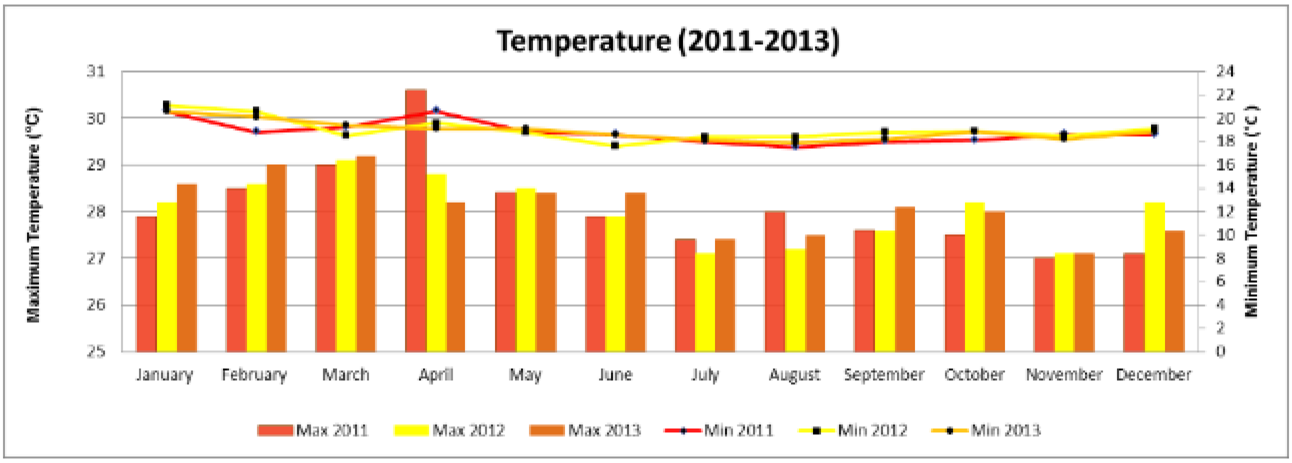


Figure 6-5: MM5 modelled monthly average temperature between 2011 and 2013

6.1.1.4 Air Quality

Air quality in EA3A was qualitatively assessed based on the identification of local sources. Potential sources included agriculture, mining, oil exploration activities, domestic fires and burning of bush, vehicle emissions and dust from paved and unpaved roads.

Agriculture in the study area has a limited effect on air quality. The Buhuka Flats are primarily grazed. Above the escarpment, subsistence and commercial farming are fairly intensive and in the south, there is a large area (39,992 ha) of untransformed forest. Overall, wind-blown dust as a result of exposed cultivated soils is not expected to significantly affect air quality in the study area. However, bush fires and domestic cooking fires are likely to have a greater influence on air quality. The burning of bush for land clearing, setting fires to drive game and unintentional fires all contribute to anthropogenic air quality impacts, particularly in the drier months. Emissions include carbon monoxide, methane and nitrogen dioxide, and large quantities of smoke, which includes fine particulates and typically creates haze over very large areas.

Firewood has become scarce in the study area and many people use charcoal, which also contributes to local emissions. Domestic fuel burning of wood or charcoal generates respirable particulates, nitrogen dioxide, carbon monoxide, polycyclic aromatic hydrocarbons, particulate benzo (a) pyrene and formaldehyde.

Industrial activities in the study area are presently limited to oil exploration in the Buhuka Flats and elsewhere up the eastern margin of Lake Albert. The intensity of these activities, at present, is generally low and intermittent. Large diesel generators drive the drilling rigs and are potential sources of short term nitrogen, sulphur dioxide and particulate emissions. The extension of the road network into the Buhuka flats has encouraged vehicle traffic into the area which, together with oil exploration and drilling traffic, is now a source of dust and exhaust emissions in Buhuka Plain. At present, this remains a minor and intermittent impact with no material long term or permanent effect on air quality.

6.1.2 Geology, Topography and Geomorphology

6.1.2.1 Regional Geology

The Albertine Graben is a 500 km-long rift basin of Mesozoic-Cenozoic origin. The Uganda / Democratic Republic of Congo border is aligned along the centre of the basin. It is developed upon the Precambrian orogenic belts of the African Craton and is bordered by steep normal faults with uplifted flanks composed of basement rocks such as gneisses, quartzites and mafic intrusions (Byakagaba, 2004).

The geological sequence in the Albert Basin is of Late Miocene to Recent age, resting on metamorphosed pre-Cambrian basement. It is thought that approximately 6,000 m of sediments were deposited in the central part of the basin, with some 3,000 m present in the KFDA. The sequence comprises a series of interbedded sandstones and shales, representing a mixture of geological events, during which sedimentation was dominated by fluvial processes and flood or high-stand events when lacustrine deposition predominated.

The high petroleum potential of the basin is due to the thickness (>5000 m) of organic-rich sediments and the well-developed reservoir rocks which contain porous and permeable sands and conglomerates. There is a very high quartz content within the reservoir rocks (>75%) which makes them resistant to compaction, which contributes to the preservation of their porosity. It is also thought that the fractured and weathered basement may act as a reservoir. Rifting within the basin caused the formation of several large-scale structural traps.

Seismic-reflection and gravity data reveal that the overall structural morphology of Lake Albert is that of a full Graben, a unique configuration in the western rift valley. The Bunia border fault bounds the entire basin along the western shore, and it is opposed on the eastern margin by a complex of several large basement-involved faults, which have created two structural sub-basins. Major basement-involved faults control the depth of the lake. The maximum thickness of the sedimentary section is 5 km and dip on pre-rift basement is shallow (<18 degrees) (Karp, et.al. 2010).

6.1.2.2 Local Geology

The Kingfisher field Development Area (KFDA) is formed by a structural trap, which comprises a southwest-northeast trending 3-way dip-closed hanging-wall anticline that seals against basement to the south-east along the main bounding fault of the Albert Basin. The field is about 10 km long by 3 km wide. The sedimentary succession of KFDA is composed of intervals of Late Miocene and Pliocene age. The Late Miocene and Pliocene intervals can be subdivided into M5 and M6 unit of Late Miocene, P1 and P2 units of Early Pliocene, P3 and P4 units of Late Pliocene.

The initial Kingfisher- well intersected a hydrocarbon-bearing interval from 1,783 - 1,795 m MD (maximum depth). This upper interval has been termed “Zone 1”. The Kingfisher-A side track subsequently discovered a lower hydrocarbon bearing interval from 2,259.5 m to 2,372.5 m which was denoted as “Zone 2”. Subsequent appraisal drilling on the Kingfisher structure comprised wells Kingfisher-2, -3 and -3A, also deviated to the northwest. These focused on the Zone 2 reservoir.

Preliminary results from the geotechnical drilling showed that Pad-2 is underlain by inorganic clays up to an average depth of 18m followed by a mixture of silty sandy clays to 30 m.

6.1.2.3 Topography

The surface of Lake Albert lies at an average elevation of 615 masl. The eastern lake shore in the area of Buhuka Flats is characterised by flat, low lying terrain, intersected by drainage lines from the escarpment. The escarpment trends northward along the eastern lake shore, varying in distance from the shoreline. At Kyakapere village, 325 m north of CNOOCs proposed Well Pad 4A, the escarpment plunges almost directly into the lake, with only a narrow strip of flat land along the lake edge. Further south, the lake shore swings away to the west, leaving an approximately 1262 ha enclave known as the Buhuka Flats, where the proposed CPF is situated.

The top of the escarpment is at an elevation of roughly 930 masl, east of which the terrain comprises gently rolling hills. Most of Hoima District is characterized by these broad, flat-topped hills, varying from about 950 m – 1,450 masl.

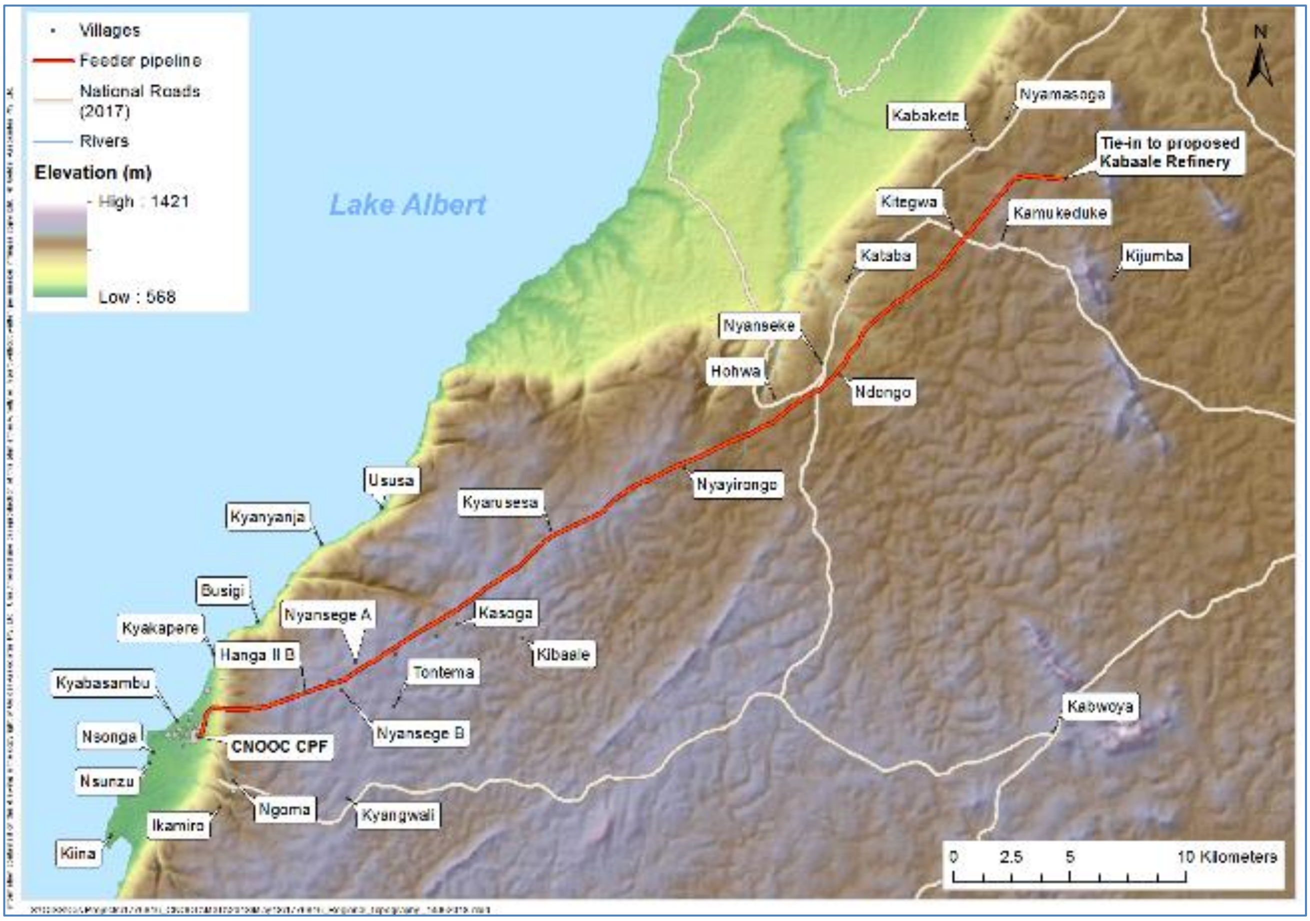


Figure 6-6: Topography of the study area

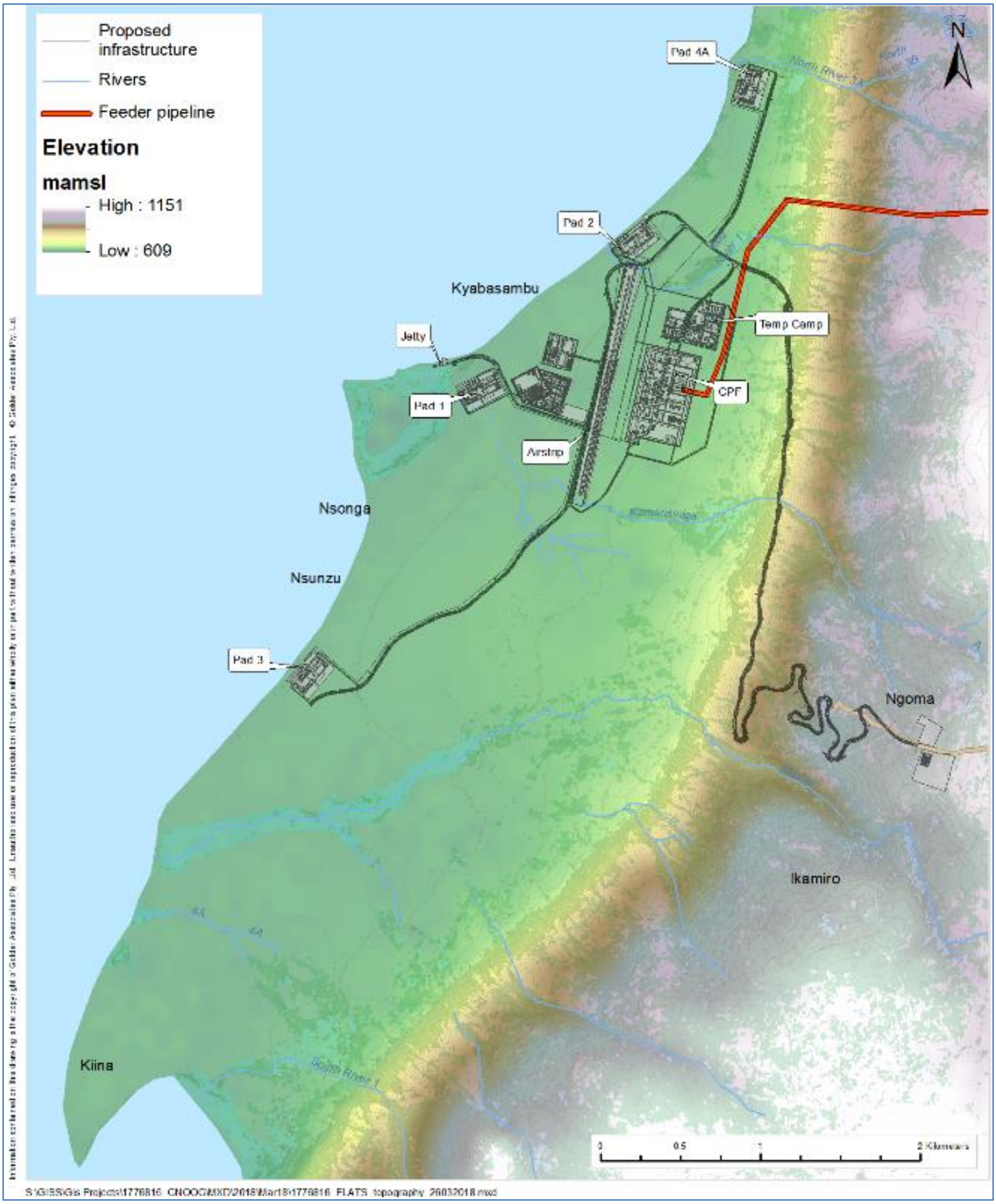


Figure 6-7: Topography of Buhuka Flats and the adjoining escarpment and plateau

Photograph 6-1: Kacunde Village

Photograph 6-2: Senjojo Village

Photograph 6-3: Steep slopes north of Kyenyanja where the escarpment plunges directly into Lake Albers

Photograph 6-4: The gorge at Kyenyanja village is located on the alluvial fan immediately below the gorge

Photograph 6-5: Buhuka Plain from near the shoreline north east of the proposed CPF

Photograph 6-6: Buhuka Plain from the escarpment, looking south west across the study area

Photograph 6-7: Gently rolling terrain along the feeder pipeline route

Photograph 6-9: Subsistence cultivation along the feeder pipeline route near Nyirongo

Photograph 6-8: Mixed agricultural crops, including cotton, cassava and maize at Hanga IIB along the feeder pipeline

Photograph 6-10: Road leading to the proposed construction camp (6km) outside Hohwa. Construction Camp entrance approximately left

Photograph 6-11: Vegetation field (limited cultivation) at site of the proposed construction camp

Photograph 6-12: Buhuka Parish with cattle grazing in the fenced of airstrip

6.1.3 Hydrogeology

6.1.3.1 Regional Hydrogeology

Groundwater depth below surface is estimated from Directorate of Water Development (DWD) data and published hydrogeological maps for the region (Figure 6-8). DWD records show that the average borehole depth is around 62m below ground level with bedrock (usually of granitic or quartzitic origin) typically encountered 30m below surface. The upper lithologies are mainly described as interbedded clay and/or sand sediments of various thicknesses. Water strikes are mainly associated with fractured and weathered bedrock and it can therefore be concluded that the aquifer systems utilised will have a fractured character. Recorded yields varied between very low (0.1 l/s) to high (20 l/s), with an average at 2.9 l/s. A quarter of boreholes recorded had yields higher than 4l/s.

Lake-front groundwater levels are on average between 5.4 m and 6.4 m below surface (confirmed by water level measurements during the hydrocensus), although in summer a perched water table often exists (refer to Section 6.1.3.2). Above the escarpment water levels averaged 18.1 m below surface. Forty percent of the recorded water levels above the escarpment were deeper than 20 m below surface.

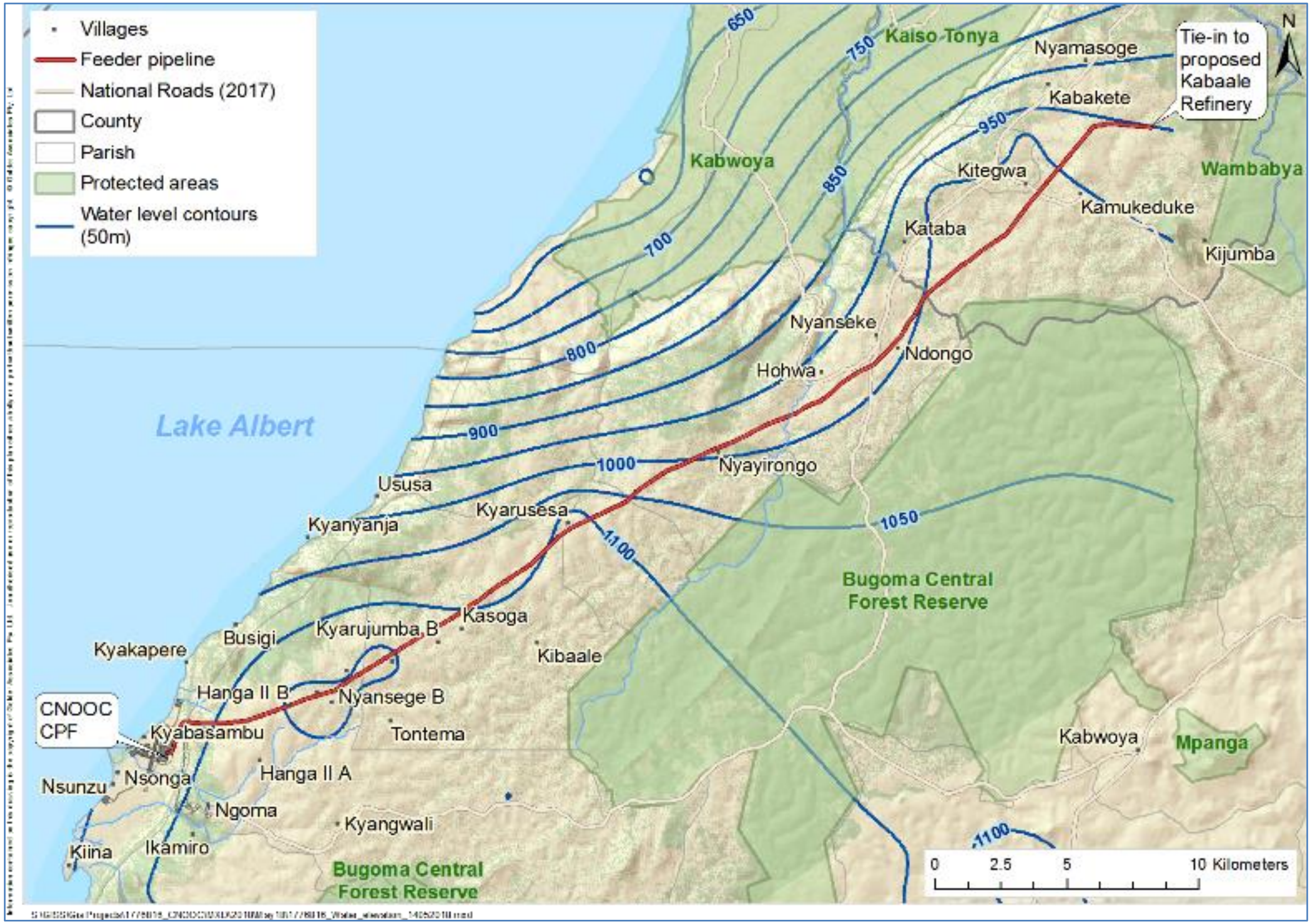


Figure 6-8: Groundwater elevation map for the study area

6.1.3.2 Site Hydrogeology

Generally, groundwater is the most important source of potable water in Uganda, particularly in the rural areas, providing 80% or more of the water supply (British Geological Survey, 2001). Availability of aggregated groundwater data for different parts of the country is limited, with scanty information for Hoima and Kikuube Districts in general and Buhuka Parish in particular. Nevertheless, villages on the Buhuka Flats do make use of groundwater, although the larger villages receive water from rivers such as the Nguse as well as seasonal streams from the escarpment. In neither case is the water treated.

Only five of the ten villages visited along the lake-front had functioning wells from which potable water could be drawn. Wells in the Buhuka Flats are prone to fail due to the corrosive properties of the groundwater and pipes that were not maintained were often corroded away. Villagers stated that the wells often yield insufficient water or that water quality is too poor for potable use. As an alternative, villagers augment their water supply with lake water and/or springs or streams arising from escarpment drainage. A gravitational pipeline installed by the previous concession-holders supplies water from the Muziizi River at the top of the escarpment to a reservoir situated just below the escarpment, near the army barracks and just South-West of the proposed CPF. This, in turn, provides a piped system to Kyakapere, Kyabasambu, Nsonga, Nsunzu and Kiina but has fallen into disrepair. The system is currently being upgraded by CNOOC, and pumps are being installed in each village. CNOOC has undertaken that each village will be provided with five waterpoints each over time.

Photograph 6-13: Typical well installation in the project area

Photograph 6-14: Community water point

It is inferred that shallow groundwater in the area flows in a generally westerly direction from the escarpment towards the lake. During the rainy season, the groundwater levels on the Buhuka Plain are less than 1 mbgl in some areas. This perched water table is probably caused by the poorly-porous and slow-draining clay soils. Accordingly, limited shallow groundwater is accessible as a water source although surface infiltration of contaminants is a major risk and the source is not reliable throughout the year.

The hydrogeology along the pipeline route differs from that on the flats and lake-front villages. Fifteen wells were recorded that supply the villages along the pipeline route. These wells are the main source of water for the people living along the route. A small percentage of the wells were shallow (<5 mbgl) dug wells with hand pumps installed. Users complained about poor quality of water and seasonality of the shallow wells. The deeper wells were found to be a generally reliable source of water although occasional complaints about poor water quality were also recorded.

6.1.3.3 Groundwater Quality

- Historical groundwater quality data are very limited for the study area and are unreliable, typically involving once off samples with an inadequate description of sampling details. The assessment of groundwater quality is therefore based on the results of the hydrocensus conducted for the ESIA.
- The location of the boreholes that were monitored in the hydrocensus is shown in Figure 6-9. A summary of selected results is presented in Table 6-2.
- Groundwater quality on the Buhuka Flats is generally poor. Boreholes serving the villages of Kina and Kyabasambu have high pH (>10), very high salinity (EC>3800 mS/m) caused by high concentrations of inorganic cations and anions (Ca, Mg and Na, Cl), and very high hardness (>1000 mg/L), which significantly exceeds potable water standards making this water unsuitable to drink. Water with such high salt loads has an unpleasant taste and inhabitants of these villages prefer to use surface water sources instead.

  Since neither the lake water nor the groundwater in the escarpment zone exhibit high salinity, the explanation for it in lake-edge boreholes must lie in evapotranspiration and seasonal groundwater fluctuation, causing a build-up of salts over time. It may be assumed that the gradient of groundwater flow towards the lake on the flats is very low, due to the heavy clays which will also contribute to the salinization of the upper soil profiles.
- Groundwater quality further inland along the escarpment and along the route of the feeder pipeline is generally good and within the drinking water standard, with the exception of some trace metals (mainly lead, manganese and iron and to a lesser extent aluminium, mercury and selenium). Lead and mercury are often associated with crude oil and natural gas occurrences but in this case the source is likely to be natural groundwater leaching through the bedrock gneiss and granite. Slightly elevated concentrations of manganese, selenium and iron may also be associated with groundwater leached from gneiss and granite bedrock formations. Long term exposure to these elements in drinking water is likely to pose some risk to the health of users of the water resource.
- In most boreholes, microbial water quality was poor. All but two (89%) of the Buhuka Flat and other lake-side groundwater samples were contaminated with coliforms, including *E. coli*[1]. Along the pipeline, two thirds of the borehole samples (10) were contaminated. Poor sanitary practices are responsible for the

[1] The most basic test for bacterial contamination of a water supply is the test for total coliform bacteria. Total coliform counts give a general indication of the sanitary condition of a water supply. Total coliforms include bacteria that are found in the soil, in water that has been influenced by surface water, and in human or animal waste. Faecal coliforms are the group of the total coliforms that are considered to be present specifically in the gut and faeces of warm-blooded animals. Because the origins of faecal coliforms are more specific than the origins of the more general total coliform group of bacteria, faecal coliforms are a more accurate indication of animal or human waste than the total coliforms. Due to the distance from accredited laboratories, water samples at Kingfisher and along the pipeline could not be submitted for microbial testing at a laboratory. As an alternative the water was tested using Colitag™[1]. Colitag™ is a Presence/Absence and MPN (most probable number) enzyme substrate test that detects as few as 1 MPN of total coliform and E. coli bacteria per 100 ml water sample.

contamination. Faecal pathogens are the principle reason for the outbreaks of diarrhoea and cholera recorded by the communities.

- No organic (hydrocarbon) pollution was found in any sample. Samples were tested for Polycyclic aromatic Hydrocarbons (PAH), Extractable Petroleum hydrocarbons (EPH), and Gasoline Range Organics.

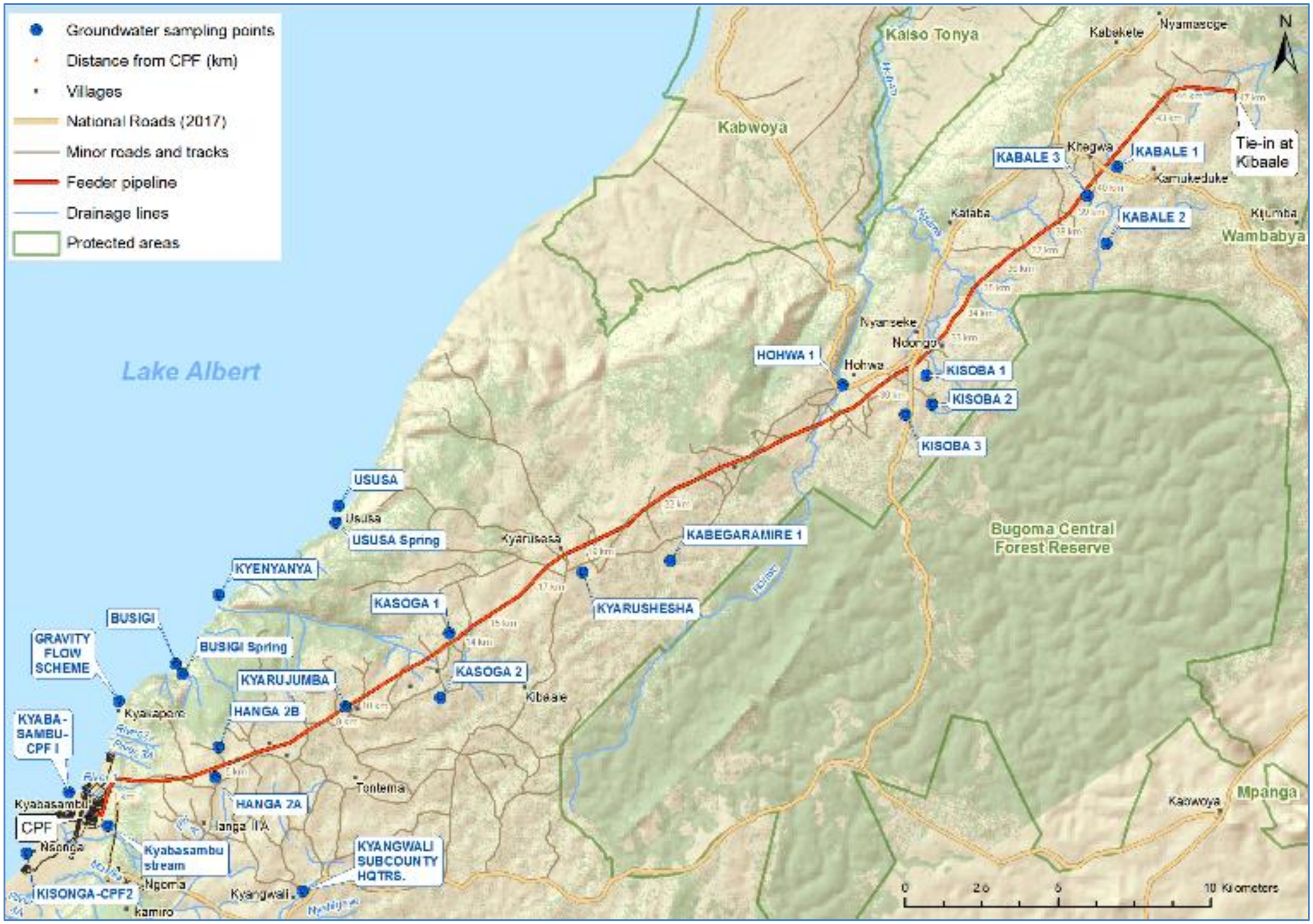


Figure 6-9: Location of groundwater quality sampling points (refer to Table 6-2)

Table 6-2: Water quality for selected groundwater samples on the Buhuka Flats and along the feeder pipeline route (refer to Table 6-10 for location of samples)

Sample Description	Type	pH	EC (mS/m)	Total Hardness ($CaCO_3$)	Total Alkalinity ($CaCO_3$)	TDS	Sulphate (SO_4)--	Nitrate (NO_3-N)	Calcium	Magnesium	Sodium	Chloride	Aluminium	Lead	Mercury	Iron	Copper	Manganese	Selenium	Nickel	Chromium	Faecal Coliforms (Y/N)
US 201 Potable Water Standard (Class 2)		**6.5 – 8.5**	**250**			**1200**			**75**	**50**	**400**	**500**	**0.2**	**0.01**	**0.001**	**0.03 - 3.5**		**0.1 – 0.5**	**0.01**		**0.05**	
Ugandan Drinking Water Standard (NEMA, 1996		**6.5 – 8.0**	**250**	**500**		**600**	**200**	**5**	**-**	**-**	**-**	**-**	**0.2**	**0.01**	**0.001**	**0.03 - 0,5**	**1**	**0.1 - 0.5**	**0.01**	**0.02**	**0.05**	**N**
Lake Albert	Lake water	10	57.6	-	48	390.4	-	0.04	27.2	34.6	-	0.03	0.19	0.0025	0.001	0.02	-	0.0008	0.024	-	0.0004	Y
Kina		7.8	4400	-	48	20100	-	1.64	2000	186	-	3.3	-	-	-	0.06	-	0.119	-	-	-	
	Deep well	6.9	3826.7	7952	258	4477	692.33	14.65	1587	948.7	5845	14979	-	0.02	-	0.22	-	0.04	-	0.002	-	N
Kyabasambu (CPF 1)	Deep well	7.1	719.3	1362	304	4776		2.21	262.4	168	858.9	2420.9	-	0.02	-	0.04	-	1.54	-	-	-	Y
Busigi	Deep well	10.2	176.6	-	100	307	-	1.33	56	33.6	-	0.03	-	0.0006	-	0.01	-	0.01	0.016	-	0.001	N
Kyenyanja	Spring	10.1	67.1	-	88	906	-	0.43	56	33.6	-	0.03	-	-	0.001	-	0.0009	0.001	0.013	-	0.0003	Y
		8.0	82	172	290	916	19.12	19.88	21.8	28	87.4	56.6	0.05	-	-	-	-	0.01	-	-	-	
Ususa	Shallow well	9.3	66.7	-	76	197.5	-	0.03	72	28.8	-	0.03	-	-	-	-	-	0.0005	0.013	-	0.001	Y
Ususa		7.23	97.9	246	222	903	47.9	133.47	57.6	24.4	81	81.3	0.17	0.01	-	-	-	0.598	-	-	0.001	
	Deep well	9.3	85	-	36	470	-	1.43	112	24	-	0.03	-	-	-	0.04	-	0.16	0.0027	-	-	N
Hanga 2B	Deep well	7.2	58	225	266	388	31.18	0.62	58.5	18.8	35.3	18	0.13	0.02	-	1.00	-	0.31	-	-	0.009	Y
Kyarujumba	Deep well	6.6	19.1	59	86	181	6.18	2.21	13.5	6	14.1	0.5	0.12	0.01	-	0.82	-	0.01	-	-	-	N
Kasoga 1	Protected dug well	7.4	47.5	227	252	341	18.04	0.75	61.4	17.5	0.02	1.4	0.2	0.01	-	0.98	-	0.35	-	-	-	Y

Sample Description	Type	pH	EC (mS/m)	Total Hardness ($CaCO_3$)	Total Alkalinity ($CaCO_3$)	TDS	Sulphate (SO_4)--	Nitrate (NO_3-N)	Calcium	Magnesium	Sodium	Chloride	Aluminium	Lead	Mercury	Iron	Copper	Manganese	Selenium	Nickel	Chromium	Faecal Coliforms (Y/N)
US 201 Potable Water Standard (Class 2)		**6.5 – 8.5**	**250**			**1200**			**75**	**50**	**400**	**500**	**0.2**	**0.01**	**0.001**	**0.03 - 3.5**		**0.1 – 0.5**	**0.01**		**0.05**	
Ugandan Drinking Water Standard (NEMA, 1996		**6.5 – 8.0**	**250**	**500**		**600**	**200**	**5**	**-**	**-**	**-**	**-**	**0.2**	**0.01**	**0.001**	**0.03 - 0,5**	**1**	**0.1 - 0.5**	**0.01**	**0.02**	**0.05**	**N**
Kyarushesha	Deep well	7.0	27.7	85	100	222	36.38	5.89	18.2	9.4	0.02	1.7	0.06	0.01	-	0.32	-	0.08	-	-	-	Y
Kabegaraire 1	Protected dug well	7.1	39.1	178	186	292	24.9	0.66	30.0	24.6	0.01	2.4	0.04	0.02	-	2.06	-	0.10	-	-	-	Y
Hohwa 1	Protected dug well	7.5	64.3	244	336	554	14.32	8.54	35.2	37.2	0.05	3.5	0.14	0.01	-	-	-	0.05	-	-	-	Y
Kisoba 1	Deep well	6.8	29.8	102	146	236	6.24	4.29	21.7	11.4	0.02	1	0.14	0.02	-	0.85	0.01	0.03	-	-	-	Y
Kabaale 1	Protected dug well	6.7	44.4	164	198	312	40.26	1.02	34.1	18.7	0.03	5.3	-	0.02	-	0.66	-	0.01	-	0.002	-	
Kabaale 2		6.6	23.3	55	114	237	5.12	2.17	12.4	5.8	0.03	0.7	1.1	0.02	-	0.94	0.01	0.06	-	0.002	-	

6.1.4 Surface Hydrology

6.1.4.1 Regional Context

All of Uganda drains towards the Nile. Most of the rivers originating on the highlands drain into lakes which, in turn, drain into the Nile River via Lake Albert. Lake Albert has a catchment area of roughly 18,223 km^2. The main rivers that feed Lake Albert are the Semliki River and the Victoria Nile. These two rivers account for approximately 83% of the total flow into the lake; direct rainfall approximately 10 %; and inflow from local catchments the remaining 7%.The Semliki River drains from Lake Edward, entering Lake Albert at the southern tip. The Victoria Nile enters Lake Albert at the northern end, next to the outflowing point of the Albert Nile. The Victoria Nile drains Lake Kyoga which in turn is fed from Lake Victoria, the largest fresh water Lake in Africa. Because the Victoria Nile enters close to the point of outflow of the lake, it has little influence on its salinity and ecology.

There are other smaller rivers that enter into the lake from Uganda and the Democratic Republic of Congo, some of which are highly seasonal and of little importance to the hydrology of the lake.

6.1.4.2 The Kingfisher Field Development Area

The study area is located within the Albert Water Management (AWM) Zone. The AWM is made up of catchments discharging into Lake Edward and Lake George; and catchments downstream of Lake Edward discharging into Lake Albert. Lake Albert occupies the majority of the approximately 2,270 km^2 area of the District covered by water bodies[1]. The Rivers Howa, Wambabya, Hoima and Waki all drain into Lake Albert.

The Kingfisher Field Development Area is situated within the catchment on the Buhuka Flats, which is a flat plain,2.9 km at its widest, bounded by the escarpment in the east and the lake in the west. The escarpment ranges from approximately 640 mamsl at the base to 930 mamsl at the top. The Kingfisher Field Development Area catchment is associated with a very high western rift escarpment that drains into Lake Albert via several scattered streams and scattered wetlands, flowing westwards. Streams within the project's area of influence include the Kamansinig and Masika Rivers.

The Kamansinig River flows south west from east of the escarpment, drains north west over the escarpment and then passes just south of the majority of the proposed project infrastructure on the Buhuka Flats (Figure 6-12). The tributaries of the Masika River (Ngoisa, Nyakatehe and an unnamed tributary) drain from east of the escarpment, combine to form the Masika, and cross the escarpment onto the Buhuka plain, entering Lake Albert roughly 1.2 km south of Pad 3. Various other smaller unnamed streams also drain over the escarpment and either join the main rivers mentioned above or independently drain into Lake Albert. In addition to the rivers mentioned, Buhuka Plain is characterised by scattered wetlands.

6.1.4.3 Lake Albert

Lake Albert is saline with a pH of approximately 9 (International Lake Envrionment Committee Foundation, 1999) and is the seventh largest lake in Africa. It has a surface area of about 5,300 km^2, is roughly 150 km long, and has an average width of 35 km. It reaches a maximum depth of 56 m within 7 km of the mid-western shore. The estimated volume of water in the lake is about 280 km^3.

[1] Other water bodies in the district include River Kafu which forms a boundary with Kibaale District and drains into Lake Kyoga (Kyoga WM Zone), east of Albert WM Zone.

The water level in the lake averages 615 masl. The water level fluctuations in the past have been recorded as an annual change of 0.5 m, but the fluctuation has increased due to climate change and the average lake levels are rising (International Lake Envrionment Committee Foundation, 1999).

Water levels at Butiaba on Lake Albert (approximately 90 km north of the project site) have been recorded since January 1948. Analysis of the records shows annual variations of approximately 4 m. The monthly variations are shown in Figure 6-10.

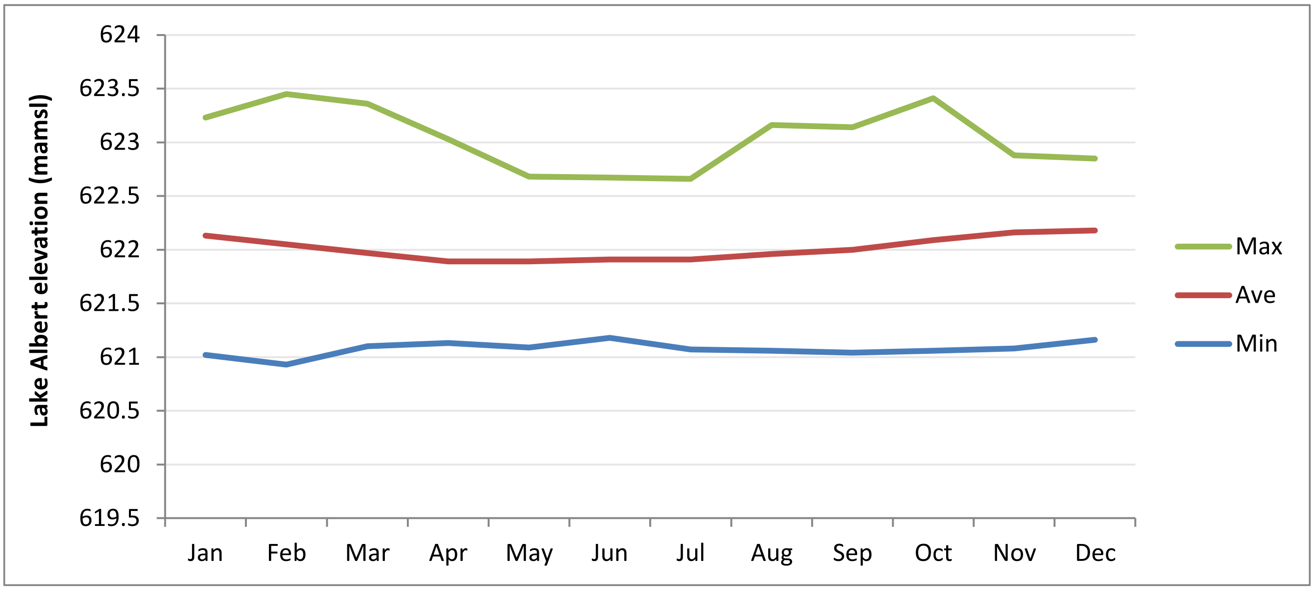


Figure 6-10: Average water levels at Butiaba on Lake Albert (65 year period)

Surface water levels do not depend solely on the hydrology of the lake, being affected also by releases from Kabelaga Dam (located on the Wambabya River in Hoima District), and wind generated waves. Wind blowing over the lake produces an effect that may appear as a widely varying and fluctuating ruffling of the surface. These small wind-induced waves can be observed at the Buhuka Flats. They are transient, dissipating rapidly when the wind dies away. However, due to the extent of the lake it is also likely that more persistent gravity waves affect the water level, probably accounting for variations of several metres at different location on the lake. A water level logger has been installed on the Flats to monitor the more localised water level of Lake Albert but no records are available yet.

The impact of these naturally occurring waves on the geomorphology of the Flats is clearly noticeable along the lake shore (Photograph 4-12). At several locations, the soil along the shoreline is being eroded by wave action. This is a naturally occurring process which may be compensated to some extent by the rate of sediment material transported from the Flats upstream catchments and discharged into Lake Albert.

6.1.4.4 Conceptual hydrology of the Buhuka Flats

The water system of the Flats is very different from the rest of its upstream catchment. A conceptual model of the Flats hydrological system is presented in Figure 6-11.

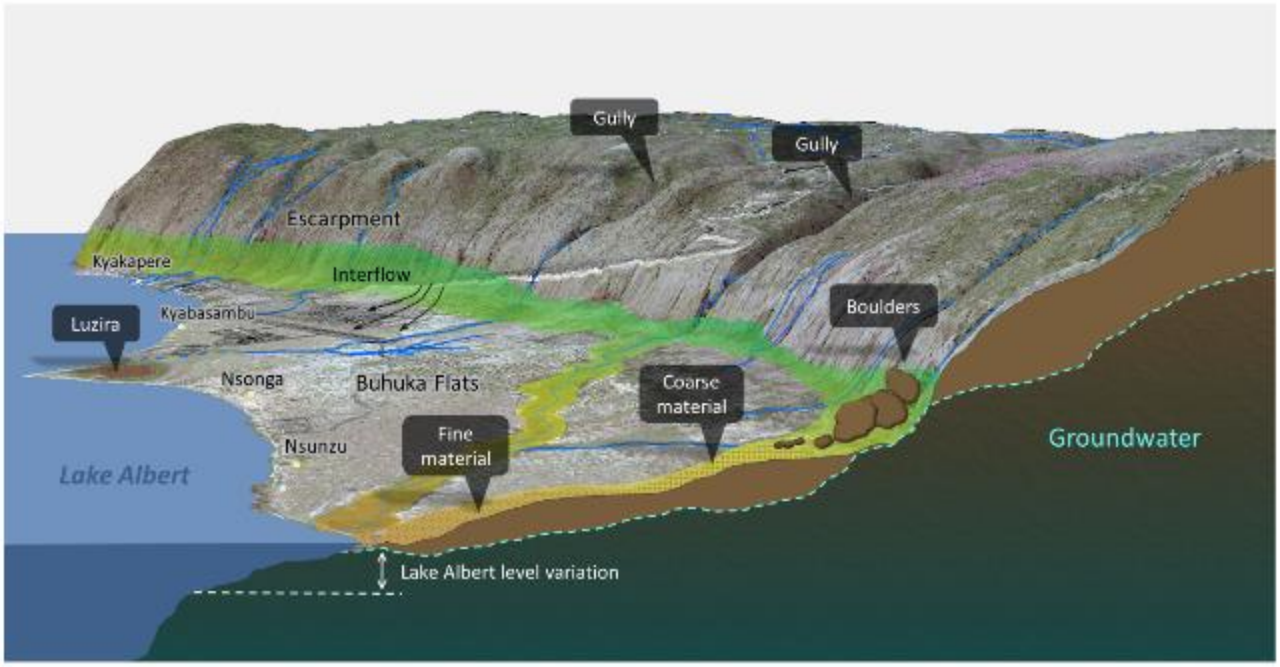


Figure 6-11: Hydrological conceptual model of water drainage from the escarpment via the Buhuka Flats into Lake Albert. Note: Luzira is a local name for the Bugoma Lagoon

The catchment of the rivers draining across the Flats covers an area of 65 km^2. Water drains through ravines in the escarpment (1). While the water through the ravines has powerful erosive energy, depositing large boulders at the footslopes of the escarpment, it is quickly dissipated as the slopes flatten onto the plain. This is a zone of recharge where water infiltrates into the soil. Water from the smaller streams dissipates entirely into the soils or is evaporated within a few hundred metres of the escarpment. Evidence of the water's pathway through the soil, as interflow, is shown where roads intercept the flow as a result of compaction of the soil. The larger streams meander across the Flats to the lake through densely vegetated wetlands.

An important feature within the Flats hydrology is a pond near the jetty, known as 'Luzira' (6). Little is known about the hydrological behaviour of this system. During the dry season, the measured water level in the pond was lower than the level of Lake Albert and no water inflow was visible on the surface. It is likely that during the dry season the pond is fed by a flow of groundwater from upstream, while during the wet season it fills up and spills into Lake Albert through a large channel.

Photograph 6-15: The Bugoma Swamp photographed from the top of the escarpment

Photograph 6-16: The effect of wind driven wave action near Nsunzu

Photograph 6-17: Wetlands near the lake shore

Photograph 6-18: Road crossing of the Masika River

6.1.4.5 Floodlines across the Buhuka Flats and Feeder Pipeline Area

Six catchments were delineated from north to south as North 1, North 2, Mid 1, Mid 2 (the Kamansinig River), Masika (the Masika River) and South 1. For the feeder pipeline, the Hohwa River crosses the pipeline, and an unnamed river referred to as Pipeline River 2. Both of these rivers are seasonal.

Figure 6-14 shows the 1:50 year and 1:100 year floodlines for the Buhuka Flats and escarpment, calculated for each catchment. Details of the method used to calculate the floodlines are included in the specialist study on Surface Hydrology (Volume 4, Specialist Study 2).

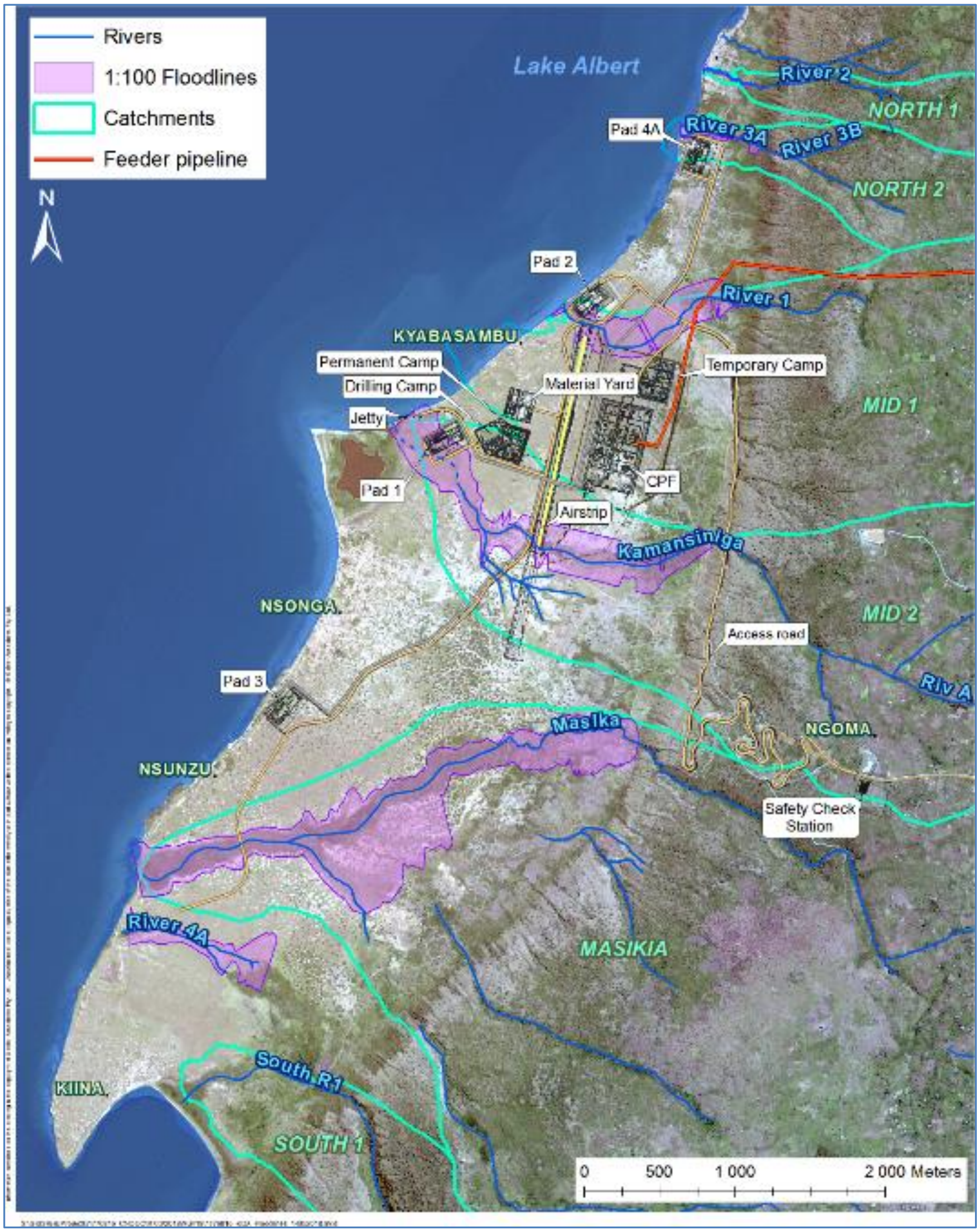


Figure 6-12: Floodlines of the rivers crossing the Buhuka Flats

6.1.4.6 Water Quality

Buhuka Flats and Feeder Pipeline

Ten monitoring stations[1] were selected for surface water quality monitoring on the Buhuka Flats and along the feeder pipeline route (Figure 6-13). A further 12 sites were monitored in situ, with a limited range of field measurements taken. Table 6-4 presents monitoring results for selected parameters from the March 2014 dry season sampling run. Further detail is provided in Volume 4, Specialist Study 2.

The results show that surface water quality during the dry season is generally good with few exceedances of the drinking water standards, except pH. The following specific conclusions are drawn from the results:

- The pH of surface water in the study area is high, exceeding the Ugandan standard of pH 8 at five of the lab-sampled sites, and 7 of the in-situ monitoring sites. The highest pH was recorded at SW03 (lab pH 8.88) and SW04 (in situ pH 9.06). The high pH in surface water samples mirrors the groundwater results and is likely to be due to the underlying geology.
- The pH at SW14 is lower than the other monitoring sites, being slightly acidic. The may be the cause of the higher concentrations of iron and manganese measured in the water sample.
- TDS and EC levels at SW01 were high and in the case of TDS exceeded the Ugandan standard (TDS 730 mg/l and EC 1030 µS/cm). This may have been due to high concentrations of organic matter associated with the upstream wetland system or contributions from the upstream villages.
- Traces of various Polycyclic aromatic Hydrocarbons (PAHs) were also detected, although not at levels that are cause for concern. The laboratory values for these PAHs are not shown in Table 6-4 but are included in Volume 4, Specialist Study 2. Oil and grease concentrations in all samples were below detectable limits.

[1] *Monitoring stations selected from a larger initial group – hence the non-consecutive numbering*

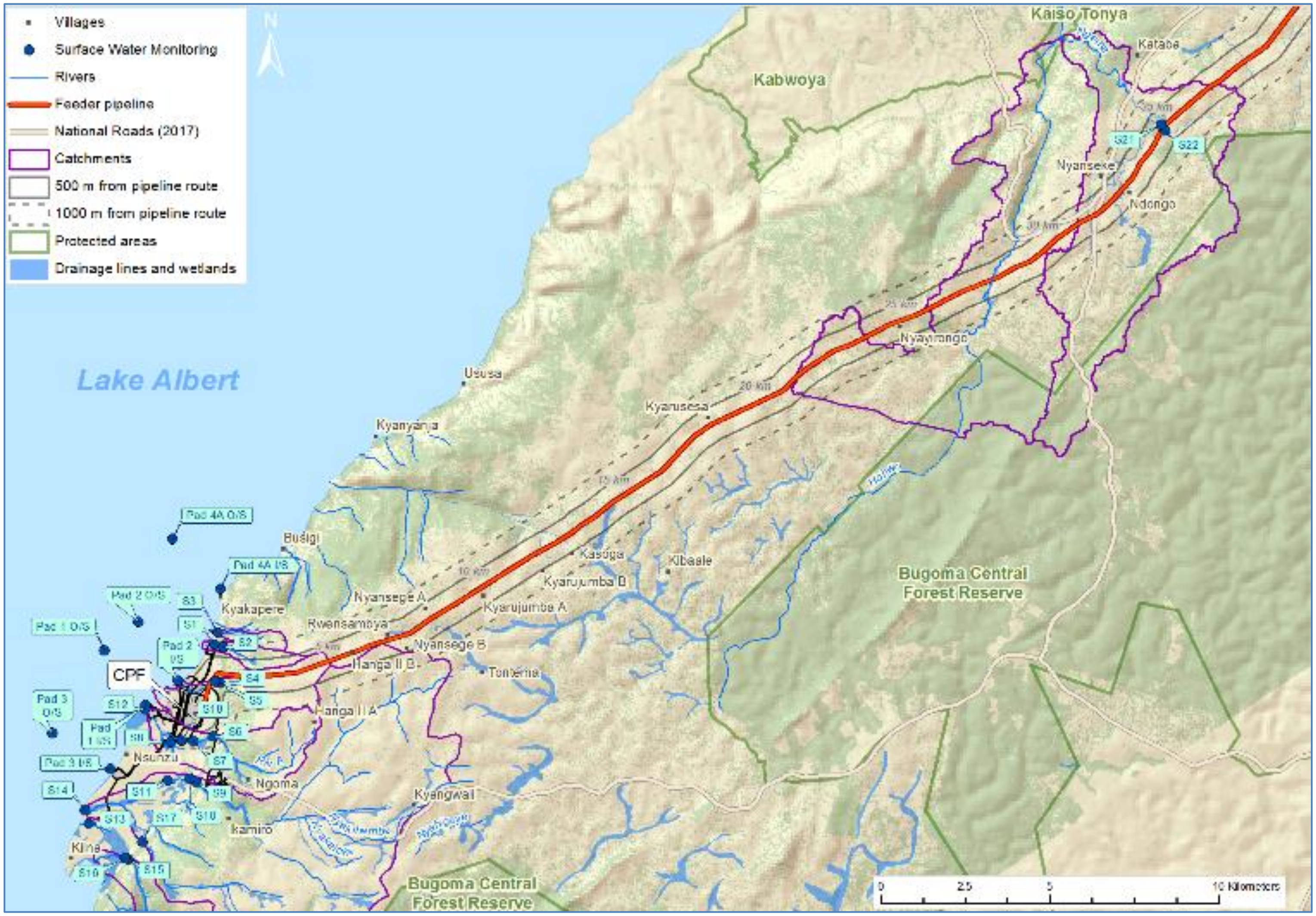


Figure 6-13: Surface water monitoring points in the LSA

Table 6-3: Surface water quality monitoring points in the LSA (refer to Table 6-14.)

Monitoring Point ID	Name or Description	Coordinates (Decimal Degrees)		Elevation (m)
		North	East	
SW1*	Tributary associated with proposed road cross section 3 (Kyakapere)	1.26472	30.75764	641
SW2*	Upstream of cross section 3 - Kyakapere (upstream)	1.22883	30.75097	677
SW3	Cross section 2	1.22847	30.74519	639
SW4*	Further upstream of SW5	1.24758	30.73917	676
SW5	Upstream of Spoil Area A(Quarry and Asphalt Plant) (Kowet)	1.21694	30.72425	649
SW6*	On Kamansinig river upstream SW7 (Kachasambo)	1.22053	30.72308	681
SW7	Kamansinig river upstream of the airstrip	1.20750	30.73461	656
SW8	Culvert on Kamansinig river western side of the proposed airstrip	1.20769	30.73378	642
SW9*	Maslka river upstream of proposed Spoils Area B - Reservoir (Nyakateke)	1.21214	30.73847	660
SW10	Maslka river downstream of proposed Spoils Area B (Nyakateke)	1.23925	30.74886	651
SW11	Maslka river below the escarpment and upstream of wetland sensitive areas	1.26406	30.75992	630
SW12*	Kamansinig river inflow to Bugoma Lagoon and adjacent to Jetty (associated with Pad 1)	1.38586	30.99458	620
SW13	Small non-perennial stream 70 m upstream of proposed Pad 5	1.38422	30.99867	619
SW14*	Downstream of Maslka prior to entering Lake Albert	1.26797	30.75853	624
SW15	Stream from escarpment flowing towards South End Fishing Village (Mugera)	1.25456	30.75917	665
SW16	Downstream of SW15 (Mugera)	1.25478	30.75772	649
SW17	Tributary of Maslka river on escarpment	1.24025	30.75725	662
SW18	Kamansinig river between SW7 and SW8 (equidistance)	1.23908	30.75200	641
SW21	Site along the pipeline 35 km from the CPF site (east of pipeline)	1.23875	30.74583	1031
SW22	Site along the pipeline 35 km from the CPF site (west of pipeline)	1.22803	30.75278	1023

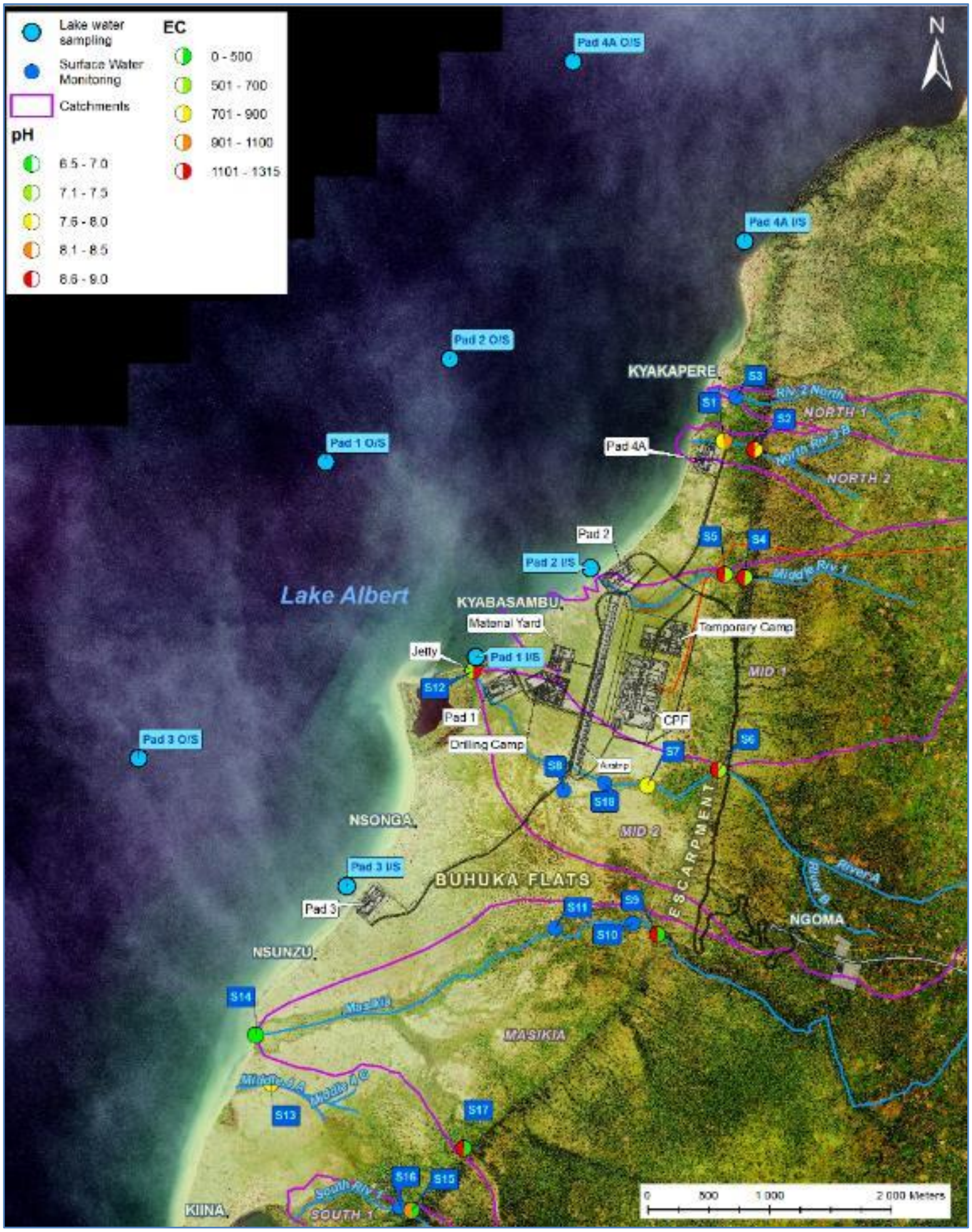


Figure 6-14: Location of surface water monitoring sites

Table 6-4: Water quality for selected surface water samples on the Buhuka Flats and along the feeder pipeline route (refer to Table 6-15 for location of samples)

Sample Description	pH	EC (mS/m)	Total Hardness ($CaCO_3$)	Total Alkalinity ($CaCO_3$)	TDS	Sulphate (SO_4)--	Ammonia Nitrogen (NH_3N)	Nitrate (NO_3-N)	Calcium	Magnesium	Sodium	Chloride	Aluminium	Lead	Mercury	Iron	Copper	Manganese	Selenium	Cadmium	Arsenic	Nickel	Chromium	Faecal Coliforms (Y/N)
US 201 Potable Water Standard (Class 2)	**6.5 – 8.5**	**250**			**1200**				**75**	**50**	**400**	**500**	**0.2**	**0.01**	**0.001**	**0.03 - 3.5**		**0.1 – 0.5**	**0.01**	**0.01**	**0.01**		**0.05**	
Ugandan Drinking Water Standard (NEMA, 1996)	**6.5 – 8.0**	**250**	**500**		**600**	**200**	**1**	**5**	**-**	**-**	**-**	**-**	**0.2**	**0.01**	**0.001**	**0.03 - 0,5**	**1**	**0.1 - 0.5**	**0.01**	**0.01**	**0.01**	**0.02**	**0.05**	**N**
Lake Albert	9.9	57.6																						
SW02	8.8	85.3	242	416	506	47.92	0.22	0.19	44.5	31.1	108.1	11.7	0.01	0.01	0.0005	0.01	0.0035	0.005	0.00	0.00	0.00	0.00	0.00	
	8.9	82.4			554																			
SW03	8.9	62.1	178	308	363	16.75	0.47	0.29	37	20.3	77.1	7.4	0.01	0.01	0.0005	0.01	0.0035	0.004	0.00	0.00	0.00	0.00	0.00	
SW09	8.5	27.4	100	146	158	4.65	0.25	0.15	20.5	11.6	17.1	1.4	0.01	0.01	0.0005	0.094	0.0035	0.01	0.00	0.00	0.00	0.00	0.00	
	8.7	25.0			172																			
SW14	6.8	37.7	133	178	217	0.27	0.59	0.025	27.7	15.2	25.4	14.7	0.01	0.01	0.0005	4.28	0.0035	0.849	0.00	0.00	0.00	0.00	0.00	
	6.7	32.3			214																			
SW15	8.4	33.0	113	160	183	0.34	0.09	0.09	20.8	14.6	26.5	2.6	0.01	0.01	0.0005	0.052	0.0035	0.007	0.00	0.00	0.00	0.00	0.00	
	8.2	32.5			244																			
SW17	8.6	46.9	153	232	231	0.2	0.5	0.27	29.7	18.7	36.7	4.5	0.01	0.00	0.0005	0.01	0.0035	0.003	0.00	0.00	0.00	0.00	0.00	
	8.5	42.0			291																			
SW19	8.7	51.7	174	274	302	5.92	0.19	0.23	33.6	21.5	50.5	4.6	0.01	0.01	0.0005	0.01	0.0035	0.001	0.00	0.00	0.00	0.00	0.01	
SW20	8.9	64.8	138	302	326	11.38	0.08	0.025	11.4	26.1	64.5	19.9	0.01	0.00	0.0005	0.01	0.0035	0.001	0.00	0.00	0.00	0.00	0.00	
SW21	7.3	31.9	112	134	187	7.43	0.44	0.21	22.9	13	16.3	5.8	0.01	0.01	0.0005	0.111	0.0035	0.026	0.00	0.00	0.00	0.00	0.00	
SW22	7.0	32.0	122	136	176	7.75	0.56	0.15	27.9	12.5	11.3	7.7	0.01	0.01	0.0005	0.121	0.0035	0.183	0.00	0.00	0.00	0.00	0.00	

Lake Albert

Water quality in Lake Albert was measured in May 2014 at eight shallow and deep water sites in the lake, shown in Figure 6-14. The water quality of Lake Albert, indicated from grab samples taken in May 2014, shows that the lake pH is strongly alkaline, and falls outside of the Uganda National Standards. However, except for faecal coliform count which indicated low levels of faecal contamination at both the inshore and offshore sites, the other parameters measured are within the Uganda National Standards

Table 6-5: Water quality in Lake Albert in May 2014 (refer to Figure 6-14 for the location of the sample)

Parameters	Units	Pad 1		Pad 2		Pad 3		Pad 4A		*Nat Std
		I/S	O/S	I/S	O/S	I/S	O/S	I/S	O/S	
Coordinates (d.dd°)		N1.24862 E30.73936	N1.26313 E30.72824	N1.25522 E30.74780	N1.27078 E30.73743	N1.23159 E30.72982	N1.24107 E30.71444	N1.27955 E30.75916	N1.29290 E30.74648	
Total Depth	m	1.5	24.3	2.6	13.5	1.8	27.3	3.3	28.1	
Secchi Depth	m	0.7	0.93	0.81	0.92	0.71	0.95	1.01	0.96	
Dissolved Oxygen	mg/L	7.53	7.80	7.03	7.94	7.56	7.72	7.50	7.95	**NS**
Temp	°C	28.4	28.1	27.8	28.1	28.5	28.1	27.8	27.8	**20-35***
Conductivity	µS/cm	634	633	633	633	632	634	633	633	**2500**
pH	--	9.60	9.62	9.61	9.61	9.45	9.63	9.66	9.66	**6.5-8.5**
Alkalinity	mg/L	316	332	316	360	324	320	240	320	**500**
Hardness	mg/L	180	200	160	240	180	200	180	160	**500**
TDS	mg/L	304	313	317	312	310	312	304	313	**1200**
TSS	mg/L	3	2	1	1	2	1	1	1	**0**
Turbidity	NTU	2	2	2	3	4	2	2	2	**10**
Calcium: Ca^{2+}	mg/L	20.8	10	24	40	24	24	24	24	**75.0**
Magnesium: Mg^{2+}	mg/L	30.7	38.4	24	33.6	28.8	33.6	28.8	24	**50.0**
Fluoride: F^-	mg/L	1.2	1.3	1.2	1.2	1.1	1.3	1.1	1.3	**1.5**
Iron	mg/L	0.01	0.01	0.02	1.01	0.04	0.01	0.00	0.06	**5**
Sulphate	mg/L	11	11	10	10	11	11	10	10	**200**
Chloride: Cl^-	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	**500**
BOD_5 at 20°C	mg/L	0.0	0.6	0.9	0.4	0.5	0.2	0.3	0.6	**30***
COD	mg/L	11	10	11	15	7	15	14	12	**100***
SRP	mg/L	0.003	0.000	0.001	0.002	0.002	0.002	0.003	0.000	**5000***
TP	mg/L	0.026	0.034	0.029	0.031	0.044	0.036	0.034	0.034	**10**
Nitrate	mg/L	0.023	0.024	0.095	0.031	0.055	0.032	0.035	0.024	**4.5**
Nitrite	mg/L	0.008	0.007	0.010	0.010	0.002	0.001	0.001	0.007	**3**
Ammonia	mg/L	0.008	0.020	0.022	0.029	0.015	0.010	0.012	0.020	**1**
Total Nitrogen	mg/L	0.32	0.122	0.185	0.372	0.122	0.140	0.122	0.122	**10**
Chlorophyll a	µg/L	2.1	2.1	2.1	1.0	1.0	2.1	3.1	3.1	**NS**
Faecal coliform	CFU/ 100mL	50	25	2	2	10	5	7	3	**0**

I/S: inshore; O/S: offshore; Nat Std: Uganda National Standard

6.1.5 Soils

6.1.5.1 Soil Characteristics (Buhuka Flats)

The dominant soils on the Buhuka Flats study area according to the FAO Soil Classification System include Ferrasols, Litosols, Gleysols and Vertisols (Figure 6-15). They are all characterised by neutral pH values (5,3 - 7,2) and low electrical conductivity values (<250 mS/m). Under these conditions plant available nitrogen (15-20 mg/kg), phosphorus (10-15 mg/kg) and potassium (>50 mg/kg) are readily available for plant uptake and sustainable plant growth. No anomalies occur in any of the different soil types.

Ferrasols: Soils with toxic B horizon. Mineral horizon at least 300 mm thick with more than 15% clay. Little or no weathering primary aluminosilicates or 2:1 clay minerals, and no water dispersible clay. Typical properties are the presence of 1:1 clays, hydrated oxides of iron and aluminium, a low cation exchange capacity (<10cmol+/kg clay at pH7). The main processes of soil formation of oxisols are weathering, humification and pedoturbation due to animals. These processes produce the characteristic soil profile. They are defined as soils containing at all depths no more than 10 % weatherable minerals, and low cation exchange capacity. Oxisols are always a red or yellowish colour, due to the high concentration of iron (III) and aluminium oxides and hydroxides. In addition they also contain quartz and kaolin, plus small amounts of other clay minerals and organic matter.

Lithosols: Shallow soils with continuous hard rock within 100mm of soil surface. Soils that do not show any profile development other than an A horizon, has no diagnostic horizons, and most are basically unaltered from their parent material, which can be unconsolidated sediment or rock.

Vertisols: Dark coloured soils with high clay content, cracks wider than 100mm in dry state, gilgai micro-relief, slickenslides, wedge-shaped peds. A high content of expansive clay known as montmorillonite that forms deep cracks in drier seasons or years. Alternate shrinking and swelling causes self-mulching, where the soil material consistently mixes itself, causing vertisols to have an extremely deep A horizon and no B horizon. Vertisols typically form from highly basic rocks, such as basalt, in climates that are seasonally humid or subject to erratic droughts and floods, or to impeded drainage. Depending on the parent material and the climate, they can range from grey or red to the more familiar deep black. The shrinking and swelling of vertisols can damage buildings and roads, leading to extensive subsidence.

Gleysols: Wet soils formed in unconsolidated materials. A Gleysol in the FAO World Reference Base for Soil Resources is a wetland soil (hydric soil) that, unless drained, is saturated with groundwater for long enough periods to develop a characteristic gleyic colour pattern. This pattern is essentially made up of reddish, brownish or yellowish colours at surfaces of soil particles (peds) and/or in the upper soil horizons mixed with greyish/blueish colours inside the peds and/or deeper in the soil.

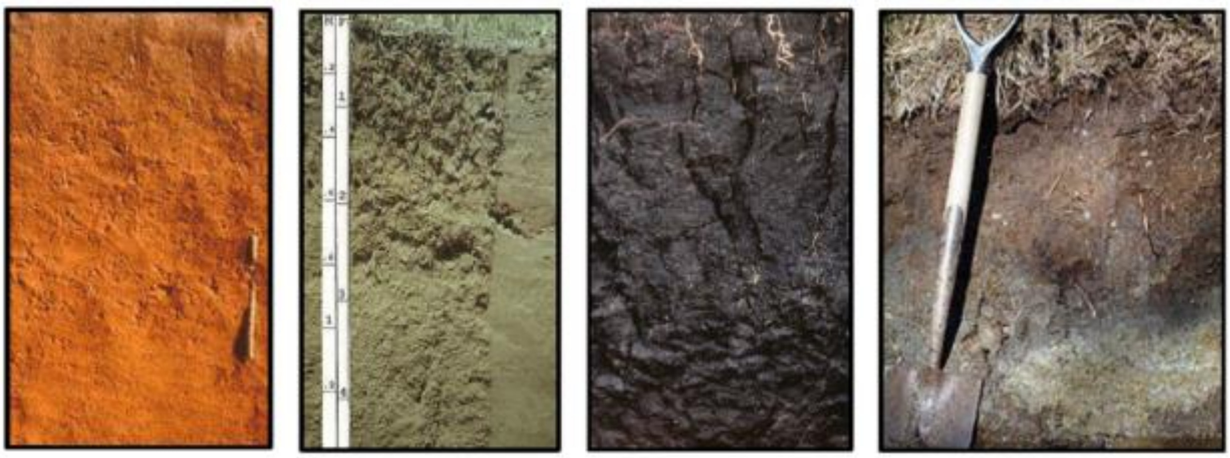


Figure 6-15: Examples of FAO classified soils (from left to right) - Ferrasols, Lithosols, Vertisols and Gleysols

Table 6-6: Agricultural potential of soils on the Buhuka Flats

SOIL TYPE	AGRICULTURAL POTENTIAL	
	DRY LAND	IRRIGATION
Ferrasols	High	High
Gleysols	Low	Low
Lithosols	Low	Low
Vertisols	Low	Medium

The Ferrasols and Lithosols have a low density structure and texture distribution of approximately 65% sand, 20% silt and 15% clay with drainage properties in the order of 10 mm/h. The dominant clay mineral is kaolinite, with a low buffer capacity due to the low cation exchange capacity. The Vertisols and Gleysols have a high density structure and texture distribution of approximately 75% clay, 10% silt and 15% sand. They contain smectite with high buffer capacity. The Vertisols are more than 1 m deep with a distinct structural development due to a high clay content. These soils are plastic, are not collapsible and have very high swell potential under a fluctuating moisture regime, considerations which are all important in foundation design. Gley mottling in the soils occurs at depths exceeding 600 mm due to aerobic and anaerobic conditions induced by a fluctuating water table. The fluctuating water table is the result of variations in the level of the lake and/or seasonal changes in rainfall patterns.

Evidence of severe soil erosion was observed during the investigation, especially along the shore line of Lake Albert. Most of the impact was linked to a lack of surface water control during civil construction. The soils are not dispersive, having levels of sodium that would not cause dispersion of clay particles and exacerbate soil erosion.

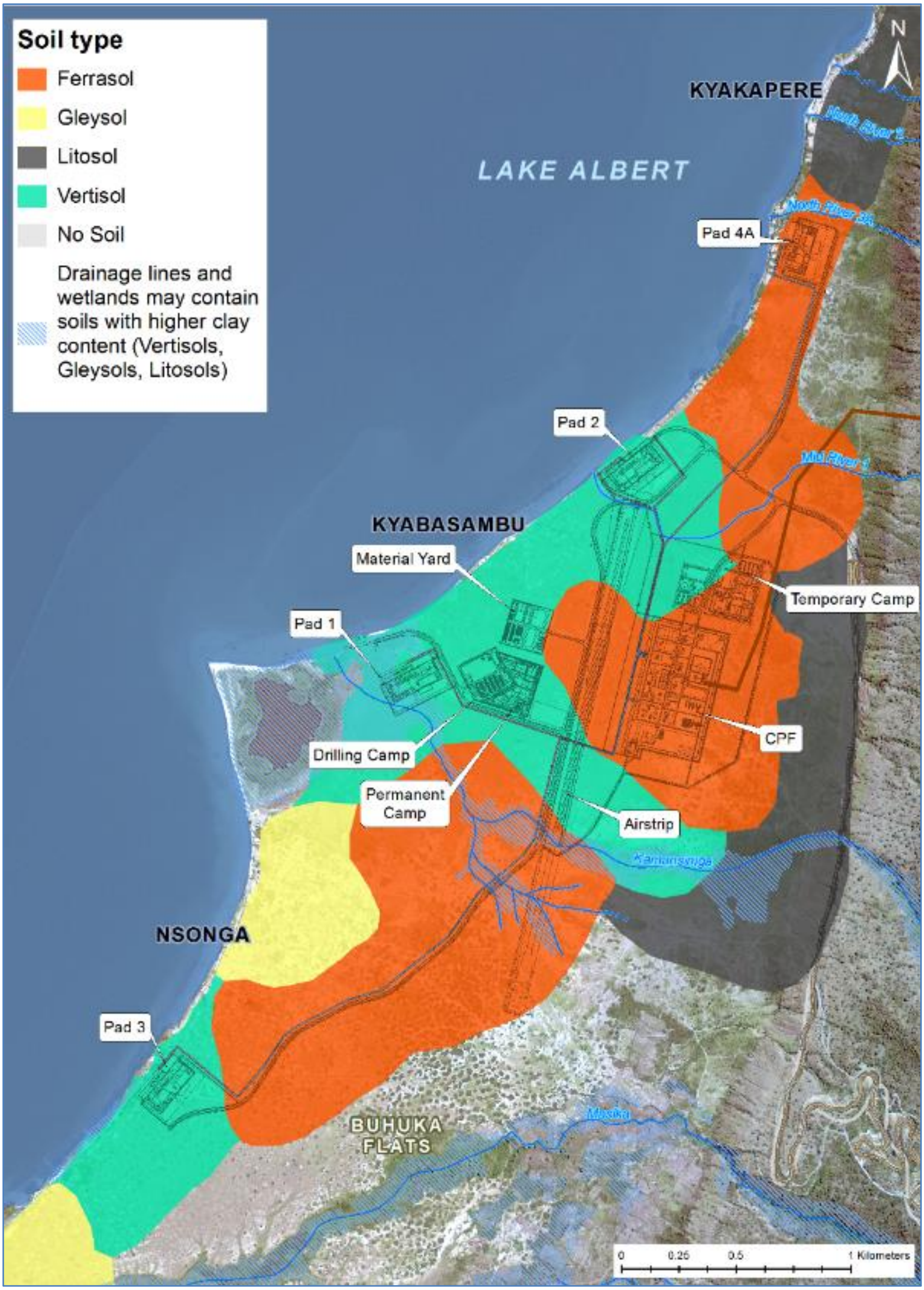


Figure 6-16: Soil types on the Buhuka Flats and adjacent escarpment

6.1.5.2 Soil Characteristics (feeder pipeline)

Table 6-7 summarises the diagnostic criteria of the different soil types:

Table 6-7: Diagnostic criteria of the different soil types.

Soil Type	Diagnostic Criteria
Ferrasols 	■ Well drained soils. ■ Red or yellow-brown colour. ■ Has clay textures. ■ Ferrosol is usually associated with previous volcanic activity. ■ Used for intensive crop production.
Greysols 	■ Associated with wetland conditions. ■ Is usually saturated with groundwater. ■ Usually covered with swamp vegetation. ■ In the tropics and subtropics they are cultivated for rice or, after drainage, for field crops and trees. ■ Characterised by both chemical and visual evidence of iron reduction. ■ Red, yellow, or brown mottles may be seen.
Litosols 	■ Shallow soils on weathered geology. ■ Lack well defined horisons.
Vertisols 	■ High clay content soil, shrinks and swells dramatically under fluctuating soil moisture contents. ■ When dry form large cracks that may be more than one meter (*three feet*) deep and several centimetres (*inches*) wide. Movement of these soils can crack building foundations and buckle roads. ■ Highly fertile due to the high clay content.

6.1.6 Ambient Sound Levels

6.1.6.1 Location of Monitoring Sites

The Buhuka Flats is a typical deep rural area without electricity. The only noise generated is that by people and animals and the occasional activity such as a television powered by car battery, or a local boat with a diesel engine. Noise levels at night are particularly low.

A baseline noise survey was undertaken in March 2014. Ambient noise measurements were taken at communities within the local study area and at other potentially noise-sensitive locations in the vicinity of the Project. Potentially noise-sensitive receptors were identified using aerial imagery and digital maps of the study area prior to commencement of monitoring. The chosen locations are shown in Figure 6-17 and listed in Table 6-8 along with the reason for their selection.

Table 6-8: Baseline noise monitoring locations (refer to Figure 6-17)

Monitoring Location	Monitoring Location Number	Decimal Degrees		Justification
		North	East	
Kyakapere Village	NMP1	1.27740	30.75949	Village; proximity to well pad 4-A
Kyakapere Village	NMP2	1.27090	30.75898	Village; proximity to pipeline
Kyakapere Village	NMP3	1.26263	30.75595	Village; proximity to pipeline
Kyakapere Village	NMP4	1.25706	30.75246	Village; proximity to well pad 2
Kyabasambu Village	NMP5	1.25276	30.74668	Village; proximity to well pad 2
Kingfisher 1 Pad	NMP6	1.24723	30.74071	Currently derelict, close to village
Nsonga	NMP7	1.23323	30.73407	Village; proximity to well pad 3
Nsunzu	NMP8	1.22458	30.72580	Village; proximity to well pad 5
Kiina Village	NMP9	1.20981	30.72324	Village; proximity to well pad 5
Ikamiro Village	NMP10	1.22650	30.76442	Village; proximity to storage yard
Inland, mid-escarpment	NMP11	1.25163	30.75838	Isolated farms; proximity to CPF
Inland, foot of escarpment	NMP12	1.22773	30.75228	Proximity to borrow pit

At Kyakapere Village monitoring was undertaken at four locations; at NMP2 and NMP4, 24-hour surveys were completed. In order to confirm that these extended measurements were representative of the character of this sprawling settlement, spot measurements were undertaken for 1 hour during the daytime and 1 hour during the night-time period at NMP1 and NMP3.

Monitoring was undertaken in accordance with international guidelines ISO 1996-1:2003 Part 1 (Ref. 6) using two Norsonic Nor-131 Class 1 sound level meter (SLMs). In compliance with IFC EHS guidelines, monitoring equipment was located at least 3 m away from any vertical sound-reflecting surfaces (e.g. walls) and at a height of approximately 1.5 m above ground level. All noise measurements were undertaken in outside 'free-field' locations, meaning that they were in locations where there would be no interference from reflective surfaces.

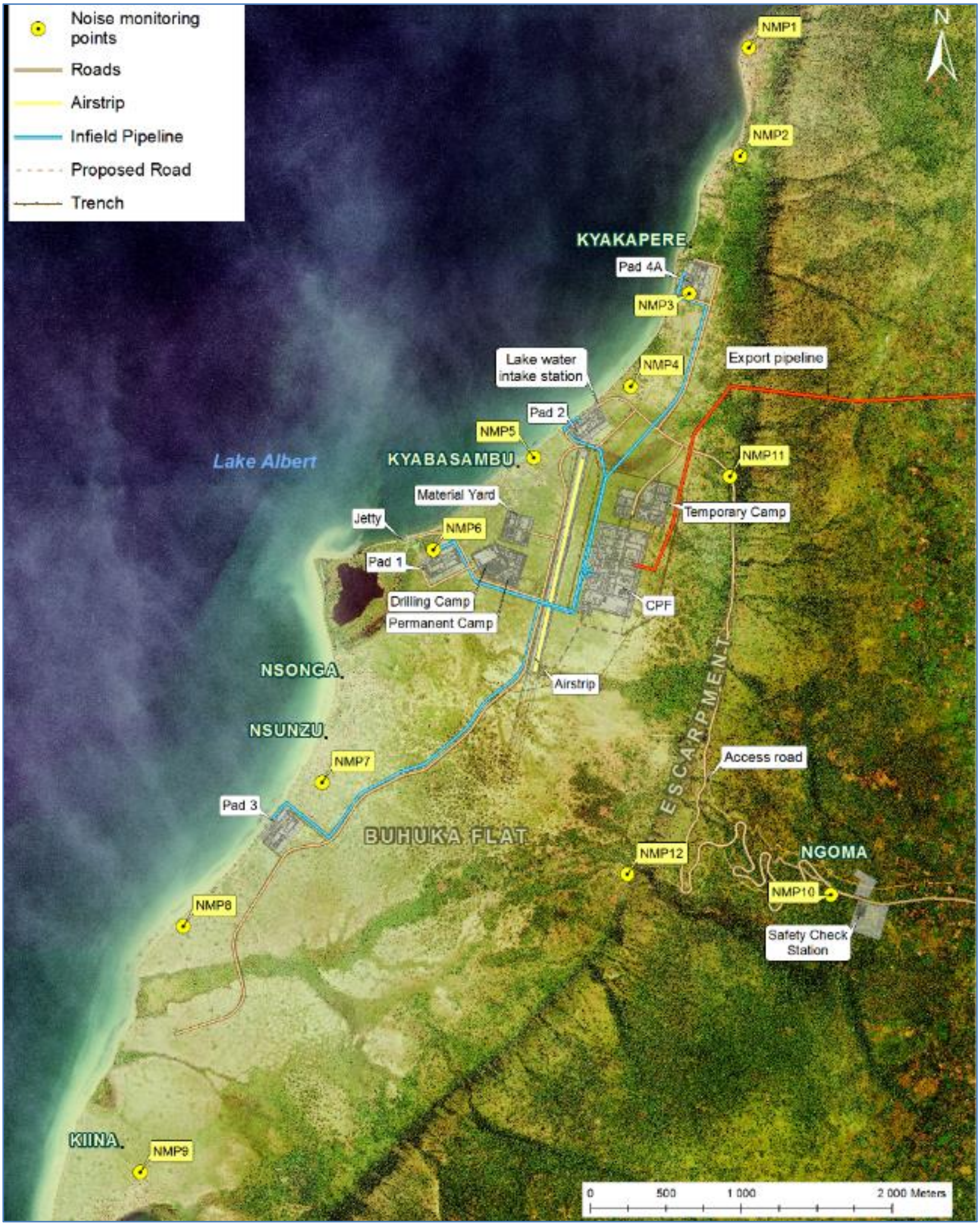


Figure 6-17: Location of baseline noise monitoring points on the Buhuka Flats (refer to Table 6-8)

6.1.6.2 The Use of Energy Average Parameters

The L_{A90} parameter (the A-weighted sound level, based on an energy average, that is exceeded 90% of the time), is typically considered to be representative of the steady 'background' sound level because it is less affected by short-term noisy events, which may not be representative of prevailing conditions, than the L_{Aeq} 'ambient' parameter (the A-weighted sound level, based on an energy average, over a defined averaging period).

The baseline measurements were conducted using a 10-minute averaging period, in order to provide sufficient resolution to characterise the variability of the ambient and background noise levels throughout the 24-hour monitoring period. For the purposes of the baseline characterisation the 10-minute values are referred to.

6.1.6.3 Baseline sound levels recorded on Buhuka Flats

Analysis of the baseline monitoring data from the 12 survey locations shows the following:

- measured sound levels were broadly similar at all locations, with maximum, minimum and average L_{Aeq} and L_{A90} values of the daytime and night-time periods typically falling within a 10 dB range;
- noise sources at the survey locations were typically wildlife, livestock, people and motorbikes; and
- diurnal variation was evident at all monitoring locations, to a varying degree. The ambient (L_{Aeq}) and background (L_{A90}) noise levels typically varied widely throughout the daytime period, becoming more consistent during the night-time period. Typically a peak was noted at sunset, followed by a gradual decrease in sound level throughout the night-time period, followed by a second peak at sunrise.
- sound levels are typical of rural areas, with long periods less than 40 dBA, dropping on occasions to less than 30 dBA.

Figure 6-18 to Figure 6-21 are selected 24-hour plots of recorded noise levels. For other plots, not included here, refer to Volume 4, Specialist Study 6.

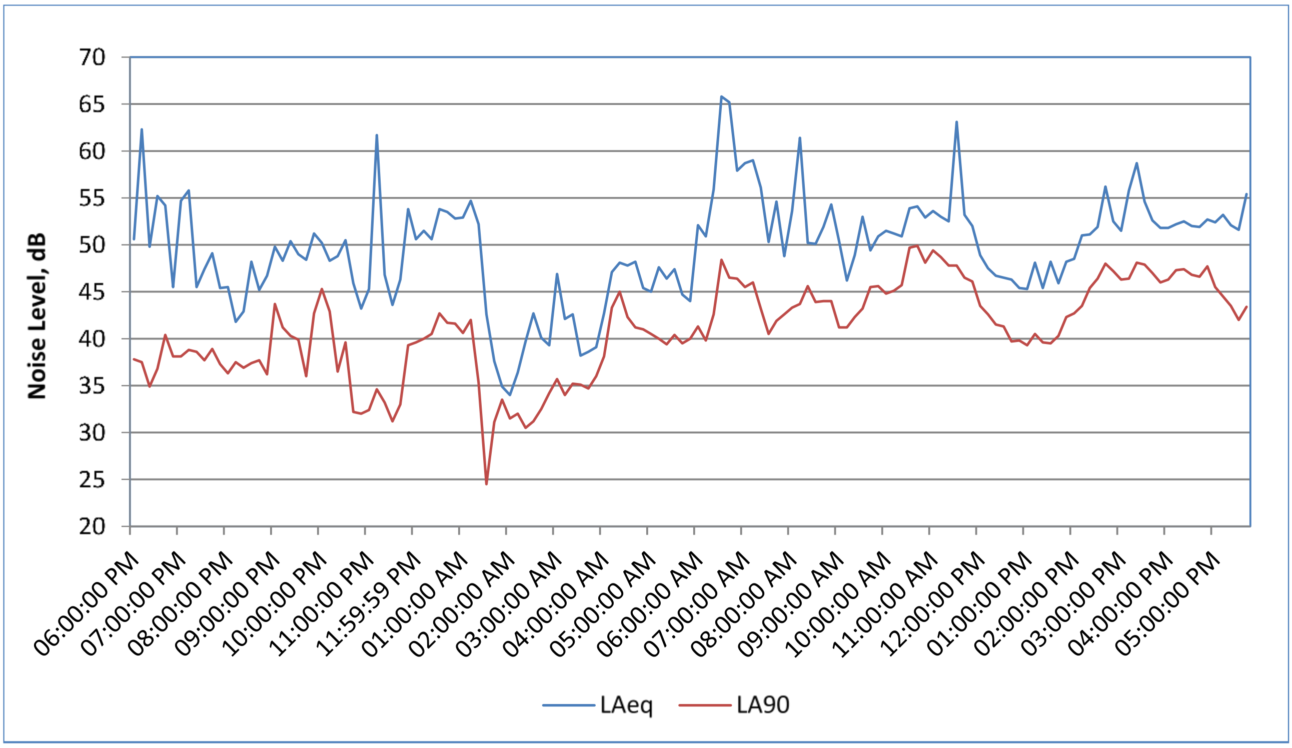


Figure 6-18: Measured LAeq, 10min and LA90, 10min noise indices at NMP2

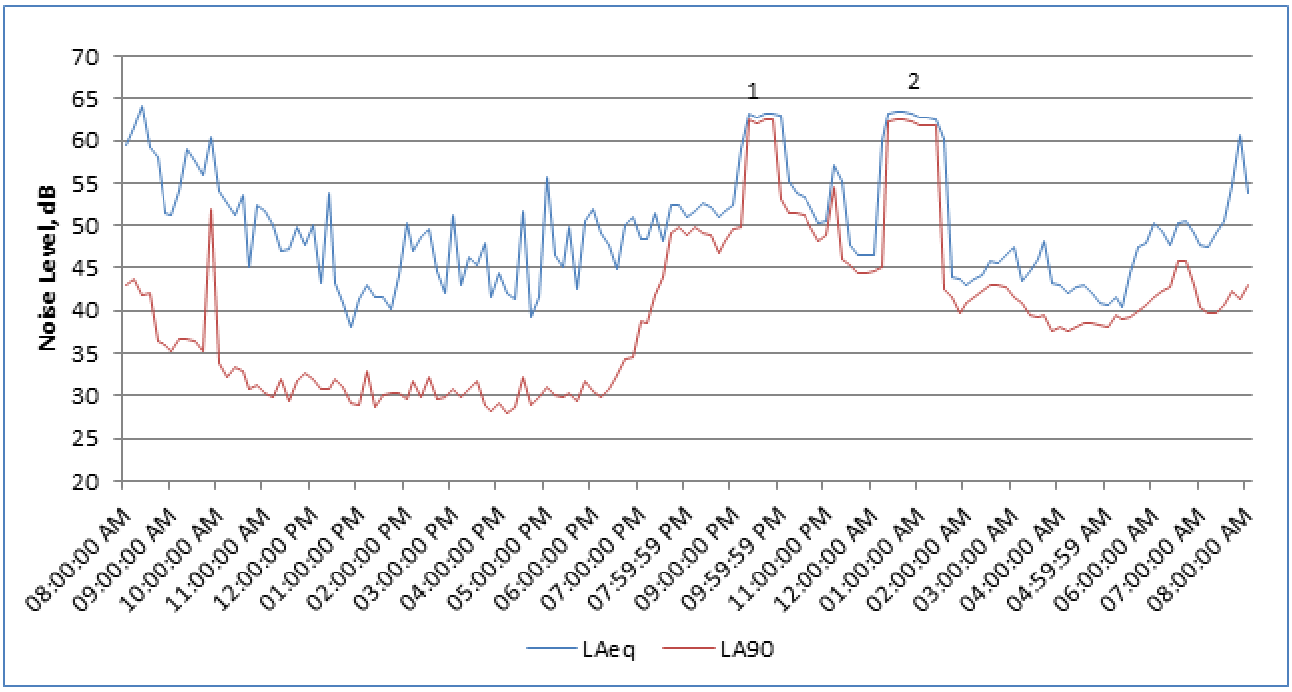


Figure 6-19: Measured LAeq, 10min and LA90, 10min noise indices at NMP4

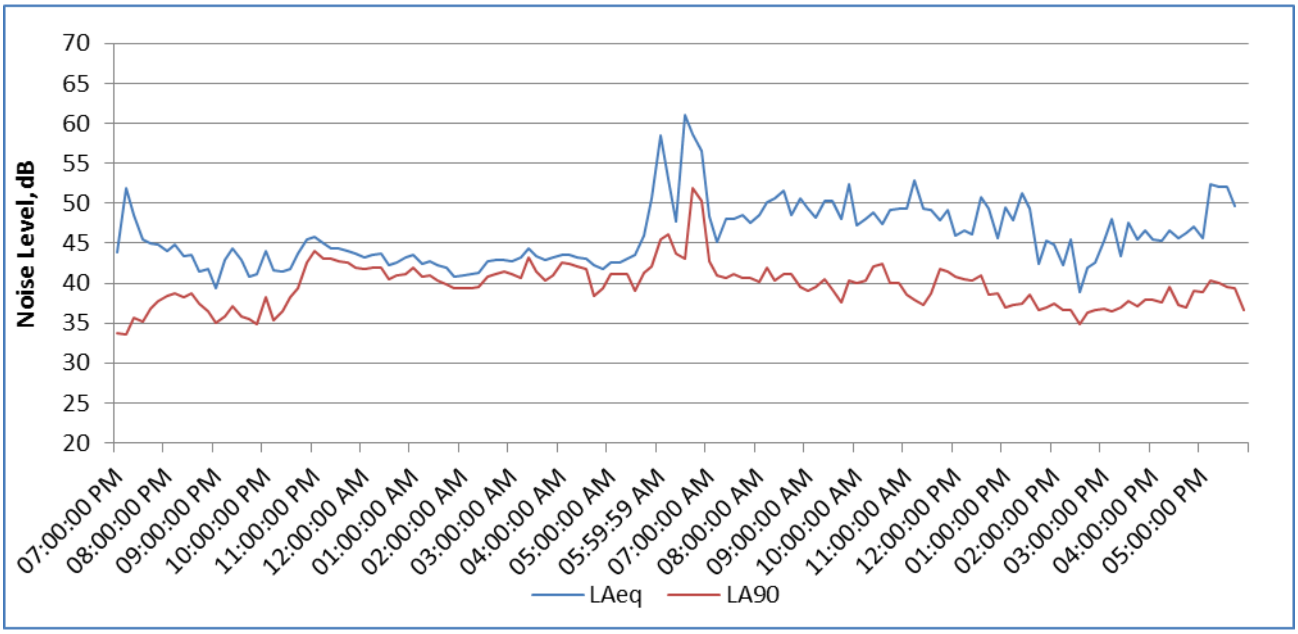


Figure 6-20: Measured LAeq, 10min and LA90, 10min noise indices at NMP5

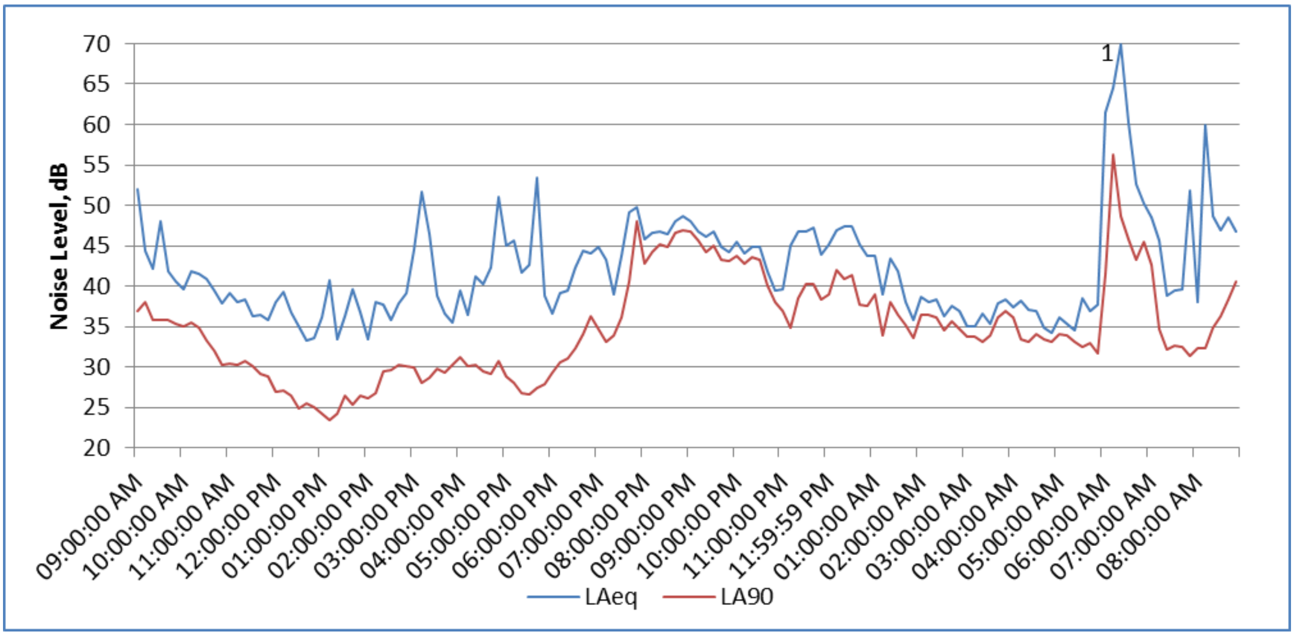


Figure 6-21: Measured LAeq, 10min and LA90, 10min noise indices at NMP6

6.1.6.4 Baseline sound levels recorded along the feeder pipeline route

Baseline noise levels have been measured around the proposed temporary construction camp along the feeder line, which is north-west of km 27, 500 m from the pipeline construction right of way. These sound levels are considered to be representative of most of the land use along the pipeline route, which is typical of rural African subsistence environments, influenced by occasional vehicle noise, people, goats, crickets and rustling of grass and trees. Monitoring points were selected at the four corners of the camp site.

Table 6-9: Sound level measurements at the temporary construction camp site along the proposed feeder pipeline

Period	location:	Start Time	End Time	L_{Aeq} dB	Notes/sources
Day time 18/12/2017	East	08:12 am	08:42 am	41.9	Occasional motorists People, crickets, wind
	West	08:49 am	09:19 am	38.6	Occasional motorists, wind
	South	09:25 am	09:55 am	40.1	Occasional motorists, wind, tree rustles
	North	10:01 am	10:31 am	35.7	Occasional motorists, wind, tree rustles
	Nearest home	10:50 am	11:21 am	41.5	Occasional motorists, tree rustles, wind, people, goats

6.2 Biological Environment

6.2.1 Background Context

The Project Area lies within the Lake Albert Basin, which encompasses much of the western East African Rift valley, from north of Lake Albert to southern Tanzania and northern Zambia. The biodiversity and biogeography of the basin are unique, and its attributes are recognised by many authorities. For example: it is part of the Eastern Afromontane Biodiversity Hotspot (Brooks *et al*., 2004); an Endemic Bird Area (EBA) (Stattersfield et al., 1998); and a 'Global-200' priority eco-region (Olson and Dinerstein, 1998; Burgess *et al*., 2004). The fishery supported by Lake Albert is also one of the most productive on the continent, providing a livelihood for many people (Snoeks, 2000). The fishery is the third largest in Uganda and supports a multi-species-based industry.

'Biodiversity value' is a term used by the International Finance Corporation (IFC) in its Performance Standard 6 (PS6), *Biodiversity Conservation and Sustainable Management of Living Natural Resources* (IFC 2012). Biodiversity value represents components of biodiversity at various levels of biological organisation, such as species or ecosystems that are important for conservation. A biodiversity assessment for a project within the Lake Albert Basin needs to be cognisant of the regional biodiversity implications and connectivity of the system. While this study initially considers the specifics of the areas that are likely to be directly affected by the project, it also takes a much broader view of the value of the system as a whole.

6.2.2 Determination of the Study Area

Two areas of project influence were used to determine the collection of baseline data for biodiversity impact assessment:

- The Local Study Area (LSA). This is the area within which the direct impacts of the project would be experienced, caused by physical disturbance of habitat or other impacts that could affect biodiversity, such as noise, dust and edge effects. The LSA is defined in Figure 6-22.
- The Regional Study Area (RSA). This is the area within which the project could have indirect or induced effects. It is a much larger area than the LSA and includes any areas of potential Critical Habitat that could be affected. Because of its sensitivity, the Critical Habitat itself has a significant influence on the physical extent of the RSA. The determination of the Critical Habitat Area of Analysis (CHAA) is independent of the proposed project footprint or other direct project effects and is based on discrete management units (DMUs), which are defined as areas with clearly demarcated boundaries within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas (IFC 2012b).

  The boundaries of the CHAA were devised cognisant of the need for an area where the ecological and land management issues have more in common with each other than they do with those in adjacent areas, and which constitutes a sensible ecological and political boundary within which critical habitat can be defined (IFC 2012b, paragraph 65).

  The RSA is defined in Figure 6-23. While a core area that consists of the CHAA is shown, the arrows indicate that the RSA may be extended outward in all directions to collect sufficient data for a holistic view of the area potentially affected by the cumulative impact of all oil industry activities.

Figure 6-22: Local Study Area (LSA) for the biodiversity baseline assessment

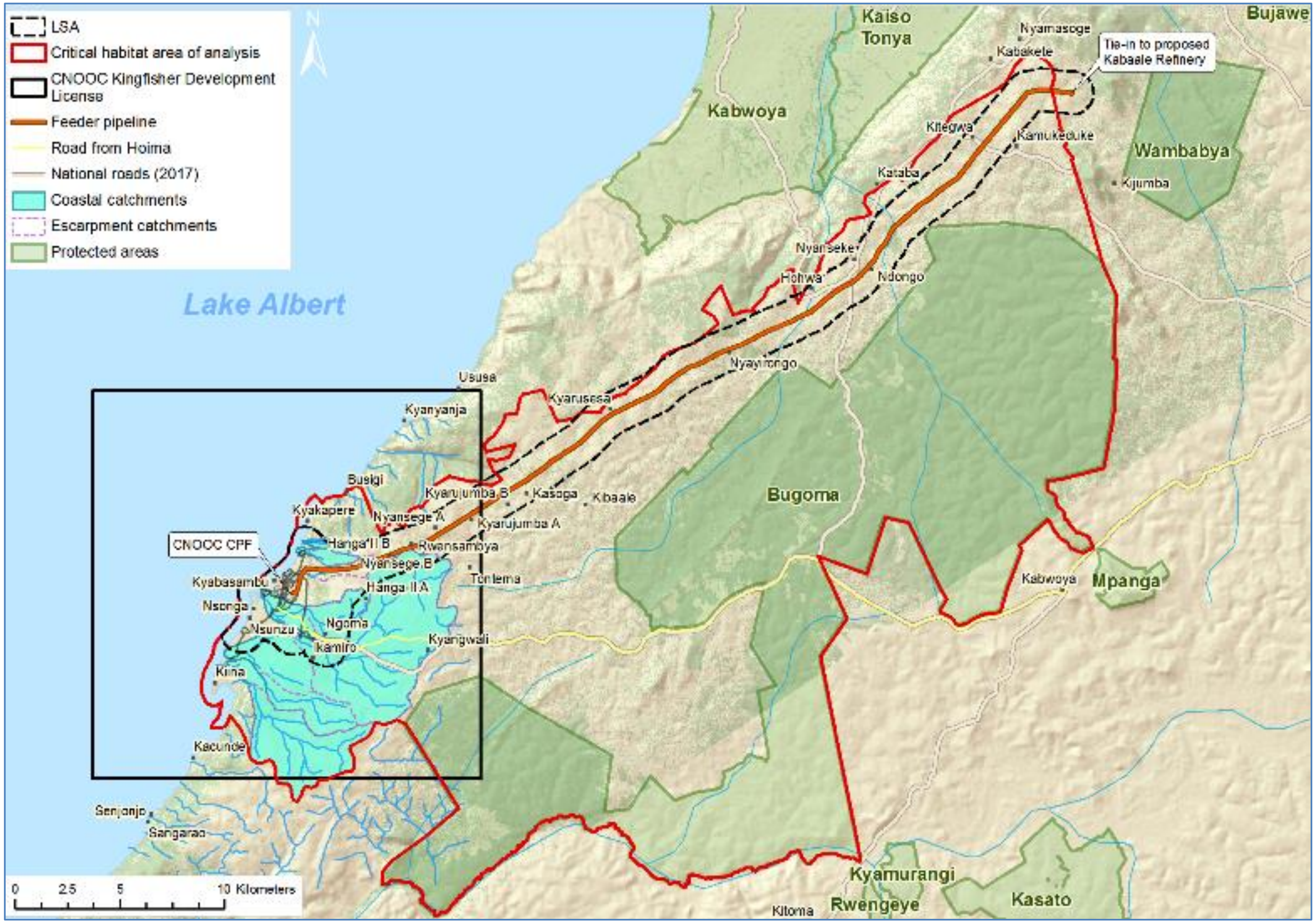


Figure 6-23: Regional Study Area (RSA) for the biodiversity baseline assessment

6.2.3 Study Objectives

The aim of the baseline assessment was to collect sufficient scientifically defendable data to characterise the biodiversity of the study area and assess how the Project could affect biodiversity. The work was undertaken with reference to Uganda's *Wildlife Policy 1999* and *National Biodiversity Strategy and Action Plan* (NEMA 2002), and the IFC Performance Standard 6, which seeks to protect biodiversity and ecosystem services from the adverse impacts of project activities, and support its conservation and sustainable use. Consequently, the specific objectives of the biodiversity baseline study were to:

- Characterise the ecological integrity of the terrestrial and aquatic (including wetland) ecosystems in the Project's area of influence and ascertain seasonal variation.
- Identify sensitive or unique habitats and species (as protected under Ugandan legislation and international obligations), which could suffer irreplaceable loss due to the Project.
- Identify species of concern that could trigger the definition of a Critical Habitat (as defined by IFC PS6).
- Identify populations and trends of exotic and invasive species in the Project's area of influence.

6.2.4 Methodology

Specialist Study 8 draws upon existing, published information, local knowledge and comprehensive, multi-season field surveys.

A large body of work relating to the ecology of the Buhuka Flats area (which covers the site), and the wider area, already exits dating back to 2006, and as recently as 2013. Those studies were undertaken as part of Heritage's exploration activities (RPS, AWE), CNOOC's activities (AWE, EACL), and Tullow's activities (AECOM).

Field surveys undertaken for the present study included:

- Quantification of species populations, abundance and trends.
- Assessment of species of concern (SoC) (including a detailed Critical Habitat assessment).
- Identification of drivers of ecosystem processes, functions, changes and trends.
- Assessment of the representativeness of ecosystems and habitats in the wider area.
- Assessment of sensitivity (vulnerability, irreplaceability) of species, populations, habitats and ecosystems to disturbance from the proposed development.
- Assessment of areas that are important for genetic transfer and movement corridors.

6.2.5 Terrestrial Biodiversity

6.2.5.1 Vegetation Communities

Langdale-Brown et al. (1964) classified the vegetation communities in the CHAA as Dry *Hyparrhenia* Grass Savanna, with undifferentiated deciduous Thicket (Q3/V1) on the Buhuka Flats; *Themeda-Chloris* Grass Savanna (Q4) on the Buhuka Flats; Dry *Combretum-Hyparrhenia* Savanna (N2) on the escarpment; and two types of Moist *Combretum-Terminalia-Albizia-Hyparrhenia rufa* Savanna/Medium Altitude Forest/Savanna Mosaic (K/F2) beyond the escarpment, towards Bugoma Central Forest Reserve along the pipeline route.

Since 1964, large tracts of vegetation have been altered in the CHAA as a result of intensive subsistence cultivation (Forest Department, 2002), grazing of cattle and charcoal manufacture. This is particularly noticeable in the area above the escarpment to the Bugoma Central Forest Reserve (see Figure 6-25). For the most part, these areas are now agricultural.

The steep slopes of the escarpment have protected it from cultivation and untransformed natural vegetation still exists there (Figure 6-25). This natural corridor extends from south of the CHAA to the Kabwoya Wildlife Reserve and the Kaiso-Tonya Community Wildlife Area. Plumptre et al. (2007) identified these corridors as an important linkage from the Semliki/Toro Wildlife Reserve in the south, to the Budongo–Bugoma–Kagombe–Itwara Forest Reserves, through to the Murchison Falls National Park in the north.

The field surveys identified seven broad vegetation communities within the LSA (as depicted in Figure 6-25):

- Wooded Grassland;
- Woodland;
- Thicket-Grassland Mosaic;
- Open Grassland;
- Bushed Grassland;
- Bushland and Shrubland; and
- Wetlands (including permanent wetlands of *Phragmites, Typha,* and *Cyperus*, and seasonally flooded grassland (floodplains) of *Sporobolus pyramidalis* and *Cynodon dactylon*).

These communities broadly align with those described by Langdale-Brown et al. (1964); although their current distribution is different to those originally described, primarily due to the increased pressures from agriculture and human disturbance over the last 50 years. The characteristics and condition of each of these communities is summarised below.

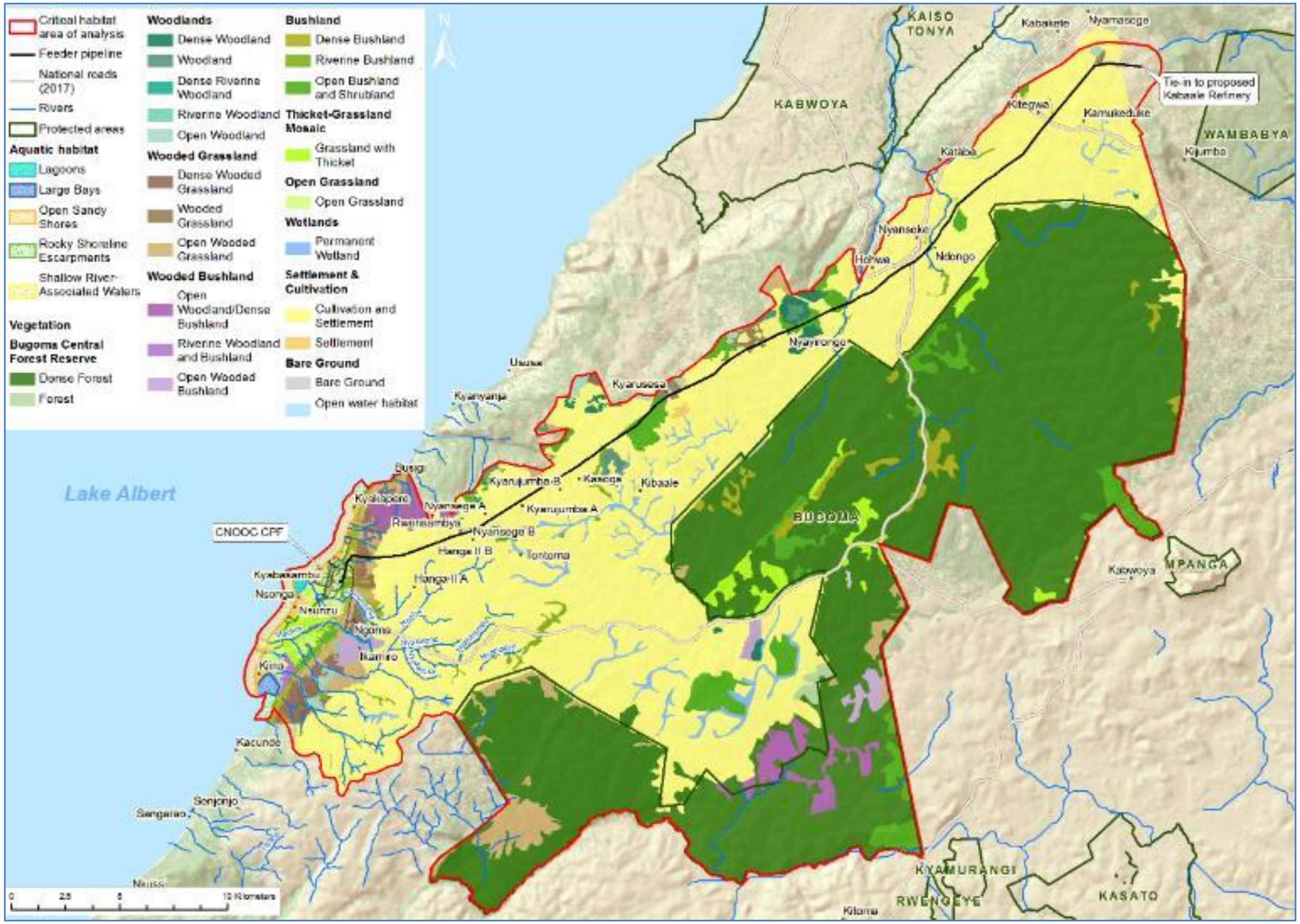


Figure 6-24: Vegetation and aquatic communities in the regional study area

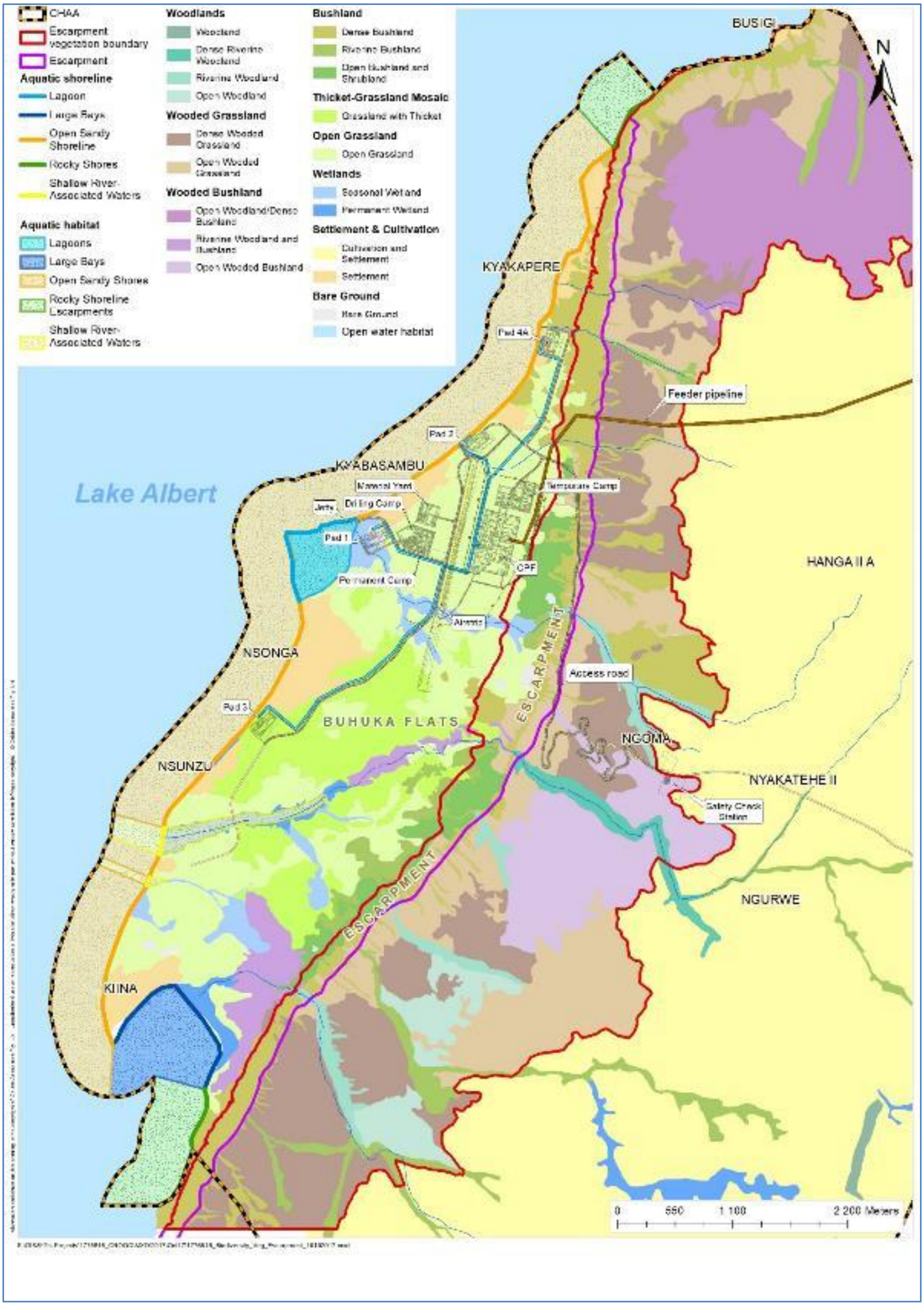


Figure 6-25: Vegetation and aquatic communities of the Buhuka Flats and escarpment and top of the escarpment i.e the local study area potentially directly affected

Table 6-10: Summary description of vegetation communities in the LSA (see Figure 6-25)

Vegetation Community	L - Brown Classification	Summary Description
Wooded Grassland 	Dry *Combretum-Hyparrhenia* Savanna (N2)	These communities comprise about 3.35% of the CHAA, and include the sub-communities of wooded grassland; open wooded grassland; and dense wooded grassland. They are largely restricted to the escarpment and beyond. Their original extent on the plateau above the escarpment has been significantly reduced in the last 50 years due to subsistence agricultural practices. On the escarpment, cultivation and grazing by cattle are the primary causes of change, together with frequent fires.
Woodland 	*Cynometra-Celtis* Medium Altitude Moist Semi-deciduous Forest (D2)	Within the CHAA, these communities were mostly dominated by *Acacia* species. They comprise about 0.70% of the CHAA, and included the sub-communities of: open woodland; and riverine woodland, and they tend to be restricted to the riverine areas along the mainly seasonal watercourses. Harvesting of large trees for the manufacture of charcoal is a noticeable activity in these communities, as well as trampling and grazing by cattle.
Thicket-Grassland Mosaic 	Dry *Hyparrhenia* Grass Savanna	Within the CHAA, particularly on the Buhuka Flats, these thickets are interspersed with grassland, forming a mosaic. They comprise about 1.37% of the CHAA, and include the sub-communities of grassland with thicket, which is largely restricted to the Buhuka Flats. Within this area, cattle limit bush encroachment and are the main reason for the vegetation mosaic.
Open Grassland 	*Themeda-Chloris* Grass Savanna (Q4)	These communities comprise about 0.71% of the CHAA and include the sub-communities of open grassland, largely restricted to the Buhuka Flats. Livestock grazing is by far the most influence affecting the structure of the plant community, keeping it closely cropped.

Vegetation Community	L - Brown Classification	Summary Description
Bushed Grassland 	Dry *Combretum-Hyparrhenia* Savanna (N2)	These communities comprise about 3.60% of the CHAA and include the sub-community of open bushland. They tend to be restricted to the areas above the escarpment. Clearing for agriculture, frequent fires and livestock grazing are noticeable causes of change in these communities.
Bushland and Shrubland 	Dry *Combretum-Hyparrhenia* Savanna (N2)	These communities comprise about 4.37% of the CHAA, and include the sub-communities of open bushland and shrubland, dense bushland; and riverine bushland. They tend to be restricted to ravines on the escarpment, occasional occurrences at the base of the escarpment, and at some places beyond the escarpment. The primary causes of change in these communities are frequent fire, harvesting of trees for charcoal manufacture and livestock grazing.
Wetlands (including permanent wetlands and seasonally flooded grassland) 	-	These communities comprise about 1.54% of the CHAA, and include the sub-communities of: seasonally flooded grassland and permanent wetlands with the most extensive wetland communities on the Buhuka Flats, the shores of Lake Albert, and the watercourses running off the escarpment (specifically the Masika River and its tributaries, the Kamansinig River, and Well Pad 2 stream). Current causes of change in the seasonal and flooded grassland wetland communities include altered flow regimes (such as the Kamansinig River wetland adjacent to the airstrip) and cattle grazing and trampling. Within the permanent wetlands, cattle grazing and harvesting of fibre by the local people appear to be the dominant causes of change.

6.2.5.2 *Flora Species*

Few studies have focused specifically on the flora of the CHAA. Those studies that do exist tend to focus on protected areas and forest reserves. For example: Plumptre et al. (2009), in a study of Kabwoya Wildlife Reserve, which is about 30 km north of Buhuka Flats and the same ecoregion as the CHAA, identified 167 flora species in that reserve; NEMA (2010) identifies the Bugoma Central Forest Reserve as a particularly species rich area; while Kalema (2005) compiled a list of species for the Semliki Wildlife Reserve, which is about 40 km south of the CHAA. These studies provide useful references for species assemblages of the wider area, and together with those provided by the IUCN (2014a), provide the basis for the identification of threatened species occurring in the CHAA.

Species Richness, Diversity and Abundance

Ninety six families and 635 species were recorded in the LSA. The number of species was strongly correlated with sampling effort. Although the highest species richness was recorded in bushland (369 species), woodland (318 species) and wetland communities (301 species), with thicket-grassland and bushed grassland communities recording 91 and 202 species respectively, a better measure is the mean number of species per survey plot, with bushed grassland (13.47 spp./plot), wooded grassland (8.89 spp./plot) and woodland (6.91 spp./plot) having the highest species richness, and wetland (5.02 spp./plot) and open grassland (5.79 spp./plot) having the lowest species richness.

Wooded vegetation communities had higher species richness compared with wetland and open grassland. Across the LSA woody species contributed 38.6% of species richness compared to 61.4% for the non-woody species. On the Buhuka Flats, herbs and shrubs dominated, while on the escarpment, shrubs dominated. Beyond the escarpment, herbs and trees dominated.

Table 6-11: Dominant species on the flats, escarpment and plateau

Buhuka Flats: *Cynodon dactylon*, *Sporobolus pyramidalis*, *Acalypha fruticosa*, *Phragmites kirkii*, *Capparis erythrocarpos*, *Senna* sp., *Asparagus africanus*, *Cissus oliveri*, *Typha capensis*, *Cyperus articulatus* and *Dichrostachys cinerea*.
Escarpment: *Acalypha fruticosa*, *Rhus natalensis*, *Hypoestes forskaolii*, *Terminalia brownii*, *Acacia brevispica*, *Cissus oliveri*, *Sporobolus pyramidalis* and *Enteropogon macrostachyus.*
Plateau: *Acalypha fruticosa*, *Rhus natalensis*, *Hypoestes forskaolii*, *Terminalia brownii*, *Acacia brevispica*, *Cissus oliveri*, *Sporobolus pyramidalis* and *Enteropogon macrostachyus*. In areas disturbed by cultivation, *Pennisetum purpureum*, *Acacia polyacantha*, *Imperata cylindrica*, *Vernonia amygdalina*, *Panicum maximum*, *Combretum collinum*, *Acanthus polystachius* .

Species of Concern

Four species of conservation concern were recorded during the field surveys in the LSA. These are:

- *Milicia excelsa* (Mvule Tree) (listed as Lower Risk/Near Threatened by the IUCN, and a restricted species on the Ugandan list of Reserved Tree Species, as promulgated under Uganda's *National Forestry and Tree Planting Act 2003*)
- *Tamarindus indica* (Tamarind Tree) (Not Evaluated by the IUCN, yet a restricted species on the Ugandan list of Reserved Tree Species, as promulgated under Uganda's *National Forestry and Tree Planting Act 2003*)
- *Cordia millenii* (Drum Tree) (listed as Lower Risk/Least Concern by the IUCN)
- *Euphorbia candelabra* (Candelabra Tree) and *Aloe* sp. (Aloe) (both Not Evaluated by the IUCN) but listed under CITES Appendix II.

Ninety-four species are uncommon in the LSA. These include *Cordia africana*, *C. millennii*, *Cynometra alexandrii*, *Pterygota mildbraedii*, and *Markhamia lutea* which are good timber tree species and are under intense pressure from logging. *Cordia millenii* is listed under Uganda's National Forestry Authority as a Reserved Species (Kalema and Bleentje 2012), and is, therefore, flagged for protection owing to excessive felling for its high-grade timber. None of the other species are listed under Ugandan legislation, or the IUCN's Red List (IUCN 2014a).

Five invasive species were recorded in the LSA, although they were uncommon. *Mimosa pigra* (Giant Sensitive Tree), *Lantana camara* (Lantana), and *Eichhornia crassipes* (Water Hyacinth) were the commonest species recorded, predominantly on the Buhuka Flats and the shore of Lake Albert (Appendix C). These species are recognised as some of most noxious weeds in the world (Lowe et al. 2000).

6.2.5.3 Invertebrates

The sampling of terrestrial invertebrates was limited to butterflies, dragonflies and damselflies. Results are summarised in Table 6-12.

Table 6-12: Summary of invertebrate data for the LSA

Invertebrate	Species Richness, Diversity and Abundance	Species of Conservation Concern	Habitats
Butterflies	One hundred and fifty species were recorded. Of these, 38 (24.7%) were forest-dependant, 27 (17.5%) forest edge / woodland species, 25 (16%) migrant species, 20 (13%) open habitat species, 42 widespread species and 2 (1.3%) wetland-dependant species	No Albertine Rift endemic species were recorded. No IUCN-listed, or Uganda-listed threatened species were recorded. Four Least Concern IUCN Red Data species were recorded: (i) Jeffry's Bush Brown (*Bicyclus jefferyi) which is widespread, favouring forest clearings and edges, common but population trend unknown. (ii)* Small Grass Yellow (*Eurema brigitta*). Common across Africa and Asia and favours a wide variety of savanna and grassland, population stable (iii) Dark Blue Pansy (*Junonia oenone*), occurs across Africa, no present threats (iv) Dark Grass Blue (*Zizina antanossa*), widely distributed in Africa, no major threats.	The majority of species recorded are habitat generalists or ecotone species, and are not dependent upon intact habitat for their survival. The most important habitats for butterflies are the watercourses draining off the escarpment and along the pipeline route, the vegetation communities of the escarpment, and forest areas. Forest-dependent species constituted ~25% of the species recorded, and ~1.5% were wetland dependent. Hence the array of habitats in the LSA is still important to maintain species diversity.
Dragonflies and damselflies	Forty-six species of dragonflies and damselflies were recorded from the LSA. The seasonally flooded wetlands along the Kamansinig River and the permanent wetlands of Masika River were the most species rich.	All the species recorded have been assessed by the IUCN, and all are categorized as being of Least Concern, with stable or unknown population trends. One species, the Common Riverjack (*Mesocnemis singularis*), although listed as Least Concern, is recommended by the IUCN for further monitoring due to possible declining population trends (Clausnitzer et al. 2010).	Although no IUCN-listed or Uganda-listed threatened species were recorded the LSA supports a rich diversity of species. Habitats of importance for dragonflies and damselflies within the LSA, based on species richness and diversity, were the seasonally flooded and permanent wetlands on the Buhuka Flats and along the feeder pipeline route.

6.2.5.4 Amphibians

Species Richness, Diversity and Abundance

Twenty-three amphibian species were recorded in the LSA; which is between 76% and 100% of the expected species in the CHAA. These represent seven families and ten genera. The most species-rich sites were along the pipeline route: 12 species were recorded at Kabakete near the proposed Kabaale refinery site, and 8 species were recorded at Zorobe. Eight species were recorded in Buhuka Flats wetland in the lower reaches of the Masika River, while 7 species were recorded in the Kamansinig River wetlands.

The most common species was the Ridged Frog (*Ptychadena* sp.1[6]), which was recorded at 42% of the sampling sites. This was followed by the Cinnamon-bellied Reed Frog (*Hyperolius cinnamomeoventris*) at 37% of the sites, the Kivu Reed Frog (*H. kivuensis*), and the Crowned Bullfrog (*Hoplobatrachus occipitalis*) at 32% of sites, while the Banded Banana Frog (*Afrixalus fulvovitattus*), Common Toad (*Amietophrynus regularis*) and Anchieta's Ridged Frog (*Ptychadena anchietae*) were found at 26% of the sites.

Species of Concern

All of the recorded species are listed as Least Concern by the IUCN, and all except one are believed to have stable population trends, or unknown trends. The Lake Victoria Toad (*Amietophrynus vittatus*) is listed as Data Deficient, with an unknown population trend (IUCN SSC Amphibian Specialist Group 2014a). This toad was recorded on the Buhuka Flats in the seasonally flooded wetlands associated with the Kamansinig River

DeSaeger's River Frog (*Amietia desaegeri*) is a range restricted species (IUCN SSC Amphibian Specialist Group 2014b), although it is listed as Least Concern by the IUCN,

Habitats

Based on species richness and diversity, important habitats for amphibians in the LSA are the seasonally flooded and permanent wetlands on the Buhuka Flats and along the pipeline route, and watercourses draining the escarpment.

6.2.5.5 Reptiles

Species Richness, Diversity and Abundance

Twenty-one reptile species, belonging to eight families and 11 genera, were recorded in the LSA, which accounts for ~70% of the expected species in the CHAA. The reptilian diversity at individual sampling sites was poor, which may be as a result of the sampling effort. Five species were found at the monitoring CPF site, four species at the Kasoga/Buhumurro-Nsanga site on the feeder pipeline route, and three species at the Masika River site and wetland site associated with the Kamansinig River. The remaining sites recorded two, one or no reptiles.

The most common species was the Speckle-Lipped Skink (*Trachylepis maculilabris*), recorded at 56% of the sites, followed by the Ground Agama (*Agama agama*) at 44% of the sites, and the Tree Agama (*Acanthocercus atricolis*) and the Striped Skink (*Trachylepis striata*) at 33% of the sites.

Species of Concern

The majority of species recorded were of Least Concern or Not Evaluated by the IUCN, and tended to be common species in the area. Four species, the Nile crocodile (*Crocodylus niloticus*), Nile Monitor (*Varanus niloticus*), Smooth Chameleon (*Chamaeleo laevigatus*), and Graceful Chameleon (*C. gracilis*) are listed under CITES Appendix II (UNEP 2014). The Nile Soft-shelled Turtle (*Trionyx triunguis*) has also been recorded from the LSA. Although not yet evaluated by the IUCN, this species is known to be under pressure from human exploitation of Lake Albert, where adults and eggs are hunted for food and medicinal purposes; and the carapace fetches a high price in the markets of Kampala.

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[6] *This species is noted to not be new to science; however, its diagnosis is difficult to separate from other species. Therefore, a specimen was sent to the museum for determination, the results of which were not available at the time of writing this report (M. Behangana, pers. comm.)*

Habitats

Based on species richness and diversity, important habitats for reptiles in the LSA are the seasonally flooded and permanent wetlands on the Buhuka Flats and along the pipeline route, and the wooded grasslands. The wetlands associated with Lake Albert's shoreline, particularly the lagoon and the lower reaches of the Masika River, are important breeding and nursery areas for the Nile Soft-shelled Turtle and the Nile crocodile. The ravines associated with the watercourses draining from the escarpment are important habitats for various reptiles. Overall, the heterogeneity of habitats in the LSA maintains reptile diversity.

6.2.5.6 Birds

Species Richness, Diversity and Abundance

Two-hundred-and-eighty-three species were recorded in the LSA, most of which are typical of the area. No forest specialists were recorded, and only a few forest generalists, reflecting the loss of most of the original forest cover on the escarpment and plateau. The seasonally flooded and permanent wetlands of the Buhuka Flats supported a wide variety of water birds, while grassland species were well-represented in the open areas.

The richness of species found on the Buhuka Flats was higher than the pipeline study area, although diversity along the pipeline route was still quite high, with 29 species recorded that were unique to the area. The diversity of aerial feeder species, like martins, swifts and their kin, was low, although the number of individuals was high.

Fifty-five species of waders and water birds were recorded, primarily along the shores of Lake Albert and in the Buhuka Flats wetlands. The most notable of these is the first Ugandan record of the Terek Sandpiper (*Xenus cinereus*) from Lake Albert and the second record of the Lesser Sandplover (*Charadrius mongolus*).

As expected, the species richness and abundance of individuals increased during the September/October peak migratory period. Some Palearctic migratory stragglers were still present in February-March but numbers and individual counts had significantly dropped by the May-June survey indicating that most had migrated away from the lake by this time. Although very large numbers of migratory species were not recorded, Lake Albert as a whole could support significant numbers. A 1 km count along the shores of the lake, south of the jetty, produced over 400 birds of 27 species. With a lake perimeter of roughly is ~180 km long, it is conceivable that as many as 100,000 birds could be supported.

Sixteen raptor species were recorded. While the Albertine Rift is a known migratory route for raptors, all the recorded species were residents.

Species of Concern

Most of the species recorded in the LSA are common and are of Least Concern on the IUCN Red List. Two Endangered species were recorded: the Grey Crowned Crane (*Balearica regulorum*) and the White-backed Vulture (*Gyps africanus*).

The Grey Crowned Crane was found only on the Buhuka Flats, where up to 14 individuals were regularly seen. There were indications of breeding pairs forming at the end of May. Twenty White-backed Vultures were seen overflying the LSA in February.

Twelve regionally listed species were recorded in the LSA field surveys. These included the vulnerable Martial Eagle (*Polemaetus bellicosus*), African Skimmer (*Rynchops flavirostris*), Grosbeak Weaver (*Amblyospiza albifrons*), Saddle-billed Stork (*Ephippiorhynchus senegalensis*), Great White Egret (*Ardea alba*); and the near threatened Purple Heron (*Ardea purpurea*), Grey Heron (*Ardea cinerea*), Goliath Heron (*Ardea goliath*), Brown Snake-eagle (*Brown Snake-eagle*), African Marsh Harrier (*Circus ranivorus*), Black-bellied Firefinch (*Lagonosticta rara*), and Vieillot's Black Weaver (*Ploceus nigerrimus*). Individuals of most of these species were encountered throughout the LSA.

Other species of interest included the east African endemics: Spotted-flanked Barbet (*Tricholaema lacrymosa*), White-headed Saw-wing (*Psalidoprocne albiceps*), Black-lored Babbler (*Turdoides sharpie*), Red-chested Sunbird (*Cinnyris erythrocercus*), Baglafecht's Weaver (*Ploceus baglafechtii*), Red-headed Quelea (*Quelea erythrops*), and Grey-headed Oliveback (*Nesocharis capistrata*).

Palearctic migratory species were more abundant during the dry season and the second wet season (corresponding to the peak migratory period of September/October), when 39 species were recorded. Overall, numbers of both Palearctic and Afrotropical species were quite high; although most of the recorded waterbirds are Ugandan residents, moving only locally in response to rainfall.

Habitats

The habitats of the LSA are a guide to the occurrence of species. For example, woody vegetation associated with wooded grassland and woodland communities was important for tree-dependent species; while the more open areas are important for species such as Temminck's Courser (*Cursorius temminckii*), Grey Crowned Crane (*Balearica regulorum*) and a variety of plovers and lapwings. The seasonally flooded and permanent swamp habitats support a wide variety of bird species.

Ranked on the basis of species richness and diversity, the most important habitats for birds within the LSA include:

- the ecotonal habitat at the foot of the escarpment and the escarpment face
- the permanent wetlands associated with the Masika And Kamansinig Rivers
- the shore of Lake Albert.

While the proposed feeder pipeline route passes through predominantly cultivated / natural habitat mosaics, which are largely disturbed and modified, these habitats are nevertheless species rich.

6.2.5.7 Mammals

Species Richness, Diversity and Abundance

Generally, the LSA supports a depauperate community of medium to large-sized mammals due to human disturbance and associated pressures (*viz.*, AWE 2008a, b, 2013a, 2014a, EAC 2013, 2014). The mammal fauna assemblage is dominated by small to medium-sized species such as rodents, shrews, bats, mongoose, rabbits, duiker, bushbuck and primates. The populations of all the species recorded within the LSA are unknown.

Eleven rodent and two shrew species were recorded on the Buhuka Flats and escarpment area. Only two species of rodent were recorded along the feeder pipeline route. These low figures for species richness and diversity may be related to sampling effort. The Pygmy Mouse (*Mus minutoides*) was the most abundant and common, followed by the Multimammate Mouse (*Mastomys natalensis*).

Two species of fruit bat were recorded from the Buhuka Flats - the Ethiopian Epauletted Fruit Bat (*Epomophorus labiatus*) and Peter's Dwarf Epauletted Fruit Bat (*Micropteropus pusillus*). Sixteen species of insectivorous bats were recorded from the Buhuka Flats, with a further two unconfirmed species. These represent most of the species expected in the CHAA. The most common and abundant species were the Yellow House Bat (*Scotophilus dingani*), the Dark-winged Lesser House Bat (*Scotoecus hirundo*) and the Banana Pipistrelle Bat (*Neoromicia nanus*).

Thirteen medium-sized mammals were recorded in the LSA. These species tended to be habitat generalists, and included four primates: Vervet Monkey (*Cercopithecus aethiops*), Red-tailed Monkey (*C. ascanius*), Colobus Monkey (*Colobus guereza*) and Olive Baboon (*Papio anubis*); three viverrids: African Civet (*Civetta civetictis*), African Palm Civet (*Nandinia binotata*) and Small-spotted Genet (*Geneta tigrina*); a herpestid: the Marsh Mongoose (*Atilax paludinosus*); three rodents: Lesser Cane-rat (*Thryonomys gregorianus*), Bunyoro Rabbit (*Poelagus marjorita*) and Stripped Ground Squirrel (*Xerus erythropus*); and two bovids: Bush Duiker (*Sylivicapra grimmia*), and Bushbuck (*Tragelaphus scriptus*). These species appear to be sparsely distributed throughout the LSA. The relatively high diversity of carnivores and omnivores is noteworthy.

A small population of Hippopotamus occurs on the Buhuka Flats. No accurate count of the number of individuals was possible, but it is doubtful that more than five animals exist.

Species of Concern

Most recorded species were cosmopolitan, generalists, assessed in the IUCN Red List as of Least Concern status with stable populations. The notable exception is the small population of Hippopotamus on the Buhuka Flats. This species is listed as Vulnerable by the IUCN, with a decreasing population (Lewinson and Oliver 2008). Within Uganda, the Hippopotamus has a restricted distribution, although it is locally abundant and is fully protected under the law (Lewinson and Oliver 2008).

Of the bats recorded in the LSA, five species are potentially cave or cavity roosting species. These include the Little Free-tailed Bat (*Chaerephon pumila*), Angolan Free-tailed Bat (*Mops condylura*), a Bent-wing Bat (*Miniopterus* sp.), the Dark-winged Lesser House Bat and Yellow House Bat. No caves or other roosting sites were found in the LSA that could serve these species, although there is a possibility that there could be sites along the escarpment. Of most interest is the Bent-Wing Bat, which is listed in CITES Appendix II (UNEP 2014), and is known to roost in caves housing hundreds or even thousands of individuals (Monadjem et al. 2010).

Habitats

The Bugoma Lagoon area and swamps along the lower reaches of the Masika River are important daytime refuges for the small pod of Hippopotamus that occur in the area, along with many other small and medium-sized mammals. Similarly, the seasonally flooded wetlands of the upper reaches of the Masika River and its tributaries, along the Kamansinig River, and those along the pipeline route, are important habitats for the small mammal assemblages.

The escarpment is an important habitat for all the mammal species recorded in the LSA. It not only forms a continuous corridor along the length of Lake Albert, but it also provides and important refuge for many of the small mammal species; notably the cavity and cave roosting bat species. The escarpment is dissected by numerous watercourses draining the platea and these form incised ravines in the escarpment that potentially provide bat roosting sites.

The thicket communities on the Buhuka Flats, and remnant vegetation patches along the pipeline route also form important refuges and resource areas for small mammals.

6.2.6 Aquatic Biodiversity

This section focuses on describing the baseline aquatic biodiversity of the LSA and CHAA. It summarises the findings reported in the aquatic ecology baseline report, as presented in Appendix D.

6.2.6.1 Phytoplankton

Species Richness, Diversity and Abundance

In the wet season survey, thirty-five genera were identified in the LSA phytoplankton communities of Lake Albert, compared to 26 genera in the dry season. Thirty-one genera, belonging to five families, were identified in the phytoplankton communities of the rivers and wetlands of the LSA.

In general, there was an increase in the species composition from the dry season to the wet season, probably attributable to increased grazing pressure from the larger zooplankton population in the wet season.

In both Lake Albert and the LSA rivers and wetlands, the blue-green algae, *Microcystis aeruginosa*, was absent from the sampled sites. This species prefers polluted environments, and its absence is indicative of relatively pristine environments (Okello et al. 2010).

Species of Concern

Of the taxa of phytoplankton identified during the dry and wet season, only the genus *Aulacoseira* is a group of special interest. This genus has almost disappeared from Lake Victoria, apparently leading to the near total decline of some native fish species that are dependent on it (Ogutu-Ohwayo et al. 2002). Its existence in Lake Albert suggests that the lake is still relatively undisturbed and unpolluted.

Habitats

The near-shore environment of Lake Albert and the watercourses and wetlands of the Buhuka Flats support a diverse assemblage of phytoplankton. These areas are naturally higher in nutrients, supporting greater phytoplankton biomass which, in turn, drives the food web along the south-eastern shores of the lake.

6.2.6.2 Zooplankton

Species Richness, Diversity and Abundance

The zooplankton communities within Lake Albert and the Bugoma Lagoon wetland on the Buhuka Flats are dominated by three taxa: Copepod crustaceans (Order: Copepoda) (comprising three species); water fleas (Order: Cladocera) (comprising seven species), and rotifers, or wheel animals (Phylum: Rotifera) (comprising nine species). Compared with other lakes in the Victoria basin (see Vincent et al. 2012, Mwebaza-Ndawula et al. 2003), the diversity of zooplankton in this part of Lake Albert is generally low. Nevertheless, the key species that characterize zooplankton assemblages of Ugandan lakes, which are important food species for fish (Mwebaza-Ndawula et al. 2004), occurred in relatively high abundance.

Species of Concern

No species of concern were identified in the zooplankton communities in the LSA.

Habitats

The zooplankton communities of near-shore and off-shore environments of Lake Albert reflect a healthy water habitat dominated by Cyclopoid Copepods. These taxa are key species that sustain fish communities in most water bodies (Mwebaza-Ndawula et al. 2001, Mwebaza-Ndawula et al. 2003, Mwebaza-Ndawula et al. 2004). A similar healthy environment was reported in Lake Albert over a decade ago by Lehman et al. (1998).

Bugoma Lagoon is an exception, where high numbers of rotifers (notably species of *Brachionus)* were observed. Typically, a high abundance of rotifers reflects elevated levels of pollution or eutrophication of water bodies (Radwan and Popiolek 1989, Tasevska et al. 2010). This could be due to the lack of connectivity between the lagoon and the lake, causing stagnation of water, coupled with an increase in nutrient loads from the inflowing Kamansinig River, which drains cultivated areas above the escarpment, as well as the presence of Hippopotamus adding to the nutrient loading.

6.2.6.3 Macro-invertebrates

Species Richness, Diversity and Abundance

Species richness of mayflies (Order: Ephemeroptera), stoneflies (Order: Plecoptera) and caddis flies (Order: Trichoptera) in Lake Albert was low. Mayflies were the most abundant of the insects, being similar in wet and dry seasons. Snails (Phylum: Gastropoda), freshwater mussels (bivalves in the Order: Unionoidea) and aquatic worms (Phylum: Annelida, Class: Oligochaeta) were the most common and abundant macro-invertebrates recovered from bottom sediments of the lake in the dry and wet seasons.

The most common macro-invertebrates in the rivers and wetlands were mayflies (*Baetis* spp., Order: Ephemeroptera) and caddis flies (*Cheumatopsyche* spp., Order: Trichoptera). The densities and species composition of the groups varied, sometimes significantly, between the dry and wet seasons, with higher densities observed for all groups during the wet season.

Since the watercourses draining the escarpment are seasonal, low counts of macro-invertebrates would be expected in these habitats during the dry season. Similarly, the Bugoma Lagoon appears to be isolated from the lake during the dry season, which would cause inadequate mixing and decomposition of plant material and account for the low dissolved oxygen in the bottom sediments.

Species of Concern

All the species recorded in the LSA were Least Concern, or not yet evaluated by the IUCN. The Critically Endangered freshwater Mud Snail (*Gabbiella candida*) has only been recorded from Butiaba, about 90 km north of the LSA (Kyambadde 2010a, GBIF 2014). While this species was not detected in targeted searches in the LSA, it could be present in suitable habitat. Similarly, the Near Threatened freshwater Snail (*Bellamya* *rubicunda*), endemic to Lake Albert (Kyambadde 2010b), may occur in the LSA although it was not found during the field surveys.

No other known macro-invertebrate species of concern were identified, or have a potential to occur, in the LSA.

Habitats

The near-shore and inshore habitats of Lake Albert in the vicinity of the Buhuka Flats provide a diverse array of substrates (for example, clay/snail shells, sand/plant materials, soft mud, and rock/shells) that support benthic macro-invertebrates. Similarly, the wetlands associated with the Masika River, Kamansinig River, Well Pad 2 stream, and the watercourses along the pipeline route, all provide important habitat for macro-invertebrates. The Bugoma Lagoon provides a unique habitat for macro-invertebrates.

6.2.6.4 Fish

Species Richness, Diversity and Abundance

The fish community in the LSA near-shore zone of Lake Albert is a fairly uniform, multispecies, mix of various ages in good condition. This is a reflection of adequate food and a healthy environment.

Twenty-four fish species comprising 16 genera and eight families were recorded in the fish catches from the LSA sampling in Lake Albert. This represents ~45% of the 53 fish species reported in Lake Albert (Greenwood 1966). Of the commercially-important species caught in the wet season, Nile Perch (*Lates niloticus*) were the most abundant[7] at 42% of the catch), followed by *Ragoge* (*Brycinus nurse*) (17%), *Ngassa* (*Hydrocynus forskahlii*) (12%) and *Angara* (*A. baremoze*) (3%). In the dry season, Shield-head Catfish (*Synodontis schall*) (9%) and Black Nile Catfish (*Bagrus bajad*) (8%) increased in importance. Five species, *Imberi* (*Alestes macrolepidotus*), *Muziri* (*Neobola bredoi*), *Mpoi* (*Barilius* (*Distichodus*) *niloticus*, *Citharinus citharus*, *C. latus*), *Kisinja* (*Barbus* (*Labeobarbus*) *bynni*), and the Lake Albert Cichlid (*Thoracochromis* (*Haplochromis*) *avium*, were recorded only in the wet season.

Two catfish species, the *Wahrindi* (*Synodontis schall*) and the Sudan Squeaker (*S. frontosus*), as well as the African Carp (*Labeo horrie*), were recorded for the first time during the second wet season surveys. These seasonal differences in the community composition may be due to migratory responses to run-off into the lake.

Species composition within the Bugoma Lagoon was noticeably different to Lake Albert. Five species dominated the biomass of each catch; these included: Nile Tilapia (*Oreochromis niloticus*) (36%); Singidia Tilapia (*O. leucostictus*) (18%); *Imberi* (18%); Senegal Bichir (*Polypterus senegalis*) (16%); and *Angara* (8%).

Species of Concern

One locally threatened species, the African Electric Catfish (*Malapterurus electricus*) may occur in the LSA. This species was not recorded, but is known from catches elsewhere in Lake Albert (GBIF 2014). Eight commercially important species occur within the LSA. These include the *Imberi*, *Angara*, Catfish (*Clarias lazera*), *Mpoi*, *Ngassa* (*Hydrocynus vittatus*), Nile Tilapia, Mango Tilapia, and Zill's Tilapia (*T. zillii*). The three species of *Mpoi*, the *Angara*, *Ngassa*, Butter Catfish, and Shield-head Catfish have become very rare in Lake Albert (Wandera and Balirwa 2010).

Lake Albert also supports at least ten endemic, range restricted, fish species, notably the commercially important *Angara*, *Ngassa* and *Imberi* (Wandera 2000, Campbell et al. 2005, Wandera and Balirwa 2010), all of which have been recorded in the LSA.

Populations of *Ragoge* and *Muziri* have increased in the lake (Wandera and Balirwa 2010; Taabu-Manyahu et al. 2012), currently making up 51% and 34% of commercial fish catches. They feed exclusively on zooplankton, and their increasing populations could have implications for the zooplankton community structure.

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[7] *Catch percentage by weight is used as a surrogate for abundance, although the limitations of this measure are recognised.*

Habitats

Lake Albert's near-shore habitats, the wetlands of the lower Masika River and Kamansinig River, and the large bays of the Buhuka Flats are important zooplankton habitats. Copepods are dominant among the zooplankton and are key species in sustaining the high biomass, high catch rates, and strong multispecies fishery in the near-shore waters of the lake (Mwebaza-Ndawula et al. 2001).

6.2.7 Overall Biodiversity Value - Ecosystems and Habitats

Uganda lies at the confluence of a number of regional centres of endemism (White 1983): the Guinea-Congo Forest; Lake Victoria Basin; Afro-Tropical Highlands; Somali-Masai; and Sudan and Guinea Savannah. This has resulted in unique biodiversity. Within Uganda, the Lake Albert Basin is an area of high endemism and many threatened species (Critical, Endangered and Vulnerable); and over 50% of birds, 39% of mammals, 19% of amphibians and 14% of reptiles and plants of mainland Africa occur in the region (Plumptre et al. 2003). The Lake Albert Basin (within which the CHAA is located), is recognised as being:

- part of the Eastern Afromontane Biodiversity Hotspot (CI 2014)
- an Endemic Bird Area (Stattersfield et al. 1998)
- a Key Biodiversity Area (IUCN 2010)
- part of three globally important ecoregions, notably, the Albertine Rift Montane Forests, the East Sudanian Savanna, and the Rift Valley Lakes Freshwater Ecoregion (Olson and Dinerstein 1998).

For these reasons, the basin is recognised as an area of global conservation importance. The valued components of this system, with reference to the CHAA, are described in the sections below.

6.2.7.1 Ecosystem Integrity

In the 1900s, the Buhuka Flats were part of the Buhuka Community Wildlife Area (CWA), but this was not maintained, and the large animal populations declined (UWA, pers. comm.). Apart from a few Hippopotamus, all of the large mammals have disappeared from the area. The CWA was degazetted in 2002 (RPS 2006). Nevertheless, the natural vegetation on the Buhuka Flats and along the escarpment would still be considered 'natural habitat' under the IFC's definition. These vegetation communities and habitats support populations of smaller mammals, birds, reptiles, amphibians, and invertebrates, including species of concern. Similarly, the near-shore environment of Lake Albert, and the wetlands associated with the rivers draining off the escarpment, support important populations of fish (including commercially valuable species), freshwater turtles and crocodiles.

Today, the LSA is heavily influenced by subsistence populations, who have impacted on species richness and diversity of plants and animals (for example, see NEMA 2010, Wandera and Balirwa 2010). The Buhuka Flats accommodates a resident population of around 22,000 people, supported mainly by the Lake Albert fishery, but who also use the flats and the adjacent escarpment area for livestock grazing, subsistence farming, firewood collection, charcoal manufacture, and harvesting of non-timber forest products. Similarly, subsistence agriculture along the feeder pipeline route has severely impacted on ecosystems, resulting in the transformation of much of the natural habitat (for a review, see AECOM 2012).

Notwithstanding these anthropogenic pressures, the LSA and the wider CHAA ecosystems and habitats remain important. For this baseline assessment, they have been grouped into the following broad categories: the near-shore environment of Lake Albert; the vegetation communities and corridors along the rift valley escarpment; wetlands of the Buhuka Flats and pipeline route; the Buhuka Flats and pipeline route and the ecosystem services they offer; and the Bugoma Central Forest Reserve.

6.2.7.1.1 Near-Shore Habitat of Lake Albert

Lake Albert's near-shore environment is defined (for this study) as the area within 500 m of the shore of the lake. Diverse habitats, water depths and temperature regimes support the flora and fauna communities in the near-shore. NEMA (2010) recognises these habitats as sensitive ecological areas.

Lake Albert supports the most diverse commercial fishery in Uganda, with at least 55 species being present (Wandera and Balirwa 2010). In terms of production, Lake Albert is second only to Lake Victoria (Taabu-Munyaho et al. 2012).

Composition and Structure

The south-central part of the lake is characterised by a steep-sided escarpment and deep water close to the shore (Taabu-Munyaho et al. 2012). In the LSA (which includes the Buhuka Flats and adjacent near-shore lake areas), the ecosystem of the lake includes all of the six main habitat types identified by Wandera and Balirwa (2010), namely shallow river-associated waters, open sandy shores, lagoons, large bays, rocky escarpments, and open-water. Of these, Wandera and Balirwa (2010) identified river mouths, lagoons, near-shore waters of large bays and rocky areas as priority habitats for fish breeding. River mouths contribute the highest number of species, while lagoons support the highest number of individuals and biomass. Wandera and Balirwa (2010) specifically recognise the Bugoma Lagoon of the Buhuka Flats as one of the important habitats in the lake, a finding which is further supported by the fish surveys for the present study. Approximately 36% of the species known to inhabit Lake Albert were recorded from the LSA, in a wide range of age and size classes, all in good condition. This suggests that the diversity of habitats in the LSA is important for the life cycle of many commercial and other fish species.

Linkages and Corridors

The movement of fish and other animals within Lake Albert is poorly understood (see Campbell et al. 2005, Wandera and Balirwa 2010). Nevertheless, it is known that certain species, notably *Angara*, *Ngassa*, African Butter Catfish (*Schilbe niloticus*) and African Catfish (*Clarias lazera*) move to shallow waters in bays and up river systems to breed (Akinyi et al. 2010a, Azeroual et al. 2010c, e, Lalèyè et al. 2010). These breeding patterns tend to be seasonally based (Kusnierz et al. 2014). How far the fish travel to reach their preferred breeding areas is not known, but since there are only a few major river systems entering the lake that are suitable for breeding, it is conceivable that large distances may be involved.

The LSA and CHAA support important breeding habitat for fish, including river mouths, lagoons, near-shore waters of large bays and rocky areas (after Wandera and Balirwa 2010)). This suggests that the near-shore habitats within the vicinity of the Buhuka Flats are an important end point, or starting point, for fish breeding.

Key Processes and Drivers of Change

Polluted drainage and eutrophication: Drainage into Lake Albert is increasingly affected by agricultural runoff. With greater nutrient loads and other contaminants entering the lake, the risk of eutrophication will grow (Wandera, 2000; Wandera & Balirwa, 2010). In the CHAA, the presence of approximately 22,000 people on the Buhuka Flats and other nearby villages, without access to running water and sanitation, increases the nutrient loading of inflowing water into the lake. Despite this, the water quality, phytoplankton and zooplankton surveys for the project showed that the LSA near-shore aquatic environment remains generally healthy. Bugoma Lagoon is an exception, where there are high nutrient loads due to increased agriculture above the escarpment, stagnant water isolated from influence of the lake, and a resident Hippopotamus population.

Overfishing: Intense pressure from commercial and artisanal fishing has decreased the populations of many commercially important species in the lake. Available data suggest that overfishing of the Nile Perch and its prey species may be changing the nature of the entire food web within the lake, and ultimately the ecosystem integrity (Wandera 2000, Wandera and Balirwa 2010, Taabu-Munyahu et al. 2012). The eleven fishing villages in the CHAA and vicinity have undoubtedly contributed to the pressure on local fish populations. Anecdotal accounts provided by local fisherman reinforce the published findings of the decrease in commercial fish stocks.

These trends are expected to worsen. There has been a substantial increase in the local population over the past 10 years, driven by many factors including regional political instability and in-migration, attractive livelihood opportunities to engage in fishing on Lake Albert, and more recently, interest in capitalising on opportunities related to oil and gas developments. At a local level, the construction of the road down the escarpment has provided good access to the Buhuka Flats, and there is already evidence of an increase in trade in fish produce as a result of this.

Climate change: Current climate change models predict that Uganda is likely to experience more extreme periods of intense rainfall, an erratic onset and ending of the rainy seasons and more frequent episodes of drought (GCCA 2012). An overall increase of approximately 180 mm per annum is predicted, which will result in a mean annual rainfall for the CHAA of 880 mm to 1580 mm for the period 2020 to 2039. Current records of the lake's water level show that it varies by approximately 4 m each year, influenced by rainfall. To what extent increased rainfall will influence the lake water level is unknown.

Representativeness

Most of the aquatic habitats within the CHAA are represented widely around the lake. The CHAA supports 3% (0.4 km) of the shallow river-associated waters, 13% (8.5 km) of the open sandy shore habitat, 2% (1.2 km) of the lagoons, 14% (1.8 km) of large bays, and 7% (1.6 km) of rocky escarpment. The lagoon is of particular significance, since it is one of only six such environments in the lake (Wandera and Balirwa, 2010).

Resilience and Stability

Lake Albert is approximately ~5,500 km^2. Given its size and the buffering effect of the large water body, it is expected to be reasonably stable and resilient.

Overall Condition

Based on the findings of the baseline studies, the condition of the near-shore habitats of Lake Albert in the CHAA are near pristine. Despite the pressures created by the local population, these habitats are still in a natural state and support healthy populations of phytoplankton, zooplankton, macro-invertebrates and fish. Around the fishing villages some areas are degraded due to polluted run-off and gross pollution but while this may be a health issue it has not materially affected water quality or ecosystem integrity in the lake.

6.2.7.1.2 Escarpment Vegetation Corridors

The escarpment supports natural vegetation bounded in the east by intensive subsistence cultivation, and the Buhuka Flats and Lake Albert in the west. The vegetation communities form part of a continuous belt to the south and north.

Composition and Structure

The vegetation communities along the escarpment of the CHAA are a mix of the communities of the area. Four dominate making up 66% of the total, namely open wooded grassland (28%), dense wooded grassland (23%), dense bushland (14%), and riverine bushland (10%). Together with the remaining 34% they make up a diverse mosaic of habitats, forming a continuous strip of vegetation approximately 2410 ha in area.

The vegetation communities appear to be driven by landscape and geology. For example, open wooded grassland and dense wooded grassland tend to be restricted to the crest of the escarpment; dense bushland to the steep slopes; and riverine communities in the valleys and along the watercourses.

Linkages and Corridors

The escarpment vegetation communities help to maintain the continuity of the many priority conservation areas within the Lake Albert Basin. In doing so, these corridors play an important role in maintaining evolutionary processes unique to the basin (Ayebare et al. 2013).

Within the CHAA the escarpment is an important habitat for many of the species recorded in the LSA. It forms a continuous corridor along the length of Lake Albert, and provides refuges for many of the small mammal species, notably the cavity and cave roosting bats.

Key Processes and Drivers of Change

Within the CHAA the increase in subsistence farming is the main cause of change in the vegetation along the escarpment. Local communities hunt, graze livestock, harvest fuel wood and manufacture charcoal. Due to shallow soils, rocky terrain and steep slopes, the escarpment has been largely protected from cultivation, which is predominant on the plateau further to the east.

Livestock is an important component of subsistence farming both on the Buhuka Flats and the plateau east of the escarpment. Stock numbers are large and there is evidence of overgrazing on the escarpment. The increasing populations have generated a growing demand for charcoal and fuel wood; large trees on the escarpment are targeted for charcoal manufacture, which is typically on-sold, while smaller woody species provide fuel wood used in the local villages.

Thatching grass and other house construction materials are harvested on the escarpment (Photograph 6-19). An increased frequency of fires is evident, started either deliberately or by mistake, which will affect the functioning and processes of savanna ecosystem over time (Smith et al. 2013).

The condition of the vegetation communities on the escarpment suggests that all these pressures are contributing to changes in their composition and structure. In particular, bushland is encroaching into the grassland and woodland communities. This is a typical consequence of intense livestock grazing and the removal of large, ecosystem-engineer species like the African Elephant (Wigley et al. 2009). Nevertheless, subsistence communities often prefer these changes because they result in increased woody resources for building and firewood and increased browse availability for goats (Wigley et al. 2009). Consequently, the plant communities are likely to be completely transformed over time.

Photograph 6-19: "Chutes" used for the transport of thatching grass harvested from the escarpment

Representativeness

The vegetation communities of the escarpment form part of a continuous vegetation corridor, extending for approximately 70 km, from the Toro-Semliki Wildlife Reserve in the south to the Kabwoya Wildlife Reserve in the north. The corridor is part of the wider Murchison Falls National Park-Budongo-Bugoma-Kagombe-Itwara Forest Reserves-Semliki/Toro Wildlife Reserve corridor (Plumptre et al. 2007). It is regionally important for savanna species (Ayebare et al. 2013).

Resilience and Stability

For the reasons described above, the structure and composition of the escarpment vegetation is likely to be completely transformed to dense bushland and shrubland in the long term. This process is already evident. Increasing populations moving into the area will speed up the transformation.

Overall Condition

The overall condition of vegetation communities on the escarpment in the CHAA is slightly to moderately degraded due to the pressures of livestock grazing, natural resource harvesting and frequent fire

6.2.7.1.3 Wetlands

The CHAA supports permanent wetlands and seasonally flooded grasslands. These wetlands form important habitat for species of concern; in particular, the Grey Crowned Crane and migratory birds.

Composition and Structure

The seasonal wetland communities of the CHAA comprise largely short, fast growing, species such as *Cyperus articulatus* and sparse *Typha* sp, underlain by black cracking clays. The permanent wetlands are dominated by tall growing species, such as *Phragmites* sp. and *Typha* sp. which tend to remain year round as a dense, tall and emergent vegetation cover.

Linkages and Corridors

The wetlands of the CHAA are part of larger drainage systems. For example, the Masika River forms permanent wetlands along it lower reaches on the Buhuka Flats, while the Kamansinig River forms seasonally flooded grasslands in some of its lower reaches. These wetlands provide a mosaic of habitats for wetland species moving up and down the Lake Albert Basin. Migratory bird species, in particular, use such wetlands as stopping points during their annual migration from Europe and Asia, between October and March (Byaruhanga et al. 2001).

The larger permanent wetlands along the feeder pipeline route form part of a more extensive network of wetlands on the plateau, many of which connect to those in the Bugoma Central Forest Reserve.

Key Processes and Drivers of Change

The wetlands of the CHAA appear to be functioning and stable. The seasonal differences in the measure wetland parameters are expected. This is especially evident in the Bugoma Lagoon where the changes in the zooplankton and the dominance of rotifers, could be due to the lack of flow and connectivity with the lake during the dry season.

The exception within the LSA is the seasonally flooded grassland associated with the Kamansinig River. This has been impacted by the road leading from the foot of the escarpment and the borrow pit for the road, which have influenced the drainage patterns supporting this wetland. On the western side of the road the wetland is no longer fully functional (see Photograph 6-20). This is a good example of how interference with surface and sub-surface flows of a wetland can affect its functionality and processes.

Photograph 6-20: Indication of poor road design and insufficient culverts negatively affects hydrological flows and resultant deterioration in wetland function

The permanent wetlands of the CHAA are important sources of fibre for house construction and container manufacture. This is especially evident in those wetlands close to human settlements, such as those along the pipeline route and the lower Masika River. Given their use as fibre sources, the frequency of human-induced fire in these wetland communities appears to be reduced.

Representativeness

The CHAA conservatively supports around 323 ha of wetlands, 76% of which are permanent wetlands while the remainder are made up of seasonally flooded grasslands. The representativeness of these wetlands within the wider area is unknown; although within the CHAA, wetlands constitute about 0.4% of habitats. This figure may well under represent the true extent of wetlands in the CHAA, particularly in the Bugoma Central Forest Reserve, which were not confirmed through field investigations.

Resilience and Stability

Many factors contribute to the resilience and stability of wetlands, and those factors are dependent on the location and type of wetland (Carvalho et al. 2013). Typically, the overriding factor determining a wetland's resilience is the maintenance of the hydrological regime, and the amount of water entering and leaving the wetland. Other factors include nutrient loading, species diversity, trampling and grazing by livestock, and fire frequency (Carvalho et al. 2013).

The experience of the damage to the Kamansinig River wetland, described above, suggests that the seasonally flooded grasslands are not very resilient, being susceptible to changes in water flow patterns. These wetlands also appear to be favoured grazing for livestock, and grazing pressure and trampling may be adversely influencing the species composition of their habitats.

The permanent wetlands are associated with the larger watercourses in the CHAA. These wetlands are expected to be reasonably resilient provided that the flow volumes along their watercourses are maintained. Trampling by livestock does not appear to be a major factor, and the plant communities are known to be very resilient to pollution and increased nutrient levels, being used to remove pollutants from water in constructed wetlands (Vymazal 2011).

The macro-invertebrate communities within the permanent wetlands are susceptible to changes in water quality, and the composition of these communities change with the seasons. At present, the seasonal changes in these communities appears to be part of the natural cycle of these wetlands, rather than human influence.

Overall Condition

The overall condition of the wetlands in the CHAA is slightly to moderately degraded due to the impact of livestock and natural resource harvesting.

6.2.7.1.4 Bugoma Central Forest Reserve

The Bugoma Central Forest Reserve is one of a handful of forests making up a network of critical biodiversity sites in Uganda. Amongst other species, it supports populations of Eastern Chimpanzee (*Pan troglodytes schweinfurthii*), African Elephant (*Loxodonta africana*), Nahan's Francolin (*Ptilopachus nahani*), and a variety of endemic birds and butterflies (NEMA 2010). It is also the source of numerous rivers in the region, including the Nguse and Rutowa Rivers (NEMA 2010), and an Important Bird Area (BirdLife International 2014a). Of the 65 forested protected areas surveyed for biodiversity in Uganda, Bugoma Central Forest Reserve ranked 11 in overall biodiversity value, and 15 in terms of rarity value (BirdLife International 2014a).

A limited description is provided here, with only important features as they relate to the potential effects of the Project. More detail is presented in Volume 4, Specialist Study 8, and in the references quoted in the specialist study.

Composition and Structure

This forest is a medium altitude, moist, semi-deciduous forest with a high biodiversity. About half is dominated by Ironwood (*Crynometra alexandri*) and a further 38% is mixed forest (BirdLife International 2014a). Two-hundred-and-fifty-seven species of trees and shrubs have been recorded in the forest, seven of which are Albertine Rift endemics, 12 are globally threatened and 14 are listed in the IUCN red list (Plumptre et al. 2003, 2010, 2011).

Linkages and Corridors

The Bugoma Central Forest Reserve is an important part of the wider Murchison Falls National Park-Budongo-Bugoma-Kagombe-Itwara Forest Reserves-Semliki/Toro Wildlife Reserve corridor (Plumptre et al. 2007). However, it is disconnected from other forest reserves, such as Budongo Central Forest Reserve, and is bordered by subsistence agricultural communities and settlements that are exerting increasing pressure on it (NEMA 2010, Plumptre et al. 2010, 2011).

Key Processes and Drivers of Change

While the Bugoma Central Forest Reserve was proclaimed to protect timber resources, the harvesting is done on a sustainable basis (NEMA 2010); and it is not expected to threaten species within the forest. The key risks are caused by the increasing incidence of illegal logging, fire wood collection and charcoal manufacture, as well as bush meat harvesting (NEMA 2010, Plumptre et al. 2010). Between 2011 and 2012, immigration into the areas surrounding the forest resulted in increased deforestation, and encroachment by about 1,000 families and pit-sawyers resulted in an estimated 5,000 ha of the forest being lost (AECOM 2013).

Many of the tree species within the forest require elephants or large primates to disperse their seeds. With the declining populations of these species, particularly elephants, many tree species are declining (Plumptre et al. 2010).

Representativeness

This forest is one the last large tracts of remaining medium altitude, moist, semi-deciduous forest in western Uganda (Plumptre et al. 2010, 2011). The CHAA encompasses the entire Central Forest Reserve of approximately 401 km^2.

Resilience and Stability

The size of Bugoma Central Forest Reserve (approximately 401 km^2) would normally make it relatively stable and resilient to disturbance, but peripheral human populations are placing the forest, and the populations of species it supports, under intense pressure. The long-term effects of the increase in the human population around the forest, including the illegal settlements within the forest (see Mugerwa 2013), are unknown. Being isolated from other forests in the region, and without protective buffers around it, it is being eroded around the outer edges (see Figure 6-26).

Overall Condition

Based on the findings of the studies and research conducted by others, the overall condition of the Bugoma Central Forest Reserve is slightly degraded to moderately degraded due to pressures of illegal logging, natural resource harvesting, and the current human pressures surrounding the forest.

6.2.8 Overall Biodiversity Value - Priority Habitat

The identification and categorisation of priority habitats, that is, modified, natural and critical habitat within the CHAA, is presented in this section.

6.2.8.1 Natural and Modified Habitats

Figure 6-26 presents the results of an assessment of natural and modified habitats in the CCHA. Most of the Buhuka Flats and the escarpment remains natural habitat, despite villages and associated grazing pressures. The plateau above the escarpment is markedly different. Good soils have encouraged subsistence agriculture and, outside of the Bugoma Forest Reserve, habitats have been transformed into cropland and plantations, interspersed with settlements and patches of natural habitat (see Figure 6-26).

6.2.8.2 Critical Habitat

Specialist Study 8 provides details of the screening and assessment of all species of concern that could trigger Criteria 1, 2, 3 and 5 in support of critical habitat designation within the CHAA. Table 6-13 presents a summary of the possible triggers of critical habitat in the CHAA. The spatial representation of critical habitat is presented in Figure 6-27.

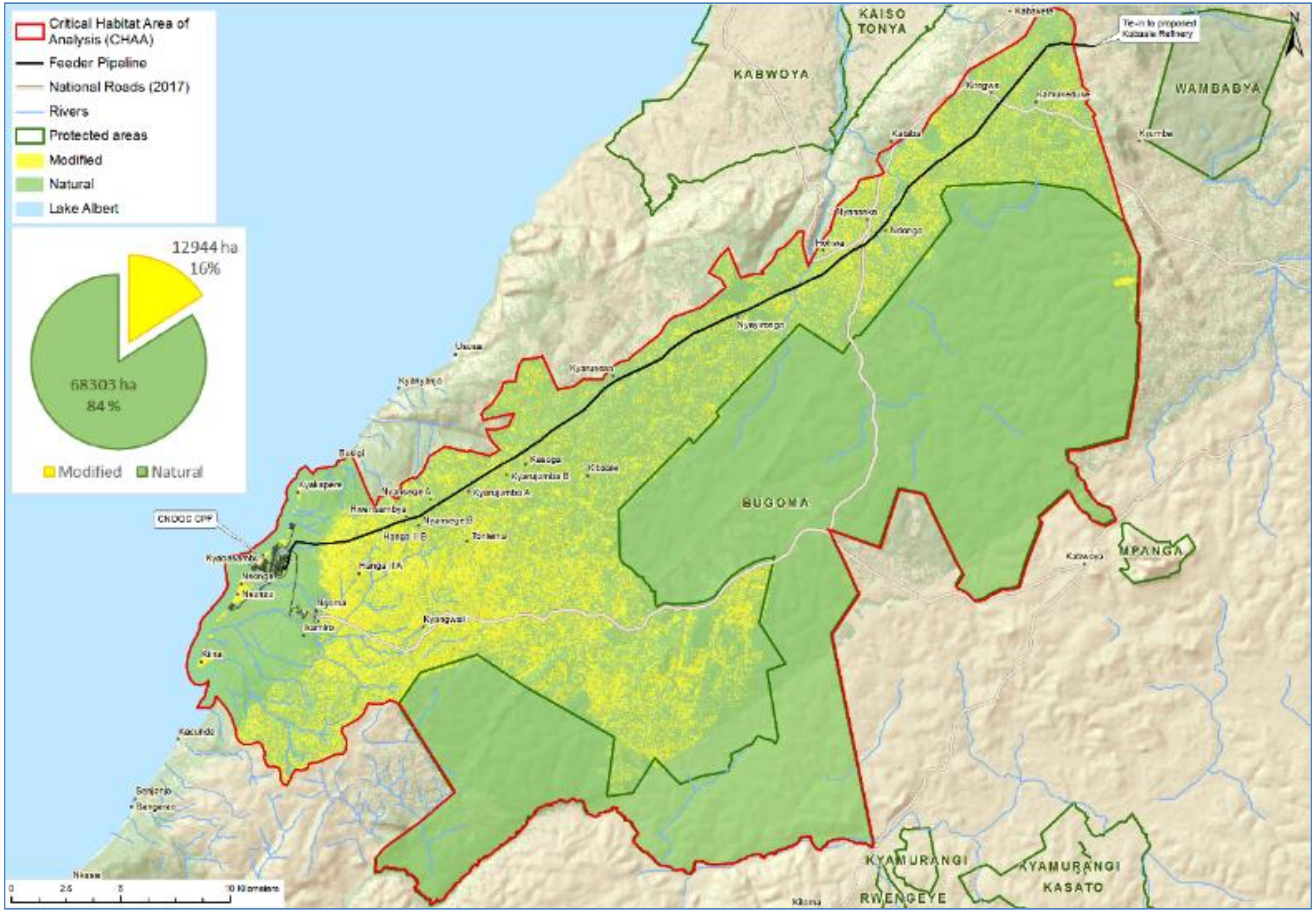

Figure 6-26: Natural versus Modified Habitat in the LSA and CHAA

Table 6-13: Triggers of critical habitat in the CHAA

Valued Component	Potential triggering criteria*	Critical Habitat Designation*	Habitat and reasoning**
Mud Snail (*Gabbiella candida*)	1 and 2	Criterion 1 Tier 2	■ Near-shore aquatic habitats (Bugoma Lagoon, large bays, open sandy shores, shallow river-associated water)
Nahan's Francolin (*Ptilopachus nahani*)	1, 2 and 5	Criterion 1 Tier 1	■ Bugoma Central Forest Reserve, possibly one of less than 10 DMUs globally (including DRC) ■ Potential for CHAA to support >10% of this species's known global population
Eastern Chimpanzee (*Pan troglodytes schweinfurthii)*	1	Criterion 1 Tier 1	■ Bugoma Central Forest Reserve ■ Great apes are an iconic species (see GN 74 and footnotes in PS6, IFC 2012a and b) ■ See Appendix G for precise reasoning
Bugoma Central Forest Reserve	4, 6, 7, 9, 11, 12, 13, 15, 16	Criterion 4	■ Threatened ecosystem – over 110 km^2 of forest has been cleared within 15 km of Bugoma CFR since mid-1980s (Plumptre 2002) ■ Therefore, conservatively assessed as Vulnerable (after Rodriguez et al. 2011) – suspected of undergoing a ≥30% decline in extent of occurrence over the last 50 years in the region (based on Plumptre 2002, Plumptre et al. 2003, 2007, 2010, 2011) ■ Of recognised importance as a climate change refugium for Endangered Nahan's Francolin and Eastern Chimpanzee (Ayebare et al. 2013), and a recognised chimpanzee conservation unit (Plumptre et al. 2010) ■ Recognised area of old growth forest (Plumptre et al. 2010, 2011) ■ Supports a population of Eastern Chimpanzee (McLennan 2008, Plumptre et al. 2003, 2010, 2011) that is recognised as being one for the four largest in the region (Plumptre et al. 2010); apart from being an Endangered species, chimpanzees are also recognised as keystone species and ecosystem engineers (Chapman et al. 2013) ■ Recognised for its unique biodiversity values, including biome restricted species (Plumptre et al. 2011) ■ Local people harvest timber, fibre, fuel wood and charcoal, and non-timber forest products from the forest (Plumptre 2002) ■ Recognised as an Important Bird Area (BirdLife International 1998, IUCN 2010, 2014b) ■ Recognised as a high conservation priority area (NEMA 2010)
Near-shore habitats of Lake Albert	13	Criterion 13	■ The near-shore habitats are important fishing grounds that support 11 fishing villages on the Buhuka Flats and surrounds

** IFC (2012b)*

*** More detailed reasons are provided in Volume 4, Specialist Study 8. In instances where more than one potential criterion could be triggered, only the highest level designation is presented*

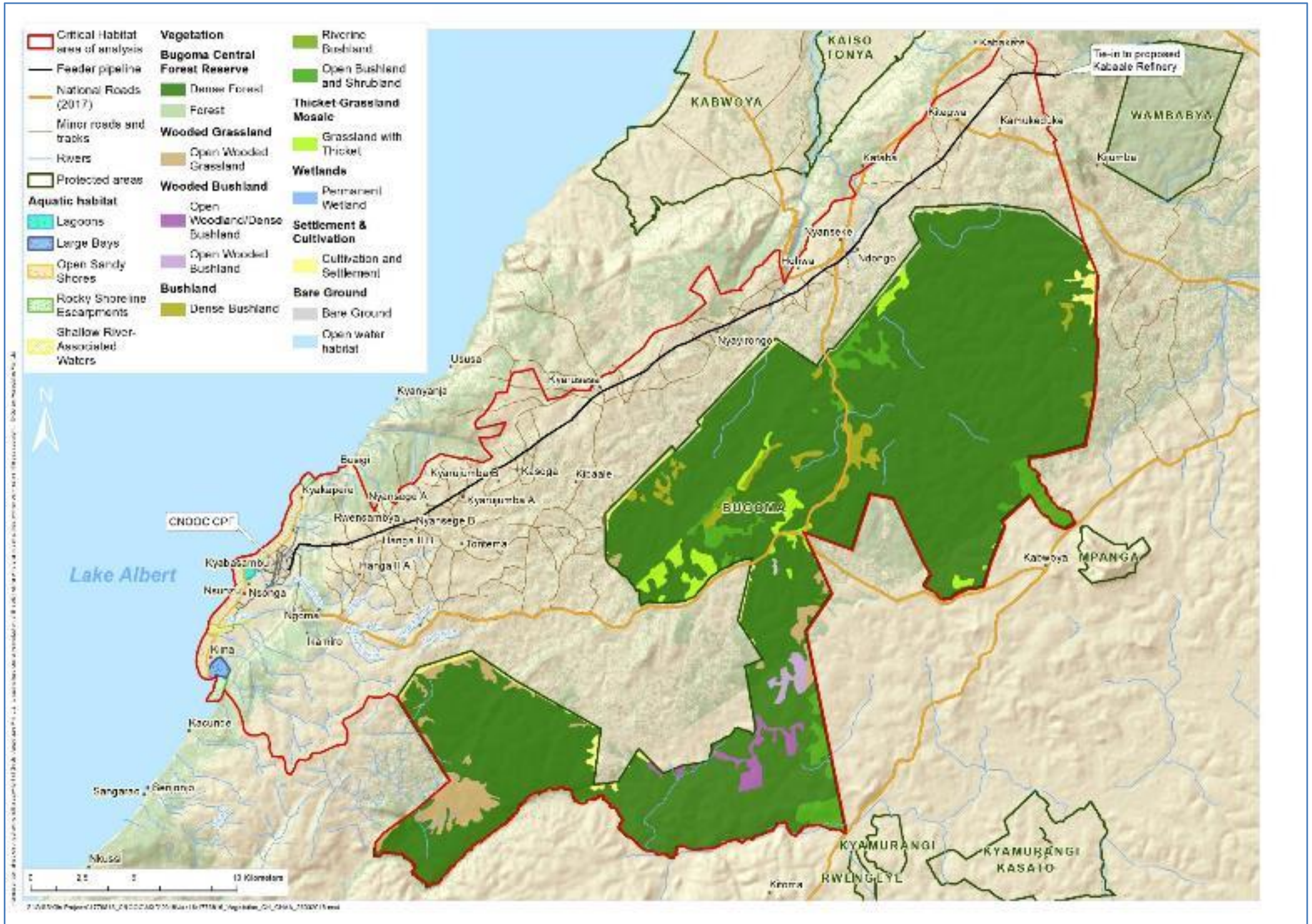

Figure 6-27: Critical habitats identified within the regional study area

6.2.9 Overall Biodiversity Value - Species of Concern

The detailed screening and appraisal of species of concern that could occur in the CHAA is included in Specialist Study 8. Based on a review of available reports and the field survey undertaken for the present study, the CHAA supports a possible 96 species of concern (excluding invasive species, which are discussed in Section 6.2.9.5). These include: six plant species, two macro-invertebrate species, 14 fish species, two butterfly species, one dragonfly and damselfly species, three amphibian species, nine reptile species, 44 bird species and 14 mammal species. Forty-six of these species were recorded during the field surveys.

6.2.9.1 Threatened, Range-restricted / Endemic and Statutory species

The CHAA potentially supports populations of seven globally recognised Critically Endangered and Endangered species, 10 Vulnerable species (six globally recognised birds, and four mammals) and 18 vulnerable species (one tree, one macro-invertebrate, twelve birds and four mammals). Table 6-14 lists the species. The CHAA also supports approximately 19 Palearctic migratory bird species that are listed under Appendix II of the Convention on Migratory Species (CMS 2014). Of the above species, those that could trigger critical habitat were considered in a more detailed and formal appraisal. Table 6-14 lists the species.

Table 6-14: Species of Conservation Concern

CITES Status	Plants	Birds	Mammals	Macro-Invertebrates
Critically Endangered				Mud Snail (P)
Endangered		Madagascar Pond-Heron (P), Grey Crowned-Crane (Pr), White-backed Vulture (Pr), Hooded Vulture (P), Nahan's Francolin (Pr)	Eastern Chimpanzee (Pr)	
Vulnerable		White-headed Vulture (P), Secretarybird (P), Grey Parrot (P), Martial Eagle (Pr), Blue Swallow (U), Brown-cheeked Hornbill (Pr), Shoebill (P)	Elephant (Pr), Hippopotamus (Pr), White-bellied Pangolin (P), Giant Ground Pangolin (P)	
Near Threatened	African Teak (Pr)	Pallid Harrier (P), White-naped Pigeon (U), European Roller (P), Red-footed Falcon (U), Semi-collared Flycatcher (P), Great Snipe (P), Black-winged Pratincole (P), Papyrus Gonolek (P), Black-tailed Godwit (Pr), Eursian Curlew (Pr), Lesser Flamingo (U), African Skimmer (Pr), Ring-necked Francolin (P), African Crowned Eagle (P), Bateleur (P)	African Straw-coloured Fruit Bat (P), Large-eared Free-tailed Bat (P), Leopard (P), African Golden Cat (P)	Snail (P), Damselfly (U)

Pr = probable (meaning the species has been recorded in the LSA or CHAA)

P = possible (meaning the species has not been recorded in the LSA or CHAA but suitably habitat exists for its occurrence)

U = unlikely (meaning that the chances of the species being present in the LSA or CHAA are small

Of the above, 23 species (one Critically Endangered, three Endangered, five Vulnerable, 14 Near Threatened), could occur in the LSA, and hence are potentially affected by direct Project impacts. A further nine species (two Endangered, five Vulnerable, two Near Threatened) could occur in the CHAA, and are potentially affected by indirect, induced and cumulative impacts of the Project.

Cites Appendix I and II *: CITES-listed species are grouped in the Appendices according to how threatened they are by international trade. Appendix I lists species that are the most endangered and are threatened with extinction. CITES prohibits international trade in specimens of these species, except when the purpose of the import is not commercial. Species listed in Appendix II are not necessarily threatened with extinction now, but are seriously threatened unless trade is controlled. International trade in individuals of Appendix II species may be authorized by appropriate authorities when specific conditions are met, above all, that trade will not be detrimental to the survival of the species in the wild (CITES Secretariat 2014).*

6.2.9.2 Species of Economic and/or Cultural Importance

Lake Albert supports a large commercial fishing industry, second in importance only to that of Lake Victoria. Within the CHAA, many of the species that form the mainstay of this fishery were recorded in the field survey, or are probably present. These include: *Imberi*, *Angara*, *Mpoi*, African Catfish, *Ngassa*, Nile Tilapia, African Butter Catfish, Mango Tilapia, and Zill's Tilapia.

The off-shore habitats in Lake Albert are important fishing grounds for the 11 villages in the CHAA and its vicinity. The near-shore habitats are likely to be breeding sites for many of the commercially important species supporting the fishing villages. Consequently, the near-shore environments of the CHAA also trigger critical habitat (Criterion 13). The near shore habitat extends over about 794 ha of the CHAA.

6.2.9.3 Species listed under CITES

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between signatory governments to ensure that international trade in species does not threaten their survival (CITES Secretariat 2014). Uganda has been a signatory since 1991.

The CHAA supports known populations of CITES-listed Appendix II plant and animal species. These include Aloes (*Aloe* spp.), the Candelabra Tree (*Euphorbia candelabrum*), Graceful Chamaeleon, Smooth Chamaeleon, Serrated Hinge-back Tortoise, Leopard Tortoise, Nile Monitor, Nile crocodile, Grey Parrot, and Hippopotamus. Other CITES-listed Appendix II species that may occur in the CHAA, but have not been recorded, include the Secretarybird, White-bellied Pangolin, African Golden Cat and Giant Ground Pangolin.

Within the CHAA, and the Bugoma Central Forest Reserve in particular, CITES-listed Appendix I species have a high likelihood of occurring, or have been recorded (see Plumptre et al. 2010, 2011). These species include the African Elephant, Eastern Chimpanzee and Leopard.

The populations of the CITES-listed species potentially and actually occurring in the CHAA are not precisely known. Indications are that the certain species are relatively common, for example Aloe and Candelabra Tree, while others, such as African Elephant may be very uncommon (see Plumptre et al. 2010).

6.2.9.4 Evolutionarily Distinct Species

This section identifies those species of concern that could trigger Critical Habitat according to Criteria 5 of the IFC's definitions (IFC 2012a). Critical habitat for key evolutionary processes does not have quantitative thresholds (for example, see IFC, 2012a) and expert opinion may be used to identify critical habitat designation.

The Albertine Rift is known as a centre of endemism driven by unique evolutionary processes. It is the most species rich region in Africa for vertebrates (Plumptre et al. 2003, 2007). It is also a recognised Endemic Bird Area (Stattersfield et al. 1998), testament to a collection of unique species derived from unique evolutionary processes. Lake Albert too is a recognised centre of endemism within the Albertine Rift, and is of biogeographical significance for a number of taxa and species, in particular snails (Plam et al. 2008) and fish (Wandera and Balirwa 2010).

At the species level, Criterion 5 applies to “distinct species”, which include those termed Evolutionarily Distinct and Globally Endangered (EDGE) species (GN 95 IFC 2012b, Jetz et al. 2014, ZSL 2014). Jetz et al. (2014) define evolutionary distinctness as a measure of “a species’s contribution to the total evolutionary history of its clade and is expected to capture uniquely divergent genomes and functions”. Based on this definition bird species were identified (together with the areas in which they occur), that are of enormous value in protecting evolutionary diversity. Bird species with the greatest evolutionary distinctness are often found outside of areas traditionally identified as conservation priorities (Jetz et al. 2014).

Based on Jetz et al. (2014) and a search of the EDGE species database covering the CHAA (see ZSL 2014), three EDGE species were identified as potentially occurring in the CHAA. These were the Shoebill, Secretarybird and Nahan’s Francolin. Given that Nahan’s Francolin triggers Criterion 1 critical habitat, it is discussed in that section. The other two are discussed and assessed in Appendix G.

6.2.9.5 Invasive and Potentially Invasive Species

The CHAA has been affected to a greater or lesser extent by human activities for a very long time. These activities have altered the landscape to a greater or lesser extent, the most noticeable being the conversion of the natural vegetation on the plateau above the escarpment to agricultural crop land (AECOM 2013). The influence of people on the Buhuka Flats is also very noticeable, the majority of the flats affected by livestock grazing, small-scale agriculture, fuel wood harvest, and building material collection.

Five invasive species were recorded in the LSA, they tended to be localised, and uncommon, although within certain areas, local populations were high. Three of these, the Giant Sensitive Tree (*Mimosa pigra*), Lantana (*Lantana camara*) and t *Eichhornia crassipes* (Water Hyacinth) were the commonest species recorded, predominantly on the Buhuka Flats and the shore of Lake Albert (Appendix D). These species are recognised as some of most noxious weeds in the world (Lowe et al. 2000).

Other species recorded include: Water Lettuce (*Pistia stratiotes*) (in a Wetland community on the Buhuka Flats, where it was locally abundant); and Castor Oil Plant (*Ricinus communis*) (recorded from wetland and woodland communities).

Other potentially invasive species to note were Neem (*Azadirachta indica*), Jatropha (*Jatropha curcas*) and Parkinsonia (*Parkinsonia* sp.). It is noted that many of these species have been planted by the local communities and offer important cultural and other ecosystem services.

6.2.9.6 Site Assesmsent of the Feeder Pipeline Temporary Consrtruction Camp

The camp is located 2 km east of the Hohwa Trading Centre, roughly 500 m north-west of km 27 along the pipeline route. A rapid assessment was undertaken in January, 2018. Vegetation was used as an indicator of habitat sensitivity.

The area of the site is 3.75 ha, It consists of secondary woody vegetation and farmlands with cultivated crops of maize, cassava and coffee. A total of 56 plant species were identified none of which classified as species of conservation concern. Herbaceous species were dominated by Digitaria scalarum, Panicum Spp, Euphorbia heterophylla, Bidens pilosa, Acalypha spp, Woody vegetation included mainly saplings of Aleurites moluccana and Kigelia africana.

Two species of invasive alien plants were recorded in low abundance, namely Senna spectabilis and Lantana.

Birds were surveyed along transects of 500 m each, from the centre point of the campsite in the four cardinal directions. Based on a 10-minute species time count method, a total of 32 species were recorded and 165 individuals. None were red-data listed in any category.

Mammals were surveyed by observation and using small mammal traps. Only four species were observed, all of which were rats: Common grass rat (Lemniscomys striatus), the Bush rat (Aethomys hindei), the African grass rat (Arvicanthis niloticus) and the Common house rat (Rattus rattus.)

Overall, the site does not conform to the description of modified habitats with significant biodiversity value (IFC, 2012), having been been extensively altered. No species of biological conservation significance were found, based on the IUCN, 2017; WCS, 2016 red lists. None of the species have restricted ranges.

6.3 Socio Economic Environment

6.3.1 Regional Study Area

The main project components will be located in Buhuka Parish, Kyangwali Sub-County, Kikuube District and a section of the feeder pipeline will be located in Kabaale Parish, Buseruka Sub-County in Hoima[8] District in Western Uganda. Lake Albert is a major geographical entity within the regional study area, forming part of the Uganda-Democratic Republic of Congo (DRC) border, and described in detail in Volume 4, Specialist Study 10.

The Congolese district, Ituri (which was earmarked to become a province but has not, to date), and the Ugandan districts of Nebbi, Amuru, Buliisa, Hoima, Kibaale and Bundibugyo surround the lake. The land around Lake Albert is partly classified as a protected area (on the Ugandan side), but is also used for agriculture (crops and livestock) and human settlements. The lake itself provides fish to the surrounding communities and beyond. The region is a complex ecosystem with high biological diversity, but increases in population are putting pressure on natural resources.

Hoima District comprises 4 sub-counties (Buseruka, Kigorobya, Kitoba, Buhanika and Kyabigambire) and 5 town councils/ divisions (Kigorobya TC, Bujumbura Division, Busiisi Division, Kahoora Division and Mparo Division) with Hoima Municipality as the main urban centre. Kikuube District comprises 5 sub-counties (Kiziranfumbi) and 5 town councils/ divisions with Hoima Municipality as the main urban centre. According to the 2014 Uganda Population and Housing Census (UPHC) results, the total population of Uganda was 34.6 million persons in 2014. This represents an increase of 10.4 million persons from the 2002 census. During this period, the population of Hoima grew from 343,618 people in 2002, to 572,986 in 2014, more or less in line with the growth at national level. At the same time, it is uncertain to what extent population totals take on board the number of refugees who have attained Ugandan citizenship, or the number of refugees who have entered Hoima and have opted not to enter a refugee settlement.

According to the Hoima District Development Plan[9], 2015-2020, the percentage of people in Hoima district who are economically active is estimated at 60%. Small scale agriculture is the main source of livelihood for about 90% of the population, both in terms of basic nutritional needs, income generating activities and social organization. It is the most important sector in the district economy as it provides employment for over 85% of its labour force and it accounts for about 71% of the district GDP.

Production systems appear to be zoned; with fishing and animal rearing more pronounced in the Buhuka Flats in the project area, while crop farming is common along the pipeline route where common crops include bananas (for food), bananas (for beer), sweet potatoes, Irish potatoes, cotton, soya beans, groundnuts, pigeon peas, beans, sorghum, maize. Traditional cash crops grown include coffee, cotton, tea and tobacco. Other crops have increasingly turned into non-traditional cash crops. Most agricultural production is carried out on small landholdings.

Subsistence farming and small-scale commercial farming serve as main economic activities in the Hoima and Kikuube Districts. Crops are mostly used for household consumption or sale in community markets. Production is carried out on small farm holdings less than 1 acre in size. The most common crops include bananas (for food), bananas (for beer), cassava, sweet potatoes, Irish potatoes, cotton, soybeans, groundnuts, pigeon peas, beans, sorghum and maize. Tobacco farming is common in the Kabarole District,

[8] Kikuube District was carved out of Hoima District in 2018. Most of the statistics in this report makes reference to Hoima District.

[9] Hoima District Development Plan, 2015-2020

whilst commercial tea plantations exist in Kabarole. Tree plantations (pine wood, eucalyptus) are becoming increasingly popular in Kabarole and Hoima Districts (Uganda Electricity Transmission Company Limited (UETCL[10])).

Hoima and Kikuube Districts also have abundant open water resources making fishing a major economic activity. Most fishing is done on Lake Albert, which covers about 2,268.6 km2 (38%) of the district. Fishing has greatly influenced social and economic development in the sub-counties of Kigorobya, Buseruka, Kabwoya, and Kyangwali. There are 22 fish landing sites, which act as major outlets to the local markets. Lake Albert has the most diverse fish fauna species including Tilapia, Nile Perch, Ngaa, Ngassa, Lanya and Male (Uganda Electricity Transmission Company Limited (UETCL)).

Kyangwali Sub-County is one of the five sub-counties in the Kikuube District. Kyangwali consists of five parishes (Kyangwali, Butoole, Kasonga, Kyangwali Refugee Camp and Buhuka) with a total of 54 villages. Buhuka Parish includes 13 villages, and is where the main Kingfisher Field Development Area project infrastructure is located.

Figure 6-28 shows the location of Hoima and Kikuube Districts within western Uganda while Figure 6-29 shows the location of Buhuka Parish in relation to the Project footprint. The fishing villages located in the Buhuka Parish and surrounding areas include Kyabasambu, Nsonga (A and B), Kyakapere, Nsunzu (A and B), Kiina, Sangarao, Kyenjojo, Kacunde, Busigi, Kyenyanja, Ususa and Senjojo. Details of the location of these villages is provided under Section 6.3.2.

[10] The UETCL data was gathered for the 2018 ESIA for the Proposed Hoima-Mputa Fort Portal-Nkenda 132 kV Power Transmission Line and Associated Substation and is the most recent trustworthy data that could be made available. Unfortunately, no definitive alternative data could be obtained, including from the Hoima District Production Department.

Figure 6-28: Administrative areas where the proposed project will be located

Figure 6-29: Location of Buhuka Parish

6.3.1.1 Governance and Administration

The Local Government Act, 1997, gives effect to the devolution of functions, powers, and services to all levels of Local Government to enhance good governance and democratic participation in and control of decision-making by the people.

The regional and district governance structure spans several levels of administration, each with an administrative head and a political head. Uganda is administratively divided into districts, which in turn are divided into counties, sub-counties and parishes, within which villages are located. Table 6-15 summarises the functions and responsibilities of the different levels of government.

Table 6-15: A summary of the functions and responsibilities of the different levels of government

Tier of Government	Summary Description of Functions and Responsibilities
District Political Head: Local Council V Chairman	Led by elected Local Council Chairman and his/her executive. The Council debates budgets, decisions and bylaws. The Council has powers to make local laws and enforce implementation. Council members are elected with sub-county representatives. Technical staff include a chief administrative officer (appointed by central government) and other staff who are responsible for various departments such as education, health, and environment and planning. The District Land Board overseas matters pertaining to land titles and land rights and is advised by the Natural Resources Department about environmental and land management issues.
County Political Head: Local Council IV Chairman	Divided into sub-counties. Each county is represented in the national parliament by an elected Member of Parliament (an MP). In major towns, the county is the equivalent of a municipality. The Executive Committee members of all the sub-councils make up the local county council. They elect an executive committee, which has limited powers
Sub-county Political Head: Local Council III Chairman	A sub-county (of which Kyangwali sub-county is applicable to the main Kingfisher field project infrastructure) is subdivided into a number of parishes. The sub-county is run by the sub-county chief on the technical side and by an elected local council chairman and his/her executive committee. The sub-county has six core technical departments: administration, finance and planning, public health, and environment, works and engineering, audit and community based services.
Parish Political Head: Local Council II Chairman	Kyangwali sub-county comprises 5 parishes (Kyangwali, Butoole, Buhuka, Kyangwali Refugee Camp and Kasonga with up to 53 Villages (LCIs). Buhuka Parish is categorized as a Local Council II (LCII) according to the administrative structure in Uganda and accommodates the offices of the parish administration. There are 9 parish councillors. Each village also typically has formal or informal groupings for women, youth, fishermen, businessmen, microfinance etc. The leaders of these often have a role in the governance of the village

Bunyoro Kitara Kingdom

Besides central government administration structures, the Bunyoro Kitara Kingdom is an important traditional or cultural institution in the project area. Its king is revered and held in high esteem among the Banyoro people.

6.3.1.2 Demographics

6.3.1.2.1 Population Size and Growth

Based on projections from the 2002 census, the population of Hoima and Kikuube Districts was expected to grow to 349,204 persons (50.4% males and 49.6% females) by 2014, with an annual population growth rate of 4.87%[11]. The more recent figures from the Uganda Bureau of Statistics (2016) (National Population and

[11] Hoima District Local Government, 2011

Housing Census, 2014), however, shows that the expected growth has been surpassed significantly, with the Hoima and Kikuube districts' population being measured at 572,986 persons (467,042 (rural); 105,944 (urban)) at the time of the 2014 census.

This exponential increase compared to estimates, is further borne-out by the figures from the Socio-Economic Village Level Survey undertaken in November and December 2017. The actual count exceeds even that of the 2017 figures of the Planning Unit, Hoima District. For example, the household survey places the Kyakapere population at 3,700[12], whereas the Planning Unit's estimate was 1,402.

Increases in population totals are largely driven by in-migration and a decline in mortality rates, according to the Hoima Municipal Council[13]. This growth is in line with that projected in the "Influx management strategy and framework plan: KFDA Project". The Framework Plan had noted a 100% increase in settlements in the preceding 10 years, predicting a further equivalent influx due to "obvious opportunities such as the KFDA and other oil projects in the Albertine region" (p. i) (executive summary).

6.3.1.2.2 Population Movement and Migration

Lake Albert plays a key role in the socio-economic support of the Ugandan and DRC people. Population movement across the lake between the two countries is significant and there has been an upsurge in in-migration and settlement along the shores of Lake Albert from the DRC. Based on information from the Immigration Officer manning the Immigration Office at Nsonga, Ugandan citizenship is provided to Congolese citizens on a discretionary basis from this office, particularly if they already have other family members residing in Uganda (personal communication, December 2017).

According to United Nations High Commissioner for Refugees (UNHCR) and Office of the Prime Minister, "while there are still a significant number of new arrivals from the DRC, there are fewer arrivals coming across on Lake Albert. This is due to reports of movement restrictions on civilians in Ituri region, DRC, as well as bad weather on the lake. The average influx was reportedly down to 683 persons per day for the month of March 2018. From January to March 2018, the arrival of over 60,000 Congolese refugees has exceeded planned arrivals for the year. All new arrivals have been granted prima facie status and biometric registration is on-going. Over 2,500 unaccompanied and separated children have been identified[14]". Unaccompanied children coming into Uganda were provided with appropriate care, including foster care where this was required.

In May 2018, the UNHCR issued a statement that between mid-December 2017 and March 2018, the population in the Kyangwali Refugee Settlement had increased from more than 36,713 to 68,703 as a direct result of an influx of refugees specifically from the DRC. It further noted that almost 70,000 people had arrived in Uganda from the DRC since the beginning of 2018 as they escape violence in the Ituri province, with the majority of refugees arriving by boat across Lake Albert.

It is uncertain what percentage of arrivals across Lake Albert was comprised of unaccompanied minors. As well, it is also not certain what proportion of Congolese found their way to one of the refugee settlements, or became integrated into settlements, particularly around Lake Albert. At the same time, it is clear (based on the growth rate for the Kyangwali Refugee Centre during the December 2017 to March 2018 period), that significantly less than half of these 7,000 DRC refugees (a maximum of 31,990) from the DRC arriving in Uganda via Lake Albert, found their way to this Refugee Centre.

In addition to migrants and refugees from other countries, Kikuube and Hoima Districts have had in-migration from other areas of Uganda of persons seeking opportunities for survival and for profit. In this regard, in an interview in June 2017, Grace Mugasa the Mayor of Hoima Municipality Council stated that there had been a

[12] Socio-Economic Village Level Survey for Kyakapere (2017)

[13] Hoima District Development Plan, 2015-2020

[14] UN High Commissioner for Refugees (April, 2017) Uganda Refugee Situation Report https://reliefweb.int/report/uganda/unhcr-uganda-factsheet-march-2017

soaring population influx into the area since oil had been discovered. This massive increase in population had not been foreseen or planned for, so “our resources are depleted even before the year ends,”[15]

Between 2002 and 2014, Hoima municipality has seen the second highest population growth rate for a local government unit at 10.7 per cent, after Wakiso district, according to the 2014 national population and housing census report. At least 100,126 people now live in Hoima Municipality, according to figures from the Uganda Bureau of Statistics. As a result of the increased economic activity, Mugasa said, Hoima was upgraded to municipality status[16].

6.3.1.2.3 Population Age and Gender

In Hoima District, children under 18 years of age make up 58.2% of the population of 572,986. The ratio of males to females is more or less equal although this was not uniform across sub-counties. Early marriage patterns and cultural and religious beliefs preferring large families as a source of sustenance and as a form of social security have contributed to high fertility rates and population growth[17].

The high percentage of children between the ages of 0 to 8 years (31.9%) has significant development related implications over the development life span, and it will be critical for the Ugandan government to ensure that there are systems in place that will allow the development needs of this vulnerable group to be addressed. Fundamental aspects to be taken into consideration are, as an example, the fact that up to 75% of children within Kikuube and Hoima Districts to not have birth certificates, as compared to an approximate 33% nationally. Where the birth of children is not adequately recorded, planning cannot be adequate. It is not clear how it is intended to roll out the Registration of Persons Act, 2015 at local level. What is certain is that it will require a well-resourced process.

6.3.1.2.4 Ethnicity, Citizenship and Religion

The National Housing and Population Census done in 2002 showed Hoima District (including the areas through which the road and pipeline route pass) to have a multitude of ethnic groups, with the indigenous Banyoro and Bagungu forming the dominant tribes comprising about 77% of the people, followed by the Alur and Jonam (7%), Bakiga (4%), Lugbara and Aringa (3%) and others (9%).

The Project Social Survey, undertaken in 2013[18] showed a rich cultural diversity with patterns that differed in the Buhuka Parish, where the main tribes at that point were the Alur (44%), Bagungu (28%), Banyoro (11%) and Banyankole (5%). Most household heads were reported to be from the Alur tribe (68.9%), with (89%) of these reporting being Ugandan, with 11.5% of respondents indicating that they were Bagungu. The Banyoro, Bakonjo, Baganda, Batoro, Bakiga, and Bamba were also represented, as well as Rwandan, and other Congolese and Ugandan tribes. A total of 83% of household heads interviewed stated that they were married.

Data collection and consultation during 2013 found that there was a substantial presence of Congolese nationals within the villages (42.4% of the population in Kyakapere, 22.4 in Kyabasambu and 6.3% in Nsonga[19]. Whilst the majority of the population were from the Alur tribe, residents in the area believed that a significant (but unspecified) proportion of the Alur population in the area had originated from the DRC and had fled conflict in their country to settle in the Lake Albert area. According to informal discussions, the residents expressed the belief that such migrants/refugees were often uncomfortable about declaring their

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[15] Twaha, A (June 14 2017) Hoima Faces Pressures of Being an Oil-Bearing Town, accessed at http://observer.ug/business/53335-hoima-faces-pressures-of-being-an-oil-bearing-town.html

[16] Ibid

[17] Uganda Bureau of Statistics (2016). The National Population and Housing Census 2014 – Sub-County Report, Kampala, Uganda

[18] The Kingfisher 4 SIA (2013) found that Congolese Nationals made up 42.4% of the population in Kyakapere, 22.4% in Kyabasambu and 6.3% in Nsonga

[19] Kingfisher 4 SIA (2013)

real nationality (for fear of being ostracised by the community or being repatriated by the Ugandan government)[20].

Results of the 2013 socio-economic household survey, undertaken amongst a sample of households, indicated that the most spoken and written language at that stage was Alur (refer to Figure 6-30), corresponding with the largest tribe in the area. The second most used language in the area was Swahili represented by 31%.

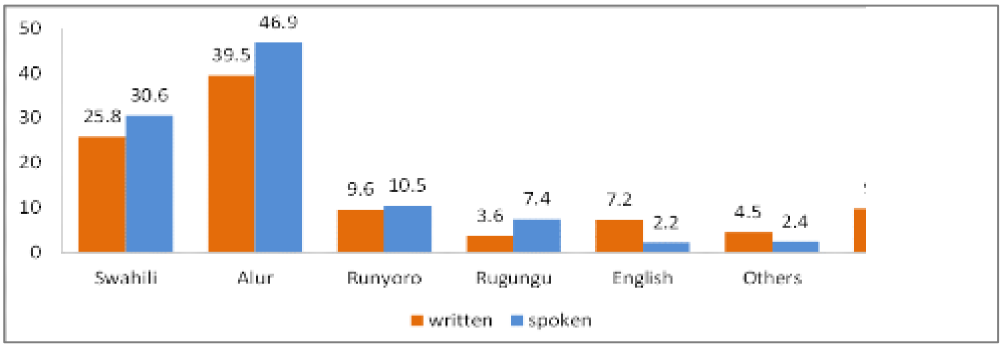

Figure 6-30: Distribution of household heads by languages spoken and written

During fieldwork undertaken in late 2017, LC I chairpersons who are responsible for village level governance, indicated that there had been a significant influx of migrants and refugees from the DRC who had taken up residence in villages along the Lake, and estimated that as many as 70% of the villagers residing in settlements along Lake Albert originate from the Democratic Republic of the Congo (DRC), with some harder to reach settlements being virtually completely made up of Congolese. Based on discussions with stakeholders, including the Nsonga Immigration Officer, [21] the in-migration of migrants and refugees from the DRC is facilitated by the fact that a large percentage of Congolese already have family members who live in Uganda. As well, that there are significant language similarities and that Alur, in particular is spoken in villages on the Buhuka Flats as well as within the Ituri Province of the DRC, which lies immediately adjacent to Lake Albert. The Alur tribe, which forms part of the Luo group is one of the predominant tribes in the Buhuka Flats area and has member clans that reside both in Uganda as well as in the (DRC).[22]

Although not yet very pronounced, ethnic tensions exist in the villages and the social team observed arguments about community leadership and in one case, fears of being excluded from focus group discussions. These tensions appear to be prevalent in the villages on the Buhuka Flats (Production Facility) as well as along the escarpment (Pipeline) and are reportedly increasingly driven by concerns about resource availability now and into the future, including land, as well as historic tribal tensions.

In a study undertaken by the Bunyoro Kitara Kingdom[23], reference is made to the manner in which patterns of settlement within Hoima and Kikuube, in particular along Lake Albert, are causing distortions in traditional populations. In this regard, it is stated in the Report that “Currently there is cultural dilution caused by immigrant ethnic tribes taking advantage of the oil boom. This development is upsetting social harmony due to conflict over the use of scarce resources including land. New settlements are making ever-increasing demands on the very limited public investments in the area for social amenities like schools and health facilities. This also results in tensions and calls for increased public investment into these amenities so as to cope with the growing volumes.” The Report further states that: “More important to note is that new ethnic groupings migrating into Bunyoro Kitara Kingdom are coming with large herds of domestic animals, grabbing

[20] Environmental and Social Impact Assessment for the CNOOC Uganda Ltd Kingfisher Project in Hoima District, Uganda (2014)

[21] Stakeholder Engagement Report (Minutes of Meeting with the Immigration Officer, Nsonga, Buhuka Parish, Uganda (2018)

[22] The Africa Institute (undated) The Alur People. Accessed at https://www.africa.upenn.edu

[23] Yolamu Nsamba and other Cultural Leaders of the Bunyoro Kitara Kingdom (2012) Action Orientated Research to Strengthen Bunyoro Kitara Kingdom to Defend her Cultural Heritage from Negative Impacts of Oil and Gas Industry development in Uganda

Bunyoro lands and hiding behind rich government officials. The Omukama warns that whoever is acquiring even an inch of Bunyoro land is doing it illegally and will thus loose it at an appropriate time"[24].

Religious beliefs co-exist in the Local Study Area (LSA) including Anglican, Catholic, Moslem, Pentecostal and numerous other faiths such as Church of God, and Church on the Rock International. There are also African traditional churches, which include the Alur African Church (Lam the Kwaru), and Faith of Unity (Itambiro). According to the Hoima District Local Government (2011), Catholics were the largest religious denomination (44%) in the Hoima and Kikuube District followed by Anglicans (41%), Moslems (5.1%) and Pentecostals (3.1%).

6.3.1.2.5 Health

In 2013, Hoima District had 54 health units including a government owned hospital with about 200 beds. The Ministry of Health[25] further reported that there was a total of three level IV health centres (one run by an NGO), 32 level III health centres of which five were run by NGOs, and 18 level II health centres, with five of these being run by NGOs. These are distributed throughout the sub-counties.

Based on the 2014 population census, 73.2% of households live within a five kilometre radius of either a private and/or a public health facility, whilst 60.5% of households live within a five kilometre radius of the nearest public health facility.[26]

In the order of 90% of the population surveyed as part of the 2013/2014 Socio-economic Household Survey indicated that they lived within an 8km catchment area, and 94% of the population indicated that they lived within 5km of a government or PFNP health unit. Access to healthcare facilities has been facilitated by the improvements in the road infrastructure, including the building of the escarpment road. At the same time, Buhuka Health Centre II is the only facility found in Buhuka Parish and all the communities within Buhuka Parish depend on this facility. Distances travelled to reach the facility range from 100 metres to 10 km, depending on the village. The need to travel longer distances to access health services is supported by data obtained via the Uganda National Household Survey (2012/13, p.xii.), which reports that only "thirty five percent of Government health centers visited by persons who fell sick are within a radius of 5 km from the population".

Table 6-16 provides an overview of the specific service delivery focus areas, provided by the various levels of health facilities.[27]

Table 6-16: Service Delivery by Level of Health Facility

Level of Health	Unit Target population	Services provided
Health Centre I (Village Health Teams)	>1,000	Community based preventive and Promotive Health Services. Village Health committee or similar status
Health Centre II	>5,000	Preventive, Promotive and Outpatient Curative Health Services, outreach care, and emergency deliveries.
Health Centre III	>20,000	Preventive, Promotive, Outpatient Curative, Maternity, inpatient Health Services and Laboratory services

24 Ibid, 2012:16

25 Ministry of Health: Health Infrastructure Division (2012:1) Master Health Facilities Inventory

26 UBOS (2017) National Population and Housing Census 2014:Area Specific Profiles –Hoima District

27 Ministry of Health: Health Infrastructure Division (2012:1) Master Health Facilities Inventory

Health Centre IV	>100,000	Preventive, Promotive Outpatient Curative, Maternity, inpatient Health Services, Emergency surgery and Blood transfusion and Laboratory services

Some NGO facilities within the broader project area include the Bujumbura Health Centre, Munteme, Azur Clinic, Kabalega Medical Centre, EDPA Medical Services, Divine Clinic, Doctor's Clinic and the Supreme Moslem Council Health Centre etc. (Lewis, Kityo and Kagoda, 2006).

Table 6-17 presents basic comparative demographic and health indicators for Hoima District for 2011[28] and 2014[29], as well as at national level for the same periods.[30]. Generally, Hoima and Kikuube District's health indicators are less favourable in comparison to national Ugandan indicators, with a higher prevalence of HIV/AIDS in Hoima and Kikuube Districts, inter alia, said to be due to high levels of commercial sex trade at the fishing villages on Lake Albert.

Table 6-17: Basic Demographic and Health Indicators for Hoima and Kikuube Districts

Indicators	Hoima (2011)	Hoima (2014)	Uganda (2011)	Uganda (2014)
Population (No)	523,300	572,986	33,000	34,634,650
Population Density(Persons/Km2)	144.9	156	123	123
Growth rate	4.7	4.3	3.5	3.5
Sex ratio	100	99.8	95.8	95.8
Average Dependency Ratio	108.4	-	113.0	103.3
Average household size (no.)	4.9	4.5	6	6
Infant Mortality Rate (per 1,000 live births)	87	53	49.5	43.9
Child Mortality (under 5 years/1000)	85	85	131	64
Maternal Mortality (per 100 000)	437	435	505	505
Percentage of females aged 15-49	21.6	21.6	43.6	43.6
Stunting (%)	26.5	26.5	39	39
Wasting (%)	8.5	8.5	4	4
Under weight (%)	19.5	19.5	24.5	24.5
Total goitre rate (%)	25.7	27.9	33.8	33.8
Fertility rate (%)	6.9	6.7	6.6	5.4
Life expectancy at birth (years)	51.7	54.731	57.80	63.6
HIV Prevalence rate	6.4%	8.2%	6.1%	6.1%
Population per doctor	49,920	28,769	15,678	15,678

[28] Hoima District Local Government Report, 2011

[29] The Republic of Uganda; Hoima District Local Government; District Development Plan 2015/2016 – 2019/2020; June 2015; http://npa.ug/wp-content/uploads/2017/05/Hoima-DDP-2015-2020.pdf

[30] Republic of Uganda; National Population and Housing Census 2014; Main Report; https://www.ubos.org/wp-content/uploads/publications/03_20182014_National_Census_Main_Report.pdf

[31] Although the UBOS 2014 Area Specific Profile for the Hoima District states that the current life expectancy at birth for Hoima residents is 63.6 years (which is the national expectancy rate), the national statistics which discusses life expectancy per district points out that it is 54.7 years as noted

The overall life expectancy at birth for Hoima District increased from 51.7 in 2011 to 54.7 years in 2014[32] for both genders, as compared to a national average of 63.6 years, with a life expectancy at birth of 63 years (males) and 64.2 years (females).

The total fertility rate (TFR) for Hoima and Kikuube Districts has remained high at an average of 6.7 children per woman, as opposed to the 5.4 TFR at national level[33]. Women of child-bearing age (15 – 49 years) comprise 21.6% (113,033) of the population in Hoima and Kikuube Districts. Nationally, the TFR declined from 7.1 children per woman in 1991 to 5.4 children per woman in 2014[34].

6.3.1.2.6 Education

The Local Governments' education system aligns with the national government system of Universal Primary Education (UPE) and Universal Secondary Education (USE). The education department is composed of seven sub-sectors including the District Education Office, Inspectorate, Sports, Special Needs Education, Primary Education, Secondary Education and Tertiary Education.

Despite the introduction of Universal Primary Education, progress in terms of educational attainment in Kikuube and Hoima Districts has been slow. It inherently shares the complexities related to the delivery of adequate educational facilities and services experienced at all levels.

The formation of Hoima Municipality in July 2010 resulted in sharing of a number of education resources. Primary schools were reduced from 164 to 131 and the teaching staff reduced from 1,591 to 1,252. This has resulted in problems such as large class sizes; pressure on infrastructure and teachers as well as shortages of books and materials. Even though there has been a significant increase in the number of primary schools from 131 in 2012, to 212 in 2016, available infrastructure (classroom blocks, pit latrine stances, teachers' houses and desks) is still inadequate owing to high enrolment rates. Currently, the district has only 890 classrooms instead of the 2,053 required and 20 permanent teachers' houses as opposed to the 293 that are needed.

At the time of the 2014 population census, more than one in four children in Hoima District between the ages of 6 and 12 years old was not in school.[35] As may be seen from Figure 6-31 below, Hoima and Kikuube (together only with Kyangwali which has a massive refugee population) has the highest percentage distribution of children aged 6 – 12 years that are not in school in the country (between 26.5 and 33.4%[36]. This is a distressingly low level of enrolment, even by Ugandan standards, where - nationally – more than 85% of boys and girls in this age group attend school. Clearly, this speaks to particular instability and vulnerability in the development area.

As identified during the 2013 socio-economic profile survey for the CNOOC Project, in addition to low enrolment, school drop-out rates in the Buhuka Parish were reported as high and a central problem facing education. Reasons for this phenomenon are reported to be related both to inadequate infrastructure as well as social factors. The closest secondary school to Buhuka Parish is in Kyangwali village - which until the opening of the escarpment road - could only be reached by trekking up the escarpment (a journey of more than an hour for adults). This situation has improved dramatically now that the new road has been built down the escarpment, making the journey far less onerous although still time-consuming. This is given the fact that access to the school inevitably still involves a long walk for most scholars on the Flats.

[32] National Population and Housing Census 2014 Area Specific Profiles

[33] Population Institute (2015: 44), Washington

[34] Uganda Bureau of Statistic, 2014, p.16

[35] National Population and Housing Census 2014 Area Specific Profiles –Hoima District

[36] National Population and Housing Census 2014 Area Specific Profiles – Hoima District

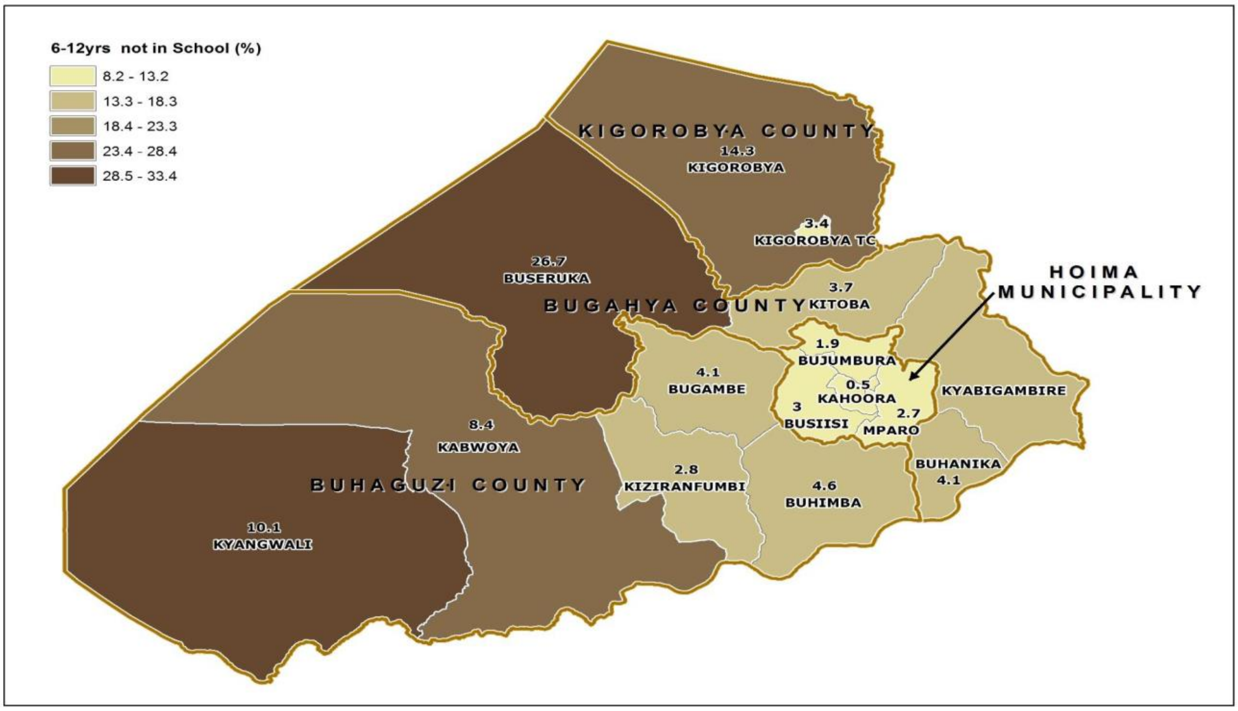

Figure 6-31: Percentage Distribution of Population Aged 6-12 Years Not in School; Hoima District, 2014[37]

6.3.1.3 Social Services and Utilities

6.3.1.3.1 Water Systems

Approximately 60% of the population in Hoima and Kikuube districts has access to safe water according to the Ministry of Water and Environment (MWE). This is down from around 72% in 2015/16 and 70% in 2013/14 financial years. However, access to safe water is only available to 32% of households in the Kyangwali sub-county, 42% in the Buseruka,[38] 49% in the Kabwoya and 63% in the Kigorobya sub-counties. In contrast, 95% of households are said to have access to a safe water supply in the Kyabagambire, Bugambe, Buhimba, Kiziranfumbi, Busisi, Kitoba and Buhanika sub-counties. The functionality rate in urban and rural areas is 71% and 72% respectively.

Hoima and Kikuube districts have 1,792 domestic water points and 2 piped water schemes. 286 water points have been non-functional for over five years and are considered abandoned.[39] The main reasons for non-functionality have been classified as low yield (20%), technical breakdown (60%) and poor water quality (20%). The main water supply technologies are the shallow well, deep borehole and protected spring technologies. Piped water and rainwater harvesting constitute only 2% and 1% of supply respectively. Piped water supplies predominate around the main towns of Hoima Municipality (90%) and Kigorobya Town (72%).

6.3.1.3.2 Sanitation and Refuse Systems

No formal domestic waste disposal services or facilities exist in the Hoima and Kikuube Districts, which has implications for health conditions of communities. Hoima District Development Plan (2016) notes that solid waste management is an increasing problem, especially at rural growth centres such as Nsonga, Kyakapere, Kiina and Hohwa amongst others. The Plan identifies the need for improvement of solid waste management around the rural growth centres and fishing/landing sites, with a Public-Private Partnership (PPP) mooted as a potential management option.

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[37] Ibid

[38] MWE: District Water Atlas, Hoima, 2017

[39] MWE: District Water Atlas, Hoima, 2017

While the average latrine coverage for Kikuube and Hoima Districts is estimated to be 71%, coverage for the Kyangwali Sub-County is estimated to be 59%. Sanitation related hygiene behaviour is low across the entire District, with an average of 21% of households surveyed reporting handwashing post latrine use. Kyangwali scores the lowest across all sub-counties with 12% of households reporting handwashing behaviour[40].

6.3.1.3.3 Energy

Hoima District has a rich renewable energy resource base, with significant energy potential that could be exploited. Currently, energy sources being utilised in Hoima and Kikuube Districts include petroleum, electricity, wood fuel, solar energy, wind, geo-thermal and hydropower.

Biomass energy represents over 97% use. Kerosene or paraffin is commonly used for lighting in lamps commonly known as tadoobas, despite the cost and the risk of fire, with fewer than 3% of all households having access to electricity supply.

Most people (approximately 98.9%) depend mainly on wood fuel, which they collect from the top of the escarpment and on the flats. However, firewood has become scarce and many people have resorted to using charcoal that is either sourced from manufacture points within the area or is brought in from outside Hoima and Kikuube, but usually manufactured relatively close to outlet. The prevalence of use of charcoal as main fuel source is both expensive and is having a devastating impact on the environment. The Population Institute (June 2015) confirms, “at current rates of deforestation, Uganda could lose all its forests by mid-century” (p.44). At the moment, most of the district is not connected to the national grid[41].

6.3.1.3.4 Roads and Communication

Based on information set out in Hoima District Development Plan (2016), the road network within the Hoima and Kikuube Districts are made up of trunk, rural feeder and community roads with a total length of 1,915 kilometres. Roads are classified according to the type of surface and institution/authority responsible for their maintenance. Trunk roads are maintained by the Ministry of Works and Transport whilst feeder roads are a responsibility of the Local Governments. Community roads are a local responsibility.

District feeder roads make up approximately 909 km of this, whilst 1,006 km are community roads. Currently only 32% of the entire road network in the district is in a good condition, 48% in a fair condition and 20% in a poor condition. The project area sub-counties have a less developed network and for a long period of time, some of its areas were unreachable due to physical barriers (escarpment).

There are paved trunk roads between Kampala and Hoima and Fort Portal. A gravel road network exists into the Counties and sub-counties, in varying states of repair. The recently constructed escarpment road, which runs from Ikamiro village at the top of the escarpment, to Kyabasambu Village in the Buhuka parish, provides paved access to the Kingfisher Field Development Area on the Buhuka Flats.

The major means of transport within the project area is comprised of saloon cars that are used as passenger service vehicles/taxis (PSVs), pick-ups and trucks and commercial motorcycles (boda-bodas). Most people move about on foot, ride bicycles or use boda-bodas as taxis to access social services. Bus transport is limited and is only easily accessible to those located near the larger roads. Those closer to Lake Albert use water transport, which has now been facilitated by the construction of the road down the escarpment to the lake. A few people are reported to own cars (in the villages of Kataaba and Nyairongo).

[40] Hoima District Development Plan 2016-2020

[41] Environmental Assessment Consult (U) Ltd, 2013

6.3.1.4 Economic and Livelihood Activities

According to Hoima District Development Plan[42], 2015-2020, the percentage of people in Hoima and Kikuube districts who are economically active is estimated at 60%. Small scale agriculture is the main source of livelihood for about 90% of the population, both in terms of basic nutritional needs, income generating activities and social organization. It is the most important sector in the district economy as it provides employment for over 85% of its labour force and it accounts for about 71% of the district GDP.

Production systems appear to be zoned; with fishing and animal rearing more pronounced in the Buhuka Flats in the project area, while crop farming is common along the pipeline route where common crops include bananas (for food), bananas (for beer), sweet potatoes, Irish potatoes, cotton, soya beans, groundnuts, pigeon peas, beans, sorghum, maize. Traditional cash crops grown include coffee, cotton, tea and tobacco. Other crops have increasingly turned into non-traditional cash crops. Most agricultural production is carried out on small landholdings.

Subsistence farming and small-scale commercial farming serve as main economic activities in Kikuube and Hoima Districts. Crops are mostly used for household consumption or sale in community markets. Production is carried out on small farm holdings less than 1 acre in size. The most common crops include bananas (for food), bananas (for beer), cassava, sweet potatoes, Irish potatoes, cotton, soybeans, groundnuts, pigeon peas, beans, sorghum and maize. Tobacco farming is common in the Kabarole District, whilst commercial tea plantations exist in Kabarole. Tree plantations (pine wood, eucalyptus) are becoming increasingly popular in Kabarole and Hoima Districts (Uganda Electricity Transmission Company Limited (UETCL[43])).

Hoima and Kikuube Districts also have abundant open water resources making fishing a major economic activity. Most fishing is done on Lake Albert, which covers about 2,268.6 km2 (38%) of the district. Fishing has greatly influenced social and economic development in the sub-counties of Kigorobya, Buseruka, Kabwoya, and Kyangwali. There are 22 fish landing sites, which act as major outlets to the local markets. Lake Albert has the most diverse fish fauna species including Tilapia, Nile Perch, Ngaa, Ngassa, Lanya and Male (Uganda Electricity Transmission Company Limited (UETCL)).

6.3.1.4.1 Agriculture and Animal Industry

According to the World Development Report on Agriculture for Development published in 2008, agriculture is critical if countries are to achieve their poverty targets and objectives. Some strands of research suggest that Hoima District is predominantly agricultural (See Mubiru and Kristjanson, 2012) and 100% of the people in the district depend on agriculture with crop production as a major economic activity, followed by poultry and livestock.

The Uganda Investment Authority/UNDP (2017) confirms that, in Hoima and Kikuube Districts, the main economic activity is agriculture and that the major tradeable is Cassava, Maize, Sweet Potatoes and Rice. Agriculture engages about 63% of the working population and a large percentage of the refugees (90%) are engaged in economic activities. Agriculture is the main activity undertaken to generate income. Other activities include retail business; trade and casual work. At the national level, agriculture is Uganda's economic mainstay.

While the contribution of agriculture to total GDP has been declining over the years, the sector has continued to dominate the country's economy. Agriculture contributed approximately 22.9% of the total gross domestic product in 2011 at current prices (UBOS, 2012).

A number of households in the sub-county are engaged in rearing animals at subsistence level. Recently, there was an influx of cattle keepers from as far as Tanzania and Kasese areas, leading to a tremendous increase of cattle in the area up to Buhuka parish in the flats. In Buhuka, the cattle keepers were attracted

[42] Hoima District Development Plan, 2015-2020

[43] The UECTL data was gathered for the 2018 ESIA for the Proposed Hoima-Mputa Fort Portal-Nkenda 132 kV Power Transmission Line and Associated Substation and is the most recent trustworthy data that could be made available. Unfortunately, no definitive alternative data could be obtained, including from the Hoima District Production Department.

mainly by the abundance of water from the Lake and open grasslands that are conducive for grazing animals (Kyangwali Sub-County Development Plan, 2011-2015).

Difficulties affecting farmers are unpredictable weather changes, vermin attacks, crop diseases, poor farming methods/techniques, environmental degradation/deforestation, poor infrastructure, poor health of household members, shortage of markets to sell produce at and a lack of water for livestock. Strategies put forward by sub-county administration to solve these problems include subsidizing farm inputs, the introduction of modern farming methods, training farmers in post-harvest techniques, the construction of dams, encouraging fish farming, sensitizing farmers about land degradation and the upgrading of local roads.

6.3.1.4.2 Fishing

Lake Albert contributes the second biggest proportion of fish catch in Uganda at 39%, after Lake Victoria which contributes 42% of the fish catch (UBOS, 2012). Kikuube and Hoima Districts have numerous fishing villages located along the shoreline of Lake Albert, which have high population densities. Inhabitants of these villages directly depend on subsistence fishing as a source of food, livelihoods and a cash income (ibid). Common fishing gear that has been observed includes gillnets, seine nets, and hooks.

The fisheries sub sector comprises of both fish farming and fishing on Lake Albert. Drying and salting of fish along the lakeshore is undertaken before selling the fish at markets in Hoima and Kikuube. Most of the catch is channelled through neighbouring districts or into the DRC and the north, which have easy access routes by boat. The fish caught in the district is spread over the 68 landing sites in the district, with the landing sites distributed quite evenly along the shoreline.[44]

The fishing sector is being threatened by declining catches mainly due to the use of destructive fishing methods such as gillnets with small diameter holes, illegal fishing gear and fishing in breeding areas, non-compliance with regulations and inadequate control of catches.

6.3.1.5 Land Access and Tenure

The 1998 Land Act recognises four major types of tenure: customary, freehold, leasehold and mailo.[45] Two predominant land tenure systems found in the project area; In Buhuka flats, communal land ownership is the main and predominant customary tenure; while along the pipeline clan and individual owned customary tenure is more pronounced. Engagement with the LCs and community members within the flats indicate that Buhuka parish was originally a game reserve with few unlicensed landing sites. Former village chairpersons and other local leaders applied to Central Government through local authorities and Uganda Wildlife Authority (UWA) for recognition and degazzetment. This request was then passed to parliament and the area was degazetted in 2001. Following the degazzetment, some of the community members opted for individual ownership, while most of the other community members opted for a communal arrangement. Following a series of judicial engagements, the Buhuka Communal Land Association (BCLA) was formally approved by the Ministry of Lands, Housing and Urban Development (MLHUD) as comprising of the five villages of Nsonga, Kyabasambu, Kyakapere, Nsunzu and Kiina. Other neighbouring villages are not part of BCLA at the moment.

While communal land use around Buhuka flats (Nsonga, Kyabasambu, Kyakapere, Nsunzu and Kiina villages) is long standing practice, institutionalised communal management is relatively recent and is not very clear to some of the community members. Registered as the land owner, the Buhuka Communal Land Association is the de-facto representative of the project-land affected community; a mandate held in respect by the client and other stakeholders but also with some contestations by some of the community members.

Land use along the pipeline project area indicates that over 80% of the land is used for agriculture, characterised mostly as subsistence production with limited livestock and commercial farming. The major

[44] Environmental Assessment Consult (U) Ltd, 2013)

[45]Although the Land Act mentions four major tenure systems in the country, it, by implication, also recognises the legal status of *customary tenants* and *licensees/ sharecroppers.*

economic activities observed around towns/rural growth centres within Kikuube and Hoima Districts are small-scale business activities and services. Land use at the Buhuka flats essentially comprises of livestock grazing, residential, social services and public use.

In Hoima and Kikuube Districts, forest conservation and wildlife conservation in protected areas occupies 20.9% of the total land area, which limits land availability for agriculture and other activities. The lack of a uniform land tenure system negatively affects land management, with land speculation having been exacerbated by the discovery of oil.

6.3.1.6 Tourism

Uganda's tourism is nature-based with about 80% of tourists coming to experience wildlife and scenery. The discovery of oil along Lake Albert creates a potential for conflict in a high biodiversity area, which is close to north-western tourism development areas such as the Murchison Falls and other areas of prime tourism potential in Uganda.

The Hoima District Development Plan has stated that the: The tourism sector has demonstrated high potential for generating revenue and employment at a low cost, the district has numerous tourism attractions including diverse nature based, faith based, culture and heritage, and eco-tourism. This plan will focus on exploitation and improvement of the following tourist attraction products: Chimpanzee tracking; Game viewing (Safaris); Avi-tourism (bird watching); Historical and Cultural sites / Monuments; These products are prioritized because they contribute the highest tourism revenue; some are unique to Bunyoro Kitara Kingdom hence giving the district a niche over other districts whereas others can be easily invested in"[46]

Countries such as Kenya and Rwanda have shown the tourism advantages and economic growth that can be achieved from a strategic focus on key existing attractions, national parks and protected areas, as anchors and key visitor attractors to the countries. An analysis of tourism in Uganda[47], undertaken by the World Bank, has shown that every tourism dollar spent leverages $2.50 of Gross Domestic Product, which includes direct, indirect and induced value addition.

6.3.2 Local Study Area – The CPF and Ancillary Works

This section provides an overview of the socio-economic conditions in the Local Study Area, which is the area that could be directly affected by the Project. The section concentrates on the Buhuka Parish where the Project is located. The social baseline overview also identifies relevant socio-economic and community features in the vicinity of the feeder pipeline, including settlement patterns, land use and tenure and economic activities).

6.3.2.1 Demographics

Population Size, Growth and Density

As described in the methodology section, a Socio-Economic Household Survey, using a proportionate sample of households, was undertaken in 11 villages during the 2013/2014 period. An additional Village Level Assessment across all these settlements was undertaken during 2017, to confirm data previously acquired and to establish specific changes that may have occurred.

Within the Buhuka Parish, there are eleven villages that were included in the Local Study Area: Nsonga (A and B), Nsunzu (A and B), Kyabasambu, Kyakapere, Kiina (located within the Buhuka Flats and therefore in close proximity to the main Project infrastructure) and Busigi, Kyenyanja, Ususa, Kacunde, Senjonjo and Sangarao (located adjacent to the Buhuka Flats and therefore ranging from directly within the project footprint to approximately 8 km from project infrastructure). These villages had a total estimated population of 2,830 households at that stage. General profiles and (where relevant) baseline information of these villages are provided, although no quantitative statistics are available for these villages.

[46] Hoima District (2015) District Development Plan 2015 - 2020

[47] The World Bank, June 2013 101 Uganda Tourism Development Master Plan

In addition, data was collected from all directly affected households (31 households and 202 PAPS), as part of the socio-economic survey of households undertaken during October and November 2016 for the Relocation Action Plan, as published in the RAP Report[48]. There were 26 affected households in Kyakapere, four affected households in Kyabasambu and one affected household in Nsunzu.

Population movements and migration

Lake Albert plays a key role in the socio-economic support of the Ugandan and DRC people. Population movement across the lake between the two countries is significant and there has been an upsurge in in-migration and settlement along the shores of Lake Albert from the DRC. Based on information from the Immigration Officer manning the Immigration Office at Nsonga, Ugandan citizenship is provided to Congolese citizens on a discretionary basis from this office, particularly if they already have other family members residing in Uganda (personal communication, December 2017).

According to United Nations High Commissioner for Refugees (UNHCR) and Office of the Prime Minister, "while there are still a significant number of new arrivals from the DRC, there are fewer arrivals coming across on Lake Albert. This is due to reports of movement restrictions on civilians in Ituri region, DRC, as well as bad weather on the lake. The average influx was reportedly down to 683 persons per day for the month of March 2018. From January to March 2018, the arrival of over 60,000 Congolese refugees has exceeded planned arrivals for the year. All new arrivals have been granted prima facie status and biometric registration is on-going. Over 2,500 unaccompanied and separated children have been identified[49]". Unaccompanied children coming into Uganda were provided with appropriate care, including foster care where this was required.

In May 2018, the UNHCR issued a statement that between mid-December 2017 and March 2018, the population in the Kyangwali Refugee Settlement had increased from more than 36,713 to 68,703 as a direct result of an influx of refugees specifically from the DRC. It further noted that almost 70,000 people had arrived in Uganda from the DRC since the beginning of 2018 as they escape violence in the Ituri province, with the majority of refugees arriving by boat across Lake Albert.

It is uncertain what percentage of arrivals across Lake Albert was comprised of unaccompanied minors. As well, it is also not certain what proportion of Congolese found their way to one of the refugee settlements, or became integrated into settlements, particularly around Lake Albert. At the same time, it is clear (based on the growth rate for the Kyangwali Refugee Centre during the December 2017 to March 2018 period), that significantly less than half of these 7,000 DRC refugees (a maximum of 31,990) from the DRC arriving in Uganda via Lake Albert, found their way to this Refugee Centre.

In addition to migrants and refugees from other countries, Kikuube and Hoima Districts have had in-migration from other areas of Uganda of persons seeking opportunities for survival and for profit. In this regard, in an interview in June 2017, Grace Mugasa the Mayor of Hoima Municipality Council stated that there had been a soaring population influx into the area since oil had been discovered. This massive increase in population had not been foreseen or planned for, so "our resources are depleted even before the year ends,"[50]

Between 2002 and 2014, Hoima municipality has seen the second highest population growth rate for a local government unit at 10.7 per cent, after Wakiso district, according to the 2014 national population and housing census report. At least 100,126 people now live in Hoima Municipality, according to figures from the Uganda Bureau of Statistics. As a result of the increased economic activity, Mugasa said, Hoima was upgraded to municipality status[51].

[48] KFDA RAP Project 2016 – Phase 1 Resettlement Action Plan

[49] UN High Commissioner for Refugees (April, 2017) Uganda Refugee Situation Report https://reliefweb.int/report/uganda/unhcr-uganda-factsheet-march-2017

[50] Twaha, A (June 14 2017) Hoima Faces Pressures of Being an Oil-Bearing Town, accessed at http://observer.ug/business/53335-hoima-faces-pressures-of-being-an-oil-bearing-town.html

[51] Ibid

Ethnicity, Citizenship and Religion

The National Housing and Population Census done in 2002 showed Hoima and Kikuube Districts (including the areas through which the road and pipeline route pass) to have a multitude of ethnic groups, with the indigenous Banyoro and Bagungu forming the dominant tribes comprising about 77% of the people, followed by the Alur and Jonam (7%), Bakiga (4%), Lugbara and Aringa (3%) and others (9%).

The Project Social Survey, undertaken in 2013[52] showed a rich cultural diversity with patterns that differed in the Buhuka Parish, where the main tribes at that point were the Alur (44%), Bagungu (28%), Banyoro (11%) and Banyankole (5%). Most household heads were reported to be from the Alur tribe (68.9%), with (89%) of these reporting being Ugandan, with 11.5% of respondents indicating that they were Bagungu. The Banyoro, Bakonjo, Baganda, Batoro, Bakiga, and Bamba were also represented, as well as Rwandan, and other Congolese and Ugandan tribes. A total of 83% of household heads interviewed stated that they were married.

Data collection and consultation during 2013 found that there was a substantial presence of Congolese nationals within the villages (42.4% of the population in Kyakapere, 22.4 in Kyabasambu and 6.3% in Nsonga[53]. Whilst the majority of the population were from the Alur tribe, residents in the area believed that a significant (but unspecified) proportion of the Alur population in the area had originated from the DRC and had fled conflict in their country to settle in the Lake Albert area. According to informal discussions, the residents expressed the belief that such migrants/refugees were often uncomfortable about declaring their real nationality (for fear of being ostracised by the community or being repatriated by the Ugandan government)[54].

Results of the 2013 socio-economic household survey, undertaken amongst a sample of households, indicated that the most spoken and written language at that stage was Alur (refer to Figure 6-30), corresponding with the largest tribe in the area. The second most used language in the area was Swahili represented by 31%.

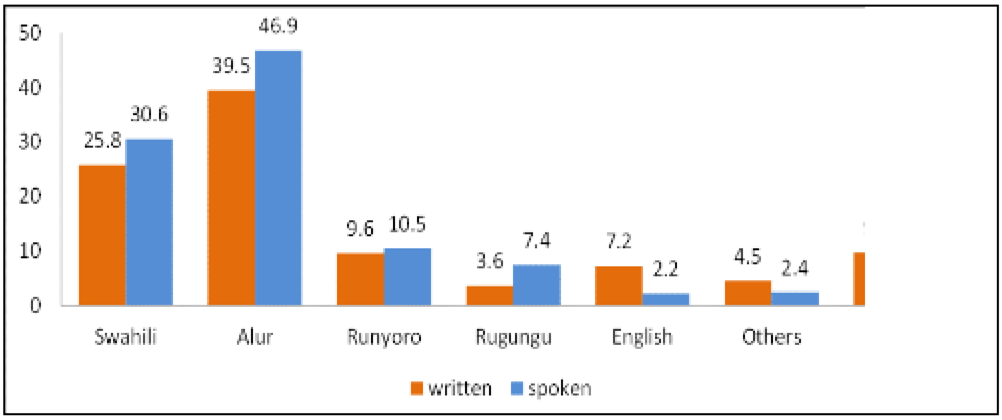

Figure 6-32: Distribution of household heads by languages spoken and written

During fieldwork undertaken in late 2017, LC I chairpersons who are responsible for village level governance, indicated that there had been a significant influx of migrants and refugees from the DRC who had taken up residence in villages along the Lake, and estimated that as many as 70% of the villagers residing in settlements along Lake Albert originate from the Democratic Republic of the Congo (DRC), with some harder to reach settlements being virtually completely made up of Congolese. Based on discussions with stakeholders, including the Nsonga Immigration Officer, [55] the in-migration of migrants and refugees from the DRC is

[52] The Kingfisher 4 SIA (2013) found that Congolese Nationals made up 42.4% of the population in Kyakapere, 22.4% in Kyabasambu and 6.3% in Nsonga

[53] Kingfisher 4 SIA (2013)

[54] Environmental and Social Impact Assessment for the CNOOC Uganda Ltd Kingfisher Project in Hoima District, Uganda (2014)

[55] Stakeholder Engagement Report (Minutes of Meeting with the Immigration Officer, Nsonga, Buhuka Parish, Uganda (2018)

facilitated by the fact that a large percentage of Congolese already have family members who live in Uganda. As well, that there are significant language similarities and that Alur, in particular is spoken in villages on the Buhuka Flats as well as within the Ituri Province of the DRC, which lies immediately adjacent to Lake Albert. The Alur tribe, which forms part of the Luo group is one of the predominant tribes in the Buhuka Flats area and has member clans that reside both in Uganda as well as in the (DRC).[56]

Although not yet very pronounced, ethnic tensions exist in the villages and the social team observed arguments about community leadership and in one case, fears of being excluded from focus group discussions. These tensions appear to be prevalent in the villages on the Buhuka Flats (Production Facility) as well as along the escarpment (Pipeline) and are reportedly increasingly driven by concerns about resource availability now and into the future, including land, as well as historic tribal tensions.

In a study undertaken by the Bunyoro Kitara Kingdom[57], reference is made to the manner in which patterns of settlement within Hoima and Kikuube, in particular along Lake Albert, are causing distortions in traditional populations. In this regard, it is stated in the Report that “Currently there is cultural dilution caused by immigrant ethnic tribes taking advantage of the oil boom. This development is upsetting social harmony due to conflict over the use of scarce resources including land. New settlements are making ever-increasing demands on the very limited public investments in the area for social amenities like schools and health facilities. This also results in tensions and calls for increased public investment into these amenities so as to cope with the growing volumes.” The Report further states that: “More important to note is that new ethnic groupings migrating into Bunyoro Kitara Kingdom are coming with large herds of domestic animals, grabbing Bunyoro lands and hiding behind rich government officials. The Omukama warns that whoever is acquiring even an inch of Bunyoro land is doing it illegally and will thus loose it at an appropriate time”[58].

Religious beliefs co-exist in the Local Study Area (LSA) including Anglican, Catholic, Moslem, Pentecostal and numerous other faiths such as Church of God, and Church on the Rock International. There are also African traditional churches, which include the Alur African Church (Lam the Kwaru), and Faith of Unity (Itambiro). According to the Hoima District Local Government (2011), Catholics were the largest religious denomination (44%) in Kikuube and Hoima District followed by Anglicans (41%), Moslems (5.1%) and Pentecostals (3.1%).

Photograph 6-21: Kyabasambu Church of Uganda in Kyabasambu Village

[56] The Africa Institute (undated) The Alur People. Accessed at https://www.africa.upenn.edu

[57] Yolamu Nsamba and other Cultural Leaders of the Bunyoro Kitara Kingdom (2012) Action Orientated Research to Strengthen Bunyoro Kitara Kingdom to Defend her Cultural Heritage from Negative Impacts of Oil and Gas Industry development in Uganda

[58] Ibid, 2012:16

6.3.2.2 Health

Disease and Illness

During the 2013 socio-economic survey undertaken for the Project, nearly 70% of the households interviewed had experienced an illness in the previous 14 days which was severe enough to require treatment. Most of these were children less than 3 years of age. Figure 6-33 below shows that diarrhoea was the most frequently reported illness, followed by dysentery and bilharzia. The former two diseases are typically related to poor water and sanitation conditions – with the survey confirming that, where households treated their water before use, the prevalence of illness was reduced significantly.

Most survey respondents (95%) were aware of the risks of HIV/AIDS, having been sensitised by Tullow and CNOOC health education efforts. Not all were as clear about the main causes of the disease with only 69.1% indicating that infection was due to unprotected sex with an infected person. Nearly 63% of the respondents said that they had lost relatives to HIV/AIDS. This is, on average, 3 persons per household. However, Fentiman et al. (2011)[59], report that Uganda is the only nation in the world that has substantially reduced its HIV infection rates, which has dropped from a high of 18% to an estimated 6.5% since 2001.

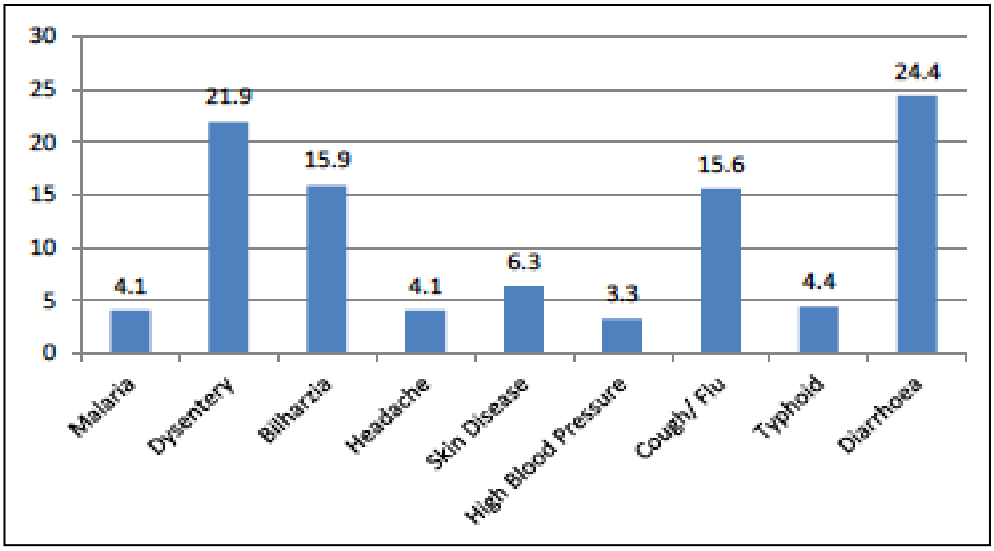

Figure 6-33: Illness Profile for the Study Area (2013 Socio-Economic Household Survey)

Malaria is a major problem for children under 5 years. Diarrhoea and cough are main problems and their incidence is higher among children aged 6-18 months. The Burden of Disease (BoD) profile appears to be maintaining more or less the same pattern over the period 2014 to 2017 across the baseline areas, with malaria, colds, skin disorders and urinary tract infections (UTI[60]s) as the most common disorders. Dysentery and typhoid fever is more pronounced in Buhuka HC III and Kyangwali HC IV catchment areas and is largely attributable to the sanitation gap and lack of access to safe water (see Figure 6-34 below). Figure 6-34 provides an overview of the Burden of Disease (BOD) in respect of the top ten reported diseases within the Project Area Sub-counties.

[59] Fentiman, A., Kamuli, E., and Afoyocan, J. (June, 2011). *Gender in East Africa: Girls against the odds. The uganda pilot study. Gender report 2*. The Centre for Commonwealth Education.

[60] UTIs are frequently associated with sexually transmitted diseases (STDs) such as chlamydia, gonorrhoea, etc.

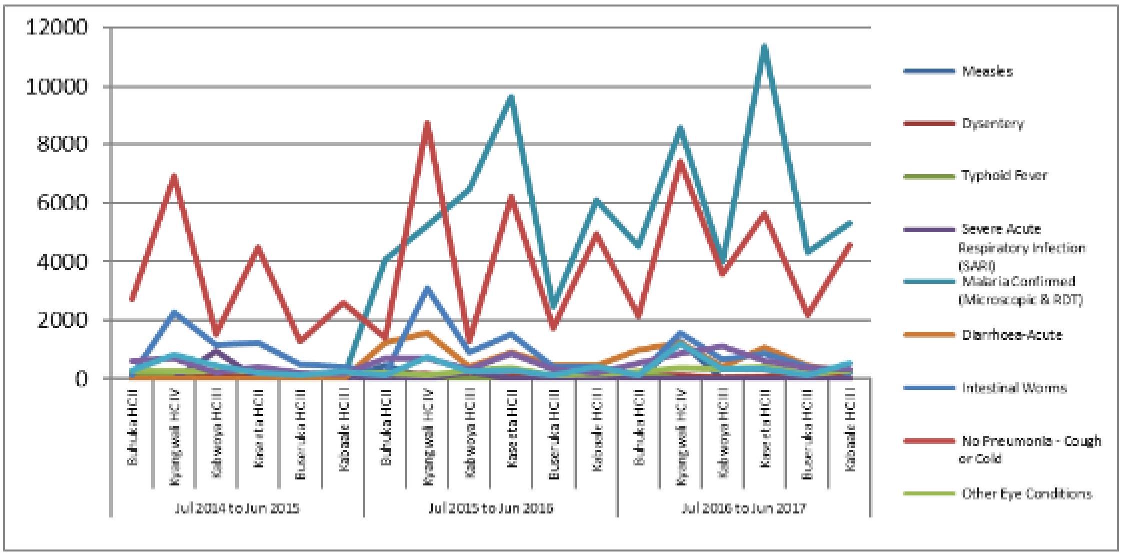

Figure 6-34: Burden of Disease (Top 10) in the Project Area Sub-counties[61]

Field reports show a declining trend in cholera cases. This is attributed to key interventions in disease surveillance, water, sanitation and hygiene, social mobilization and case management by the Ugandan Government together with partner organisations such as UNICEF, WHO, UNHCR, URCS, Action Africa Help (AAH) and MSF. A total of 36% of all cholera cases are children under five years of age. Over 76,000 people are estimated to be at risk of cholera in Kyangwali, which is known as a cholera endemic sub-county, with many hot-spot areas around the shores of Lake Albert. Social mobilization efforts are on-going in the affected areas.[62]

Nutrition and Food Security

Based on information obtained as part of the Socio-economic Household Survey undertaken for the KFDA Project during 2013, villages in Kikuube and Hoima Districts and the LSA demonstrate poor food self-sufficiency with 59% of households having experienced hunger in the previous six months. Most of these were from Kyakapere village (44%) followed by Kyabasambu at 30%. Most of the households experienced hunger during the months of January (31%), March (12%) and April (21%). Other months of food insecurity were found to be from June to September.

The Kingfisher 4 SIA (2013) suggests that this food insecurity is linked to weather conditions (wind, temperature and precipitation) and resultant thermal stratification of the lake that impact fish harvests as well as impacting seasonality of agricultural production. Bumper fish harvests/catches (March and April) are probably related to stable temperature stratification in the lake, when fish move from the cold bottom water layers to the warm shallow or near-surface waters. From June through August, the water column is more fully mixed due to wind, reducing stratification and fish movement to the near-surface. Under these conditions, catches are lower, incomes poorer and food insecurity is more prevalent.

While temperature stratification in the lake has generally, in the past, supported high fish catches between March and April, it is the start of the rainy season and first season planting usually only commences at this point. Despite the potential increase in fish catch during this period, there is usually an absence of sufficient crops for harvest and/or stored crops at household level. Households are, therefore, obliged to “buy in” foodstuffs during this period and many have insufficient cashflow to do so. Mubiru and Kristjanson (2012: iii) state that: “Food security is a major issue in Hoima – only one-third of households reported being food secure throughout the year. One-tenth of these families face food deficits for over six months per year.” They further

[61] District Health Office-Hoima District, 2017

[62] UNICEF (March, 2018). Uganda Humanitarian Situation Report. https://reliefweb.int/report/uganda/unicef-uganda-humanitarian-situation-report-march-2018. Accessed 1 May 2018.

state (2012, p.21), “the monthly source of food for the family was queried, i.e. whether it came mainly from their own farm, or elsewhere for each month (in an average year). Households were also asked during which months of the year they struggled to have enough food to feed their family, from any source. Most households get their food supplies from their own lands throughout the year. The worst months for food supplies, when more than 20% of households get their food supplies mainly from off–farm sources (e.g. purchases, gifts/transfers, food aid) are March and April. These months mark the beginning of the rains after several months of dry season. Up to 40% of households suffer food deficits in March and April in Kikuube and Hoima. 10% or more are not getting a sufficient amount of food for their families throughout the year”.

Photograph 6-22: Market at Nsonga

6.3.2.3 Education

Uganda’s formal education system comprises seven years of primary schooling, followed by four years of lower secondary and two years of higher secondary education. This pattern is followed by three years of tertiary education.

The introduction of Universal Primary Education[63] in 1997 saw a rapid increase in primary school enrolment. This has resulted in problems such as large class sizes; pressure on infrastructure and teachers as well as shortages of books and materials.

According to Fentiman et al. (2011), Uganda was the first African country to offer free secondary education. Notwithstanding this, the gap between primary and second school enrolment remains high. Estimates are that only 25% of children make the transition from primary to secondary school. In addition, there is an alternative path of vocational and technical schools after primary. The age of entrance into primary school is 6 years.

Key challenges among schoolgirls in Western Uganda include pregnancy; early marriages, peer pressure from male peers, child labour and poor menstruation management. Whilst differences between urban and rural situations exist, access and distance to schools, types of livelihoods affecting participation, ethnicity, lack of

[63] In 1948, as part of the Universal Declaration of Human Rights, Article 26 was formulated as follows: “everyone has the right to education”, and that “elementary education shall be compulsory and free”. Despite this, Uganda (in tandem with a significant proportion of the Sub-Saharan Region) has yet to attain the minimum standard envisioned by the UN 70 years down the line.

parental involvement and kinship obligations are singly, or cumulatively evident causes for poor attendance and early drop-out.[64]

The Local Governments' education system aligns with the national government system of Universal Primary Education (UPE) and Universal Secondary Education (USE). The education department is composed of seven sub-sectors including the District Education Office, Inspectorate, Sports, Special Needs Education, Primary Education, Secondary Education and Tertiary Education.

Despite the introduction of Universal Primary Education, progress in terms of educational attainment in Kikuube and Hoima Districts has been slow. It inherently shares the complexities related to the delivery of adequate educational facilities and services experienced at all levels.

The formation of the Hoima Municipality in July 2010 resulted in sharing of a number of education resources. Primary schools were reduced from 164 to 131 and the teaching staff reduced from 1,591 to 1,252. This has resulted in problems such as large class sizes; pressure on infrastructure and teachers as well as shortages of books and materials. Even though there has been a significant increase in the number of primary schools from 131 in 2012, to 212 in 2016, available infrastructure (classroom blocks, pit latrine stances, teachers' houses and desks) is still inadequate owing to high enrolment rates. Currently, the district has only 890 classrooms instead of the 2,053 required and 20 permanent teachers' houses as opposed to the 293 that are needed.

At the time of the 2014 population census, more than one in four children in Hoima and Kikuube Districts between the ages of 6 and 12 years old was not in school.[65] As may be seen from Figure 6-35 below, Hoima and Kikuube (together only with Kyangwali which has a massive refugee population) has the highest percentage distribution of children aged 6 – 12 years that are not in school in the country (between 26.5 and 33.4%[66]. This is a distressingly low level of enrolment, even by Ugandan standards, where - nationally – more than 85% of boys and girls in this age group attend school. Clearly, this speaks to particular instability and vulnerability in the development area.

As identified during the 2013 socio-economic profile survey for the CNOOC Project, in addition to low enrolment, school drop-out rates in the Buhuka Parish were reported as high and a central problem facing education. Reasons for this phenomenon are reported to be related both to inadequate infrastructure as well as social factors. The closest secondary school to Buhuka Flats is in Kyangwali village - which until the opening of the escarpment road - could only be reached by trekking up the escarpment (a journey of more than an hour for adults). This situation has improved dramatically now that the new road has been built down the escarpment, making the journey far less onerous although still time-consuming. This is given the fact that access to the school inevitably still involves a long walk for most scholars on the Flats.

[64] Fentiman et al (2011)

[65] National Population and Housing Census 2014 Area Specific Profiles –Hoima District

[66] National Population and Housing Census 2014 Area Specific Profiles – Hoima District

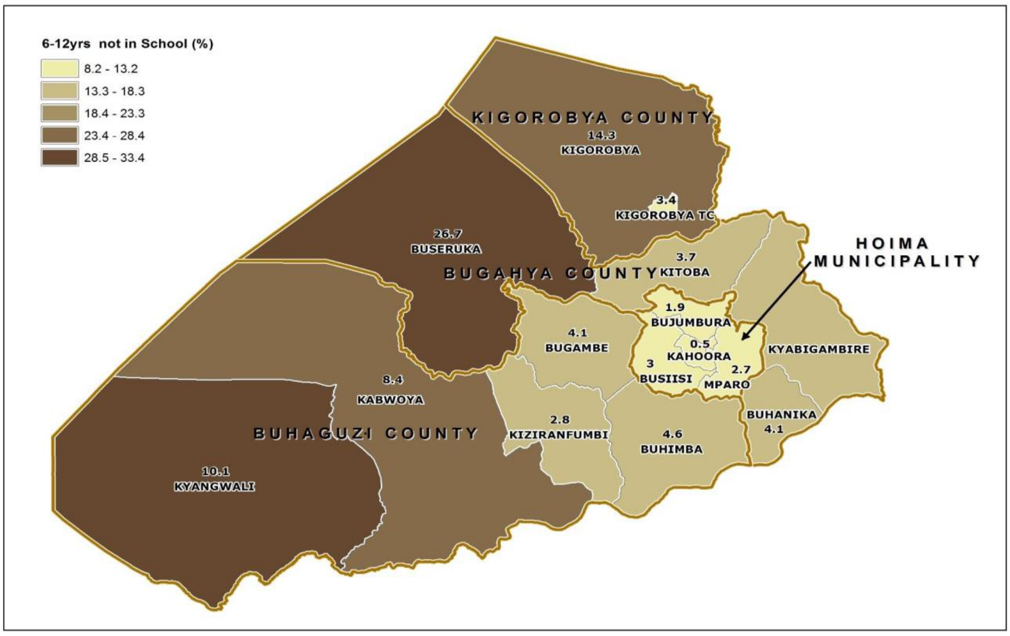

Figure 6-35: Percentage Distribution of Population Aged 6-12 Years Not in School; Hoima District, 2014[67]

Poverty forces many families to draw their children into fishing or agriculture (particularly sugarcane farming) at a young age as part of their resource base, which prevents them from going to school. In addition, fishing demands contribute to school dropout rates as parents move continuously between landing sites to follow fish availability and catch. This obliges children to move with them, even if they are not directly involved in helping with this task.

At secondary school level, there are some deficits in gender parity with boys being provided the opportunity to access secondary education opportunities to a slightly greater degree than girls. Factors that could counter the achievement of gender parity include cultural expectations that girl children must marry young and have children, resulting in early marriages and pregnancies and associated dropout from school. There is, also, in and of itself the situation where unmarried girls who fall pregnant whilst at school are forced to drop out. Other factors such as issues related to menstrual hygiene management and inadequate water and sanitation facilities have been mooted as contributing factors. Finally, the fishing trade is accompanied by a high incidence of prostitution, which suggests that the need for money exposes young- and adolescent girls to the commercial sex trade, resulting in further drop-outs from school.

At the same time, despite a generalised sense that there is less investment in secondary level schooling for girl children in Uganda, there is significant parity between girls and boys in the rate of attendance of secondary school in Hoima and Kikuube (26.3% of male versus 26% of female child attendance). Equally, as may be seen from Table 6-18 below, there is very little percentage difference (3.2%) between male and female students who drop-out prior to completion of year S4[68]. Failure to complete year senior 4 (S4) means that not even the O-level Uganda Certificate of Education (UCE) is achieved[69].

Table 6-18: Persons aged 15 and above not in school - highest level of education completed below S.4

Persons	Number	Percent

[67] Ibid

[68] National Population and Housing Census 2014 Area Specific Profiles – Hoima District

[69] Ibid

Total	176,338	84.3
Males	88,593	82.7
Females	87,745	85.9

Overall, there is an extremely limited number of learners in Hoima and Kikuube that actually achieve their A-levels (the Uganda Advanced Certificate of Education), with only 2.3% of males and .8% of females over the age of 20 in Hoima who have completed their A-levels. It is important to note that the achievement of this certificate is a pre-requisite for tertiary level education.

Although poverty is seen as a key driver of the persistently high levels of school dropout, there is a steady call on the provision of private schooling facilities as a direct result of poor performance standards at public school (Hoima District Development Plan, 2015-2020).

As identified during the 2013 socio-economic profile survey for the Kingdfisher Field Development Project Area Project, most of the surveyed household heads (56%) had at least primary education (see Figure 6-36), although a substantial minority (25%) indicated that they had no formal education. Overall 2% of the sample indicated that they were in possession of a post-secondary qualification, 1% indicated another qualification, whilst none had received a tertiary education of any kind, including university. In a breakdown at village level, Busigi fared worst, with 46.2% of household heads having no education, while Kyenyanja fared best with only 16% of household's heads reported as not having received any formal education. Only Kyakapere and Nsonga indicated the presence of household heads with tertiary level qualifications (1.3% and 3.5%, respectively). On average, the survey study found that at least 4 members per household indicated that they were able to read and write.

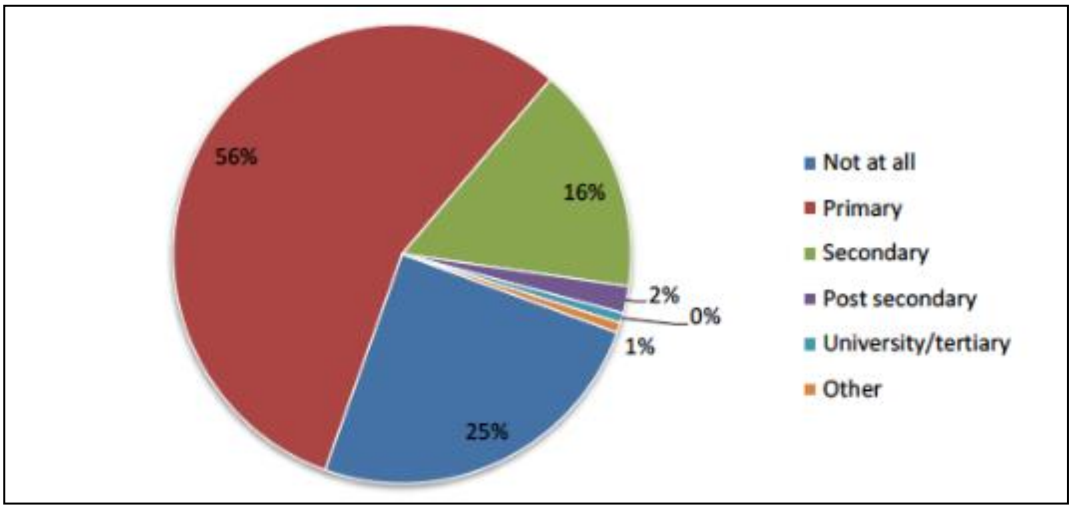

Figure 6-36: Level of education of household heads

There are obvious and well tested economic benefits, including the reduction of poverty attached to improvements in the provision of quality education. However, there are additional intrinsic spin-offs for a variety of reasons, including social benefits such as improved health outcomes, the tendency to have fewer children and greater investment in education for the next generation.

Given the long lead time from the first year of schooling to the point of entering a tertiary institution, Uganda will need to make haste in providing significant investment in the quality of education provided, as well as in the number of schools available at both primary as well as secondary level if it hopes to close the gaps in economic and human development outcomes required to achieve its development vision.

6.3.2.4 Social Infrastructure, Services and Utilities

Social infrastructure and services refer to the community facilities, services and networks such as education, health care, and community management which help individuals, families or groups and communities meet their social needs, maximise their potential for development, and enhance community well-being.

Limited social infrastructure and facilities exist in Hoima and Kikuube in general as well as the villages in the local study area. The Kingfisher 4 SIA (2013) determined that, as a rule of thumb, churches, retail shops and water sources were located within a half a kilometre of homesteads. However, primary schools were found to be located on average about 3 kilometres relative to the homesteads while secondary schools were on average 16 kilometres but varied from village to village[70].

Photograph 6-23: Sports and recreational facilities in Buhuka Parish

Photograph 6-24: Places of worship in Buhuka

Settlement Types, Housing Units and Ownership

Settlements in the LSA are characterized by semi-detached huts, built close to each other. Most huts are built mud and wattle walls. Floors are predominantly compacted earth, with only 0.8% having a cement base. Around three quarters of houses are roofed with thatching grass, the balance being corrugated iron. Around 32.9% of houses have one room while a further 31.6% have two rooms.

[70] Environmental Assessment Consult (U) Ltd, 2013

Photograph 6-25: Clustered settlement in Kyenyanja

Photograph 6-26: A grass-thatched house in Busigi constructed with mud & wattle

Household and Household Assets Ownership

Three quarters (75%) of the respondents interviewed during the Socio-economic Household Survey for the Project, undertaken in 2013, reported that they own the house they live in. Most of the remainder indicated that they lived in rented houses or rented single rooms. Among those who own their houses, 93% of respondents indicated that they own the land as well. Most households (62.2%) reported that they purchased the land although the selling sources were not disclosed. 12% of respondents said that they had acquired the land through the customary laws of land transfer. Just over 10% of respondents said that they had acquired their current pieces of land through a lease from the sub-county.

The most commonly owned asset in the area is a radio (62.4%) followed by fishing nets (52.6%), boats (51.2%), land (49%), buildings (44.5%) and a bicycle (14.8%).

Education Infrastructure

The population within the Buhuka Flats is youthful. Of the households interviewed for the 2013 project survey, respondents indicated that 34% of the surveyed population was between the ages of 18 and 35, while 25% was between the ages of 6 and 17 and therefore within the age-group normally regarded to be of school-going age. A total of 27.5% of household members was reported to be below the age of five (830 out of 3,289).

Based on results of this survey, 52.81% of children (1,737 of 3,289) were below the age of 18, as compared to 58.2% for the District. Data from the RAP Report and the associated socio-economic survey of households undertaken during October and November 2016[71], indicate that a total of 25 directly affected households were interviewed. These households had a total of 67 children of school-going age between them, comprising a total of 52.5% in line with the findings of the sample socio-economic household survey.

The high percentage of children results in a higher demand for the provision and sustainability of social services, including in respect of schools. However, out of the 830 school going age children (6-17 years) in the fishing villages, 41% have never attended school and another 31% had dropped out of school for various reasons ranging from lack of money, early pregnancies, long distances to schools and no secondary school in the area. Others have engaged in fishing business from the age of 9 years at the expense of education. Without intervention, this lack of education therefore becomes a constraint to future opportunities to employ children from the local area.

School drop-out rates in the Buhuka Parish are significantly higher as compared to the (high) rate for Kikuube and Hoima Districts and must be regarded as a fundamental problem.

The reasons are both infrastructure and socially related. The closest secondary school to Buhuka Flats is in Kyangwali village, which until recently could only be reached by trekking up the escarpment – a journey of more than an hour for adults. This situation is expected to improve now that the new road has been built down the escarpment, but it is still a long walk for most children in the Flats. In addition, fishing demands contribute to school dropouts as parents move continuously between landing sites to follow fish availability and catch, which obliges the children to move with them.

Poverty forces many families to draw their children into fishing at a young age, which prevents them from going to school. There are also cultural expectations that children must marry young and have children, resulting in early marriages and pregnancies and dropouts from school. Finally, the fishing trade is accompanied by a high incidence of prostitution, which suggests that the need for money exposes young- and adolescent girls to the commercial sex trade, resulting in further drop-outs from school.

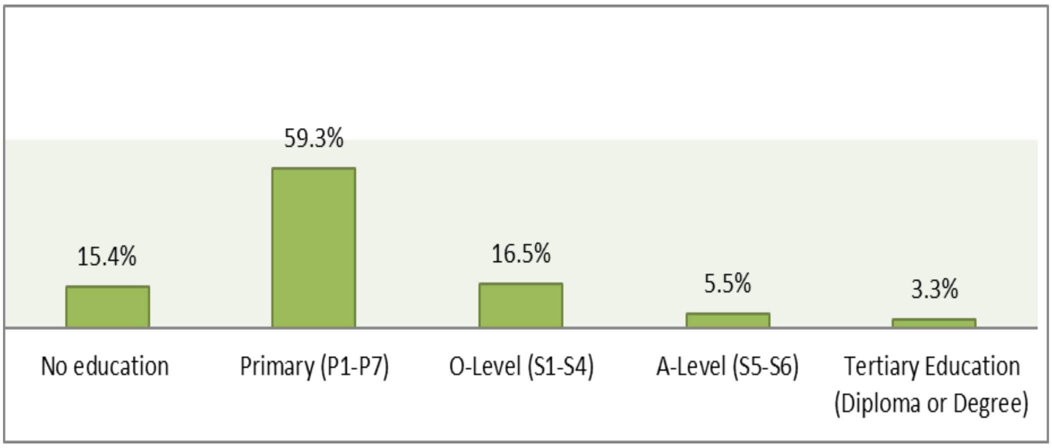

Figure 6-37: Level of Education of household members indicated in percentage

[71] Survesis/Nomad Consulting (2016) KFDA RAP Project Phase 1

The introduction of the Education (Pre-Primary, Primary and Post-Primary) Act, 2008 makes it compulsory for children of school-going age to attend primary school. Despite this, there is extremely limited infrastructure and services, with schools sometimes having as much as one teacher for a hundred pupils. Despite the large number of potential pupils to draw from, the Buhuka Parish has only one public primary school with limited class rooms and teachers and six private schools. There are no secondary schools in the Parish.

Table 6-19 below provides an overview of the current situation:

Table 6-19: Primary and Secondary Schools within Buhuka Parish[72]

VILLAGE	PRIMARY SCHOOLS		SECONDARY SCHOOLS	
	PUBLIC	PRIVATE	PUBLIC	PRIVATE
Busigi	00	00	00	00
Kacunde	00	01	00	00
Kiina	00	00	00	00
Kyabasambu	00	00	00	00
Kyakapere	00	01	00	00
Kyanyanda	00	00	00	00
Nsonga	01	02	00	00
Nsunzu	00	01	00	00
Senjojo	00	01	00	00

Health Infrastructure

Medical facilities in the LSA are limited. Numerous drug shops are located in Buhuka Parish, which support the only health centre III, located in Nsonga, which services the entire parish (see Photograph 6-27 and Photograph 6-28). The health centre has in-patient services but there are no mattresses for the beds and patients have to provide their own when admitted. Pregnant mothers suffer most because they cannot easily access the health centre for antenatal care. There are no emergency services at the facility.

[72] Primary data gathered during socio-economic survey of households in the Project (Footprint) Villages undertaken in 2017

Photograph 6-27: Buhuka Health Centre III

Photograph 6-28: A drug shop in Nsonga village

Water Systems

The villages in Buhuka Parish along Lake Albert are largely dependent on water from the lake for washing, cooking and cleaning. While some households report using Lake water for drinking, others report purchasing water from water vendors. While there is an existing piped gravity water scheme, the district water engineer has described the system as “crude, poorly constructed, intermittently dysfunctional and generally regarded as unsafe (personal communication, 2017). This system is currently being upgraded by CNOOC, including the installation of hand pumps (Photograph 6-29).

Photograph 6-29: Water sources in Buhuka Parish

The socio-economic survey of directly affected households for the Kingfisher Field development area, undertaken during October and November 2016[73], indicated that just over a third of PAPs (11 or 36.7%) used spring water for drinking, while the same number (36.7%), indicated that they drank water from a stream. There were eight (26.6%) households that obtained drinking water from the lake itself.

Clean and reliable water supply is an issue in most of the villages. Table 6-20 below summarises data gathered during the Village Level Survey as part of the SIA process undertaken during November and December 2017 with regard to the water supply for each village in the LSA. The stated water supply is in addition to access obtained directly to water from Lake Albert. As well, CNOOC had commenced fixing the broken-down gravity fed water supply system feeding hand pumps in each of the villages on the Flats. Although the current status is not known, CNOOC had undertaken to supply each village with a water supply system that would include five operational handpumps at various points in each village.

[73] Survesis/Nomad Consulting (2016) KFDA RAP Project Phase 1

Table 6-20: Water Supply by Type – Buhuka Flats Settlements

Settlement	No. of Water Protected Water Sources (Springs)	No. of Unprotected Water Sources (Springs)	No. of Boreholes	H/H connected to piped water
Busigi Village	00	00	01	00
Kacunde Village	00	00	00	00
Kiina Village	00	00	00	00
Kyabasambu Village	00	00	00	00
Kyakapere Village	00	00	00	00
Kyanyanda Village	00	00	01	00
Nsonga Village	00	00	00	00
Nsunzu Village	00	00	00	00
Senjojo Village	00	00	00	00

Sanitation and Refuse Systems

The Hoima District Health Officer confirmed that all sub-counties with settlements that have landing sites on Lake Albert have poor sanitation. Low levels of latrine facilities are in part ascribed to difficulties in building dry sanitation systems due to poor soil texture (causing collapse of structures), lack of appropriate technologies for latrine construction using local materials and massive seasonal fluctuations in numbers of people residing within these settlements. This is exacerbated by the fact that there is a belief that defecation in the Lake ensures increases in fish populations as well as the stated cultural attitude amongst (mainly Congolese) immigrants that toilets are superfluous[74].

As identified in the RAP report[75], twenty-five households (83.8%) had access to shared latrine services either in the greater neighborhood or at the household level. Of the 25 households with latrines, there were 19 (76%) that had latrines without ventilation and six (24%) that had latrines with ventilation. Of the five households that had no access to latrines, four used the bush and one used the lake.

Most homes along the lakeshore do not have kitchen infrastructure and cooking is mostly done on verandas. Some of the shower shelters are positioned adjacent to the lake and all of the wastewater is discharged into the lake. Inhabitants have been observed bathing and washing kitchen utensils in the lake.

Sixteen households (51.6%) surveyed indicated that they disposed of waste in the bush, 11 households (36.7%) had private waste pits near their homes, and four households (13.3%) burnt their waste (RAP Report).

[74] Hoima District Water Office and villagers at Lakeside settlements, Personal communication, 2017

[75] KFDA RAP Project 2016 – Phase 1 Resettlement Action Plan

Photograph 6-30: Organic and inorganic waste pollution

Photograph 6-31: Pervasive evidence of improper waste management

Energy sources

Amongst the PAPs surveyed as part of the RAP, it was reported that the major source of energy for lighting was solar (40%) although some households used batteries (33%), whilst others used paraffin (20%). There were two households that relied on the moon for lighting. Four households used paraffin as an alternative to solar when needed. Most households (80.6%) used charcoal for cooking alternating it with wood. There were six households that used wood alone for cooking. Paraffin was never used alone for cooking[76].

Transport

Until recently, residents in Buhuka Parish walked long distances to access most essential services and facilities. Until 2017, there were no public transport connections between Buhuka and the villages on top of the escarpment, such as Ngoma and Ikamiro. A footpath connected the Flats to the top of the escarpment at

[76] KFDA RAP Project 2016 – Phase 1 Resettlement Action Plan

Ikamiro, where the road began. Fifty seven percent of respondents in the LSA socio-economic survey said that they used mostly canoes or boats as their major means of transport. The remainder (43%) use the footpath up the escarpment – a one hour journey from the foothills of the escarpment to Ikamiro (CNOOC Escarpment Road ESIA Report).

The lack of road access has been a major hurdle affecting development and poverty alleviation on the Buhuka Flats. The sick are carried up the escarpment to seek medical treatment and, in most cases, those in critical condition never make it. Foodstuffs (48.9%) make up most of the materials and produce that are man hauled over the escarpment, followed by fish for sale (20.2%) and firewood.

The newly constructed road down the escarpment has changed this situation, in that it has allowed villagers from the Buhuka Flats ready acces to to facilities, including secondary schools and health facilities in areas above the escarpment,

Equally, it has allowed ready access to opportunity seekers, including traders and migrants into the area. Although the Buhuka Parish is rural by nature of its setting, it has developed a distinctly non-rural nature with strong commercial activity along the main village roads. Daily markets are run on an alternating basis from Nsonga and Nsunzu that can draw upwards of 500 people at a time. Apart from Kyabasambu, villages such as Nsonga and Kyakapere have a proliferation of bars, gambling and gaming institutions and a flourishing trade in sex workers.

Figure 6-38: Primary means of transport in Buhuka Parish

6.3.2.5 Social Order, Security and Crime

On a national level, the top ten leading crimes reported in 2014 were (i) Defilement, (ii) Common Assaults, (iii) Threatening Violence, (vi) Obtaining by False Pretence, (v) Theft of Cash, (vi) Criminal Trespass, (vii) Theft of Mobile Phones, (viii) Burglaries, (ix) Child Neglect and (x) Malicious Damage to property.

Of the above, all of the following crimes showed an increase in occurrence from previous years:

(i) Defilement (the most common), (ii) Common Assaults, (iii) Theft of Cash, (iv) Criminal Trespass, (v) Child Neglect and (vi) Malicious Damage to Property registered an increase in the number of cases reported and investigated.

Sexual contact outside marriage with girls less than 18 years of age, regardless of consent or age of the perpetrator is considered "defilement" under the law and carries a maximum sentence of death; however, such cases often are settled by a payment to the girl's parents. Perpetrators of sexual abuse often were family members, neighbours, or teachers.

Marriage of young girls by parental arrangement is common, particularly in rural areas, although the legal age for marriage is 18. Hoima and Kikuube are among the top 10 districts in Uganda in terms of the frequency of early marriages.

Child abuse remains a serious problem, particularly rape and sexual abuse of girls. According to the police annual crime report, defilement remains the most common crime. For cases committed against children, the district local government works with UNICEF and NGOs including the African Network for the Prevention and Protection against Child Abuse and Neglect to combat child abuse in the district. There are isolated reports of corporal punishment in schools since the 2006 ban on the practice.

There are limited data related to crime, security and social order for Kikuube and Hoima Districts, including in respect of data gathered by the National Police. Although there is a Police Division in Hoima, no specific crime data could be sourced due to an absence of available statistics.

The Annual Police Crime Report (2014)[77] Uganda Police (2014) Annual Crime Report makes mention of Hoima in terms of its contribution to aggravated robbery of cash (11 out of 221 cases) but is otherwise silent on the specific incidence and type of crimes within the District.

It does, however, provide an overview of areas of concern for the Albertine region for the 2014 period as follows, inter alia:

- Murders;
- Theft of police guns;
- Highway robberies (specified as in the Kiryandongo District);
- Targeted crimes against Boda Bodas;
- Piracy by DRC soldiers (specifically on Lake Edward as opposed to Lake Albert);
- Tribal conflicts (in particular between Alur cultivators and Balaalo cattle keepers);
- Uncontrolled movement of refugees;
- “Many Congolese on landing sites along Lake Albert”; and
- Threats of Allied Democratic Forces[78] (ADF) attacks from the DRC and their suspected movements within the Region (particularly Kabaale District).

Grace Mugasa, the Mayor of Hoima Municipality Council stated that there had been a rise in crime rates in the District since the discovery of oil. According to reports she had received, the majority of crime incidents were related to drug abuse, theft and prostitution. She believed that a significant cause of this increase in crime stemmed from the upsurge of people into the area seeking opportunities and resorting to crime to survive. “These days, we normally see many prostitutes in town, which was not the case before.”[79]

6.3.2.6 Economic Activities

General Economic Activity

According to the Hoima District Development Plan[80], 2015-2020, the percentage of people in Hoima and Kikuube districts who are economically active is estimated at 60%. Small scale agriculture is the main source of livelihood for about 90% of the population, both in terms of basic nutritional needs, income generating activities and social organization. It is the most important sector in the district economy as it provides employment for over 85% of its labour force and it accounts for about 71% of the district GDP.

[77] Uganda Police (2014) Annual Crime Report

[78] The Allied Democratic Forces is a rebel group in Uganda and the Democratic Republic of the Congo

[79] Twaha, A (June 14 2017) Hoima Faces Pressures of Being an Oil-Bearing Town, accessed at http://observer.ug/business/53335-hoima-faces-pressures-of-being-an-oil-bearing-town.html

[80] Hoima District Development Plan, 2015-2020

Production systems appear to be zoned; with fishing and animal rearing more pronounced in the Buhuka Flats in the project area, while crop farming is common along the pipeline route where common crops include bananas (for food), bananas (for beer), sweet potatoes, Irish potatoes, cotton, soya beans, groundnuts, pigeon peas, beans, sorghum, maize. Traditional cash crops grown include coffee, cotton, tea and tobacco. Other crops have increasingly turned into non-traditional cash crops. Most agricultural production is carried out on small landholdings.

Subsistence farming and small-scale commercial farming serve as main economic activities in Kikuube and Hoima Districts. Crops are mostly used for household consumption or sale in community markets. Production is carried out on small farm holdings less than 1 acre in size. The most common crops include bananas (for food), bananas (for beer), cassava, sweet potatoes, Irish potatoes, cotton, soybeans, groundnuts, pigeon peas, beans, sorghum and maize. Tobacco farming is common in the Kabarole District, whilst commercial tea plantations exist in Kabarole. Tree plantations (pine wood, eucalyptus) are becoming increasingly popular in Kabarole and Hoima Districts (Uganda Electricity Transmission Company Limited (UETCL[81])).

Kikuube and Hoima Districts also have abundant open water resources making fishing a major economic activity. Most fishing is done on Lake Albert, which covers about 2,268.6 km2 (38%) of the district. Fishing has greatly influenced social and economic development in the sub-counties of Kigorobya, Buseruka, Kabwoya, and Kyangwali. There are 22 fish landing sites, which act as major outlets to the local markets. Lake Albert has the most diverse fish fauna species including Tilapia, Nile Perch, Ngaa, Ngassa, Lanya and Male (Uganda Electricity Transmission Company Limited (UETCL)).

Agriculture and Animal Husbandry

According to the World Development Report on Agriculture for Development published in 2008, agriculture is critical if countries are to achieve their poverty targets and objectives. Some strands of research suggest that Hoima District is predominantly agricultural (See Mubiru and Kristjanson, 2012) and 100% of the people in the district depend on agriculture with crop production as a major economic activity, followed by poultry and livestock.

The Uganda Investment Authority/UNDP (2017) confirms that, in Kikuube and Hoima Districts, the main economic activity is agriculture and that the major tradeable is Cassava, Maize, Sweet Potatoes and Rice. Agriculture engages about 63% of the working population and a large percentage of the refugees (90%) are engaged in economic activities. Agriculture is the main activity undertaken to generate income. Other activities include retail business; trade and casual work. At the national level, agriculture is Uganda’s economic mainstay.

While the contribution of agriculture to total GDP has been declining over the years, the sector has continued to dominate the country’s economy. Agriculture contributed approximately 22.9% of the total gross domestic product in 2011 at current prices (UBOS, 2012).

A number of households in the sub-county are engaged in rearing animals at subsistence level. Recently, there was an influx of cattle keepers from as far as Tanzania and Kasese areas, leading to a tremendous increase of cattle in the area up to Buhuka parish in the flats. In Buhuka, the cattle keepers were attracted mainly by the abundance of water from the Lake and open grasslands that are conducive for grazing animals (Kyangwali Sub-County Development Plan, 2011-2015).

Difficulties affecting farmers are unpredictable weather changes, vermin attacks, crop diseases, poor farming methods/techniques, environmental degradation/deforestation, poor infrastructure, poor health of household members, shortage of markets to sell produce at and a lack of water for livestock. Strategies put forward by sub-county administration to solve these problems include subsidizing farm inputs, the introduction of modern

[81] The UECTL data was gathered for the 2018 ESIA for the Proposed Hoima-Mputa Fort Portal-Nkenda 132 kV Power Transmission Line and Associated Substation and is the most recent trustworthy data that could be made available. Unfortunately, no definitive alternative data could be obtained, including from the Hoima District Production Department.

farming methods, training farmers in post-harvest techniques, the construction of dams, encouraging fish farming, sensitizing farmers about land degradation and the upgrading of local roads.

Fishing

Lake Albert contributes the second biggest proportion of fish catch in Uganda at 39%, after Lake Victoria which contributes 42% of the fish catch (UBOS, 2012). Kikuube and Hoima Districts have numerous fishing villages located along the shoreline of Lake Albert, which have high population densities. Inhabitants of these villages directly depend on subsistence fishing as a source of food, livelihoods and a cash income (ibid). Common fishing gear that has been observed includes gillnets, seine nets, and hooks.

The fisheries sub sector comprises of both fish farming and fishing on Lake Albert. Drying and salting of fish along the lakeshore is undertaken before selling the fish at markets in Hoima and Kikuube. Most of the catch is channelled through neighbouring districts or into the DRC and the north, which have easy access routes by boat. The fish caught in the district is spread over the 68 landing sites in the district, with the landing sites distributed quite evenly along the shoreline.[82]

The fishing sector is being threatened by declining catches mainly due to the use of destructive fishing methods such as gillnets with small diameter holes, illegal fishing gear and fishing in breeding areas, non-compliance with regulations and inadequate control of catches.

Employment, Income and Poverty Analysis

Secondary and key informant data indicate that over 90% of the Hoima and Kikuube districts population reside in rural areas. The vast majority are comprehensively dependent on a rain-fed subsistence agricultural resource base and/or a natural resource base (for fishing, grazing, food and wood fuel inter alia).

Agricultural productivity in the district is low. The subsistence-based pattern of agricultural practices is reflected in very low incomes in Hoima and Kikuube Districts, with the annual average income per capita estimated to be USD 554,[83] which is just above half of the NDP II aspiration of achieving a per capita income of USD 1,039 by the year 2020. About 24% of the rural population in Hoima and Kikuube districts is estimated to live below the poverty line. Majority of the people (over 70%) are subsistence farmers who live marginally. Dwindling fish catch at the lake shores have made the situation worse within the Buhuka Flats.

The fact that, apart from fishing, crop and animal farming are key source of income is also reflected in the data from the Phase 1 and Phase 2 KFDA Resettlement Action Plans and confirmed by the UNA-RAP Report for the Kaseeta-Kyarusesa-Hohwa-Nyairongo road project as set out in the Table 6-21 below.

Table 6-21: Household Sources of Income and monthly income

SN	Type of Activity	Hohwa-Butoole	Kabaale-Kiziranfumbi	Kaseeta – Rwera	Total
1	Subsistence crop farming (crop/ animal, poultry)	78%(248)	88%(149)	87%(107)	82%(504)
2	Self-employment	42%(135)	42%(72)	41%(50)	42%(257)
3	Rental, interest, dividend income land/property income)	12%(38)	18%(31)	14%(17)	14%(86)
4	Salary employment	6%(19)	6%(10)	3%(4)	5%(33)
5	Large scale farming (10acres)	5% (17)	1%(2)	4%(5)	4%(24)

[82] Environmental Assessment Consult (U) Ltd, 2013)

[83] Hoima District Development Plan, 2016-2020

SN	Type of Activity	Hohwa-Butoole	Kabaale-Kiziranfumbi	Kaseeta – Rwera	Total
6	Wage-based activities/causal labouring	6%(18)	3%(5)	2%(3)	4%(26)
7	Fish farming	0.3% (1)	2%(3)	2%(2)	1%(6)
8	Public transfer/pension	0.6%(2)	0	1%(1)	1%(3)
9	Charity/alms	0.3%(1)	0	1%(1)	0.3%(2)
10	Private remittance/transfer (own children)	0	0	0	0

From the above data, it is clear that the vast majority of people across the broad study area note that they are self-employed and/or involved in subsistence agriculture. On average, only 5% of the population is in salaried employment.

The insecure and subsistence nature of the type of self-employment as found in Hoima and Kikuube, which largely relies on seasonality and uncontrollable variables related to the natural environment (dry-land agriculture, livestock farming and fishing). In addition, there are inherent seasonal vulnerabilities attached thereto which creates an uncertain income generation environment.

The tenuous nature of employment in the Buhuka study area is coupled with the fact that, apart from the Bujumbura and Kamoora divisions of the Hoima Municipality, the Bugahya County has the highest percentage of youth who are aged between the ages of 18 and 30 who are neither at school, nor employed. Unemployment, poverty, limited social infrastructure and food insecurity all create a particularly unstable environment within the study area. Both Kyangwali and Kabwoya sub-counties show a far greater degree of stability with both showing between 4.3% and 7.3% of 18 to 30-year olds who are neither in school nor working.

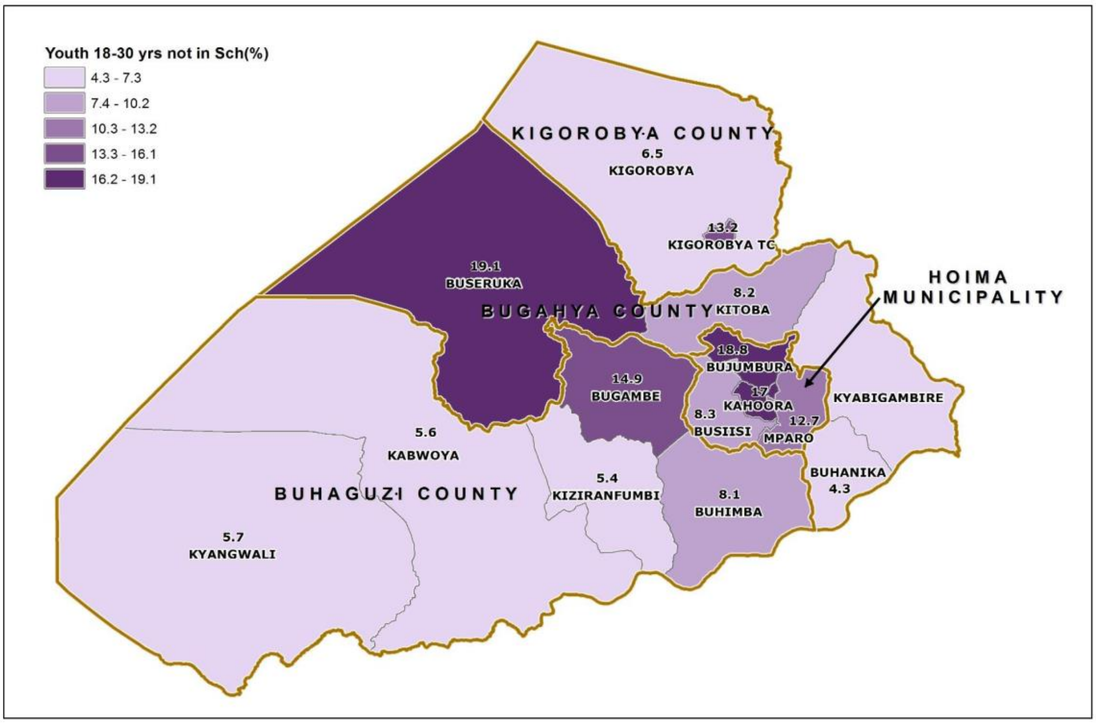

Figure 6-39: Population aged 18-30 years, not in school and not working – Hoima and Kikuube Districts

There are several drivers of poverty and, by its nature, poverty in Hoima and Kikuube is a complex multidimensional phenomenon influenced by climatic, cultural, gender, historical, social, political, economic, physical, age, communication and educational factors.[84] Some of these drivers are discussed below.

Adult literacy rate is 71% and female-headed households represent 26% of the total. The multidimensionality of poverty implies that non-literate people become hard to reach; they get isolated from rapid information and development communication advances and become marginalized along the way. Female headed households are therefore more likely to be poor. On the shores of Lake Albert, there are 1.5 men for every woman. Child bearing begins very early; by age 17, 43% of all girls have either given birth or are pregnant with their first child and over 70% have given birth by age 19. Only 15% of married women use contraceptive methods, up from 5% in 1989, and there is a large unmet demand for family planning services. (FAO, Field Gender Diagnostic Study, 2003).

Women head 29% of total households. Although 83% of male headed households are currently married and living with spouse, 54% of the female-headed households are without spouses. The percentage of female headed households is higher in urban (33%) than in rural areas (26%). In addition to women headed households. 1% of households are headed by children under 18, due to various factors mostly by AIDS. Girls head 80% of child headed households. About 24% of women in Hoima and Kikuube are employed, 26% are either poor, young to go to school or disabled or too old to work, 21% are still in school or 29% classify themselves as housewives. Nevertheless, women constitute 47% of the active labour force including wage employment, self-employed and unpaid family workers. The majority (77%) of workingwomen are unpaid family workers (District Development Plan, Hoima District 2016-2020). Although 78% of the women control the family food stocks and determine the day-to-day outflow of food from storage, decisions to market are usually made by men (70%) or jointly by husband and wife (15%). Under customary tenure, men inherit the land and women gain access to land through marriage. The patterns of inheritance that result tend to exclude women from the customary tenure sector. While 97% of women have access to land in farming area;

[84] Hoima District Development Plan, 2016-2020

and 30% control proceeds, only 8% have leasehold and 7% have land title (District Development Plan, Hoima District 2016-2020).

Poverty, Local Vulnerability and Insecurity

Based on the UN MPI, it is clear that the broader study area within the Hoima and Kikuube Districts(Kabwoya, Kyangwali and Buseruka sub-counties) shows a population that reflects deficits and intense and entrenched poverty on an extended multi-dimensional basis. This includes in respect of:

1) Income, material well-being and poverty rate.
2) Formalised employment and GDP.
3) Environmental degradation and lack of a sustainable natural resource base.
4) Education, including net enrolment in primary school, years of schooling attained and number of children who drop out prior to completion of secondary schooling.
5) Standard of Living, including in respect of cooking fuel, water, sanitation, electricity, flooring type and household asset base).
6) Gender equity and parity, including in respect of female participation in household decision-making.
7) Health, including in respect of communicable diseases, nutrition, child mortality.
8) Social infrastructure and services, including schools and health services.
9) Social safety networks and access to welfare and social support services.
10) Social cohesion, including intergroup and cultural cohesion.
11) Security, specifically in respect of rule of law, number of refugees and internally-displaced persons.

"Vulnerability can be assessed at personal and household level. At personal level, vulnerability is a state of being in which a person is likely to be in a risky situation, suffering significant physical, emotional, or mental harm that may result in his/her human rights not being fulfilled"[85]

The vulnerability parameters identified from key informant interviews, secondary sources (including the 2014 national census) and community engagements indicate that the following social groups are highly vulnerable; youth, refuges and minority migrants, persons with disabilities (PWDs); unemployed; the chronically ill; female household head; child-headed families; and the elderly/advanced age. At the same time, it is vitally important to note that the population within the study area, particularly in the Buseruka and Kyangwali sub-counties demonstrate high levels of living within multi-dimensional poverty situations, exacerbating high levels of vulnerability and low levels of resilience and ability to recover from stress situations, including climate change related shocks and insecurities.

During the community meetings as part of the field work for this Project, women reported that not only were they denied the right to own land, but also were not in a position to make decisions on matters concerning land transactions and ownership. From a cultural perspective, male children are favoured above female children, and there is a spending bias in favour of boy children (e.g. payment for school fees). This partly explains why the rate of school dropout among girls is high as compared to that for boys, although it is interesting that there is a higher rate of enrolment for girls than for boys at primary school level. However, at secondary school level the reverse is true.

Although not confirmed, this may well be related to specific roles that male and female children fulfil within the household where male children usually assist with cattle herding, fishing and agricultural activities, whereas girl children (especially when they are somewhat older) have a specific role to fulfil in maintaining the

[85] UBOS (2017) National Population and Housing Census 2014 Area Specific Profiles –Hoima District

household. Additional factors cited as responsible for the higher dropout rate of girls in terms of secondary school are said to be related to failure by parents to provide support in respect of school fees and/or s well to provide in their basic needs such as sanitary pads. This situation is exacerbated by factors such as poverty, poor care-giving (in terms of follow-up and supervision), early pregnancies, early marriages and the need to assist parents in their daily tasks. Secondary data also shows that household division of labour generally indicates a highly skewed assignment profile, with most of the domestic responsibilities being shouldered by women and children. At the same time, it is noted that the dropout rate across both sexes at secondary level is high.

Strategic decision-making traditionally favours males, including in respect of the sale of produce, the use of financial resources, and the use and ownership of strategic assets such as land (which may be regarded as the most important strategic asset to hold) and livestock. The ability to hold strategic assets is significantly restricted amongst women, including for female headed households[86]. In the project area, especially along the pipeline alignment, land is majorly owned and transferred through the male line. In the pastoral economy, which is the second predominant household economy after fishing in the Buhuka flats, cattle is owned and strategically managed by the males.

The gender issues identified from the district development plans for Hoima and Kikuube include unequal distribution and access to resources, low educational attainment, low employment and business opportunities for women and youth, low participation of women and youth in civic matters, low participation of women in family decision-making, and poor access to strategic resources and health services by women, the elderly, PWDs and youths.

Of critical concern from a girl-child perspective is the fact that the Buseruka and Kabwoya sub-counties and, to a lesser extent the Kyangwali Sub-county, have the highest percentage of marriages for children between the ages of 10 and 19 in Uganda (26.5% - 33.4%), the vast majority of whom are girl children. That means that one in three children in the greater study area is married before the age of 19[87]!. Hoima and Kikuube Districtsever married (see Figure 6-40 below).

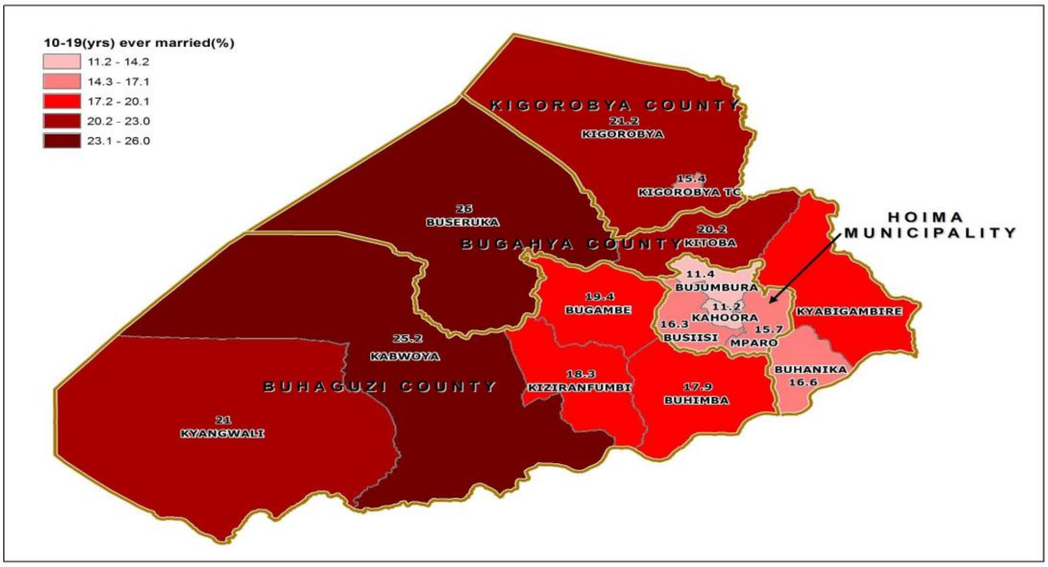

Figure 6-40: Percentage Distribution of Population aged 10-19 Years, Ever Married; Hoima District, 2014

86 Hoima District Development Plan, 2015-2020; and the UNRA (2017)-RAP Report for the Kaseeta-Hohwa-Nyairongo Road Project.

87 National Population and Housing Census 2014 Area Specific Profiles – Hoima District

Child-headed households as well as orphans are more likely to suffer abuse and neglect, the inherent marginalisation suffered by people with disabilities is exacerbated by discrimination and further marginalisation. Low literacy and formalised skills levels create a vicious cycle of low income and associated high levels of poverty which is difficult if not impossible to escape without reverting to mechanisms such as prostitution, crime and early marriage.

These vulnerable groups are likely to face disproportionate exposure to negative project impacts if mitigation measures and community development interventions don't include enhancing the adaptive capacity of such social groups.

Other vulnerabilities mentioned by the PAP households, but with a wider community application, were: nature-derived vulnerabilities associated largely with climatic change impacts such as unpredictable weather, prolonged drought and water source failure and failing crop yields and fish catches; social risks such as land conflicts around the project area; and life cycle risks related to old age and incapacitation.

The attainment of critical goals of the NDP II are fundamentally premised on ensuring Gender Equality, the Empowerment of Women and the achievement of Social Inclusion, including for the aged and the disabled. For this reason, the Social Development Sector Plan (2015/16- 2019/20) in support of the NDP II focuses on the following thematic areas, viz: (i) the promotion of Human Rights, (ii) Gender Equality and Women's Empowerment in the development process, (iii) Labour and Productivity, (iv) social protection and (v) community development..

6.3.2.7 Land Use and Tenure

Communities in Buhuka Parish occupy the public land with sole possession of usufruct rights especially settlement, fish processing, recreation, and cattle grazing (Figure 6-41).

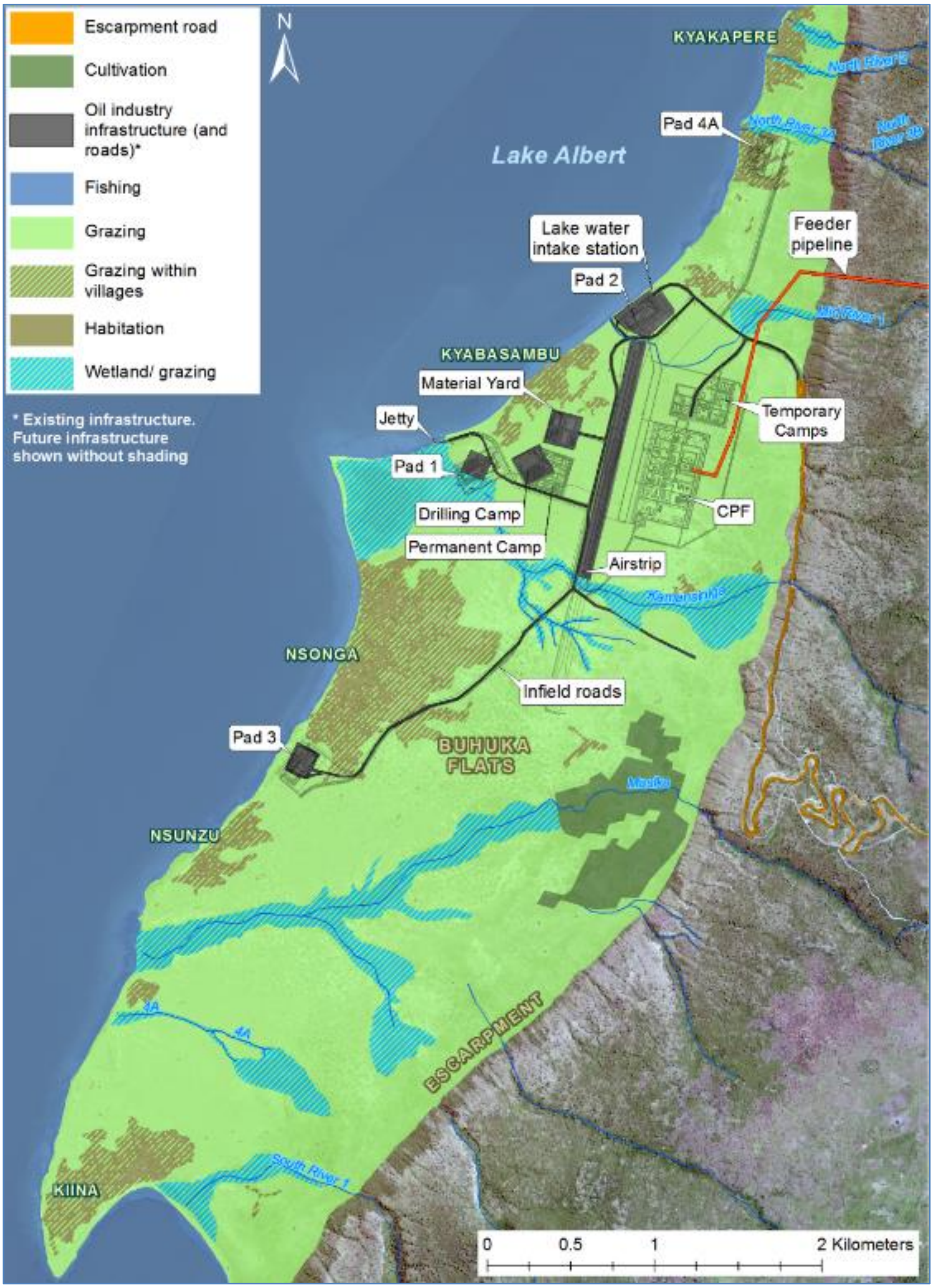

Figure 6-41: Land use on the Buhuka Flats and escarpment

The 1998 Land Act recognises four major types of tenure: customary, freehold, leasehold and mailo.[88] Two predominant land tenure systems found in the project area; In Buhuka flats, communal land ownership is the main and predominant customary tenure; while along the pipeline clan and individual owned customary tenure is more pronounced. Engagement with the LCs and community members within the flats indicate that Buhuka parish was originally a game reserve with few unlicensed landing sites. Former village chairpersons and other local leaders applied to Central Government through local authorities and Uganda Wildlife Authority (UWA) for recognition and degazzetment. This request was then passed to parliament and the area was degazetted in 2001. Following the degazzetment, some of the community members opted for individual ownership, while most of the other community members opted for a communal arrangement. Following a series of judicial engagements, the Buhuka Communal Land Association (BCLA) was formally approved by the Ministry of Lands, Housing and Urban Development (MLHUD) as comprising of the five villages of Nsonga, Kyabasambu, Kyakapere, Nsunzu and Kiina. Other neighbouring villages are not part of BCLA at the moment.

While communal land use around Buhuka flats (Nsonga, Kyabasambu, Kyakapere, Nsunzu and Kiina villages) is long standing practice, institutionalised communal management is relatively recent and is not very clear to some of the community members. Registered as the land owner, the Buhuka Communal Land Association is the de-facto representative of the project-land affected community; a mandate held in respect by the client and other stakeholders but also with some contestations by some of the community members.

Land use along the pipeline project area indicates that over 80% of the land is used for agriculture, characterised mostly as subsistence production with limited livestock and commercial farming. The major economic activities observed around towns/rural growth centres within the Hoima District are small-scale business activities and services. Land use at the Buhuka flats essentially comprises of livestock grazing, residential, social services and public use.

In Hoima and Kikuube Districts, forest conservation and wildlife conservation in protected areas occupies 20.9% of the total land area, which limits land availability for agriculture and other activities. The lack of a uniform land tenure system negatively affects land management, with land speculation having been exacerbated by the discovery of oil.

6.3.2.8 Ranking of Community Needs

Respondents were asked to prioritise their main needs for community development (Table 6-22). Overall, 21.5% of the respondents ranked roads as the main community development priority for Buhuka parish. Schools were the second priority, followed by a health centre and piped water. Only a small percentage thought sanitation issues were important (private toilets, garbage refuse collection, public laundry). These results are consistent with focus group discussion results from other studies undertaken in the area

Table 6-22: Priority ranking for community needs

Priority Needs	Frequency	Percent	Rankings
Roads	359	21.5	1
Schools	347	20.8	2
Health centre/clinic/hospital	318	19.0	3
Piped water	257	15.4	4
Electricity	172	10.3	
Telephones	62	3.7	
Public toilets	42	2.5	
Modern central market	35	2.1	

[88]Although the Land Act mentions four major tenure systems in the country, it, by implication, also recognises the legal status of *customary tenants* and *licensees/ sharecroppers.*

Priority Needs	Frequency	Percent	Rankings
Private toilets	33	2.0	
Others	27	1.6	
Garbage/refuse collectors	9	0.5	
Public bathrooms	7	0.4	
Recreation/sports centre	3	0.2	
Public laundry facility	1	0.1	
Total	**1672**	**100.0**	

6.3.3 Local Study Area – The Feeder Pipeline

The pipeline Local Study Area (LSA) included 23 villages within about 46 km of the proposed pipeline route. Focus group meetings were held in each village and an assessment of land use was undertaken based on satellite imagery and ground-truthing.

6.3.3.1 Village Establishment

According to inhabitants, most of the villages in the LSA were established between 1920 and 1990 (with the majority between 1970 and 1985, see Figure 6-42.

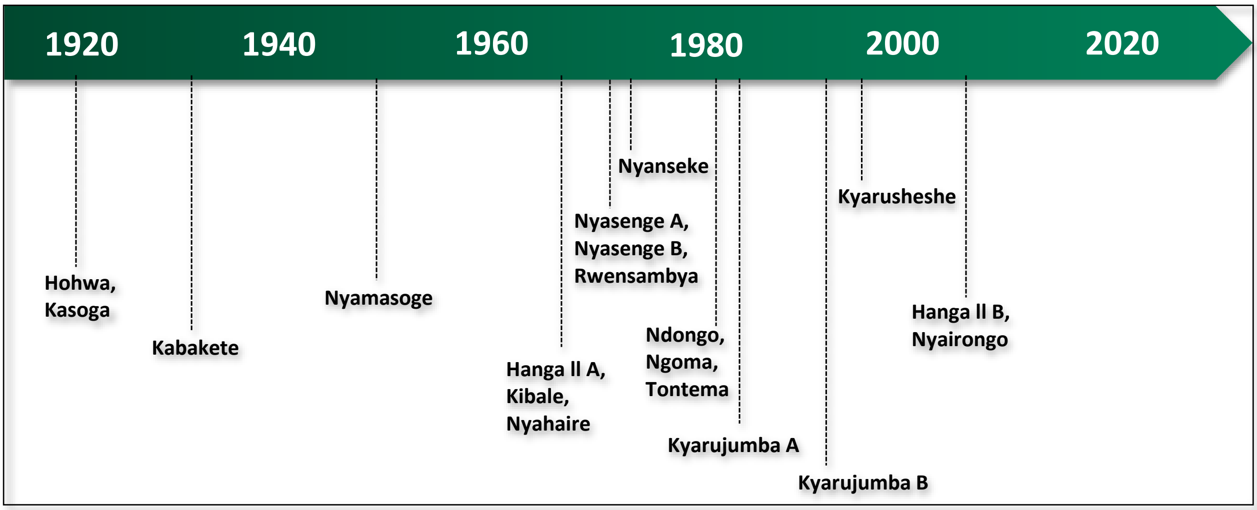

Figure 6-42: Age of villages along the pipeline LSA

6.3.3.2 Governance

All village governance is based on the same structure. The LCL council governs at a village level, elders hold a level of authority as well, and generally households are headed by males, who hold most of the decision-making power.

6.3.3.3 Demography

As may be seen from the tables and figures below, the villages in the various Parishes along the pipeline LSA vary greatly in size. As is the case on the Buhuka flats, the population of the LSA has grown exponentially and by far exceeds estimates, often more than double[89]. For example, the surveyed Kyenjojo population was 10,000 compared to the estimate (Ibid.) of 1,819[90].

[89] Village level survey for the project (2017)

[90] Hoima Development Plan (2016) Planning Unit, Hoima District

There are some exceptions where these estimates are:

- higher than the actual count. For example, in the Butoole Parish, the 2017 estimate for Kyarujumba was 1,633, whereas the surveyed figure was 1,000; and
- almost on par with the household survey data, e.g. the 2017 estimate for Kataaba was 1,662 compared to 1,700 (survey).

Butoole Parish

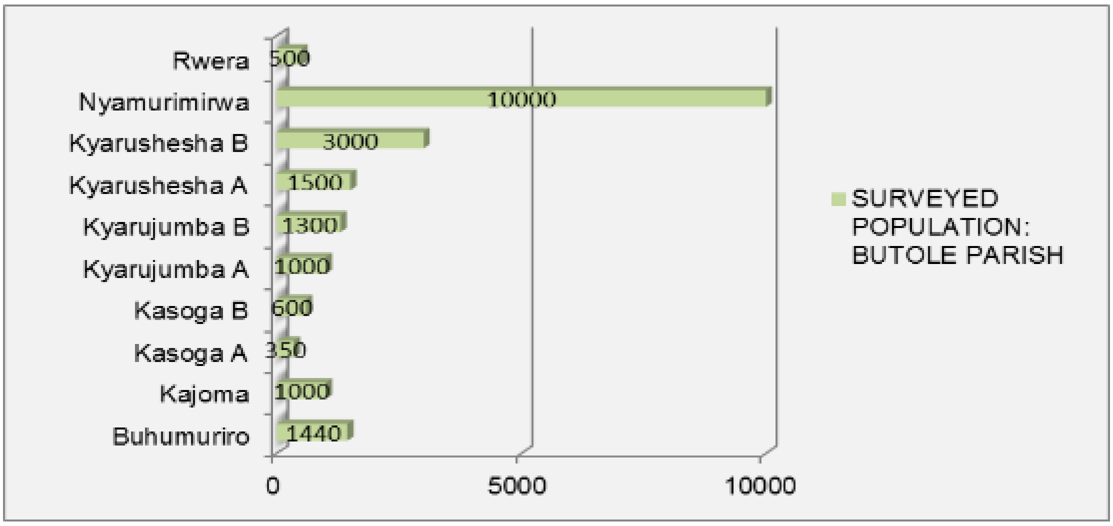

Figure 6-43: Butoole Parish Villages[91]

[91] Village level survey for the project (2017)

Kabaale Parish

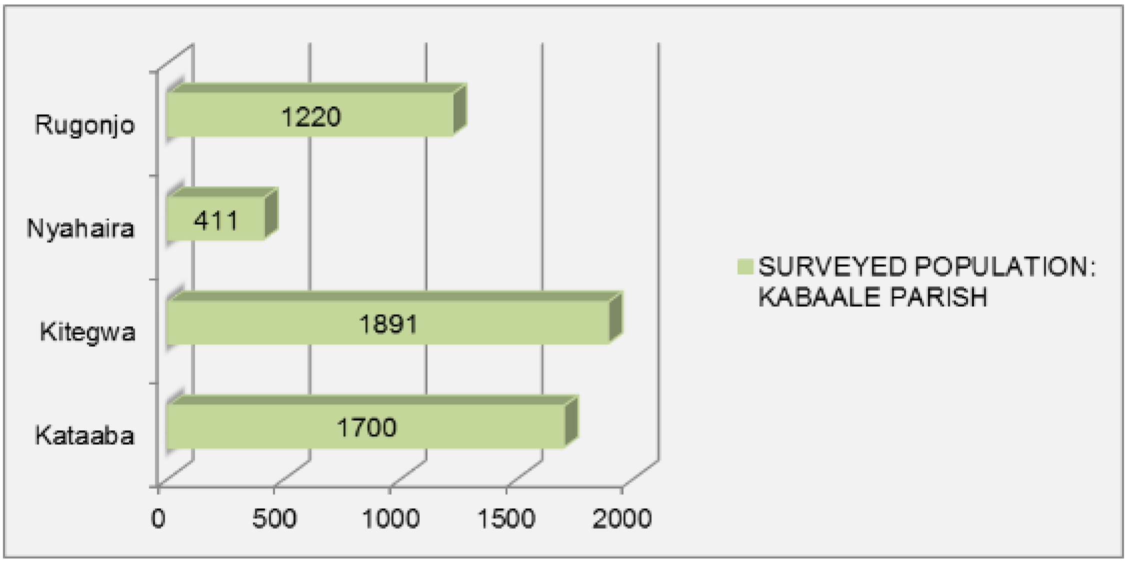

Figure 6-44: Kabaale Parish Villages92

Kaseeta Parish

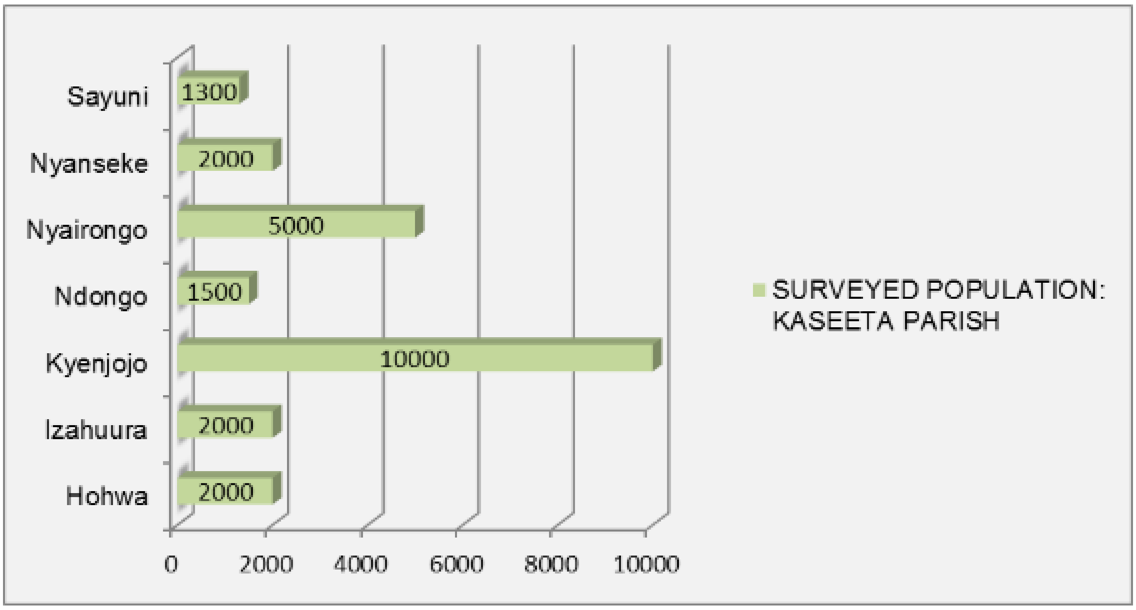

Figure 6-45: Kaseeta Parish Villages (surveyed)

[92] Ibid

Kyangwali Parish

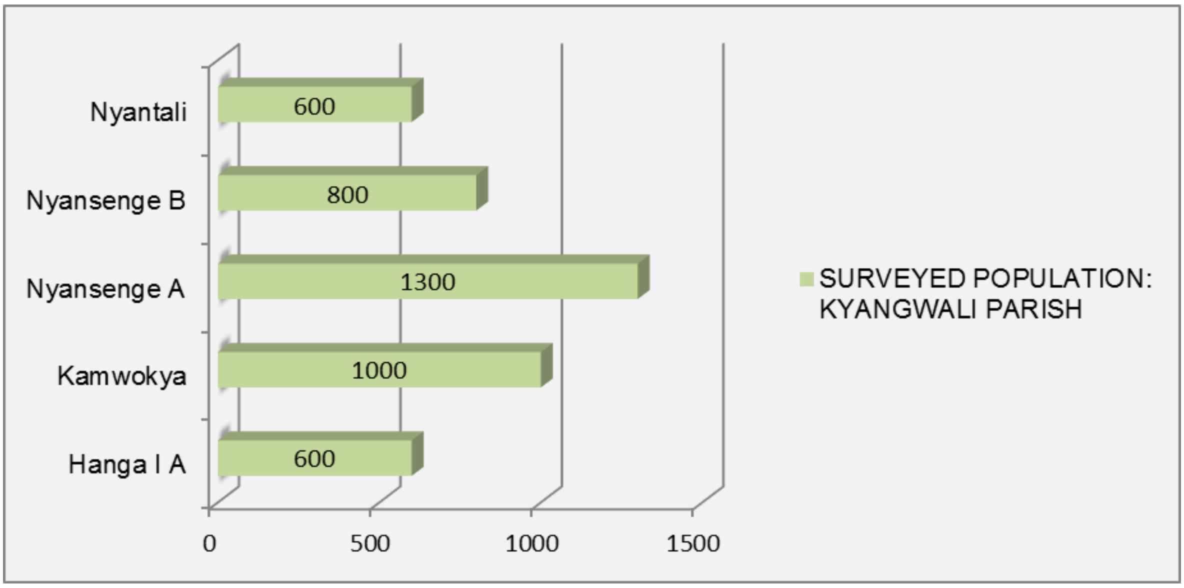

Figure 6-46: Kyangwali Parish Villages (surveyed)

6.3.3.4 Livelihoods

Determining of the livelihoods of the project affected households gives a platform for monitoring of project impact especially after the completion of the project to see whether there has been a negative or positive economic impact of the project. This being a rural population, the main means of livelihood is tilling the land, fishing, petty trading, farm produce and livestock trading.

Table 6-23: Sub-counties, parishes and villages within vicinity of the pipeline[93]

Livelihoods	Percentage of households engaged
Crop Farming	98.8
Use of Trees and Tree Farming	82.2
Livestock Rearing	89.0
Fishing	6.8
Collecting Materials from the Bush	95.8
Small Businesses and Trading	36.7

Land above the escarpment is predominantly fertile and most of the villagers in the LSA originally settled there because of the good agricultural land. Most villages are involved in both subsistence and non-mechanised small scale productive agriculture in varying proportions. Villagers were not always able to quantify the proportions. In six of the villages, the view was expressed that the majority of the crop produced (ranging from 70 – 90%) would be sold, although there was not agreement on this. Eight villages estimated that subsistence agriculture makes up 60%-70% of total production. The remaining nine villages did not venture a proportion, but all indicated that both commercial and subsistence agriculture took place.

[93] Survesis/Nomad Consulting (2017) Kingfisher Development Area and Feeder Line Resettlement Action Plan Phase Two

The majority of persons in the affected households are employed in the agricultural sector. There were some people employed full time in formal jobs, others who are self-employed and mainly in the business sector and the women were also home care givers.

Table 6-24: Occupations in Project Affected households[94]

	Gender		Total
	Female	Male	
Casual Employment	0.07	0.1	0.17
Disabled and Employed	0.27	0.31	0.58
Disabled and NOT Employed	0.03	0.1	0.13
Farmer	15	16.0	31
Fulltime Employed	0.34	0.34	0.68
Home caregiver	1.32	0	1.32
Not employed	0.1	0.27	0.37
Pensioner	0	0.07	0.07
Pre-School Child	7.66	8.27	15.93
Retired	0.14	0.03	0.17
Self Employed	1.39	2.75	4.14
Student	2.31	2.78	5.09
Student/Scholar	17.63	22.38	40.01
Temporary /Contract worker	0.1	0.17	0.27

The common types of crops grown along the pipeline areas have been extrapolated from the UNRA-RAP report for the Kaseeta-Kyarushesa-Nyairongo-Hohwa road project, 2017 (see Table 6-25). Whereas a wide range of crops are grown on the affected land, the two main crops grown are Matooke and Coffee, which are the perennial crops. The rest of the crops are mainly seasonal crops that are harvestable and restorable between 3 to 6 months.

94 Survesis/Nomad Consulting (2017) Kingfisher Development Area and Feeder Line Resettlement Action Plan Phase Two

Table 6-25: Types of crops grown along Kaseeta-Hohwa-Rweera areas[95]

Crop	Hohwa-Butoole	Kabaale-Kiziranfumbi	Kaseeta-Rwera	Total
Maize	37%(117)	38%(65)	42%(51)	38%(233)
Beans	30%(97)	36%(61)	37%(46)	33%(204)
Matooke	25%(80)	32%(55)	29%(36)	28%(171)
Cassava	16%(51)	29%(121)	19%(23)	20%(123)
Sweet potatoes	13%(42)	17%(28)	11%(13)	14%(83)
Groundnuts	5%(17)	12%(21)	7%(9)	8%(47)
Coffee	8%(24)	11%(19)	2%(3)	8%(46)
Tomatoes	2%(7)	1%(2)	5%(6)	2%(15)
Yams	0.3%(1)	1%(1)	2%(2)	1%(4)
Others	12%(37)	27%(45)	10%(12)	15%(94)

Both men and women practice agriculture. Small-scale farming for profit is slightly more common than pure subsistence farming for household use. All villages are involved in similar economic, commercial and livelihood activities. Most villagers indicate that they sell the use right to portions of their allocated land in order to obtain cash during the planting season. Whilst land is their most important asset, villagers who resort to this measure indicate that they need to obtain cash to pay school fees and to buy seed. The land is most often sold to newcomers to the area.

The most common cash crops include cotton, tobacco and coffee. A wide range of other crops are produced, both for sale in the local markets, to traders and for subsistence consumption. These include potatoes, sweet potatoes, Irish potatoes, cassava, jack fruit, maize, millet, rice, sorghum, matoke, groundnuts, bananas, beans, tomatoes, onions, cabbages and pineapples. Eucalyptus trees are grown at Kyarajumba A for timber and housing material. One of the areas is well known for its production of green peppers. Livestock consists mainly of cows, goats, pigs and sheep. Ducks and chickens are commonly kept around the household. Trade in fish occurs in many villages.

A myriad of small business activities take place in order to generate cash income. Many villages have brick layers among them and brick making is done in a number of villages. Sand is quarried for building purposes. People open small shops in order to trade food, clothing and household goods. Palm oil is sold and charcoal is manufactured and sold (some respondents noted the increasing difficulty of finding suitable wood to make charcoal). Brewing alcoholic beverages (Warage and Bushera) is common and bars and restaurants are found in a number of villages. Some villagers have handicraft skills and make ropes and baskets. Stone quarrying and bee keeping is recorded in Kijimbu. Motor cycle (boda-boda) and bicycle repair shops are found in several villages. Fuel (paraffin) is sold by local shops for lighting.

Based on the RAP Report, and the findings from the socio-economic survey, it was found that there are 97.9% of the households who harvest natural resources. The harvests are mainly for household consumption or for

[95] UNRA RAP Report-Kaseeta-Kyarusesa-Nyairongo-Rwera Road Project, 2017

sale and in some cases they serve both purposes. The items harvested range from raw materials like wood for charcoal, wood for artisanal works, and sand to edible items like wild game or fruits.

Table 6-26: Harvesting of Natural Resources by Project Affected Households[96]

Natural resource	Percent households harvesting	Percent use of the resource		
		Both home consumption and selling	Home consumption	Sell only
Fish	11.4	6.2	2.1	2.4
Wood for charcoal	4.7	1.9	2.2	0.7
Firewood	87.6	1.9	87.9	0
Wild fruits and vegetables	28.7	2.6	26.8	0.2
Wood for artisan items	13.8	5.5	6.4	2.3
Grass for thatching	53.7	2.8	51.8	0.2
Hunt birds and animals	7.2	2.0	6.2	0.2
Medicinal plants	48.1	3.3	45.8	0
Sand	4.7	1.0	3.8	0
Salt	37.6	0	100	0

Photograph 6-32: Typical small commercial farm above escarpment

[96] Survesis/Nomad Consulting (2017) Kingfisher Development Area and Feeder Line Resettlement Action Plan Phase Two

6.3.3.5 Education

The school going age is five years. During the socio-economic survey of households undertaken during October and November 2016[97], it was discovered that most of the persons in the affected households have attained some form of education and only 11.8% had not completed education, as indicated in Figure 6-47 below.

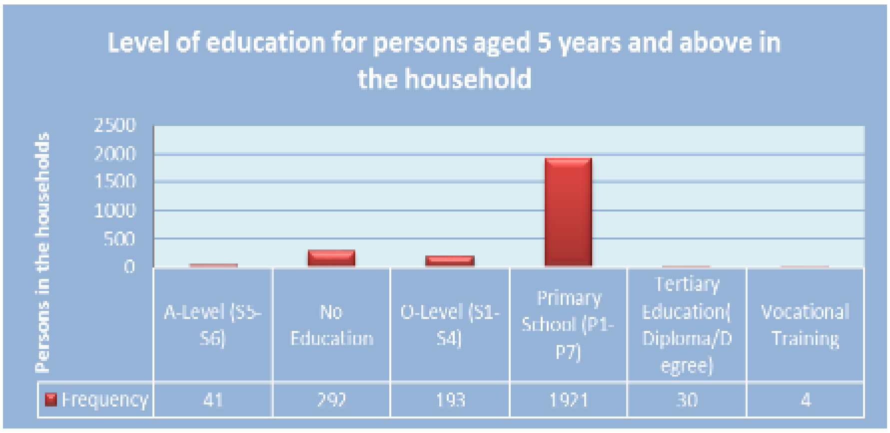

Figure 6-47: Level of education persons aged 5 years and above in Pipeline LSA

Of the children in the school going age group, there are 92.9% (1,285) who are in school. The children who are in primary school are in the nearby schools and the duration of the walk to school ranges between 10 minutes and 2 hours one way. The secondary school going children attend schools out of the area. The main reason given for children of school-going age who are not in school is that school is expensive and as such the parents cannot afford to put their children in school. The other reasons include; children having work to do at home as well as schools being too far away for the children to access them.

Provision for schooling in the LSA is very limited (see Figure 6-48 to Figure 6-51 below). Access to schools without long travel distances is an almost universal complaint among respondents. The near absence of secondary schools condemns most young people to their existing living standards, with little hope of acquiring the necessary skills to escape poverty.

The Hoima Municipal Council Development Plan 2016 – 2020 (2015:52) makes provision for increasing educational infrastructure, with a budget of UGX50million per annum being allocated for building additional classrooms, teachers' quarters and latrine facilities. However, there are currently no plans to increase the number of classrooms and/or build additional government schools in the development area.

Schools in the Butoole Parish

The schools in the Butoole Parish are set-out in Figure 6-48 below.

[97] Survesis/*Nomad Consulting (2017)* Phase 2 KFDA Resettlement Action Plans

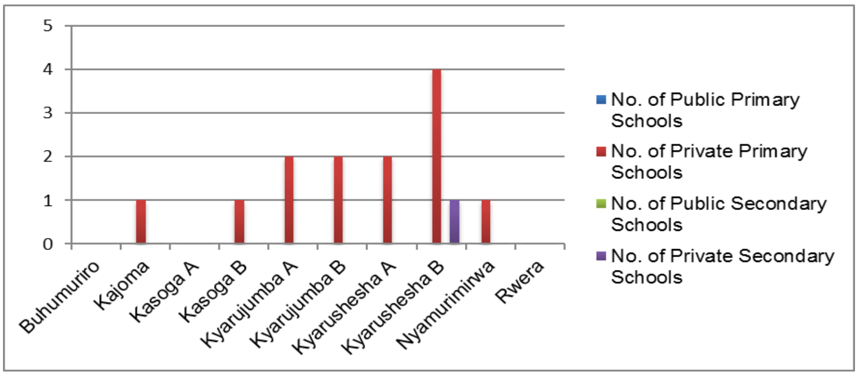

Figure 6-48: Schools in the Butoole Parish

Schools in the Kabaale Parish

The schools in the Kabaale Parish are set-out in Figure 6-49 below.

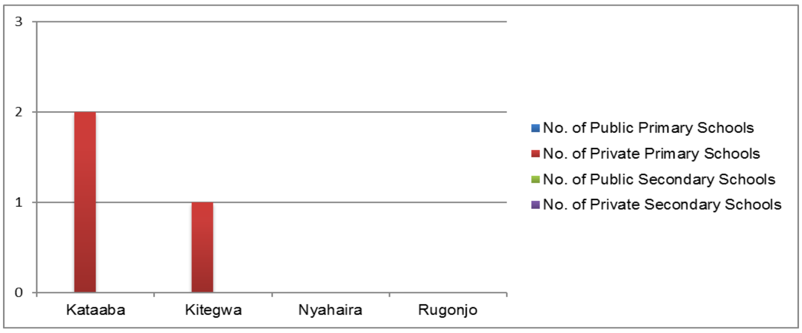

Figure 6-49: Schools in the Kabaale Parish

Schools in the Kaseeta Parish

The schools in the Kaseeta Parish are set-out in Figure 6-50 below.

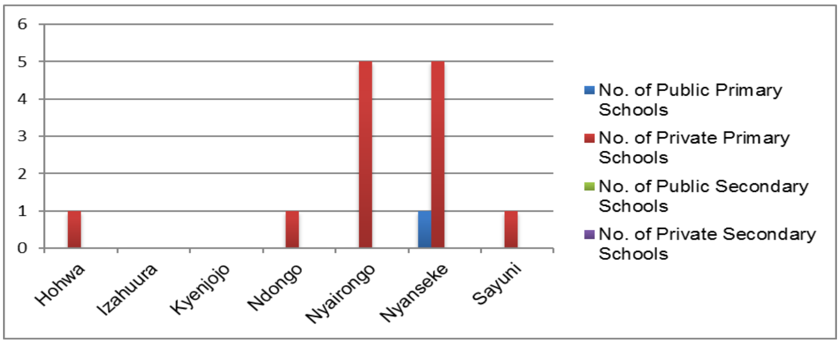

Figure 6-50: Schools in the Kaseeta Parish

Schools in the Kyangwali Parish

The schools in the Kyangwali Parish are set-out in Figure 6-51 below.

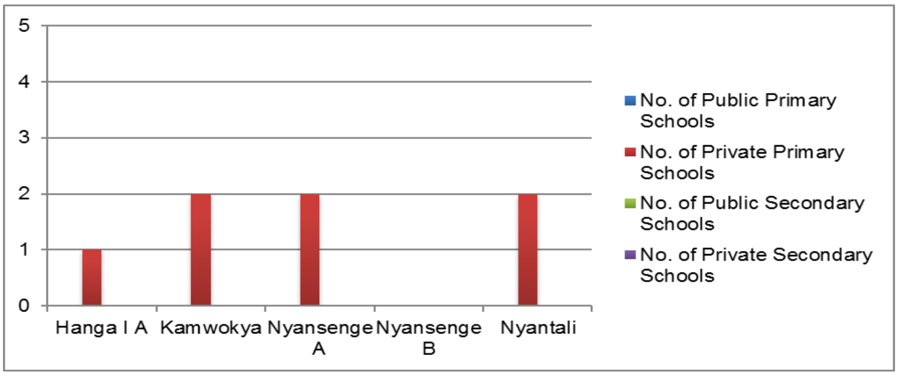

Figure 6-51: Schools in the Kyangwali Parish

Photograph 6-33: School located within the Feeder Pipeline LSA

6.3.3.6 Ethnic Groups and In-migration

The main ethnic and secondary ethnic groups per parish are set-out in Table 6-27 to Table 6-30 below:

Butoole Parish

Table 6-27: Butoole Parish main ethnic and secondary groups

PARISH	VILLAGE	MAIN ETHNIC GROUP	SECONDARY ETHNIC GROUPS
BUTOOLE	Buhumuriro	Bakiga	Banyarwanda, Bafumbira, Batoro, Banyoro
	Kajoma	Bakiga	Bafumbira, Alur, Batoro, Banyakole
	Kasoga A	Bakiga	Bafumbira, Banyakole, Banyoro, Alur
	Kasoga B	Bakiga	Banyoro, Alur, Bafumbira, Banyakole
	Kyarujumba A	Bakiga	Bafumbira, Alur, Batoro, Banyakole
	Kyarujumba B	Bakiga	Bafumbira, Alur, Banyakole
	Kyarushesha A	Banyakole	Banyoro, Bafumbira, Bakiga, Bakonzo, Basoga, Alur
	Kyarushesha B	Banyakole	Rwandese, Banyoro, Bakiga, Bakonzo, Alur
	Nyamurimirwa	Bakiga	Bafumbira, Banyakole, Alur, Baganda, Batoro, Banyoro
	Rwera	Bakiga	Basoga, Banyoro, Banyakole, Rwandese, Alur, Baganda

Kaseeta Parish

Table 6-28: Kaseeta Parish main ethnic and secondary groups

PARISH	VILLAGE	MAIN ETHNIC GROUP	SECONDARY ETHNIC GROUPS
KASEETA	Hohwa	Lugbara	Banyarwanda, Bakiga, Bagegere
	Izahuura	Bakiga	Banyankole, Bafumbira, Banyoro
	Kyenjojo	Lugbara	Banyoro, Alur, Abamba, Bakonzo Bakiga
	Ndongo	Bafumbira	Banyoro, Lugbara, Bakiga, Rwandese
	Nyairongo	Bafumbira	Bakiga, Alur, Lugbara, Banyoro, Banyankore
	Nyanseke	Lugbara	Rwandese, Bakiga, Banyoro, Bakonzo
	Sayuni	Banyankole	Banyarwanda, Alur, Bakiga, Bafumbira

Kyangwali Parish

Table 6-29: Kyangwali Parish main ethnic and secondary groups

PARISH	VILLAGE	MAIN ETHNIC GROUP	SECONDARY ETHNIC GROUPS
KYANGWALI	Hanga I A	Bafumbira	Alur, Banyoro, Bakiga, Rwandese
	Kamwokya	Bakiga	Rwandese, Banyoro, Alur
	Nyansenge A	Bakiga	Alur, Banyoro, Bafumbira, Bakonzo
	Nyansenge B	Bakiga	Alur, Banyakole, Banyoro,
	Nyantali	Alur	Bakiga, Bafumbira, Banyakole, Banyoro

Kabaale Parish

Table 6-30: Kabaale Parish main ethnic and secondary groups

PARISH	VILLAGE	MAIN ETHNIC GROUP	SECONDARY ETHNIC GROUPS
KABAALE	Kataaba	Alur	Banyoro, Banyarwanda, Bafumbira, Bakiga
	Kitegwa	Alur	Banyoro, Bakiga, Lugbara
	Nyaihara	Alur	Banyoro, Bakiga, Balende, Bagungu
	Rugonjo	Alur	Banyoro, Lugbara, Lende, Rwandese

Immigrants from Rwanda, the DRC and elsewhere are found in some villages although their numbers are probably under-reported, for fear of being victimised or deported. Some villagers complain about the influx of rich people into the area to claim land. Villagers try to discourage the in-migration of foreign people.

Fieldwork activities in 2017 for this project confirmed the observations of the presence of ethnic tensions in a number of villages across the escarpment. However, whereas in 2013 the tensions appeared to be more pronounced in the villages contiguous to the feeder pipeline than in those on the Buhuka Flats in 2013, fieldwork during 2017 found the opposite to be true. Where there was tension, as previously, the main focus of the tension related to arguments around community leadership and on a fairly consistent basis, fears of being excluded from focus group discussions as a component of historic tribal tensions. Additionally, tensions along the top of the escarpment are increasingly being driven by speculative land acquisition by immigrants into the area.

The major religions in the area are Roman Catholics, Anglican, Ow'busobozi which is an indigenous religion in Banyoro region and Islam.

6.3.3.7 Health

The most common illness in the project affected households is malaria with 82.2% of households confirming suffering from malaria in the six months before the survey[98]. Diarrhoea is another common ailment in the area with 8.4% of households confirming having someone with it. The other health problems include high blood

[98] Survesis/*Nomad Consulting (2017)* Phase 2 KFDA Resettlement Action Plans RAP Report - Socio-economic survey of households undertaken during October and November 2016;

pressure, diabetes, typhoid, pneumonia, asthma and others. Though there are cases where households seek medical care from heath facilities (67.5%) when they have persons with the different ailments, they also have alternatives that include: giving plenty of water and food (20.1%) to the patient; visiting traditional healers (9.6%), treating the sick person with herbs (6%); other a purchase treatment from a drug store, resorting to prayer and in some instances, taking no action whatsoever.

The persons who seek help from health facilities mainly go to government health facilities including Hoima regional referral hospital, Kabaale health centre (Health centre III), Kaseeta Health centre (Health centre II), Kituti Health centre (Health centre III) or Kyangwali health centre (Health centre III).

The provision of health facilities in the LSA is shown in Table 6-31. Facilities are very limited and are a central concern in the communities. All of the villages make reference to the need for better and closer health care facilities.

Table 6-31: Inventory of Health Facilities

PARISH	VILLAGE	PUBLIC HEALTH FACILITIES	PRIVATE CLINICS/ PHARMACIES
BUTOOLE	Buhumuriro	00	00
	Kajoma	00	01
	Kasoga A	00	03
	Kasoga B	00	02
	Kyarujumba A	00	03
	Kyarujumba B	00	06
	Kyarushesha A	00	02
	Kyarushesha B	00	06
	Nyamurimirwa	00	01
	Rwera	00	00
KABAALE	Kataaba	00	02
	Kitegwa	00	00
	Nyaihara	00	00
	Rugonjo	00	00
KASEETA	Hohwa	01	02
	Izahuura	00	00
	Kyenjojo	00	01
	Ndongo	00	01
	Nyairongo	00	07

PARISH	VILLAGE	PUBLIC HEALTH FACILITIES	PRIVATE CLINICS/ PHARMACIES
	Nyanseke	01	06
	Sayuni	01	04
KYANGWALI	Hanga I A	00	02
	Kamwokya	00	04
	Nyansenge A	00	00
	Nyansenge B	00	02
	Nyantali	00	02

6.3.3.8 Transport

Most people move about on foot, bicycles or use boda-bodas as taxis to access social services. Bus transport is limited and is only easily accessible to those located near the larger roads. Those closer to Lake Albert use water transport, which has now been facilitated by the construction of the road down the escarpment to the lake. A few people are reported to own cars (Kataaba, Nyairongo).

6.3.3.9 Water Sources

The majority of households access water from the bore hole whether during the dry season or the wet season. There is no significant difference with regard to where they access the water from be it in the dry or wet season as show in the graph. Only water from the borehole, deep well, rain water tank and the tap can be considered clean. This implies that, on average there is access to clean and safe water.

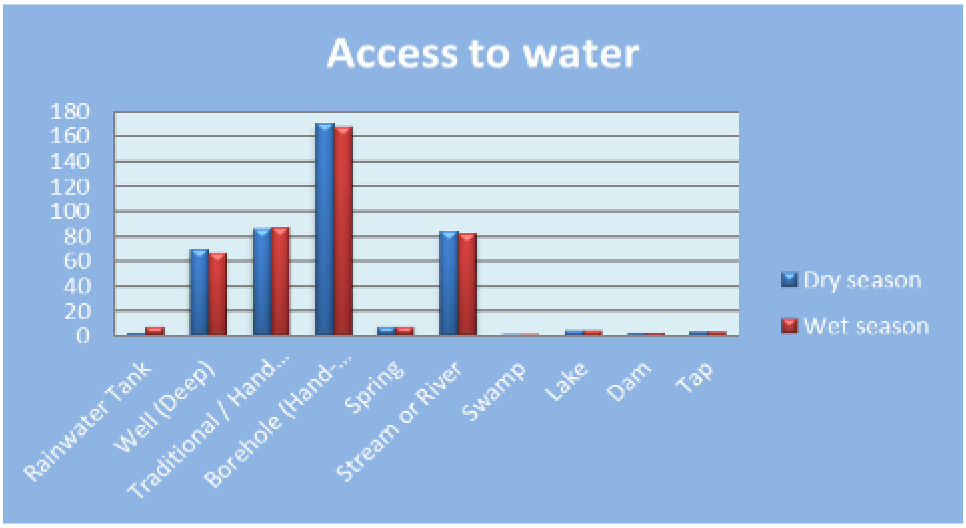

Figure 6-52: Access to water within the Pipeline LSA

Clean and reliable water supply is an issue in most of the villages. Table 6-32 to Table 6-35 summarise the water supplies to each village in the LSA. A total of 74% of villages raised water supply as one of their key needs.

Butoole Parish

Table 6-32: Water Supply to Villages in the Butoole Parish

	No. of Water Protected Water Sources (Springs)	No. of Unprotected Water Sources (Springs)	No. of Boreholes	H/H connected to piped water
Buhumuriro	00	04	00	00
Kajoma	00	01	00	00
Kasoga A	00	04	00	00
Kasoga B	00	06	00	00
Kyarujumba A	00	07	02	00
Kyarujumba B	00	03	01	00
Kyarushesha A	00	02	00	00
Kyarushesha B	00	06	01	00
Nyamurimirwa	00	04	01	00
Rwera	00	00	00	00

Kabaale Parish

Table 6-33: Water Supply to Villages in the Kabaale Parish

	No. of Water Protected Water Sources (Springs)	No. of Unprotected Water Sources (Springs)	No. of Boreholes	H/H connected to piped water
Kataaba	00	02	00	00
Kitegwa	00	03	02	00
Nyaihara	00	01	00	00
Rujonjo	00	00	01	00

Kaseeta Parish

Table 6-34: Water Supply to Villages in the Kaseeta Parish

	No. of Water Protected Water Sources (Springs)	No. of Unprotected Water Sources (Springs)	No. of Boreholes	H/H connected to piped water
Izahuura	00	01	00	00
Kyenjojo	00	05	02	00
Nyairongo	00	01	00	00
Nyanseke	00	02	01	00
Sayuni				

Kyangwali Parish

Table 6-35: Water Supply to Villages in the Kyangwali Parish

	No. of Water Protected Water Sources (Springs)	No. of Unprotected Water Sources (Springs)	No. of Boreholes	H/H connected to piped water
Hanga II B	00	00	00	00
Kamwokya	00	03	01	00
Nyansenge A	00	02	01	00
Nyansenge B	00	02	01	00
Nyantali	00	01	00	00

6.4 Archaeology and Cultural Heritage

The cultural heritage baseline survey was conducted over 14 days in late January/early February 2014 and, following updates to the Project design, November 2017. The following section provides an overview of the findings of the study. A total of 393 tangible cultural heritage resources (including archaeological, historic, cultural and sacred sites) were identified in the Study Area during the field survey phase. In addition, a range of intangible heritage activities were observed and recorded.

6.4.1 Cultural Heritage Background and Settlement History

There has been a lack of research into the history of western Uganda and Kikuube and Hoima Districts in particular. Kikuube and Hoima District lie within the extent of the former Bunyoro Kitara Empire which extended throughout parts of Masindi, Hoima, Kikuube, Kabaale, Kabarole and Kasese and engulfed parts of present day Kenya, Tanzania and The Democratic Republic of Congo. Following the disintegration of the Bunyoro Kitara Empire in the 19th Century, smaller kingdoms rose up, including the Bunyoro, whose leader Kabalega, is renowned for resisting British colonial rule. The one previously documented heritage site in proximity to the Study Area is associated with the colonial period – Baker's View, where explorer Samuel Baker first had a view of Lake Albert while looking for the source of River Nile. The site is noted on Uganda's Inventory of Sites (held by the National Museum in Kampala).

The pre-colonial history of the Bunyoro Kingdom is poorly studied with most written from oral traditions recorded at court (Robertshaw, 1999). Analysis of the records appear to reveal that the Bunyoro were one is a succession of small scale polities, akin to chiefdoms, across the region (*ibid*). There is some debate regarding the Bunyoro's origins, some historians believe the Bunyoro are decedents of the Bachwezi. The Bachwezi are however, surrounded by obscurity with some historians dismissing them as purely mythical, while others credit them with the introduction of long horn cattle and salt extraction, both of which came to dominate the economy of the Great Lakes region (Tumusiime, 1993, Robertshaw, 1999).

The settlement history of the Study Area is not known. The archaeological evidence gathered during this study provides some clarity that the region has been occupied to some degree from at least the Iron Age. Earlier, Neolithic-dated artefacts, are more likely indicative of transient, seasonal activity on the escarpment (as discussed below). The community interviews undertaken by the cultural heritage team suggest that the current lakeside population may be the 5th or 6th generation and potentially 150 – 200 years old. This is attested by the oral traditions of the communities (e.g., with recollections of grandparents' making pottery; stories associated with the area during the colonial wars and/or the number of chairmen that the village has had). The oral history recorded along the villages of the pipeline route suggests that many are more recently settled.

6.4.2 The Local Study Area – the CPF, Ancillary Works and Feeder Pipeine

6.4.2.1 Paleontological Sites

Although a number of animal bones were recovered (Volume 4, Specialist Study 12) no fossilised remains were identified within the Study Area during the purely visual / non-intrusive baseline survey. The paleontological potential of the area is however considered to be reasonably high with well-studied fossil sites in the near vicinity (e.g., faunal remains at Kaiso, approximately 35 km northeast, on the eastern shore of Lake Albert). In the wider vicinity of the Great African Rift, the Kikorongo Crater, near Lake George, has revealed debated evidence of a fossilized hominoid femur, potentially *homo sapiens*, tentatively dated 8,000-10,000 BP (NEMA, 2001, 2009, De Silva et al, 2005).

6.4.2.2 Archaeological and Historic Sites

A total of 245 archaeological and historic sites were identified in the LSA during the two phases of cultural heritage field survey. This section aims to summarise those sites which are particularly significant and/or within close proximity to areas of proposed development elements, either on the Buhuka Flats or along the feeder pipeline route. A full account of the identified baseline archaeological and historic environment is included in Volume 4, Specialist Study 12.

For ease of reference all identified site locations have been assigned a unique identification number (ID) in the text and maps, for example, all pottery sites have been numbered and prefixed with 'PO'. Only those sites in close proximity to proposed project infrastructure are mapped here (Figure 6-53). All of the sites are mapped in Volume 4, Specialist Study 12.

Figure 6-53: Heritage sites within the LSA

Neolithic and Stone Age Periods

Archaeological evidence of early (potentially pre-Neolithic) occupation is provided by a number of lithic artefacts encountered throughout the LSA. These include typical Middle to Later Stone Age lithics, LI-37 and LI-38, recorded directly within the footprint of the proposed permanent camp (materials yard) and site LI-39, within the vicinity of the proposed CPF and associated with a metal findspot (ME-04) possibly associated with an ancient burial. Find spots LI-45 (a Middle Stone Age discoid) and LI-46 (a multi-platform core) were also recorded within the footprint of Pad 4A. Concentrated lithic scatter and debitage was also recovered south of the Airstrip (site LI-04, Figure 5), potentially associated with bone fragments (BO-27).

Further evidence gathered in 2014 tentatively suggests human utilization of the wider area dating to the Ugandan Neolithic (6000 to 5000 BC). The evidence relates to sherds of Kansyore pottery (characterized by incised wavy lines) observed 300 m from the Escarpment Road route (**PO-182**) and site **PO-161** between Kabaale and Kitegwa (1,200 m from the current Pipeline route).

Along the proposed pipeline route, four lithic scatter sites were noted within 15 m of the route, including LI-47 (multi-platform core) and LI-51 – LI-53 (flake fragments and discoid). The latter three were found in close proximity to Nyantai village (Figure 6-53). Although these are isolated finds their presence in the wider vicinity is important; Kansyore pottery in particular is a significant indicator of cultural interaction across the East African region. It has been identified in Sudan (referred to as ‘Khartoum Neolithic’ pottery) and in several parts of Kenya and Tanzania. The presence of the sherds is likely indicative of others in proximity with both sherds found in conjunction with other (unidentifiable/undateable) pottery scatters. The Kanysore pottery is potentially associated with early transitory, hunter-fisher-gatherer communities for whom the escarpment/ escarpment top would have provided a favorable (perhaps seasonal) position.

Photograph 6-34: Lithic scatter (LI-04) within the LSA

Iron Age - Modern Periods

Iron Age activity (from 500 BC) was found to be particularly prevalent across the LSA and wider area with evidence asserted by concentrations of pottery scatter on the shore of Lake Albert (at Kiina Village in particular). Three Iron Age pottery traditions were subsequently identified – ‘Urewe’ (Early Iron Age, c. 500 – 700 AD); ‘Bourdine’ (Middle Iron Age, undated); and ‘Roulette’ (Late Iron Age, undated). A large concentration of Roulette pottery was noted within and surrounding proposed Well Pad 3 (Figure 6-53). The footprint of proposed Well Pad 4A also yielded a significant amount of Iron Age pottery scatter (Figure 6-53).

In summary, the artefactual evidence identified is a significant indicator of extensive settlement and potential industry, particularly where concentrated pottery scatters were found associated with other artefacts. On the northern end of the proposed Pipeline Route near Kitewga and Nyanseke, pottery scatter sites were found associated with iron slag, potentially indicative of Iron Age activity. It is notable that these areas were more easily accessible to the survey team and are likely representative of similar archaeological evidence in the wider vicinity / other sections of the pipeline. Further investigation will be required to determine whether these remains are indicative of past activity in the immediate project locality or purely representative of ephemeral, possibly migratory, landscape exploitation.

Iron slag and iron objects were recorded at four locations within the Flats. Site **ME-04** (bangle fragment), is associated with lithic scatter **LI-39**, recorded within the proposed CPF footprint and potentially indicative of an ancient burial (Photograph 6-36).

Photograph 6-35: Late Iron Age 'roulette' pottery PO-52 (Nsunzu A Village)

Photograph 6-36: Metal bangle fragment (ME-04) associated with site LI-39, CPF / pipeline route

Three historic sites were identified within the LSA including an ancient salt-making site close to Nsonga village (**HI-03**) and an abandoned settlement (**HI-02**). Both are well known to the lakeside communities and **HS-02** is in close proximity to the in-field pipeline and the existing road north of the temporary camp. Site **HI-01** is a stone-walled structure, possibly house foundations (Photograph 6-37) was noted at Kyakapere Village. The site is particularly unusual in the lake side communities, where no other stone walled structures were recorded. There may be some potential links with (Iron Age) stone building traditions in central and southern Africa (e.g., Zimbabwe enclosures). Although the site is beyond the proposed infrastructure developments it highlights a potential for sub-surface stone structures in the wider vicinity.

*Photograph 6-37: Stone-walled Structure at Kyakapere Village (**HI-01**)*

The location of historic (abandoned) quarry sites were identified in the wider area (**QU-01** and **QU-02**), these are approximately 200 m from the Escarpment Road route and may be representative of other quarrying and/or settlement activity in the escarpment area.

Faunal artefacts (i.e., bones and shells) were recorded throughout the LSA with three sites (BO-25, BO-30 and BO-31) within the pipeline footprint. Most of the bones were in a fragmentary state and could not be analysed. However, fish vertebrae and cow bones were noted. No fossilized bone was identified. Analysis of the shell sites did not reveal any evidence that they were part of any midden deposits (rubbish dump) and consequently their anthropogenic nature is unproven. However, until any further analysis takes place (e.g., targeted trial trenching) these sites may have archaeological potential, particularly where found in association with pottery and/or lithics.

6.4.2.3 Cultural Sites

The results of the cultural site survey are summarised in this section. This is drawn from the data collated during the community consultation surveys. In total 148 sites of cultural importance were identified within the Study Area. A thorough account is provided in Specialist Study 12. The cultural sites comprise nine categories: religious sites (churches and mosques), cemeteries, ritual sites, ritual objects, sacred rivers, sacred trees, cultural trees (bark cloth), cultural landscapes and medicinal plants.

Many of these sites were disclosed in confidence and are considered secret and highly sensitive. During disclosure, the interviewees often made reference to the rituals they would have to perform as a result of their discussions with the field team (and the site's exposure). Consequently (where appropriate) sacred sites are discussed with limited reference to their geographic location. A complete list of site grid references and location maps will be presented to the client to assist Project planning and these will be disseminated purely on a 'need to know' basis.

Where appropriate, each site location has been mapped in relation to the proposed Project infrastructure. For ease of reference each site has been assigned a unique identification number (ID) pre-fixed with the appropriate site category (e.g., CH for church, RS for ritual sites and ST for sacred tree).

Churches and Mosques

A total of 59 churches and two mosques were identified within the LSA and 19 of these sites are situated within 250 m of proposed infrastructure development. These include **CH-16** – **CH-17** and **CH-43 – CH-**44 in proximity to the proposed Material Yard. **CH-01 – CH-03, CH-06 – CH-08, CH-30 – CH-35 and CH-**40 at Nsunzu, east of Pad 3.

Along the proposed Pipeline route, two churches were identified within 250 m. These include **CH-42** and **CH-**50 in proximity to the new road section of Pad4A. The buildings recorded on the pipeline are indicative of those throughout the LSA in general, particularly given that not every village was surveyed (i.e., those inaccessible areas along the pipeline route). Unrecorded churches and mosques are possible throughout the LSA, potentially within the development footprint.

Cemeteries and Burials

A total of 25 burial/cemetery sites were recorded within the Study Area. These do not include burials within, or within very close proximity to, houses[99]. Of the 25 recorded, 14 were noted to be within, or in close proximity (within *c* 250 m) to the proposed project footprint. These include, **CE-04 – CE-06** at Nsunzu village, east of Pad 3 and **CE-17** 100 m from the pipeline as it leaves the CPF; **CE-22 – CE-23** and **CE-37** in close proximity to the airstrip and **CE-32 – CE-35** within and surrounding Well Pad 4A. Site **CE-36** is also adjacent to the new road section to Pad 4A (see Figure 6-53).

The cemeteries and burials are indicative of those throughout the Study Area in general – both traditional (spoil-heaped) and modern (cemented) graves were observed (Photograph 6-38). The burials recorded

[99] Burials within houses were noted in the cultural heritage community interviews (see Volume 4, Specialist Study 12 APPENDIX F – interview transcripts)

were dependent on those areas accessible for survey and consequently there remains a potential for unrecorded graves throughout the LSA, potentially within the development footprint.

Photograph 6-38: Traditional burial ground at Kiina Village

Ritual Sites - confidential

Animist activity and areas set aside for traditional ceremonies (tied to a particular natural place of cultural significance e.g. Lake Albert) were observed during the field survey programme and disclosed to the field team during the community consultation phase.

The cultural site maps include redacted buffers to give an idea of the distribution of sensitive sacred sites throughout the Study Area. An accurate depiction of individual sacred site locations (using GPS coordinates) in relation to the Project development will be presented to the client to assist in Project planning.

The sites included below are those within relative proximity to proposed Project infrastructure (within the footprint, or within c. 250m).

- Luzira / Iziba Iya Wamara

A ritual and historic site (**RS-03**), sited within the area known locally as 'Luzira', was identified as a sacred area for the lakeside communities at the Buhuka Flats. The site is a traditional place of worship characterized by its inaccessibility (the name 'Luzira' is also that of Uganda's main prison). The pool and the surrounding reed bed are an active place of traditional worship, particularly for seasonal ceremonies related to fishing. The **RS-03** site was also identified as the historic centre of cultural activity of the wide LSA with many myths and taboos surrounding the locality. The Jetty is currently sited within approximately 200 m of site **RS-03**. It is marked with a redacted buffer in Specialist Study 12.

- Akasonga / Kasonga Beach and Kagera Well

The Lake Albert beachfront area lying around the Jetty site (RS-02), Nsonga Village and heading south towards Nsunzu (RS-01), was also identified as an area of traditional activity associated with Luriza. Ceremonies take place specifically for fish catches in the vicinity of the beach i.e. when fish stocks appear low and/or the fishermen have any troubles. The site is known locally as 'Akasonga' or 'Kasonga' Beach (**RS-01** and **RS-03**) and is shown in Specialist Study 12. Site **RS-02** is potentially within the footprint of the area proposed for the Jetty. Furthermore, the nearby marshy area (adjacent to the River Kamansiniga (SR-02)) in the vicinity of the proposed Jetty site is known locally as 'Kagera' and is a focus for ritual and sacrificial activities.

Photograph 6-39: Kasonga Beach (RS-01 and RS-02)

- Sacred Pool

A secret site of ritual activity (**RS-04** and **RS-05**) was highlighted to the field survey team during the community consultation phase. The site is well known by the elders of the community, and it is considered taboo for the younger members to go here. The site, which is located on the River Masika, is utilized during cholera outbreaks in particular, and if required, the local cultural leader travels from his village to oversee the rituals.

- Family Shrines

Secret shrine sites exist within individual houses. These are controlled by the head of the family and are not for public viewing or discussion. No sites were specifically identified by the field team although they exist within the lakeside communities. A secret shrine site known as ‘Ochaka’ was also mentioned to exist within Kyakapere village. This site is popular with the village as a whole.

- Swamp Site

The swamp (**RS-08**) south of Nsunzu Village and adjacent to the road/infield pipeline to Pad 3, is associated with the Afrocreed / Lam-the-Kwar cult (prevalent at Kyakapere) and is used to extract holy water for ritual purposes and other associated cultural activities[100]. This site is approximately 350 m north east of Well Pad 3.

- Riverside Site

Site **RS-09** is a ritual site associated with the river immediately north of Pad 4A. A recent cow skull was recorded here during the field survey with locals attesting to the stream’s use for ritual purposes during Key Informant Interviews (2017).

- Cultural Site

Site **RS-10** is a sacred site known as ‘coet’ or ‘Kuwait’ situated approximately 300 m south of Pad 4A and 125 m west of the in-field pipeline. Little is known about the site which was raised in 2017 community interviews and warrants further investigation, locals mentioned that is was forbidden to settle in the area, believing it to belong to ‘the spirits’.

[100] This is contested by residents at Nsunzu who intimated that the leaders of the *Lam-the-Kwar were claiming association with the swamp in order to receive compensation in an event that the location is affected by the Project (see Specialist Study 12)*

Ritual Objects – confidential sites

One ritual object (RO-01) a feet-washing stone, was identified in Kyakapere village within c 250 m of Pad 4A. Two other ritual objects (**RO-02** and **RO-03**) in the LSA comprise stones used for worship. **RO-03** is sited over 500 m from the proposed feeder pipeline route, north of Kyarusesa. These sites are unlikely to be unique and are considered indicative of others potentially in the vicinity. Their locations are confidential.

Sacred Rivers – confidential sites

- River Masika

The cultural importance of the River Masika (**SR-01**) was highlighted by those communities local to the Project in 2014 and 2017, particularly at Nsonga. Areas on the river bank are used regularly for ceremonies to improve fish catches (in February / March) and occasionally to cure sick children. The mouth of the river is considered especially significant in this regard. The Masika River is approximately 1 km south of proposed well pad 3.

- River Kamansiniga

The significance of the River Kamansiniga was also highlighted during interviews on the Buhuka Flats in 2017. The water, extracted from point **SR-02** is used for ritual purposes, during ceremonies to increase fish catches etc. The river flows south of the CPF, Camp and Pad 1, reaching Lake Albert immediately west of the proposed Jetty upgrade site.

Sacred / Cultural Trees – confidential sites

- Sit of Sacred Tree 1

A particularly sensitive tree (**ST-01**) was located in the vicinity of the lake shore. The tree was very important for Nsunzu village, respected and feared as a place 'where bad things happen'. The site remains associated with a number of myths and oral histories. A number of significant taboos (rules) related to this tree site including:

  - People do not walk near the site;
  - To get to the land behind the site, people must take a big diversion around it;
  - No women should ever go near the site; and
  - People must never point at the site. If a child accidentally points at the site a special ceremony takes place to protect that child.

- Sacred Tree 2

A tree of cultural importance (**ST-02**) was identified in the vicinity of the Escarpment Road, where it crosses the existing footpath.

- Cultural Tree 1

The village assembly tree at Nsonga (**CT -01**) was highlighted by the community as an important cultural point for village meetings and related ceremonial matters. The tree is over 500 m from the permanent camp and associated facilities.

- Bark Cloth Trees

Three bark cloth trees (**BC-01 – BC-3**) were recorded during the Pipeline field survey. Tree **BC-01** appears to be located 250 m northwest of the proposed Pipeline route with **BC-02** and **BC-03** at Hohwa c 500m also to the northwest.

The location of these trees was given to the field team in confidence. The exact GPS location of the sties will be provided to the design team as required.

Cultural Landscapes

- Lake Albert and the Escarpment

Three areas of cultural landscape (**CL-01** - **CL-03**) were identified within the Study Area during the baseline field survey. These have been recognised with reference to the UNESCO definition of an 'associative cultural landscape': "…*justifiable by virtue of the powerful religious, artistic or cultural associations of the natural element*" (http://whc.unesco.org/en/culturallandscape/#2).

Both Lake Albert (**CL-01**), the Escarpment (**CL-02**) and the viewpoint (**CL-03**) on the escarpment road are iconic features of the natural landscape, defining the local (communal) sense of place and apparent (traditional) cultural associations of the natural (rivers, lakes, trees). These sites provide a strong historic and religious focus for the lakeside communities in particular, evident within the oral traditions and the sacred places associated with both locations. The value of both sites is heightened by their palaeontological, archaeological and historic potential.

Photograph 6-40: The escarpment, viewed from Nsunzu Village

6.4.2.4 Intangible Cultural Heritage

In the context of the LSA, intangible heritage is defined as the traditional practices, cultural norms and knowledge transmitted from one generation to the next, which communities or individuals recognise as part of their cultural heritage. These elements are recognised by Uganda's Cultural Policy (2006) and IFC PS 8 (2012a).

A full account of the intangible heritage observed in the Study Area is presented in Volume 4, Specialist Study 12. This was collated from that information that the community was willing to share; there may be rules governing certain places, or ceremonial practices that were considered too sensitive to share with the field team. A summary is included below:

- **Making Ghee**: as practiced by The Balalo pastoralist community

Photograph 6-41: Traditional Gourds for making ghee

- **Animal Husbandry and Architecture**: hand built shelters for poultry were observed within the villages surveyed by the field team. Traditionally built houses, without any manmade materials, were also prevalent amongst the isolated communities on the Buhuka Flats. Although not unique in remote Uganda, these structures are representative of traditional lifestyles and knowledge that may change as a result of the Project (and related economic development, increased availability of other (manmade) building materials etc.)
- **Revered Species**: Snakes, pythons in particular, were mentioned as special and revered by all lakeside communities within the Study Area. A giant lucky snake can be seen bring good fortune to those who see it (once the elders have carried out the right rituals). A fire-breathing snake can also be seen swimming in Lake Albert and along the shore. A giant crocodile, swimming along the lake shore can bring or take away the fish as he chooses.
- **Beliefs associated with the Escarpment**: particular 'no go' areas were mentioned (but not specified). There are stories of white people or white smoke appearing in the ravines and deep in the bush, but they always disappear. Historically it was also unlucky to walk up the escarpment at midday as the path (and you) would disappear. There is a speed boat sound, commonly heard out on the lake, in the bush or up on the escarpment, the noise is unlucky. There is a tradition that, as a sign of respecting the fish and ensure their continued supply from the lake, if a woman comes from the escarpment top with cassava flour, it's up to her husband to prepare it to accompany a fish. When the women leaves the lake shore to return she is then given a fish to take back up the escarpment top.
- **Beliefs associated with Lake Albert**: specific rituals (and seasonal ceremonies) are required to increase fish stocks in the lake. Ceremonies are also carried out on the lake in the event of sickness. At the new moon (when rituals may take place at Luzira), fishing on the Lake is forbidden. Historically, pregnant women were not allowed to fetch water from the lake, especially during mid-day and late evening for fear of evil spirits roaming the area which would cause miscarriages. It is also traditionally taboo for women to fish or bathe in the Lake, particularly in the area surrounding site **RS-03** and in the vicinity of RS**-01** and **RS-02**. Sometimes it sounds like there are people drowning on the water but when people go to rescue, there is never anyone there. The appearance of a fire moving along the water the in the evening was also mentioned.
- **Taboos:** Traditional sacred sites and cultural practices identified during the baseline study were found to incorporate a number of unique local taboos or rules. Those recorded by the field team are summarized below:

- No go areas surrounding sacred sites;
- No go areas for women on Lake Albert (including the shoreline / around the Jetty area;
- Historically, pounding cassava, splitting firewood and fetching water during the night was forbidden for fear of upsetting ancestors;
- No pointing at sacred sites;
- Twins born into local communities will undergo the ‘kuturuka mahasa’ ceremony and will stay indoors until they got the first teeth;
- Women who bring cassava down the escarpment should return with fish; and
- Do not kill pythons.

■ **Traditional Religious Cults:** A traditional local religion called ‘*Lam-the-Kwar*’, which has its roots in the Nebbi district (Northern Uganda) and Afrocreed religion, is led by a priest in Kyakapere (previously known as ‘Kuwait’). Ceremonial activities and worship take place in the building north of the village (called the ‘Ugonjo’ shrine or ’Lam-the-Kwar church, **CH–49**) on a Tuesday, Friday and Sunday (with drums, singing and dancing). During prayer, should one be possessed by spirits they would use holy water from the lakeside swamp/well site **RS-08**.

■ **Medicinal plants:** It was noted by the field team that many of the grasses, trees and shrubs present within the Study Area are being used locally as medicine. These sites are mapped in Specialist Study 12 (sites **MP-01** – **MP-42**) which include the local plant names identified and the specific disease they treat. These are considered representative traditional healing sites across the LSA and there is a potential for unrecorded sites to remain. The medicinal plants recorded were located in two areas, within the footprint of the proposed Crusher Plant / Spoil Area A and the Escarpment Road.

7.0 CONSTRUCTION IMPACTS OF THE PRODUCTION FACILITY

The impact of the CPF and associated infrastructure is discussed in a series of five chapters that address impact and mitigation during construction (Chapter 7), operational (Chapter 8) and decommissioning (Chapter 9) of the CPF and associated infrastructure, a discussion on unplanned events (Chapter 10) and a discussion of the alternatives which were considered in development of the CPF and associated infrastructure (Chapter 11).

The current chapter, Chapter 7, describes the impacts associated with construction of the CPF and associated infrastructure.

7.1 The Physical Environment

7.1.1 Air Quality

7.1.1.1 Methodology

The assessment of construction air quality impacts separately considers the impacts of the construction activities to build the processing complex (the CPF, well pads, flowlines access, roads where not already built, other ancillary infrastructure and work areas on the Buhuka Flats, including the water intake station, the safety check station at the top of the escarpment and borrow pits); and the impacts of drilling. Air quality impact in the construction phase will last for 3 years, being limited to the period prior to first production at the CPF complex. Drilling continues beyond this date, but is then considered to be a joint operational impact, continuing for a further 5 years before all of the production and reinjection wells are completed. Air quality impact during decommissioning is considered to be similar to construction air quality impact for the CPF complex, excluding the drilling.

Figure 7-1 provides a simple illustration of the sequence of steps taken to determine air pollution impacts.

Existing meteorological data was obtained from The Penn State University (PSU) / National Centre for Atmospheric Research (MM5 data) for the Buhuka Flats for the period 01 January 2011 to the 31 December 2013 (3 years). The data was confirmed to be representative of the actual meteorological conditions in the study area. The existing airshed was assumed to be unaffected by any pollution.

Air pollutants assessed in Volume 4, Specialist Study 1 included nitrogen dioxide (NO_2), sulphur oxides (SO_X), carbon monoxide (CO), and particulates (TSP, PM_{10}, $PM_{2.5}$ and dust fallout). Additional pollutants that were considered included hydrogen sulphide (H_2S); volatile organic compounds (methane and ethane; BTEX; glycols; and polycyclic aromatic hydrocarbons). Source emissions data were obtained from international references based on CNOOC's description of equipment types. Emission rates and location for specified equipment were obtained from the project description.

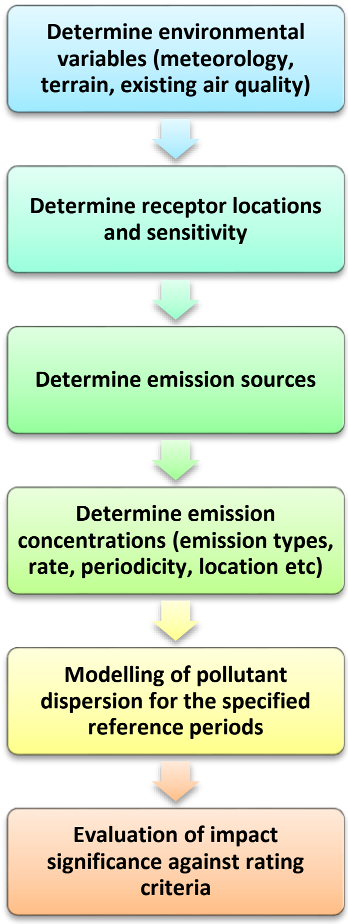

Figure 7-1: Steps involved in the air quality assessment

To assess the potential air quality impacts associated with the project, standard internationally accepted evaluation criteria were used. These were derived from the maximum permissible air quality limits set by the IFC (2007) and other international air quality guidelines. While Draft Ugandan air quality standards were published in 2005 (NEMA, 2005) these are less stringent than the IFC guidelines and have not been promulgated into law.

Following the general ESIA impact rating guideline described in Section 4.5, impact significance is determined by a combination of magnitude, duration, geographical extent and probability of occurrence, combined numerically. In the present case, the magnitude rating in Table 7-1 is based on air quality guideline values set out by the IFC (2007). Hence Table 7-1 shows that impact magnitude is a simple relationship between intensity (percentage in relation to the guideline value), and the number of resident people affected (in the final case, where the guideline value is exceeded, the number of people affected is no longer material). As a general rule, the IFC suggests 25% percent of the applicable air quality standards as a limit to allow additional, future sustainable development in the same airshed. The value of 25% is therefore a reasonable threshold distinguishing impacts of negligible magnitude from those that are more substantial.

The duration of construction phase impacts is related to the period of time over which the impact persists, and is not necessarily the same as the period of time of the project's construction phase (3 years). Nevertheless, in the case of air quality it is not expected that persistent impacts will affect surrounding populations beyond the construction phase and all impacts are therefore considered to be short term. Impacts are also local in geographic extent.

Table 7-1: Ratings used to determine the magnitude of air pollution impacts

Criterion	Rating	Definition
Magnitude	very low	Pollutant concentration ≤ 25% of guidelines, very little human exposure[1]
	low	Pollutant concentration >25% and ≤ 50% of guidelines, mainly community land and grazing areas
	medium	Pollutant concentration >50% and ≤ 100% of guidelines, some settlement
	high	Pollutant concentration >100% of guidelines, any degree of human use

While the dispersion of most of the gaseous pollutants referred to above was mathematically modelled for the construction phase of the project, only NO_2 is described in this section, **since it is the only modelled pollutant where ground level concentrations at the nearest receptors approach the 25% (low) guideline threshold** (Table 7-2). Specialist Study 1 provides details of the assessment of the other pollutants.

The IFC guidelines for NO_2 are shown in Table 7-2 below.

Table 7-2: IFC guideline limits for nitrogen dioxide (NO_2)

Parameter	Period	Unit of Measurement	Standard
Nitrogen dioxide	Max hourly (99th percentile)	$\mu g/m^3$	200
	Max annual	$\mu g/m^3$	40

*Note: For the dispersion simulations, 3 years of recent meteorological data were used to allow for seasonal and annual variations. For **maximum hourly average values (99th percentile):** there will be 365 x 24 x 3 = 26 280 values for each receptor, the 99th percentile of the 26 280 values is reported. For **maximum annual values**: there will be 3 values*

[1] *As a general rule, the IFC General EHS Guideline suggests 25% percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed.*

for each receptor (calculated by averaging 365 x 24 = 8760 hourly values for each year); the highest of the three annual values is reported.

For the construction phase, particulates (PM_{10}, $PM_{2.5}$, dust fallout) were not modelled since these sources will be highly mobile and temporary. For these pollutants, a qualitative assessment was made and mitigation to minimize their effect is included in the report.

For the dispersion modelling, the The Penn State University (PSU) / National Centre for Atmospheric Research (NCAR) meso-scale model (version 2) model was used. This internationally recognized model takes into consideration a wide range of parameters including the location of the emission source(s), the emission rates and concentrations, the height of the source(s), atmospheric dispersion potential (factors like air buoyancy and mixing potential), wind speed and direction and terrain. A variety of model outputs can be generated showing pollutant concentrations with increasing distance from the source(s). The figures presented in the Air Quality Specialist Study provide a colour coded representation of impact, from around 20% of the guideline value to over 200% of the guideline value.

7.1.1.2 Impact of Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a pollutant generated by combustion (e.g: vehicles, gas and diesel-driven generators). Figure 7-2 and Figure 7-3 present the expected NO_2 concentrations at the nearest receptors during the construction phase. The key sources are the generators driving the drilling rigs. Other sources at construction sites for the CPF complex including the safety check station and on the roads and borrow pits will be mobile and short term and have not been modelled. For ease of reading, Figure 7-2 and Figure 7-3 show the consolidated impacts of drilling on the three well pads - the impacts will, in fact, not occur simultaneously since there will be only one drilling rig on site at any time. Nevertheless, drilling is a continuous (day and night) activity, and the drilling of multiple oil and reinjection wells on the same well pad will mean that the emission source in one location will continue over an extended period. In sequence, the drilling during the construction phase is expected to be as follows; Well Pad 2 (240 days), Well Pad 3 (255 days); and Well Pad 1 (210 days). It is important to note that during the construction phase of the CPF complex no drilling will take place at Pad 4A, which is why it does not feature in this immediate discussion.

While the drilling periods at each well pad are less than a year, the IFC thresholds for hourly <u>and</u> annual exposure have been applied, acknowledging that there is some conservatism built into the assessment of the latter.

The following is concluded from Figure 7-2 and Figure 7-3:

- None of closest residents to the well pads in Kyabasambu, Nsonga and Nsunzu will experience maximum <u>hourly</u> NO_2 concentrations that exceed the threshold between very low and low magnitude (25% of the guideline value, which is a concentration of 50 ug/m^3). Impact duration (for individual households) will be short term and geographic extent will be local. Impact significance will be **low.**
- None of closest residents to the well pads in Kyabasambu, Nsonga and Nsunzu will experience maximum <u>annual</u> NO_2 concentrations that exceed the threshold between very low and low magnitude (25% of the guideline value, which is a concentration of 10 ug/m^3). Impact duration (for individual households) will be short term and geographic extent will be local. Impact significance will be **low.**

7.1.1.3 Impact of Particulates

Particulates (PM_{10}, $PM_{2.5}$ and dust fallout) can be significant, generated by mobile sources such as trucks, excavators, bulldozers and other large mechanical equipment. Without mitigation, given the proximity of communities to the construction sites, these emissions are expected to exceed short term IFC guideline limits at a number of residential receptors from time to time. Impact magnitude will therefore be high, but taking into consideration the short period of exposure and the local geographic extent, community impact significance will be **high medium**.

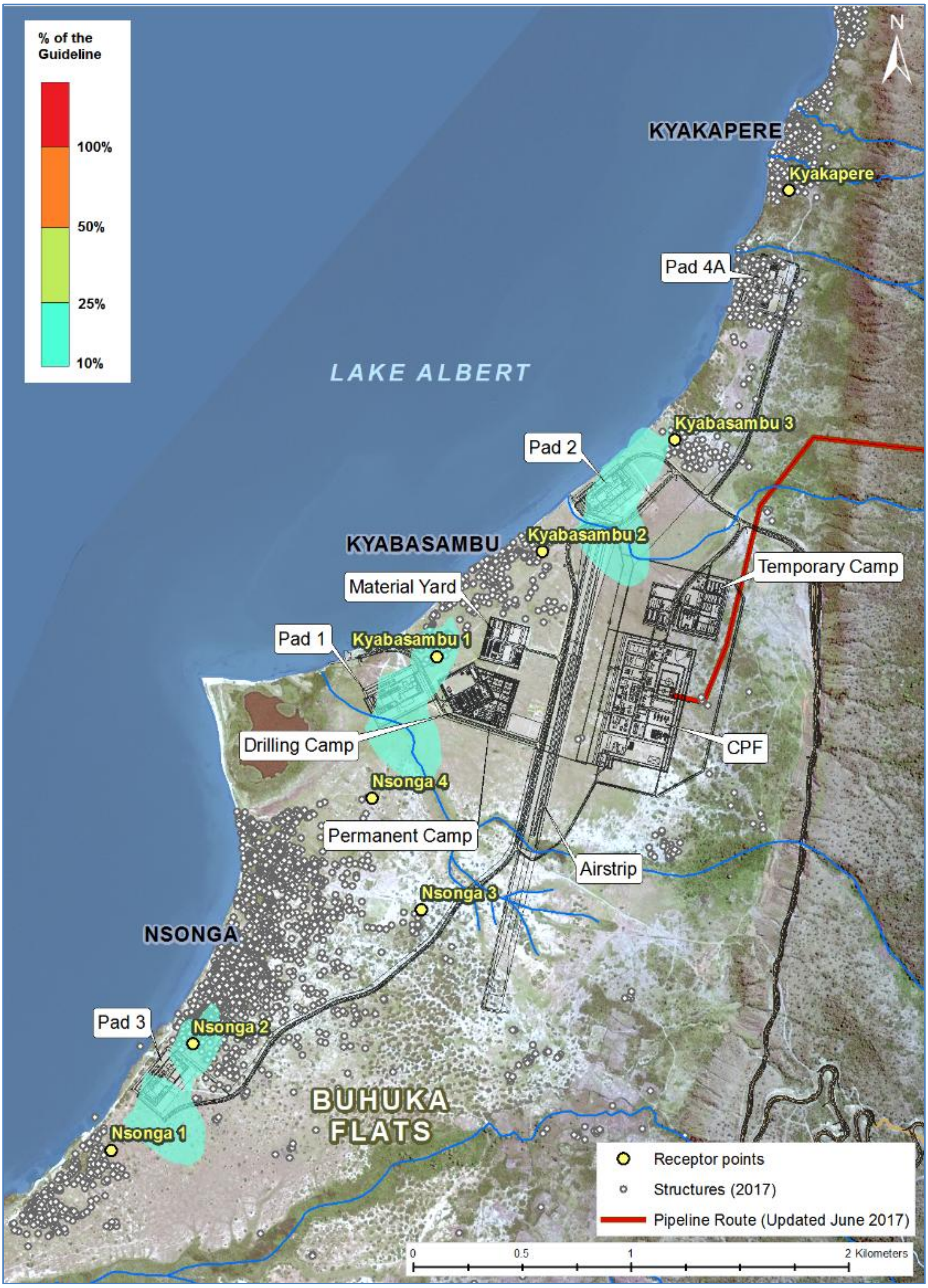

Figure 7-2: Consolidated map showing maximum hourly concentrations of NO_2 around well pads 1, 2 and 3 during the construction phase

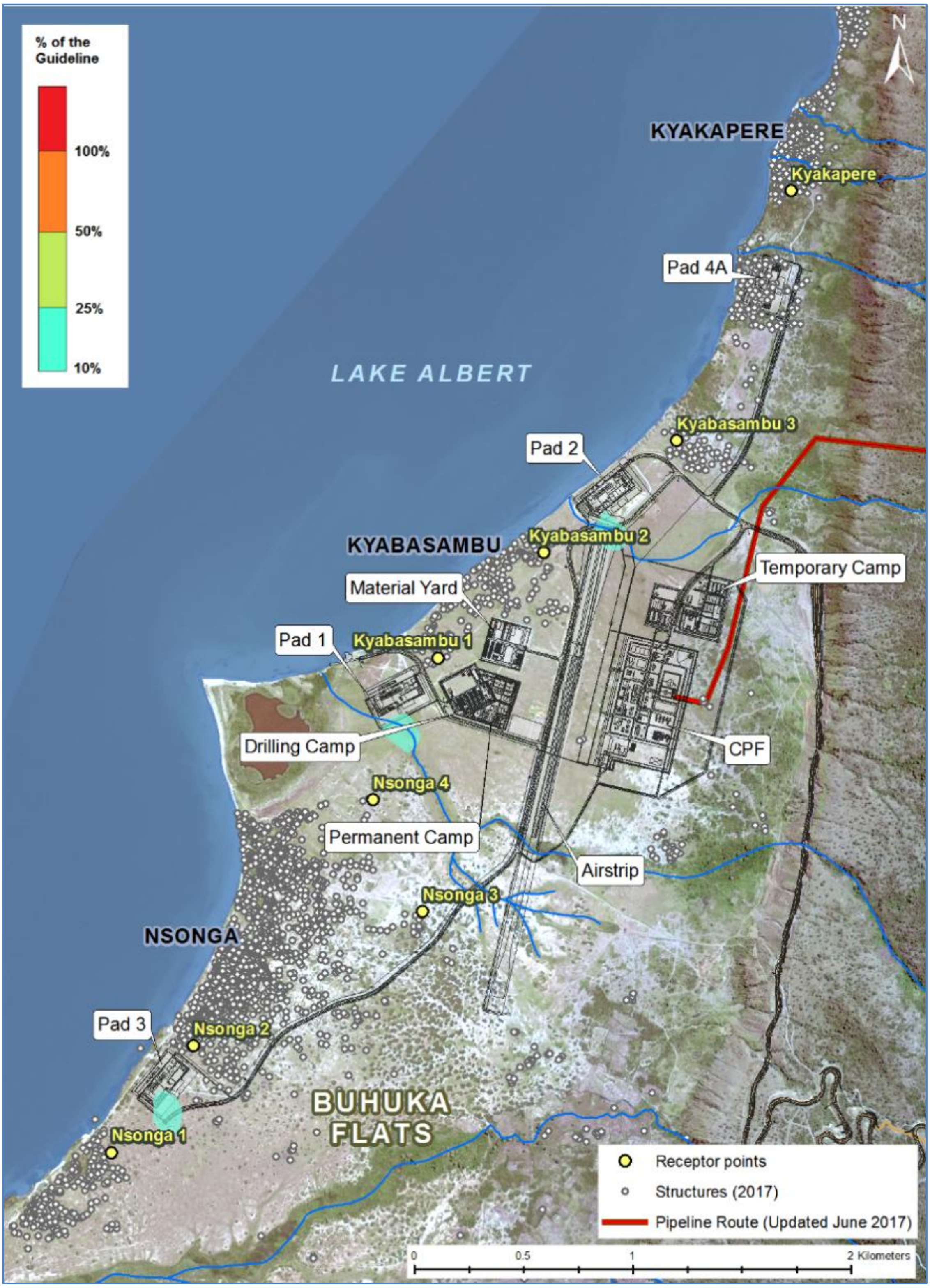

Figure 7-3: Consolidated map showing maximum annual concentrations of NO_2 around well pads 1, 2 and 3 during the construction phase

7.1.1.4 Mitigation and Monitoring

Recommended mitigation and monitoring is as follows:

For particulates:

- Use wet suppression and wet misting during materials handling activities;
- Apply wet suppression on Buhuka Flats[2] unpaved roads and at the borrow pits using water or a suitable dust palliative to achieve 50% control efficiency or better;
- Ensure that the road between the Buhuka Flats and Kikuube (P1) is tarred before construction begins (Responsibility: Government of Uganda);
- Cover stockpiles and keep stockpile heights as low as practicable (< 1.5 m vertical height) to reduce their exposure to wind erosion and dust generation;
- Progressively rehabilitate and re-vegetate disturbed areas;
- Reduce unnecessary traffic;
- Control vehicle speeds and institute traffic calming measures to reduce vehicle dust entrainment;
- Train all personnel who operate heavy equipment to be aware of and minimise dust generation; and
- Monitor dust generation daily, through visual observation, and act immediately on any episodes that are clearly resulting in nuisance in adjacent communities (ie. If high levels of dust can be seen to be generated by a particular activity, controls should be implemented to mimise nuisance to neighbouring communities). This implies competent, effective and full time ECOs, interacting with the EPC contractor management.

For NO_2:

- Maintain and service all vehicles and diesel generators regularly to ensure that exhaust particulate and trace gas emissions are kept to a minimum with post-combustion control measures;
- Use low sulphur fuels to minimise SO_2 emissions;
- Operate and maintain a site-specific particulate monitoring and trace gas monitoring network. This network should be installed at the start of the construction phase and continued through the operational phase (see monitoring plan for details);
- Audit and optimise the air quality monitoring network annually audit to ensure that it is maintained in accordance with best practice and is relevant to the key emission sources on the ground; and
- The emissions inventory and model should feed into future updates of the air quality management plan.

[2] *Note: The access road between Buhuka and Kabwoya is due to be tarred by Government. This needs to be completed before start of construction on the Buhuka Flats*

7.1.1.5 Impact Significance Rating

Table 7-3: Construction phase impacts on air quality

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Particulates (PM_{10}, $PM_{2.5}$, dust fallout)	8	2	2	4	High Medium 48	4	2	2	3	Low 24
Nitrogen dioxide (NO_2) - Hourly	2	2	2	5	Low 30	2	2	2	5	Low 30
Nitrogen dioxide (NO_2) - Annual	2	2	2	5	Low 30	2	2	2	5	Low 30

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.1.2 Surface and Groundwater

The construction phase at the CPF and associated infrastructure will involve a range of civil, structural and electrical activities that have the potential to impact on surface water and groundwater. Summarised, these are:

- Domestic wastewater discharge from personnel camps;
- Sanitation waste generation at work sites;
- Non-hazardous solid waste generation;
- Hazardous solid waste generation; and
- Drilling waste generation.

7.1.2.1 Impact of Domestic Wastewater Discharge on Surface and Groundwater Quality

The temporary camp will be fully sewered, with raw sewage and grey water from kitchens, bathrooms and administration areas being delivered to a sewage treatment plant. The capacity of the plant will be ~300 m^3/day, sized to meet peak construction demands. The plant will be designed to comply with the Ugandan Government effluent discharge standards or, IFC standards where these are more stringent. Key project standards for domestic wastewater are oil and grease (10 mg/l), total nitrogen (10 mg/l), phosphate (10 mg/l), total phosphorous (2 mg/l), soluble phosphorous (5 mg/l), BOD (30 mg/l) and total suspended solids (50 mg/l).[3] Treated sewage effluent that meets these criteria will be discharged into the seasonal drainage system that leads to Lake Albert, just south of Well Pad 2.

Construction camp sewage plants often perform poorly. Typically, this is due to a lack of appropriate plant management, under-capacity of the plant or inappropriate technology selection for operation in remote conditions on a large construction site. In CNOOC's case, the project specification is for a membrane bioreactor (MBR) sewage treatment works designed to accommodate the maximum personnel compliment during construction. While the necessary capacity is planned for, the MBR is not ideal for a construction works in a remote area, being a sophisticated design that requires highly skilled operation. For this assessment, it is assumed that occasional non-compliance with the standards is likely to occur in the unmitigated case.

While impacts of treated sewage effluent discharge into the small seasonal drainage line immediately north of the CPF are unlikely to have a material impact on surface and groundwater use on the Flats, the single point of discharge into the lake could result in increased concentrations of nutrients in the near-shore lake environment around the discharge point, with the possibility of algal blooms developing in the local area, affecting both lake biota and human use. Impacts will be short to medium term (2½ years), local (unlikely to migrate far from the discharge point) and of high magnitude (some exceedance of the discharge standard from time to time), resulting in impacts of **low medium** significance. Surface and groundwater is of variable quality on the Buhuka Flats, being contaminated *with E.coli and nutrients due to high rates of stocking and uncontrolled human defecation*, but it continues to be used for washing clothes and dishes and there is therefore receptor sensitivity to changes in water quality. River 1 (the seasonal stream into which treated sewage effluent from the temporary EPC camp would be discharged) is little used for domestic water supply, being seasonal.

Photograph 7-1: River 1, a seasonal stream which passes north of the CPF and discharges into Lake Albert south of Well Pad 2 (the photograph is at the stream culvert under the main tar road into the Buhuka Flats looking southward in the direction of the future CPF and EPC camp – see Figure 7-4 below. The road to the future CPF has already been build and can be seen in the middle ground of the photograph).

[3] *Quoted standards are the more stringent of the Ugandan and IFC standards. There is no common phosphorus standard, so all three Ugandan/IFC standards are quoted. Both standards have the same value for total nitrogen. The Ugandan standard includes various forms of nitrogen, namely nitrate, nitrate and ammonical nitrogen, but it calls for a more stringent nitrate standard than total nitrogen, which is a contradiction - hence only total nitrogen is used for the project standard, which matches the IFC requirement.*

7.1.2.1.1 Mitigation and Monitoring

The following mitigation and monitoring is proposed:

- Ensure that the construction contract specifications include provision for a sewage plant with a capacity of ~300 m^3/day to be constructed during the advance works and to be functional in the construction phase before personnel numbers ramp up;
- Use an appropriate sewage treatment technology which is suited to operation in remote locations and which is capable of achieving the project standard (Table 7-4). Membrane Bioreactors (MBRs) are generally less suitable in these circumstances, due to their complexity of operation, and could be reconsidered in favour of activated sludge treatment plants (ISBR or MLE[4]). In all cases, the final effluent should be disinfected before release. The project standard that must be achieved is as follows:

Table 7-4: Standards for effluent discharge

Parameter	Unit	Uganda	IFC	Project Standard
pH	pH	6 – 8	6 – 9	6 - 8
BOD	mg/l	50	30	30
COD	mg/l	100	125	100
Total nitrogen	mg/l	10	10	10
Total phosphorus	mg/l	10	2	2
Oil and grease	mg/l	10	10	10
Total suspended solids	mg/l	100	50	50

- Make provision for a modular plant which allows for maintenance without complete shutdown. Plant selection should also take into consideration buffering capacity, redundancy in terms of structures and mechanical equipment and options for automation;
- Monitor treated sewage effluent discharges daily for pH, TSS, BOD, nitrogen and phosphorous. Field measurements can be supported by monthly lab tests which serve as quality assurance;
- Re-use on roads for dust damping, other working areas where dust control is required, and recreational areas (eg: soccer field) created for contract employees. Sanitary wastewater that meets the project standard but is not re-used is to be disposed into Drainage line 1, which enters the lake immediately south of well pad 2.

7.1.2.1.2 Impact Significance Rating

Table 7-5: Construction phase impacts of the discharge of domestic wastewater on surface and groundwater quality

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Domestic Wastewater Discharge on Surface	6	4	2	4	Low Medium 48	4	2	2	3	Low 24

[4] *ISBR is ;Internittant Feed Sequential Batch Reactor' and EL is 'Modified Ludzac Ettinger' ISDR is modular in nature, can be automated and has excellent redundancy.*

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
and Groundwater Quality										

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

7.1.2.2 Impact of Sanitation Waste on Surface and Groundwater Quality

During the construction phase of the well pads, flowlines and associated project infrastructure on the Buhuka Flats (located away from the personnel camps), sanitation waste will be generated by workers. There are no permanent ablution facilities near these construction sites, and workers will be provided with portable toilets to prevent the unsanitary disposal of human waste. Field toilets on construction sites are often inadequate for the purpose, being too few and poorly maintained, which discourage personnel from using them.

These issues can become significant through lack of management. Given the large numbers of construction workers, pollution of surface water and groundwater is possible under these conditions, with a consequent potential for an increase in waterborne diseases such as cholera. Unmitigated, the impact could exacerbate the existing sanitation problems on the Flats, where health risks already exist due to poor sanitary practices (all of the lakeside borehole samples were contaminated with *e.coli*). Assuming that responsible sanitary practices are not fully enforced, measureable effects on surface water and groundwater are possible. The impact would be highly probable without mitigation, local and short term (during the period construction workers are on site). Magnitude of impact would be high. Overall impact significance will be **low medium,** which reflects the need for specific management control during the construction phase.

7.1.2.2.1 Mitigation and Monitoring

The following mitigation and monitoring is proposed:

- Install ventilated chemical toilets at the well pads, along the flowline construction sites, at the safety check station construction site and at other work areas where the camp toilets are inaccessible to the work force. Portable toilets should be within easy walking distance of any work site;
- Ensure that there are sufficient toilets for the workforce at the work site;
- Keep toilets in a clean and sanitary condition at all times;
- Add disinfectant to toilets to minimise E.*coli;*

- Train construction personnel to use the toilets (training to be ongoing, starting at induction and continuing by means of tool box[5] talks); and
- Monitor the use of site toilets throughout the construction contracts.

7.1.2.2.2 Impact Significance Rating

Table 7-6: Construction phase impacts of sanitation waste on surface and groundwater

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of Sanitation Waste on Groundwater Quality	8	2	2	4	Low Medium 48	4	2	2	3	Low 24

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.1.2.3 Impact of Hazardous Waste Generation on Surface and Groundwater Quality

A wide range of hazardous wastes will be generated during the construction phase of the CPF and associated works. Much of the waste will be generated on the well pads and is regarded as a petroleum waste, based on the definition of these wastes in Schedule 2 of the Ugandan Draft Petroleum Waste Act (2006). The typical wastes expected during construction are described in Table 7-7.

Table 7-7: Hazardous Waste Inventory during the Construction Phase

Waste type	Description
Batteries (wet and dry)	Wet-cell batteries (lead acid) are typically used in vehicles, and contain a liquid electrolyte, such as sulfuric acid, which may be hazardous. In contrast, dry cell batteries do not contain a liquid. These batteries may contain alkaline, lithium, mercury, silver oxide, zinc, lithium ion, nickel-cadmium, or nickel metal hydride, which are also hazardous.
Spent chemicals and residue	Chemical hazardous wastes are solids, liquids, or gases that display either a hazardous characteristic or are listed specifically by name as hazardous. The four hazardous waste characteristics include ignitability, corrosivity, reactivity, and toxicity.

[5] *Short talks that take place at the beginning of a shift for a group of construction workers responsible for a particular task*

Waste type	Description
Contaminated containers	Containers, such as oil drums that have been used for the storage and transport of hazardous substances, such as chemicals or oily waste.
Contaminated hydrotest water	Hydrotest water is used for the pressure testing of equipment and pipelines. Chemical additives, corrosion inhibitors, oxygen scavengers, and dyes) may be added to the water to prevent internal corrosion or to identify leaks.
Contaminated personal protective equipment	Personal protective equipment contaminated by hazardous substances, such as chemicals or oily waste.
Contaminated scrap metal	Scrap metal contaminated by hazardous substances, such as chemicals or oily waste.
Completion and well work-over fluids	Completion and well work-over fluids are typically used to clean the wellbore and stimulate the flow of hydrocarbons, or simply used to maintain downhole pressure. Once used these fluids may contain contaminants including solid material, oil, and chemical additives.
Electrical/electronic waste	Electrical/electronic waste, such as mobile phones, computers, and laboratory equipment, contain hazardous substances such as heavy metals.
Foam	Water, surfactants, and air are combined to create a stiff foam which is circulated as a drilling fluid.
Medical waste	Certain types of medical wastes are classified as a biohazard as these could potentially lead to the spread of infectious disease.
Oil contaminated soil	Soils (including produced sands) contaminated by oily waste.
Oily rags, filters etc.	Rags, filters and other consumables contaminated by oily waste.
Oily sludges (from the bottom of vessels)	Oily sludges that collect at the bottom of vessels.
Paint residue (solid and liquid)	Residual paints which may contain hazardous substances.
Pipe dope	Pipe dope is used as a pre-connecting pipe conditioner, which may contain high levels of lead.
Sewage solids	Sewage sludge is classified as potentially hazardous as it can contain (infectious) pathogens which pose risk to the environment and human health.
Spent fluorescent tubes and lamps	Fluorescent tubes and lamps contain mercury which is classified as hazardous.
Spent welding rods, epoxy coatings, grinder wheels, visors, shot blast etc.	Workshop consumables that may contaminated by hazardous substances, such as chemicals or oily wastes.
Used aerosol cans	Aerosol cans may contain paint, lubricants, glues, pesticides, and many other chemicals that are classified as hazardous.
Used fabrication material (e.g. paint, cement, insulation)	Certain fabrication materials contained by hazardous substances such as paints, cements or insulation.
Used lubricating / hydraulic oil, grease, solvents and absorbent materials	Residual lubricating/hydraulic oil, grease, solvents and absorbent materials which pose risk to the environment and human health.
Naturally Occurring Radioactive Materials (NORM) – not typically expected during construction	NORM can be carried up to the surface by the produced fluids and/or from scale on the inside of piping

CNOOC's Waste Management Design Philosophy (2016) commits the company to comply with the principles underpinning the waste hierarchy, which are, wherever possible, to avoid or reduce the generation of waste at source, and/or to re-use or recycle waste before considering disposal options (Figure 7-4). This philosophy is also enshrined in the Ugandan Waste Management Regulations and in most international waste management standards and guidelines, including those of the IFC/World Bank.

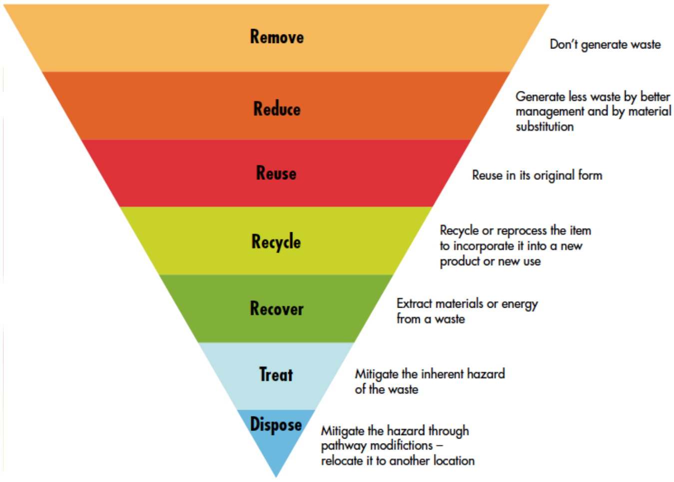

Figure 7-4: The solid waste management hierarchy

The EPC and drilling contractors will be contractually bound to comply with CNOOC's standards for hazardous materials storage, handling and waste management. All hazardous materials must be stored in covered areas on impermeable surfaces, and bunded to contain 110% of a possible spill. Waste generation and waste disposed to landfill must be minimised. All re-usable and recyclable waste must be separated at source from waste destined for disposal to landfill. Hazardous waste must be contained in bunded, impervious and roofed areas, typically in sealed and labelled drums, in accordance with the labelling requirements specified in the Ugandan waste regulations. In the vehicle and equipment maintenance yards, work must be on impervious surfaces draining to sumps with mechanical oil separators, before washwater may be released. The EPC and drilling contractors will be required to appoint specialist subcontractors to remove the waste to a suitable hazardous waste disposal site registered with the Ugandan regulator. Waste disposal sites that will be considered by CNOOC include the three shown in Figure 7-5.

Subject to the contractors' compliance with this waste management philosophy, the magnitude of hazardous waste generation, storage and disposal on surface water and groundwater quality on the Flats is likely to be low, the duration short term and the geographic extent local, resulting in impacts of **Low** significance. However, lack of (or delayed) compliance is often a problem affecting environmental performance on large construction contracts, particularly if environmental systems and skilled environmental personnel are not on site from the start of construction, and workers are unfamiliar with hazardous materials and safe waste management practices. Occasional spillages are likely to occur. There is usually great pressure on the Contractor to finish technical work on time and environmental considerations, as a result, are not always regarded as priorities.

In the present case, there is significant receptor sensitivity with surrounding populations close to the construction works and with a high level of dependence on the lake as a source of nutrition and income. Assuming that the contractor's performance may not always meet the required standard, and that spills of material or waste spills could escape the confines of the controlled areas on occasions, impact magnitude could be high, contaminating local drainage lines and boreholes with chemicals or hydrocarbons, and potentially spreading to the lake environment (with the pollution potentially spreading beyond the local area). The duration of the impact may persist beyond the term of the construction contracts (short term) into the medium term. Under these circumstances, impact significance would be of **high medium** significance.

7.1.2.3.1 Mitigation and Monitoring

The following mitigation and monitoring is proposed:

General Requirements:

- Strictly enforce CNOOC’s waste management philosophy and the Ugandan waste regulations through the project EMP and the EPC and drilling contract specifications, ensuring that all hazardous products are safely stored and used, and that measures are taken to avoid, minimise, separate, sort and recycle/reuse hazardous wastes before disposal options are considered. In preparing a method statement for compliance with these requirements, the Contractor is to identify each potentially hazardous product and waste and demonstrate that the principles of the waste hierarchy have been implemented;
- Assess the risks of using hazardous materials in specific applications and train the personnel who use them about materials handling and spill management protocols. Training is to be ongoing in tool box talks;
- Monitor waste management performance through review of waste records and regular on-site checks. Monthly ECO monitoring reports are to include specific details about hazardous waste management compliance;

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Figure 7-5: Location of third party hazardous waste disposal Sites

- Store all potentially hazardous products in fully secured areas, with an impervious floor, bunded perimeter or walls, and roof to avoid rainfall ingress. Place a PPE storage box and spill kit within immediate vicinity of waste storage areas;
- Temporarily store all hazardous waste, prior to transport off-site, in a fully secured, area, with an impervious floor, bunded perimeter, and roof to avoid rainfall ingress. Design the hazardous waste storage area to have sufficient capacity to safely contain the flux of wastes generated during construction and to have sufficient ventilation;
- Store hazardous waste in sealed containers, labelled in accordance with the Ugandan waste regulations. Ensure that waste transport manifests are signed on departure from the construction site and on receipt at the approved disposal site in accordance with the regulations;
- Ensure that hazardous waste is regularly collected from site in order to minimise build-up in the temporary storage area;
- Contract with a specialist hazardous waste contractor for the transport and disposal of all hazardous waste from site;
- Verify that the selected hazardous disposal site is registered with the Ugandan authorities and is suitable for the hazardous wastes being disposed; and
- Maintain accurate manifests of all hazardous waste that is temporarily stored and transported from site in accordance with Ugandan waste regulations. This will necessitate an appropriate industrial scale to weigh all wastes. Verify that the quantity of waste transported tallies with the amount disposed.

Specific Requirements:

- Ensure that any water treatment brines or hydrocarbon sludges are in sealed containers to avoid spillage during transport;
- Conduct all servicing of vehicles or equipment within the designated areas for maintenance;
- Place any field equipment that could leak oil onto drip trays or plastic liners, to prevent spillage into the environment;
- Prohibit fueling of vehicles and mobile equipment outside of the designated fueling areas, wherever possible. If unavoidable make use of suitable catch trays;
- Prohibit the use of equipment with lubricants containing PCBs;
- Develop and implement a procedure for a rapid response to management of spills; and
- Manage the wastes described in Table 7-8 in accordance with the recommendations in the table.

Table 7-8: Management of specific activities that generate potentially hazardous waste

Hazardous Waste Type	Hazardous Waste Management
Hydrocarbon waste from vehicle maintenance and washing	Ensure that all vehicle washing and maintenance, and the maintenance of potentially oil contaminated equipment takes place in defined workshop areas which have impermeable floors, and have controlled washwater/stormwater drainage through a sump and mechanical oil separator. Test potentially contaminated waste water to ensure it meets the project standard before being released into the environment.
Brines from raw water treatment	Collect and drum all brines and waste chemicals generated by water treatment and dispose at either a hazardous waste disposal site or a domestic site, to be determined by testing the quality of the brines.
Sludges from sewage treatment	Collect and remove sewage sludge to a hazardous waste disposal site.

Hazardous Waste Type	Hazardous Waste Management
Water from pressure vessel testing**	Prior to release of any water from pressure vessels or flowlines that are hydrotested to check their integrity, pass the water through sand filters and test for toxicity, based on recognised bioassay methodologies. Avoid the use of biocides or corrosion inhibitors by minimising residence time of the water in the vessels.
Waste paints, scale, sand blasting residue, waste glues and sealants	Collect waste sweepings in bags, seal and deliver to the temporary storage area for hazardous waste prior to disposal. Contaminated drums to be sealed, labelled and stored for removal.
Hydrocarbon contaminated waste (oily rags, oils sludges, etc.)	Contain and drum all hydrocarbon or hydrocarbon-contaminated residues for disposal at a hazardous waste disposal site.
Pesticide waste	Select and use pesticides following the principles set out in the IFC PS3. These include management of the type of pesticides used (extremely hazardous pesticides, as defined by the WHO, are prohibited), and their handling, storage, use and disposal.
Waste fluorescent lights containing mercury	Store separately and dispose to hazardous waste disposal site.
Biomedical waste	Store separately and remove to hazardous waste disposal site.

** *Pressure test water included as a precaution. No biocides / corrosion inhibitors are planned for use. However, should they be used the water will need to be tested and potentially handled as a waste*

If the above requirements are complied with, the likelihood of hazardous substances or wastes escaping to surface and groundwater during the construction phase will be low; the magnitude of the expected impact will remain high but any instances will occur for only a short period of time, before clean-up, the geographic extent will be limited to the site and the significance of impact will be **low.**

7.1.2.3.2 Impact Significance Rating

Table 7-9: Construction phase impacts of hazardous waste on surface and groundwater

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of Hazardous Waste Generation on Groundwater and Surface Water Quality	8	3	3	**4**	**High Medium 56**	8	2	1	2	**Low 22**

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.1.2.4 Impact of Non-Hazardous Solid Waste Generation on Surface and Groundwater Quality

The construction phase will generate large quantities of non-hazardous solid waste. Estimates of the relative proportions of different wastes and approximate tonnages are set out in the project description in Chapter 2. Wastes will consist of a typical range, including food and vegetable waste, plastics, paper and packaging, metals, glass, rubber, wood and miscellaneous wastes such as insulation, used tyres, used parts, textiles and leather, construction and demolition materials and waste cement and concrete. Nearly half of the waste is expected to be organic (food and vegetable waste), and most of the remaining half plastics and paper and packaging.

As described in Section 7.1.2.3 above, CNOOC has committed to fully comply with the requirements of the waste hierarchy, avoiding or reducing the generation of waste at source, and/or re-using or recycling waste before considering disposal options. Third party contractors will remove recycleable/reusable materials and waste destined for disposal. No incineration will be permitted on site.

With some assumed management limitations (at least initially), surface water and groundwater impacts of non-hazardous waste management will be local, short term and reversible, with medium magnitude, resulting in impacts of **low medium** significance.

7.1.2.4.1 Mitigation and Monitoring

The following mitigation and monitoring is proposed:

- Strictly enforce the requirements of Ugandan legislation and the waste hierarchy through the EMP and the EPC and drilling contract specifications, ensuring that all reasonable measures have been taken to minimise, separate, sort and recycle/reuse wastes before disposal options are considered;
- Train all personnel in responsible waste management and provide the necessary colour coded bins for separation of waste at source. Training is to be provided during induction of all personnel and ongoing by means of tool box talks;
- Monitor waste management performance through review of waste records and regular on-site checks. Monthly ECO monitoring reports are to include specific details of waste management compliance for the recording period;
- Ensure that waste is neatly stored in a defined, secured, area;
- Ensure that waste transport manifests are signed on departure from the construction site and on receipt at the approved disposal site;
- Verify that the selected disposal site is registered with the Ugandan authorities;
- Ensure that waste is regularly collected from site in order to minimise build-up, particularly organic wastes;
- Consider the use of an industrial bailer to compact cardboard, paper and plastic wastes; and
- Install an industrial composter for the treatment of organic kitchen waste.

Subject to compliance with these requirements, the magnitude of impacts on surface and groundwater should be reduced to very low, and the impact significance will be **minor.**

7.1.2.4.2 Impact Significance Rating

Table 7-10: Construction phase impacts on surface and groundwater

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of Non-Hazardous Waste Generation on Groundwater and Surface Water Quality	6	2	2	4	**Low Medium 40**	6	2	1	2	**Low 18**

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

7.1.2.5 Impact of Drilling Waste Generation on Surface and Groundwater Quality

CNOOC proposes to drill 20 production and 11 injection wells from four onshore well pads. During the three-year construction period, drilling will be limited to well pads 1, 2 and 3, but will continue on these pads, and on pad 4, for 5 years after the first production of oil.

Drilling wastes constitute by far the largest potentially hazardous waste stream. It is estimated that an average of 1,158 m^3 of WBM (aqueous) and SBM (synthetic) drilling cuttings and liquid waste will be generated per well, together with 656 m^3 of other solids. This will extend over the construction phase and into the operational phase for a total period of 5 years. Ugandan law prohibits the disposal of petroleum wastes on the well pad or in the surrounding environment. All petroleum wastes defined in Schedule 2 of the regulations must be collected, transported, treated (as necessary) and disposed by an independent petroleum waste handler, contracted by the licensee (CNOOC), and registered with the regulator. All of these wastes may be temporarily stored at the well pads in impervious facilities, protected from rainfall runoff and flooding and covered to prevent direct rainfall ingress, before being transported off-site[6].

The equipment and infrastructure on each well pad will include a drilling rig and auxiliary facilities, drilling waste storage pits, a fuel storage area, a drilling fluids preparation area and mud tanks, flare pits for emergency use and a control room. The pad will be security fenced. Perimeter drains are proposed around the potentially contaminated areas on the well pad so as to intercept any runoff or washdown, and route it to a lined conservancy tank.

The location of existing disposal facilities, developed principally for oil industry use, are shown inFigure 7-5.

[6] *The assessment of impact of disposal of waste at the registered third party waste disposal sites is not a part of this ESIA*

Two types of drilling fluids will be used for each well – Water Based Muds (WBMs) for the upper sections (the 26” hole section) and Synthetic Based Muds (SBMs) for the lower sections. WBMs are generally considered to be environmentally friendly (non-hazardous), consisting mainly of water, bentonite (as a weighting agent and lubricator) and a variety of other non-toxic chemicals. The main risk is high salinity which may reach an EC of 50 000 µS/cm or more. At these concentrations, clear liquid and cuttings waste would be likely to contaminate surface water and groundwater resources if released into the environment without specific management measures. While WBMs are not listed under the Petroleum Waste Regulations (2017), and could theoretically be disposed onto land around the wells or further afield, as was done during some of the early exploration drilling, this practice has been discontinued due to concerns about land and water contamination. CNOOC’s waste management philosophy excludes this option from further consideration, and all WBM waste generated by drilling is to be handled in the same manner as SBM waste.

The design philosophy governing drilling waste management is to ensure that:

- the wet waste streams are cleaned and conditioned to enable the reuse of the drilling fluids and to minimise drilling waste, with only the residual from this process being regarded as waste for off-site disposal.
- all drainage from potentially contaminated areas of the well pad is contained in lined, impervious, sumps for testing prior to disposal – any contaminated stormwater will be managed with other hazardous drilling waste.

With the exception of rainfall runoff on the potentially contaminated areas of the pad, which will be captured, any oil removed by mechanical separators, and if compliant released after testing, there will be no discharges released from the well pads into the environment during drilling. Impacts on surface water or groundwater could arise from spillages on the well pad escaping into the environment, or (for groundwater) from inadequate sealing of the well bore where aquifers are intersected. The risk is generally low, subject to appropriate well pad design and ongoing management. Grouting of the well casing through near-surface water bearing formations is a standard, effective, practice and the likelihood of leakage of oil into these formations is small. The likelihood of significant spillages escaping from the pad is also small, although a high degree of vigilance will be necessary over an extended period to ensure that spills do not occur as a result of poor maintenance or carelessness. Taking into consideration the high sensitivity of surrounding users and their proximity to the well pads, and the sensitivity of the lake environment, the magnitude of this impact, should it occur, is considered to be very high, following a conservative approach. Duration of impact could be medium term with the effects of pollution, especially in the lake, persisting beyond the period of construction. Geographic extent would also be an increased risk due to the proximity to the lake, and the possibility of the pollutants spreading beyond the local nearshore environment. Unmitigated impact significance will be **high medium**.

7.1.2.5.1 Mitigation and Monitoring

Most of the necessary design mitigation is built into the project base-case. All drilling waste is to be removed from the well pads by a registered hazardous waste contractor. The design of the well pad infrastructure includes drains to collect spills and contaminated stormwater from the potentially contaminated areas on the pad, and impervious temporary storage for liquid and drill cutting wastes, covered to prevent rainfall ingress and protected from floods. The following additional mitigation is proposed:

- Develop and implement an environmental management system which defines the responsibilities of members of the drilling crew for environmental management. Ensure that full time, competent, HSE staff are employed to manage all aspects of drilling waste;
- Develop checklists for daily, weekly and monthly monitoring to ensure that all important aspects of drilling waste management are supervised;
- Train all members of the drilling crew to understand the risks of drilling and to report any observed incident that could result in a pollution hazard. In addition to induction training, tool box talks should reinforce these lessons throughout the drilling contract;

- Prepare a detailed method statement, prior to development drilling, which identifies and evaluates all of the specific risks associated with the handling of hazardous products, wastes and spillage during drilling, and the measures to be taken to manage these risks (to be completed by the drilling contractor for review by CNOOC);
- Comply with all the aspects of hazardous waste management described under mitigation for hazardous wastes in Section 7.1.2.3 above, where hazardous materials such as acids and biocides are used in the drilling and well completion process;
- Implement methods of enhancing recovery and reuse of the fluids from the drilling cuttings, so as to minimise disposal requirements;
- Consider methods of cuttings waste storage that allow for ongoing removal by the waste contractor (such as temporary storage in skips) to minimise the need for waste storage on site;
- Verify that the contractor selected to dispose of the waste is registered with the environmental regulator and that the disposal site is suitable and is certified for the type of waste being disposed; and
- Maintain spill kits on site and develop rapid response protocols for the clean-up of any spills.

Subject to compliance with these requirements, the probability of impact on surface and groundwater should be reduced to low, and while magnitude will remain high, impact duration will be short term and geographical extent local. Impact significance will be **low.**

7.1.2.5.2 Impact Significance Rating

Table 7-11: Drilling impacts on surface water and groundwater

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of Drilling Waste Generation on Groundwater and Surface Water Quality	10	3	3	4	High Medium 64	10	2	2	2	Low 28

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.1.3 Noise

7.1.3.1 Methodology

The assessment of construction noise impacts separately considers the impacts of the construction activities to build the processing complex (the CPF, well pads, flowlines access roads where not already built and other ancillary infrastructure and work areas on the Buhuka Flats, including the water intake station, the safety check station at the top of the escarpment and borrow pits); and the impacts of drilling. Noise in the construction phase will last for 3 years, being limited to the period prior to first production at the CPF. Drilling continues beyond this date, but is then considered to be a joint operational impact, continuing for a further 5 years before all of the production and reinjection wells are completed. Decommissioning noise is considered to be similar to construction noise for the CPF complex.

To determine criteria for the assessment of construction noise impact, the Ugandan noise regulations and internationally accepted standards were reviewed. There are considerable differences in the quoted target values. It is our understanding that the existing Ugandan construction noise standard is based on indoor limits (Table 7-12). To convert this to outdoors so as to be comparable with other standards requires an estimate of the expected attenuation between indoors and outdoors. While 15 dBA is often assumed, this as unlikely for the Buhuka Flats where most inhabitants live in thatched roof huts without ceilings. Indoor / outdoor attenuation is estimated to be 5 dBA, which adjusts the Ugandan daytime standard to 65 dBA and nighttime standard to 45 dBA.

For night time, at least, this corresponds with the first part of the IFC guideline for outdoor noise levels (Table 7-12). The second part of the IFC guideline, which specifies that sound levels should not be increased by more than 3 dBA above the background ambient, is typically not achievable in the context of construction noise and is often interpreted to apply only in cases where the baseline ambient already exceeds the IFC maxima specified in Table 7-12.

Table 7-12: Ugandan Noise Standards compared with IFC Guidelines

Period	IFC	Ugandan Construction Noise Standard (Indoors)[7]	Draft (Revised) National Ugandan Construction Noise Standard (Outdoors)[8]
Daytime Noise	55 dBA	60 dBA	75
Nighttime Noise	45 dBA	40 dBA	65

Other standards for construction noise impact distinguish between noise levels based on the period of construction. The most cogent of these, and the one used for the purpose of this assessment, is 'Noise *and Vibration Criteria Impact Assessment Criteria and Methodology*'[9] (Table 7-13), produced by Rio Tinto.

[7] National Environment Noise Standards and Control Regulation, 2003. Noise attenuation between indoors and outdoors for traditional thatched roof buildings is typically only 10 dBA, bringing the outdoor limit to 50 dBA
[8] Draft National Environment (Noise and Vibrations Standard and Control) Regiulations, 2013: Schedule 4 Part A. The quoted standard is for buildings other than schools, hospitals and places of learning
[9] Rio Tinto (undated)

For long term construction noise (>6 months), the target values are 55 dBA (daytime) and 45 dBA (nighttime). Impact significance ratings based on this threshold value are shown in Table 7-13.

Table 7-13: Rio Tinto Impact Rating Scale for Construction Noise for periods longer than 6 months[10]

Time of Day	Noise Level (dB LAeq, I hr)					
	<45	45-50	50-55	55-60	60-65	>65
Daytime	NS	NS	NS	Minor	Moderate	Major
Night time	NS	Minor	Moderate	Major	Major	Major

NS = Not significant

To adapt the ESIA impact rating scale to conform to the above approach, the normal impact rating criteria are not applied. The ratings of 'minor', 'moderate' and 'major' in Table 7-13 are deemed to be equivalent to 'low', 'medium' and 'high' significance in the ESIA rating scale.

Further details of the assumptions and methodology used in the construction phase noise assessment are included in Volume 4, Specialist Study 6.

7.1.3.2 Impact of Civil Construction Noise (excluding drilling noise)

The noisiest stage of the construction works has been assumed to be clearance and construction works at the well pads, CPF and the laying of pipelines. Such works typically generate higher levels of noise than fabrication and finishing works, since greater numbers of heavy mobile plant are required. CNOOC have confirmed that no noisy construction works will be undertaken during the night-time period; this assessment therefore assumes that night-time activities will be restricted to use of hand tools and assembly activities, and no heavy plant will be used.

The construction sites will involve a multitude of activities, employing up to 2,000 personnel (including day workers) at peak times. Cranes, excavators, bulldozers, heavy vehicles, vibrating rollers, and a wide range of other mechanical and hand-operated equipment will be used. Most of the activity will be restricted within defined work areas, the principle of these being the CPF, permanent camp, as well as ancillary work areas which will include road construction sites (not already completed), borrow pits, the water intake station, the safety check station, the jetty (upgraded) and the airfield (upgraded), and the completion of 3 well pads (well pads 1, 2, and 3)[11].

Noise during the construction phase has been modelled on the basis that works will take place at the CPF over the full construction period of three years, and at each well pad over a short period during the construction phase. A representative assemblage of plant, comprising two excavators, two road wagons, a dozer, a crane and a vibrating roller has been modelled at each worksite and noise levels predicted at the closest receptors to the worksite. Mobile plant items have been assumed to have an utilisation of 80 percent.

Figure 7-6[12] presents an example of the effect of construction noise at well pad 3[13]. Table 7-14 shows how many structures will be exposed to noise levels that exceed the upper permissible limits of the project standard. The increase in noise levels above the pre-existing background can be seen by comparing the data in the table with the measured sound levels shown for each village presented in Column 1 of the table.

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[10] Ibid

[11] Well pad 4A will be constructed during the operational phase, prior to the start of drilling in 2024

12 Figure 7-4 shows a snapshot of construction while civil activities are taking place at well pad 3. The plots showing construction noise on the other well pads, combined with construction on the CPF, are presented in the Specialist Study on Noise Impact (Volume 4, Specialist Study 5).

[13] Other plots are included in the Specialist Study on Noise (Volume 4, Specialist Study 5).

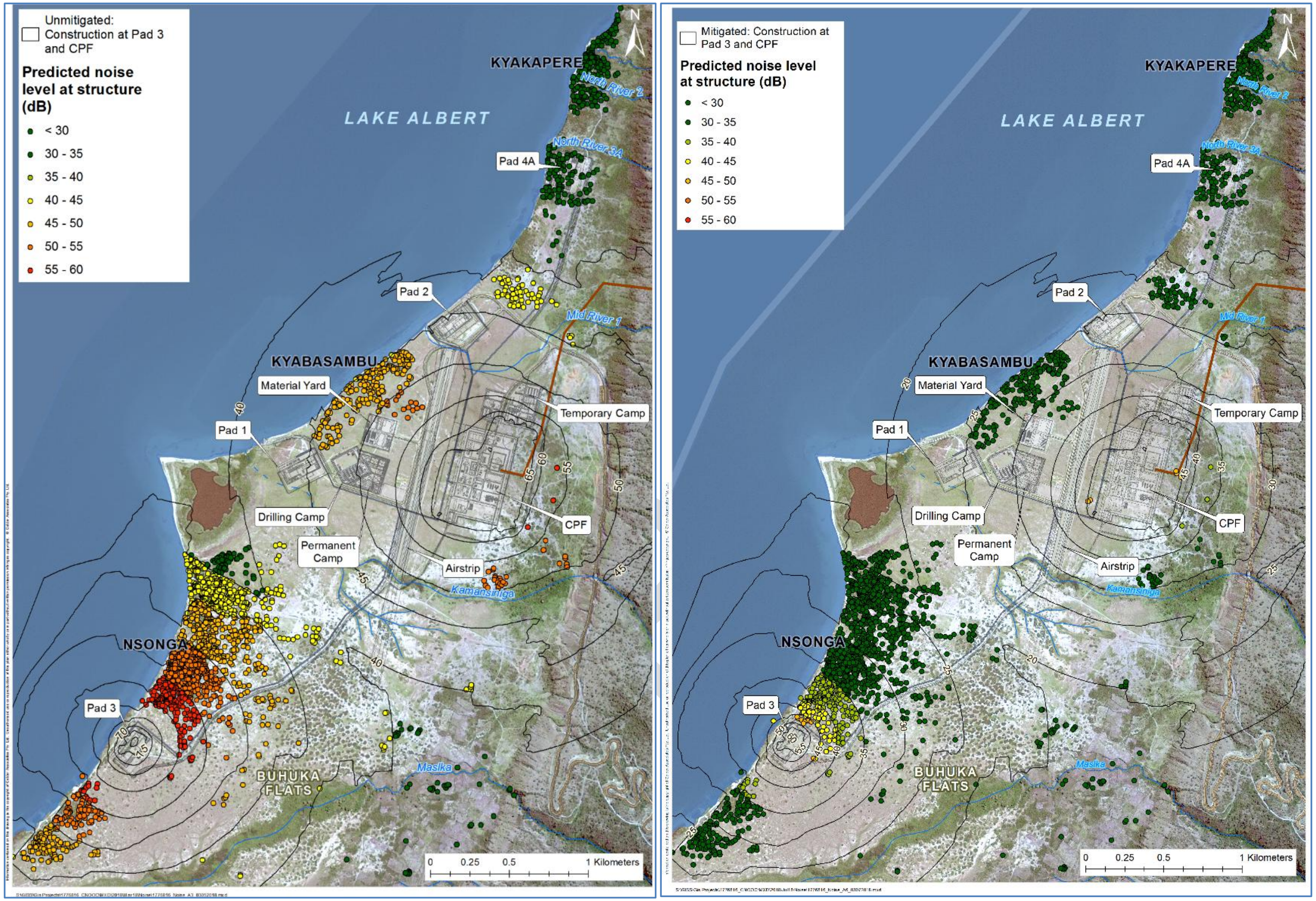

Figure 7-6: Example of unmitigated (LHS) and mitigated (RHS) civil construction noise showing CPF construction and civil works ongoing simultaneously on Well Pad 3

Buildings are mainly residences, but since a family may occupy more than 1 building, or the buildings may only be seasonally occupied, reference in Table 7-14 is to buildings rather than households. A rough estimate is that, on average, each structure represents 4.5 people[14].

Table 7-14: Household exposure to construction noise during the 3-year construction period and exceedance of daytime and nighttime project standard - unmitigated case

Village (and adopted background noise levels)	Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the daytime project standard are highlighted in blue)						Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the nighttime project standard are highlighted in brown)					
	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA
CPF households			29	3	5				29	3	5	
Kyabasambu South *Daytime: 25 dBA* *Nighttime: 33 dBA*			23	22	8				23	22	8	
Nsonga North *Daytime: 37 dBA* *Nighttime: 32 dBA*	1	359	53	3			1	359	53	3		
Kyakapere South *Daytime: 30 dBA* *Nighttime: 38 dBA*		9	27	30				9	27	30		
Kyabasambu North *Daytime: 37 dBA* *Nighttime: 32 dBA*			58	50	10				58	50	10	
Nsonga South *Daytime: 31 dBA* *Nighttime: 35 dBA*		153	330	153	55	9		153	330	153	55	9
Nsunzu North *Daytime: 31 dBA* *Nighttime: 42 dBA*	7	96	67	12			7	96	67	12		
Kyakapere Village *Daytime: 37 dBA* *Nighttime: 32 dBA*	86	16					86	16				
Nsonga East *Daytime: 31 dBA* *Nighttime: 35 dBA*	20	25	1				20	25	1			
Nsonga *Daytime: 31 dBA*	2	94	10				2	94	10			

[14] *This is based on data for Kyakapere, which is assumed to be representative for other villages. LC 1 estimates indicate that the population of Kyakapere is 3,700 people. Satellite imagery indicates 824 structures. Therefore a rough relationship between structures (measurable from satellite imagery and population is that 1 structure represents 4.5 people.*

Village (and adopted background noise levels)	Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the daytime project standard are highlighted in blue)						Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the nighttime project standard are highlighted in brown)					
	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA
Nighttime: 35 dBA												
Kyabasambu East *Daytime: 37 dBA* *Nighttime: 32 dBA*		19	5					19	5			

Note: (i) The boundaries of the villages may be seen from the Baseline section of the report. This table presents a consolidated assessment of construction at the CPF and well pads 1, 2 and 3. Well pad 4 is constructed during the operational phase of the project and is not included here. (ii) Baseline noise levels at Kyabasambu East were not measured and are assumed to be the same as Kyabasambu North (iii) Table 7-17 combines the impact of noise on people affected by construction on different well pads. This construction will not take place simultaneously.

The worst affected villages will be Nsonga and Kyabasambu. At night, the number of households affected by noise levels above the standard will be much higher, due to the more stringent threshold limit of 45 dBA. The unmitigated base case does not assume that construction activity will stop at night.

The impacts of greatest magnitude occur near the well pads when the platforms are under construction. This is simply due to their proximity to residents – the CPF construction generates similar or higher noise levels but is a greater distance from most settlement. Daytime noise levels will not exceed 60 dBA at any household (refer to Table 7-16). Forty one people (9 building structures at an average of 4.5 people per structure) are expected to reside within the 55-60 dBA **low** significance zone (Table 7-12). For nighttime noise, with its more stringent compliance requirement to avoid nuisance and sleep disturbance, 360 buildings (1621 people) would be affected by noise levels that exceed the target limit of 45 dBA. Impact significance will vary with distance from the well pad - Table 7-14 shows the numbers of people affected by varying degrees of daytime and nighttime noise impact.

7.1.3.2.1 Mitigation of Impact

The following mitigation of construction noise is proposed:

- Silence construction plant with enhanced exhaust mufflers and engine compartment sound insulation;
- Restrict construction works involving heavy vehicles, plant and noisy equipment to the daylight hours[15] only. Only hand tools may be used during any night-time work; and
- Provide truck drivers and equipment operators with training not to generate unnecessary noise.

Subject to careful vehicle and equipment selection in favour of low noise signatures, daytime construction noise impact can be reduced to very **low** levels of significance. Regarding night time noise nuisance, the

[15] *The term 'daylight hours' is used in preference to 'daytime period' because the 'daytime period', as defined in noise guidelines, extends to 22:00. It is intended that construction noise sources should not be permitted after dark.*

measures that are proposed, and which have been agreed to by CNOOC, will eliminate most night time construction noise, and the significance of this impact will be **low.**

7.1.3.2.2 Impact Significance Rating

Table 7-15: Construction phase impacts of noise (civil works of CPF complex and associated infrastructure)

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Daytime Impact of Civil Construction Noise (9 buildings – 55-60 dBA)	-	-	-	-	**Low**	-	-	-	-	**Low**
Night time Impact of Civil Construction Noise (9 buildings - 55-60 dBA)	-	-	-	-	**High**	No work at night				**NSI**
Night time Impact of Civil Construction Noise (78 buildings - 50-55 dBA)	-	-	-	-	**Medium**	No work at night				**NSI**
Night time Impact of Civil Construction Noise (273 buildings- 45-50 dBA)	-	-	-	-	**Low**	No work at night				**NSI**

KEY (Note: The standard rating scale does not apply to construction noise – refer to the methodology above)

Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	4	Permanent	5	International	5	Definite/don't know
8	High	3	Long-term (>6 months)	4	National	4	Highly probable
6	Medium	2	Medium-term (1-6 months)	3	Regional	3	Medium probability
4	Low	1	Short-term (<1 month)	2	Local	2	Low probability
1	Minor			1	Site only	1	Improbable
						0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +. NSI No Significant Impact

7.1.3.3 Impact of Drilling Noise

The drilling rig is the single most significant construction phase noise source associated with the project. Drilling noise is generated on the platform and by the motor on top of the mast, at an elevation of around 40 m above the ground. Drilling is a 24/7 activity, and while there will be only one drilling rig on site, which moves from well pad to well pad, the drilling of multiple oil and reinjection wells on the same well pad will mean that the noise in one location will continue over an extended period. In sequence, the drilling during the construction phase is expected to be as follows:

- Well Pad 2 (240 days);
- Well Pad 3 (255 days); and
- Well Pad 1 (210 days).

These periods of noise exposure are far beyond what would be regarded as transient in the Rio Tinto rating scale, being considered to be long term (>6 months).

Table 7-16 shows the significance of the noise impact in the villages affected by combined CPF construction and unmitigated drilling noise in relation to the number of building structures affected[16]. Figure 7-7 is a plot of noise levels caused by CPF construction and drilling on well pad 3 at the same time. Other plots showing the combination of CPF construction noise and drilling noise on well pads 1 and 2 are included in Specialist Study 6.

Many households are above the project's target threshold for daytime (blue shading) and nighttime (brown shading) construction noise. Most people will also experience a very large increase in noise levels, in some cases exceeding 30 dBA above the natural background noise levels. Assuming a relationship of roughly 4.5 people per building, approximately 972 and 6,485 villagers will be exposed to daytime and night time noise levels respectively that exceed the project's target thresholds.

Table 7-16 shows that in the daytime, most people are impacted by sound levels within 5 dBA of the 55 dBA target threshold. During the nighttime, with the more stringent requirements for quiet, larger numbers of people will experience higher levels of noise, with around 15% of the affected people being more than 10 dBA above the 45 dBA target.

Broken down, the nighttime impact significance in the unmitigated case will be as follows (refer to Table 7-16):

- **High** significance (>55 dBA): 972 people (216 building structures) will be exposed to higher night time noise levels exceeding 55dBA;
- **Medium** significance (50-55 dBA): 2,556 people (568 building structures) will be exposed to moderate night time noise levels within the range of 50-55 dBA; and
- **Low** significance (45-50 dBA): 2,957 people (657 building structures) will be exposed to lower noise levels within the range of 45-50 dBA.

Table 7-16: Household exposure to CPF construction and drilling noise during the 3-year construction period and exceedance of the daytime and nighttime project standard – unmitigated case

Village (and adopted background noise levels)	Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the daytime project standard are highlighted in blue)								Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the night time project standard are highlighted in brown)							
	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	60-65 dBA	65-70 dBA	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	60-65 dBA	65-70 dBA
CPF Households																
Kyabasambu South *Daytime: 25 dBA* *Nighttime: 33 dBA*					19	22	12						19	22	12	
Nsonga North *Daytime: 37 dBA* *Nighttime: 32 dBA*			153	257	6						153	257	6			
Kyakapere South *Daytime: 30 dBA*			3	17	46						3	17	46			

[16] *Plots of drilling noise impacts on other well pads are included in the Specialist Report on Noise*

Village (and adopted background noise levels)	Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the daytime project standard are highlighted in blue)								Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the night time project standard are highlighted in brown)							
	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	60-65 dBA	65-70 dBA	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	60-65 dBA	65-70 dBA
Nighttime: 38 dBA																
Kyabasambu North *Daytime: 37 dBA* *Nighttime: 32 dBA*				23	75	20						23	75	20		
Nsonga South *Daytime: 31 dBA* *Nighttime: 35 dBA*			32	164	344	129	30	1			32	164	344	129	30	1
Nsunzu North *Daytime: 31 dBA* *Nighttime: 42 dBA*		2	15	99	64	2				2	15	99	64	2		
Kyakapere Village *Daytime: 37 dBA* *Nighttime: 32 dBA*	127	90	101						127	90	101					
Nsonga East *Daytime: 31 dBA* *Nighttime: 35 dBA*	4	53	10	19					4	53	10	19				
Nsonga *Daytime: 31 dBA* *Nighttime: 35 dBA*		1	37	68						1	37	68				
Kyabasambu East *Daytime: 37 dBA* *Nighttime: 32 dBA*				10	14							10	14			

Note: The boundaries of the villages may be seen from the Baseline section of the report. This table presents a consolidated assessment of construction at the CPF and well pads 1, 2 and 3. Well pad 4 is constructed during the operational phase and is not included here.

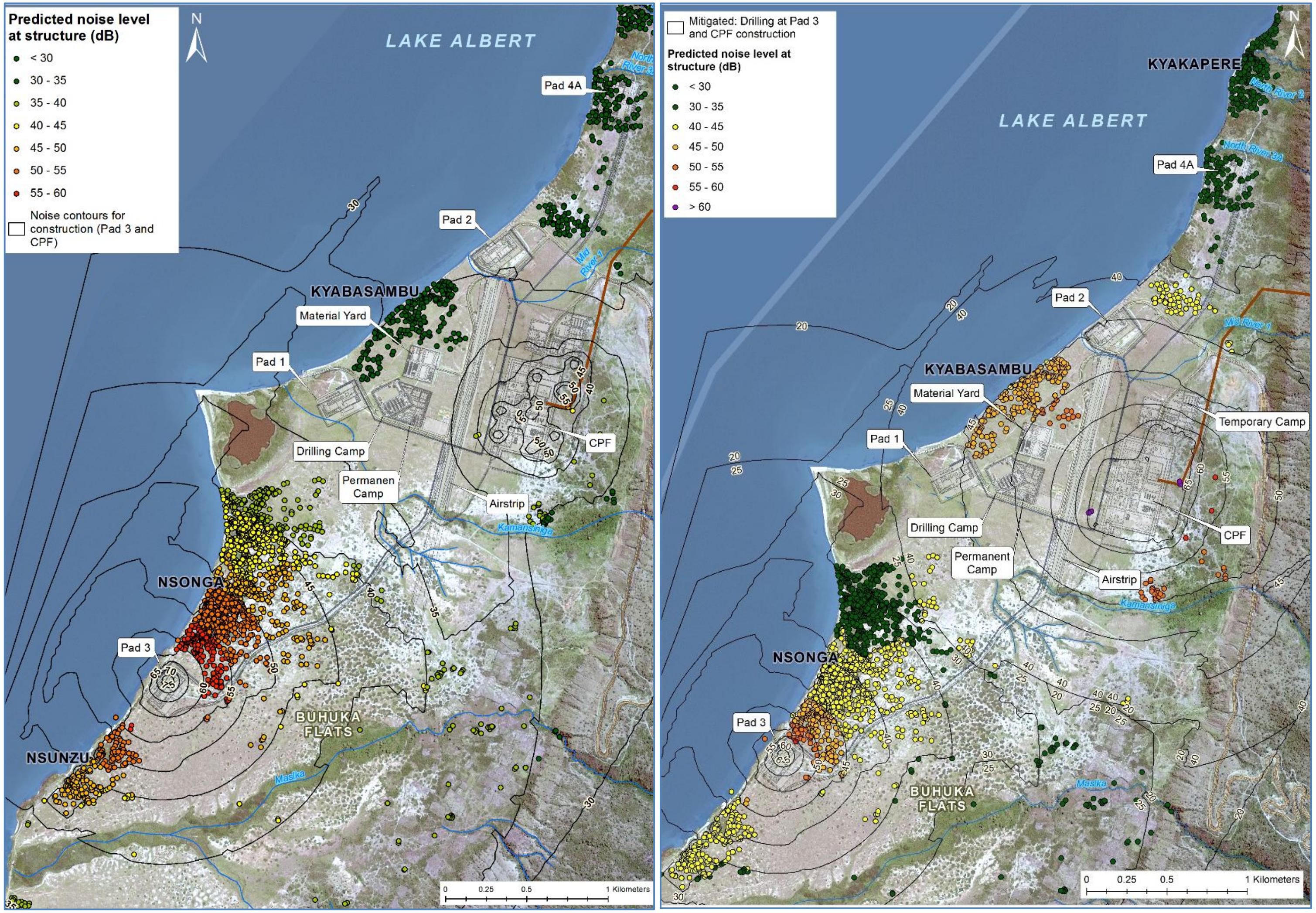

Figure 7-7: Example of unmitigated (LHS) and mitigated (RHS) drilling noise modelled together with noise from CPF construction and drilling on Well Pad 3

7.1.3.3.1 Mitigation and Monitoring of Impact

The following mitigation of drilling noise is proposed:

- Erect acoustic barriers (noise 'curtains') around the drilling rig, screening to above the drilling platform, and 5m high screens above ground level around the perimeter of the site;
- Separate the top drive and the blower fans and install the fans at ground level, and
- Consider providing soft ear plugs to affected households

Estimates based on data provided by vendor estimates show that up to 10 dBA of source attenuation could be achieved. Screens could be made from a variety of materials of which the most practical may be stacked shipping containers. Table 7-17 shows the change in affected building structures that will result from the decrease in noise. During the daytime, impact significance will be **low**, with only 1 building structure (roughly 5 people) affected by noise exceeding the 55 dBA target. At night, 973 people (216 buildings) will be affected by noise above the 45 dBA target. Of these, most (60%) will reside in Nsonga South, which is affected primarily by the drilling of wells on well pad 3. The significance of residual impact for nighttime noise will be as follows (refer to Table 7-17:

- **High** significance (>55 dBA): 5 people (1 building structure) will be exposed to higher night time noise levels exceeding 55dBA;
- **Medium** significance (50-55 dBA): 189 people (42 building structures) will be exposed to moderate night time noise levels within the range of 50-55 dBA; and
- **Low** significance (45-50 dBA): 779 people (173 building structures) will be exposed to lower noise levels within the range of 45-50 dBA.

Table 7-17: Household exposure to CPF construction and drilling noise at well pads 1, 2 and 3 during the 3-year construction period and exceedance of the daytime and nighttime project standard (the plots show combined noise with construction of the CPF) - mitigated case

Village (and adopted background noise levels)	Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the daytime project standard are highlighted in blue)								Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the night time project standard are highlighted in brown)							
	20-25 dBA	25-30 dBA	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	20-25 dBA	25-30 dBA	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA
CPF households			30	4	1						30	4	1			
Kyabasambu South *Daytime: 25 dBA* *Nighttime: 33 dBA*					19	22	12						19	22	12	
Nsonga North *Daytime: 37 dBA* *Nighttime: 32 dBA*			153	257	6						153	257	6			
Kyakapere South *Daytime: 30 dBA* *Nighttime: 38 dBA*			3	17	46						3	17	46			

Village (and adopted background noise levels)	Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the daytime project standard are highlighted in blue)								Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the night time project standard are highlighted in brown)							
	20-25 dBA	25-30 dBA	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	20-25 dBA	25-30 dBA	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA
Kyabasambu North *Daytime: 37 dBA* *Nighttime: 32 dBA*				23	75	20						23	75	20		
Nsonga South *Daytime: 31 dBA* *Nighttime: 35 dBA*			32	164	344	129	30	1			32	164	344	129	30	1
Nsunzu North *Daytime: 31 dBA* *Nighttime: 42 dBA*		2	15	99	64	2				2	15	99	64	2		
Kyakapere Village *Daytime: 37 dBA* *Nighttime: 32 dBA*	127	90	101						127	90	101					
Nsonga East *Daytime: 31 dBA* *Nighttime: 35 dBA*	4	53	10	19					4	53	10	19				
Nsonga *Daytime: 31 dBA* *Nighttime: 35 dBA*		1	37	68						1	37	68				
Kyabasambu East *Daytime: 37 dBA* *Nighttime: 32 dBA*				10	14							10	14			

Note: The boundaries of the villages may be seen from the Baseline section of the report. This table presents a consolidated assessment of construction at the CPF and well pads 1, 2 and 3. Well pad 4 is constructed during the operational phase and is not included here

While the temporary nature of the noise permits higher acceptable noise levels, people around the drilling rigs will still be exposed to residual noise (particularly at night) which is far above the existing ambient. Even in the event of a change from rural conditions to a more urbanised environment, the noise levels that are typically accepted as a standard for such areas would be exceeded.

The acceptability of the residual noise levels must be negotiated with NEMA. If the revised draft Ugandan noise regulations are still considered to provide an acceptable maximum noise limit for construction-related activities (a nighttime standard of 65 dBA; daytime standard of 75 dBA), this could form the basis of a legal compliance requirement. Once an upper limit has been agreed with Government, CNOOC must actively monitor noise levels around the active well pads to ensure compliance and as a basis for action in the event of non-compliance.

7.1.3.3.2 Impact Significance Rating

Table 7-18: Construction phase impacts of CPF Construction and drilling noise

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Daytime Impact of CPF Construction and Drilling Noise	1 structure (5 people)				High	-				NSI
	42 structures (189 people)				Medium	-				NSI
	173 buildings (779 people)				Low	1 structure (5 people)				Low
Night time Impact of CPF Construction and Drilling Noise	216 buildings (223 people)				High	1 structure (5 people)				High
Night time Impact of Civil Construction Noise	568 buildings (2556 people)				Medium	42 structures (189 people)				Medium
Night time Impact of CPF Construction and Drilling Noise	657 buildings (2956 people)				Low	173 structures (779 people)				Low

KEY (Note: The standard rating scale does not apply to construction / drilling noise – refer to the methodology above)

Magnitude	Duration	Scale	Probability
10 Very high/ don't know	4 Permanent	5 International	5 Definite/don't know
8 High	3 Long-term (>6 months)	4 National	4 Highly probable
6 Medium	2 Medium-term (1-6 months)	3 Regional	3 Medium probability
4 Low	1 Short-term (<1 month)	2 Local	2 Low probability
1 Minor		1 Site only	1 Improbable
			0 No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +. NSI No Significant Impact

7.1.4 Visual Aesthetics

7.1.4.1 Methodology

The assessment of visual impact follows a specific methodology described in Figure 7-8. The method is based on an international approach to Visual Impact Assessment (VIA) while also conforming to the general impact assessment methodology for the CNOOC ESIA as a whole. Reference is made to this methodology throughout the section below.

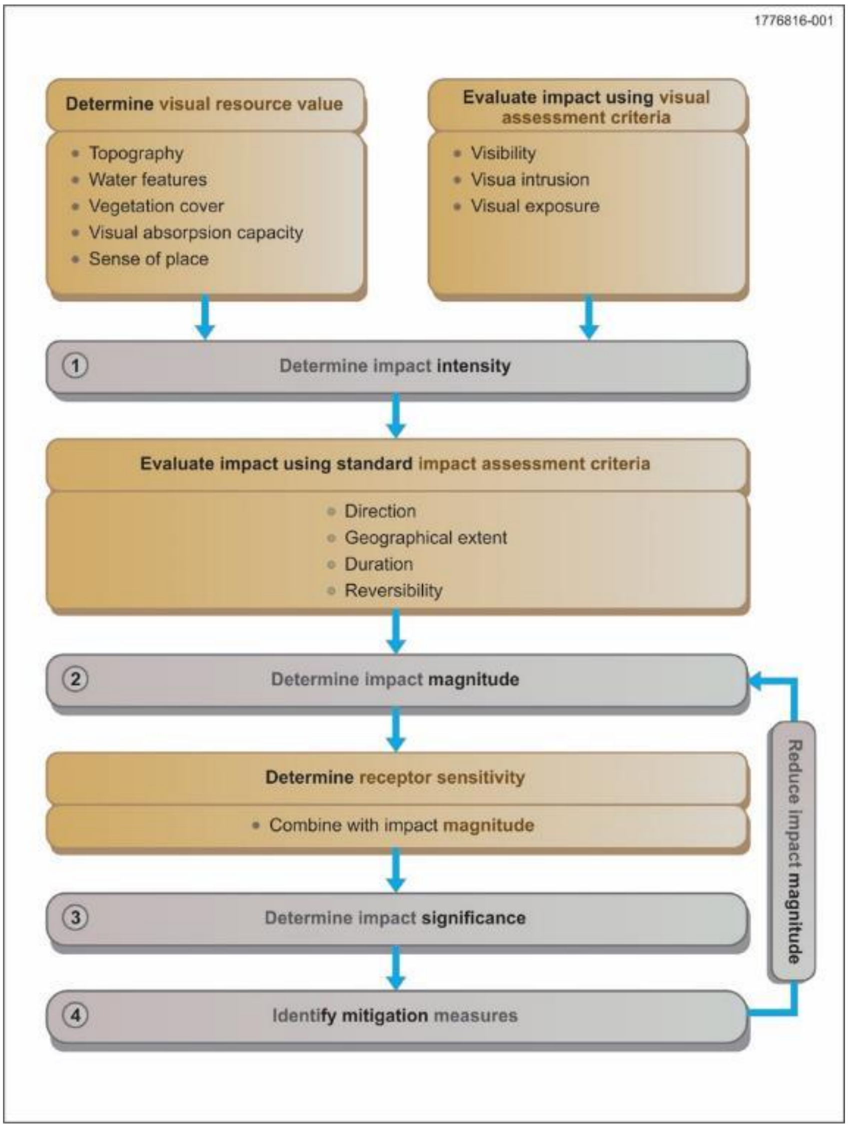

Figure 7-8: Methodology for assessing visual impacts

7.1.4.2 Impact on Visual Resources – Daytime

Visual Resource Value

Details of the visual resource are provided in Section 6, and in Specialist Report 7. Many studies have shown human preferences for specific types of landscapes. Typically, people prefer more complex landscapes to homogenous ones. The study area has most of the attributes that contribute to a resource of high value. These include:

- Dramatic changes in topography between the escarpment, the Buhuka Flats, Lake Albert and the distant mountains in the DRC;
- Extensive water bodies (Lake Albert); and
- Vegetation cover which varies between grasslands on the flats, low thickets along the drainage lines and woody vegetation on the escarpment.

Grassland vegetation is not always rated highly in respect of visual resource value, being fairly uniform, but in the context of the escarpment and Lake Albert, and the varying colours and textures of the vegetation on the plains and the steeper slopes, it contributes to a strongly defined sense of place. The stark juxtaposition between the prominent linear relief of the escarpment and the vast, near-flat, surface formed by the peninsula and adjacent water body creates the unique and highly recognisable character of the study area, which is irreplaceable.

Photograph 7-2: The view from the escarpment across the Buhuka Flats, Lake Albert and the distant mountains in the DRC (CNOOC's drilling camp is in the middle ground)

Visibility, Visual Intrusion and Visual Exposure of Project Construction Activities

Visibility concerns how much of the construction is seen from the receptor. Visibility was determined using viewshed analysis. Visual exposure is related to the distance of project infrastructure from the visual receptor – the further the receptor from the impact source, the less the exposure. At distances beyond two kilometres, most visual features become indistinct.

Specialist Study 7 presents a number of viewsheds, from both the position of the 'receiver' (the villages) and the 'impactor' (either the CPF or the well pads). Figure 7-9 shows the combined viewshed of the CPF and well pad 3 (i.e.: the view from these 'impactors'), taken from a level of around 5 m above the ground, which is the average mid-level height of most CPF infrastructure. Table 7-19 summarise the visibility and exposure of the main villages in the study area to the construction sites. This varies, with views from Kyabasambu most affected, followed by Nsonga North. Visibility of and exposure to project infrastructure at the other villages, by comparison, is low.

It is noted, however, that people on the Flats are not restricted to their villages, which are used in the visual assessment simply as convenient reference points. Inhabitants of the Flats will be acutely aware of the operation of the kfda facility as they go about their daily lives. Large numbers of construction vehicles will operate in and around the KFDA work areas. Around 60 heavy vehicles a day will enter and leave the site via the escarpment road and materials and supplies will also be brought in via the jetty on Lake Albert. Many personnel (around 1200 workers[17]) will be on site. Cranes will stand above the structures gradually rising above ground level as construction proceeds at the CPF work site.

Table 7-19: Visibility and visual exposure ratings of villages (receptors) and impactors (CPF, well pads and safety check station)

Village	Visibility	Visual Exposure
Kyakapere	Most project infrastructure obscured except for well pad 4, which is within 500 m of the village. Overall visibility rating of project infrastructure is low	Low
Kyabasambu	Located near the centre of the study area. Most of Production complex at the CPF will be visible as well as well pads 1, 2 and 4. Well pad 2 will be within 500 m of the village. Overall visibility rating of project infrastructure is high.	High
Nsonga North	Located just south of the centre of the study area. Parts of the CPF and supporting infrastructure and well pad 1 will be visible. All of the project infrastructure is more than 500 m from this village. Overall visibility rating of project infrastructure is medium.	Medium
Nsonga South	Located in the south of the study area. Parts of the CPF and supporting infrastructure and well pad 1 will be visible. Most of the CPF will be hidden but the village will be fully exposed to well pad 3 at distances less than 500 m. Overall visibility rating of project infrastructure is low.	Low
Ngoma	Located at the top of the escarpment at the site of a decommissioned construction camp. The safety check station will be visible to people living at the top of the escarpment, but hidden from villages on the Buhuka Flats. Given its relatively small footprint (3,750 m^2) and smaller number of resident receptors, the overall visibility rating is low.	Low

Visibility Ratings: High means more than half the study area is visible from the receptor. Medium means between a quarter and half of the study area is visible. Low means less than a quarter of the study area is visible.
Visual Exposure Ratings: High means views over a distance of 500 m or less. Medium means views of between 500 m and 2000 m. Low means views of greater than 2000 m

[17] *Demand for day workers will vary and total numbers of full time construction personnel and day workers could fluctuate between 1,000 and 2,000*

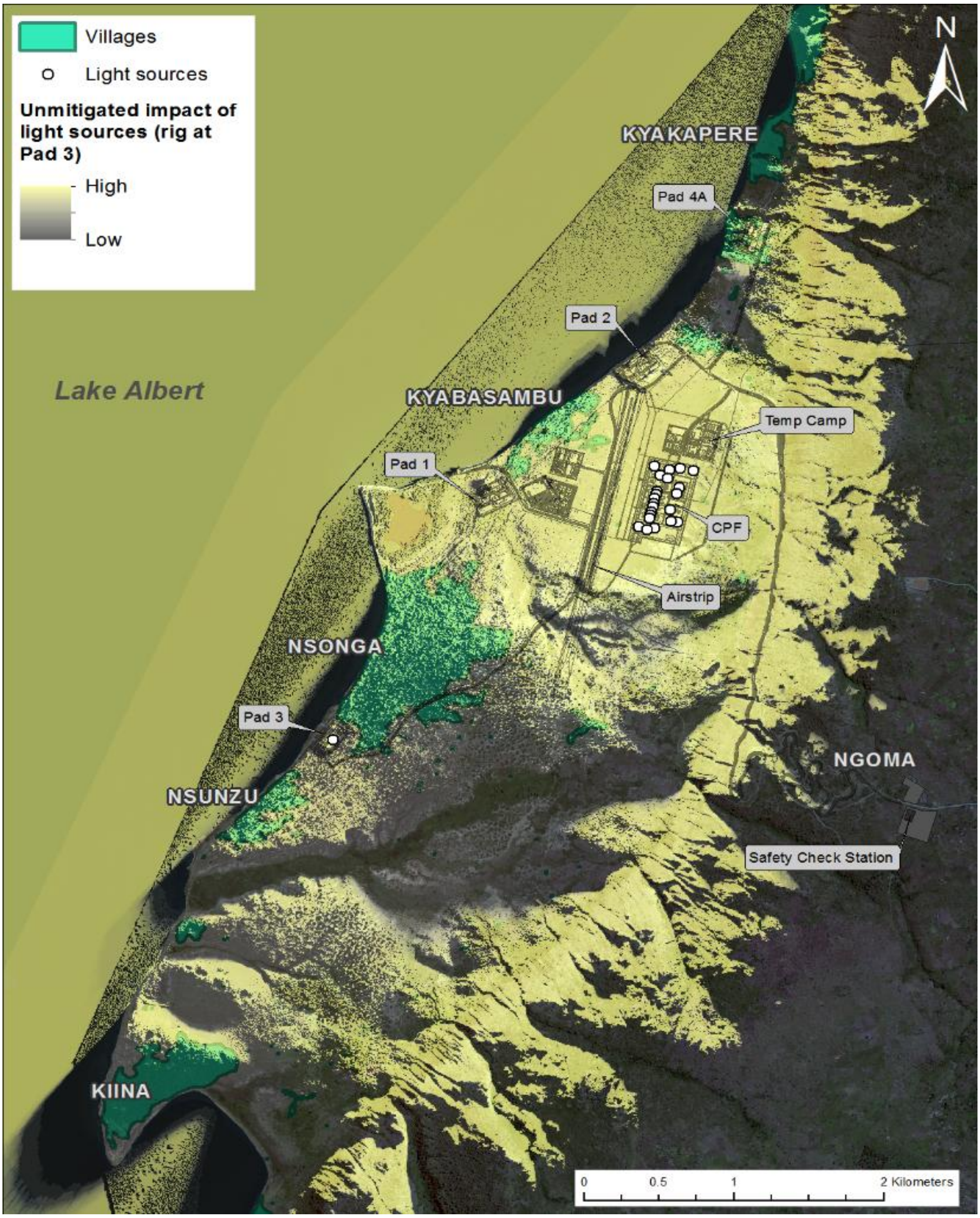

Figure 7-9: Viewshed from the CPF and Well Pad 3 (impactor based) at night

Visual intrusion (how intrusive the industrial infrastructure is in the context of the pre-existing environment) will be moderate in the daytime, with a large industrial facility under construction in a predominantly rural environment. Local people (resident receptors) on the flats are expected to attach a high degree of value to the LSA landscape, which has cultural and religious sensitivities, and will therefore be sensitive to the aesthetic changes that the project will bring about. People travelling to the Flats (transient) receptors are likely to be less concerned about changes in the aesthetics of the LSA. Few (if any) tourists visit the Flats, which are not a recognised tourism destination. For these receptors, sensitivity is low.

The greatest degree of visual intrusion is expected to occur at night when the construction site will be brightly lit (Figure 7-10). The effect will be particularly severe when viewed from elevated locations, such as along the escarpment.

Based on the above evaluation the day-time visual intrusion of the project infrastructure and associated changes in site topography and loss of vegetation cover is rated as moderate, whereas the night-time level of visual intrusion is rated as high.

Visual Impact Magnitude (daytime) and Significance

Combining the visual resource value with visibility, visual exposure, and visual intrusion, the magnitude of visual impact will be high. The significance of impact (which includes the duration of impact and geographic extent), will be **high medium** (being tempered by the local geographic extent of the impact and the short (3-year) period of most of the construction activity.

Visual Impact Magnitude (nighttime) and Significance

Figure 7-10 shows a viewshed of the project at night, with the drilling rig at well pad 1 on the left and the lighting associated with the construction of the CPF on the right. The industrial lighting will be visible over large distances and the magnitude of impact will be high. The significance of impact will be greater than the daytime but will still fall within the same impact category, **high medium** (being tempered slightly by the local geographic extent of the impact and the short (3-year) period of most of the construction activity.

Figure 7-10: View of night lighting at the CPF construction site and a lit drilling rig on well pad 1

7.1.4.2.1 Mitigation and Monitoring

For the construction phase, opportunities to limit visual impacts are restricted to management of nuisance-related issues like dust and maintaining a tidy site. Longer term measures, such as tree screening and the management of lighting at night, which may reduce visual impact during the operational phase will not be effective during the construction phase. Thus, while mitigation is recommended below, it is unlikely that this will reduce the residual visual impacts to minor significance. Post-mitigation construction impacts will remain of **low medium**.

The following mitigation is recommended:

Daytime:

- Water down any large bare areas associated with the construction and rehabilitation phases as frequently as is required to minimise airborne dust;
- Rehabilitate temporary bare areas as soon as feasible using appropriate vegetation species;
- Place a sufficiently deep layer of crushed rock or gravel over parking surfaces for vehicles and machinery;
- Apply chemical dust suppressants if wet dust suppression is insufficient;
- Implement a dust bucket fallout monitoring system;
- Maintain the construction sites in a neat and orderly condition at all times;
- Create designated areas for material storage, waste sorting and temporary storage, batching, and other potentially intrusive activities;
- Limit the physical extent of areas cleared for material laydown, vehicle parking and the like and rehabilitate these areas as soon as is feasible; and
- Repair project related erosion damage to steep or bare slopes and re-vegetate these areas using a suitable mix of indigenous grass species.

Night time:

- Use down lighting to avoid spillage of construction light into surrounding areas.

7.1.4.2.2 Impact Significance Rating

Table 7-20: Construction phase impacts on aesthetics in the LSA

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Daytime impact on local inhabitants	8	2	2	5	High Medium 60	6	2	2	5	Low Medium 50
Nighttime impact on local inhabitants	10	2	2	5	High Medium 70	5	2	2	5	Low Medium 45

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.2 The Biological Environment

Construction impacts on the biological environment are assessed in two broad categories:

- Impacts on habitats and ecosystem integrity, which include the near-shore environment of Lake Albert, the vegetation corridors along the escarpment, wetlands and drainage lines in the LSA and RSA and the Bugoma Central Forest Reserve. Refer to Section 7.2.1. Within each category, the assessment considers, where relevant, impacts on representativeness, ecosystem composition and ecosystem configuration (Table 7-21); and
- Impacts on species of concern, specifically the Mud Snail, Nahan's Francolin, Grey Crowned Crane and Eastern Chimpanzee. Refer to Section 7.2.2.

Table 7-21: Definitions of impact indicators related to habitats and ecosystem integrity

Impact Criterion	Impact Characterisation
Representativeness	Impact on the uniqueness of the ecosystem. This rarity factor is related to the concepts of irreplaceability (rarity or uniqueness in the landscape) and vulnerability (the degree of threat).
Ecosystem Composition	Impact on diversity and complexity of the ecosystem - what is there and how abundant it is
Ecosystem Configuration	Impact on the linkages between habitats of the same or different ecosystems. Natural linkages provide an important 'playing field' for ecological processes and enable the goal of their persistence. These linkages are in contrast to a highly-fragmented landscape where patches of natural habitat are effectively isolated.

Lake Albert, the Bugoma Central Forest Reserve and the threatened species listed above are all potential triggers of Critical Habitat, in accordance with the IFC definition in Performance Standard 6, and impacts on them are assessed in the context of a defined Critical Habitat Area of Analysis (CHAA), which corresponds to the Regional Study Area (RSA).

The migration of people into the study area in search of work is expected to have a significant indirect impact on habitats and ecosystem integrity and species of concern. Consequently, this impact is discussed separately at the end of the chapter in Section 7.2.3.

7.2.1 Habitats and Ecosystem Integrity

7.2.1.1 Impact on the Near-Shore Environment of Lake Albert

7.2.1.1.1 Impact on Representativeness

The Regional Study Area supports 16.2 km of near-shore aquatic habitat in Lake Albert, which is about 810 ha if this habitat is taken to extend 0.50 km into the lake. The direct physical impact of construction on these communities will result from the upgrade of the jetty and the construction of the water intake works. No other project infrastructure lies within the near-shore habitat.

Approximately 0.12 km of open sandy shoreline will be physically lost or severely disturbed by construction. This represents ~0.2% of the near-shore habitat within the RSA, which is a much localised impact, within the expected range of natural disturbance caused by extreme weather events and lake level rise and fall. Impact will be long term but largely reversible after decommissioning. Taking all factors into account, the magnitude will be low. This must be weighted against the high sensitivity of the lake ecosystem, being a fresh water body that supports many species of fish, threatened snails (the Critically Endangered Mud Snail, *Gabbiella candida,* and the Near Threatened Snail*, Bellamya rubicunda*), and a shoreline important for many species of migratory birds. Overall impacts will be of **low medium** significance, prior to the application of the recommended mitigation measures.

7.2.1.1.2 Impact on Ecosystem Composition - Sediment Transport

Sediment drift is recognised as an important driver in shoreline ecosystems, contributing to the nutrient cycling that supports phytoplankton, zooplankton and fish communities (Parks et al. 2013). The jetty will be upgraded, but given that material changes to its dimensions are not planned, the upgrade should not further alter the geomorphological processes and sediment drift that currently govern the shoreline ecosystem of the Buhuka Flats, additional to the sediment deposition and erosion on either side of the jetty that has already taken place. The water intake station will extend a similar distance (~20 m) into the lake as the jetty, but will be an open lattice structure which allows for the movement of sediment along the shore.

The magnitude of the impact of the jetty upgrade and the new water intake on lakeshore sediment transport is considered to be minor, and the impact of **low medium** significance.

7.2.1.1.3 Impact on Ecosystem Composition - Water Quality

In this section, the impact of changes in water quality is assessed from the point of view of biodiversity. The section should be read in parallel with Section 7.1.2 on surface and groundwater quality.

Increased Sediment

The construction of the jetty upgrade and water intake station will alter the water quality within the immediate surrounds of the works through disturbance of the lake bed, and introduction of sediment into the water column during the works. The increased sediment loads are expected to dissipate quickly and will probably not exceed those that would be experienced during windy periods on the lake.

Sediment generated during construction of the CPF itself and other onshore infrastructure will enter the lake during storm flows over the three year construction period, peaking during site establishment when vegetation is being cleared and civil earthworks is ongoing. The soils of the Buhuka Flats are dispersive and active soil erosion is evident in the LSA. Cleared areas will be prone to sheet flow and scour, and high sediment loads may be expected, particularly in River 1, which will receive the drainage from the CPF earthworks and temporary camp (Figure 7-11). Additional sediment will also be contributed from the expansion of well pad 2 to its full size and the construction of the permanent camp. These watercourses report to Lake Albert and the Bugoma Lagoon, and, hence, there is a potential for increased sediment loads in the near-shore environments. While the water courses of the LSA support dense emergent vegetation. This vegetation forms an impactive filter for most sediment (IECA 2008), and it is expected that sediment loads reporting to the near-shore habitats, at least via the two potentially affected seasonal streams, the Kamansinig River and River 1, would be minimal. However, sediment loads from overland (stormwater) flows may not be retarded by vegetation, and hence may report to the near-shore habitats, contributing to measurable increased turbidity in the lake during and after storms, in the vicinity of the construction works.

Overall, the impact of increased sediment in drainage lines and the lake will be short term and reversible. In the context of the RSA near-shore habitats as a whole, the pre-mitigation impact magnitude will be will be of **low medium** significance.

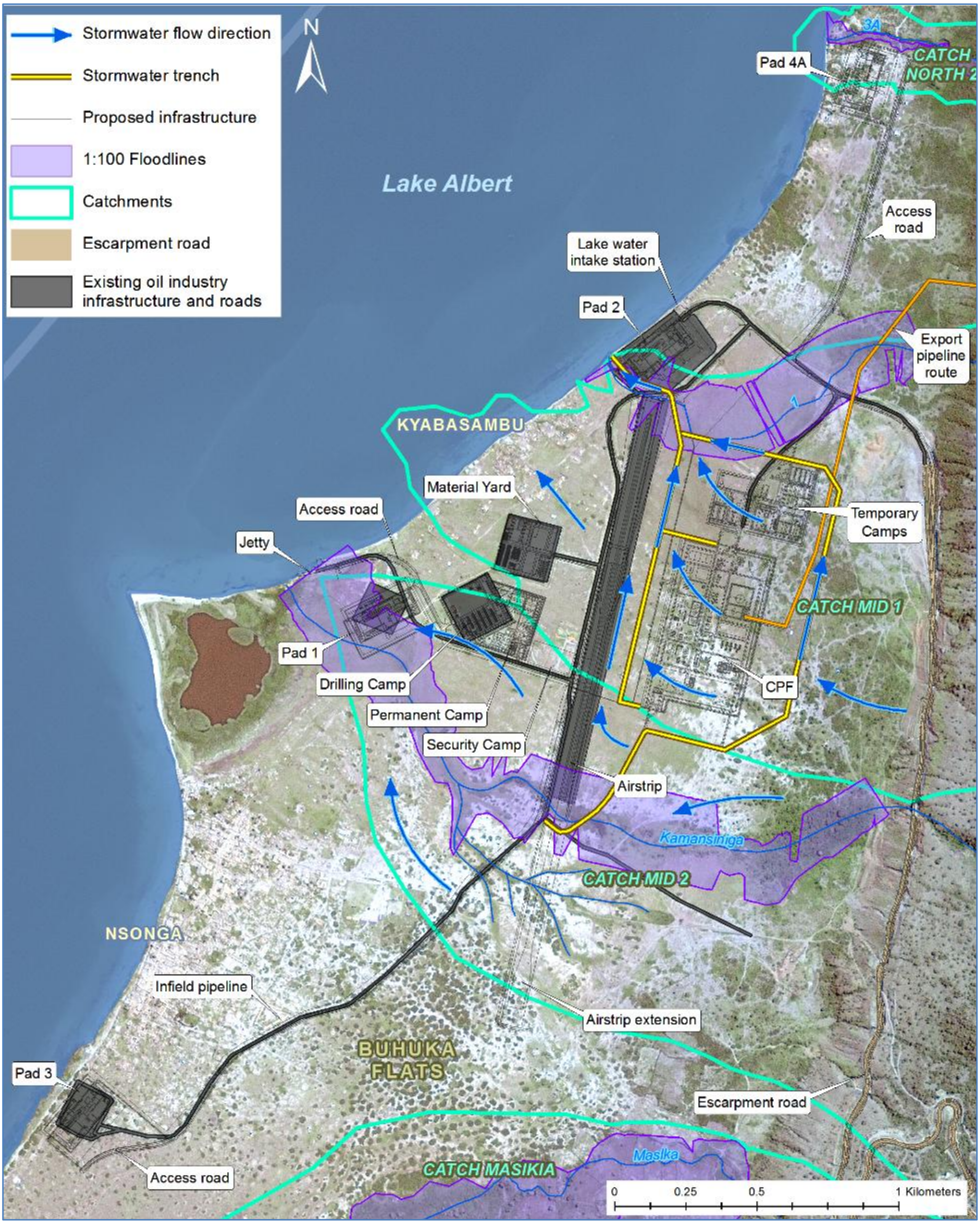

Figure 7-11: Direction of drainage from the construction areas

Oil and Chemical Pollution

The entrainment of small quantities of oil and chemicals into storm water draining from construction areas could increase the concentrations of these pollutants in River 1 and consequently in Lake Albert south west of well pad 2. In the absence of adequate construction controls, this is considered to be likely, although concentrations will probably be moderately low, in the absence of an accident, and the contamination will be short term over a small geographical area in the near-shore environment. Minor spillages and rain wash from oily construction equipment that is working on the jetty and water intake station may also contribute to pollution loads in these areas, particularly as the deposition would be directly into the near-shore lake environment. The overall magnitude (without mitigation and not including a significant accidental spill, which is described in Section 10), is considered to be medium.

A further risk will result from the construction and drilling of the wells. While control systems are proposed to manage waste cuttings, fluids, contaminated stormwater and washwater from the well pads, the presence of drilling crews on site for nearly a year (estimated to be over 200 days for each well pad during the construction phase), using potentially hazardous drilling fluid and other hazardous materials; the Phase 1 separation of the drilling wastes on the well pads; the transport and further Phase 2 separataion of drilling wastes at the facility adjacent to Well Pad 2; and the absence of a buffer between the well pads and the lake (in the case of well pad 1, the seasonal wetland); makes it possible that occasionally contaminated drainage will reach the lake unless there is a very high level of control of day to day activities.

This must be assessed in the context of the sensitivity of the near-shore environment to oil and chemical spills. The concentration of hydrocarbons and other pollutants in the lake water is currently below levels that could cause harm in the lake environment. Some invertebrate species such as aquatic snails (Araujo et al. 2012), mayflies (Savić et al. 2011) and juvenile fish (for example, Agamy 2013) are highly sensitive to chemical pollutants, particularly hydrocarbons. In such a sensitive environment, in the absence of mitigation, the overall impact significance of chemical and oil pollution in Lake Albert will be of **low medium** significance, with a medium probability of occurrence.

7.2.1.2 Sewage Effluent Discharges

All six of the main habitat types in Lake Albert, as identified for fishes by Wandera and Balirwa (2010) (that is, shallow river-associated waters, open sandy shores, lagoons, large bays, rocky escarpments, and, open-water habitats), occur within the near-shore areas of the RSA. These ecosystems are in good condition and reflect the aquatic diversity of Lake Albert. The aquatic habitats have a well-developed structure, that is, well-defined aquatic plant layers associated with underwater features and substrates.

With the exception of treated sewage effluent discharge, the construction of the Project is not expected to cause a noticeable alternation of the ecosystem composition of the aquatic communities. Even construction within the lake (the jetty upgrade and water intake station) should not substantially alter that section of open sandy shoreline within which they are located. This habitat is not complex, consisting of a gently sloping lake bed comprised of fine and medium-grained sediments (Wandera and Balirwa 2010), with occasional aquatic plants.

The only continuous discharge into the lake during the construction phase will be from the sewage treatment plants. At peak construction, the discharge will be around 300m^3/d at the EPC contractor plant, and 50m^3/d at the drilling camp plant. Both of these discharges will, in the absence of mitigation as described in Section 7.1.2.1 and indicated in Figure 7.4, enter the lake via drainage line 1, just south of drilling pad 2. The treated effluent should be disposed of via irrigation within the area indicated. In the event of a point source discharge of treated sewage effluent, and the quantity of effluent involved, there is a risk of eutrophication, causing algal growth and possibly even fish kills around the discharge point. The currents in the near-shore area of the LSA are not well known, so dispersion of nutrients in the sewage effluent have not been modelled, but impacts would be local, short term, largely reversible and of low magnitude. The overall impact is considered to be of **low medium** significance.

7.2.1.2.1 Impact on Ecosystem Composition – Invasive Species

Invasive species usually have potential to spread further once there is disturbance. There are various ways through which invasive species may be introduced into Lake Albert, such as being carried on vehicle tyres or in construction materials such as gravel or aggregates. The near-shore environment of Lake Albert is already heavily infested with water hyacinth (*Eichhornia crassipes).* It is possible that construction vehicles, equipment and materials could introduce other invasive aquatic species into the lake. The impact of construction will be long term and local and of potentially high magnitude. Combined with the possibility of spreading of the weed regionally across the lake, the impact significance without mitigation would be **high medium.**

7.2.1.2.2 Impacts on Ecosystem Configuration

The construction of the production facility and associated infrastructure is not expected to result in any noticeable change in the ecosystem configuration of the aquatic ecosystems of Lake Albert, and impact magnitude will be negligible. Connectivity between the aquatic habitats will remain essentially unchanged and impacts will be of **low** significance.

7.2.1.2.3 Mitigation and Monitoring

The following impact mitigation is recommended to minimise the risks of the construction phase of the production facility on the lake biota:

- Establish a pollution management system, to be fully defined in the Contractor's contractual commitments, covering personnel, training, lines of responsibility, immediate action requirements, on-site spill kits, and all other factors necessary to ensure there is a provision for effective preventative and corrective action during all stages of construction and drilling;
- Inspect all machinery and vehicles prior to enter to the construction site for aquatic weed propagules. Issue clearance certificates for each piece of machinery and equipment. If necessary, kill any propagules attached to vehicles or equipment with an approved biocide;
- Develop a culture of zero tolerance for pollution during the construction phase of the project;
- Provide a high level of competent environmental oversight during drilling of wells and construction of the CPF;
- Provide for thorough induction training of all construction personnel regarding pollution management, and ongoing refresher training throughout the construction/drilling contracts;
- Provide specific training to staff responsible for the oversight of pollution control systems, and
- Ensure structured, daily, monitoring of pollution control systems on the well pads and at the CPF to minimise the risk of inadvertent spills and to respond quickly and effectively to any spills that occur. Emphasis must be on preventative measures.

7.2.1.2.4 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 7-22 does not take into account the induced effects of population influx on the near-shore habitats of Lake Albert; those impacts are assessed separately in Section 7.2.3.

Table 7-22: Construction phase impacts on habitats and ecosystem Integrity - the near-shore environment of Lake Albert

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Representativeness	4	4	1	5	**Low Medium 45**	2	4	1	2	**Low 14**
Ecosystem composition										
-sediment transport	2	4	1	5	**Low Medium 35**	2	4	1	5	**Low Medium 35**
-water quality (increased sediment)	4	2	2	4	**Low Medium 32**	2	2	2	2	**Low 12**
-water quality (oil and chemical pollution)	6	2	2	4	**Low Medium 40**	2	2	1	2	**Low 10**
-water quality (sewage effluent)	4	2	2	5	**Low Medium 40**	2	2	1	1	**Low 5**
- invasive species	8	5	2	4	**High Medium 60**	2	4	1	3	**Low 21**
Ecosystem configuration	1	2	1	4	**Low 16**	1	2	1	2	**Low 8**

KEY

Magnitude	**Duration**	**Scale**	**Probability**
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.2.1.3 Impact on the Escarpment Vegetation Corridors

7.2.1.3.1 Impacts on Representativeness

There is approximately 2,435 ha of untransformed vegetation in the RSA section of the escarpment corridor, bounded in the east by agriculturally modified landscapes, and in the west by the Buhuka Flats. These communities form part of the wider Murchison Falls National Park-Budongo-Bugoma-Kagombe-Itwara Forest Reserves-Semliki/Toro Wildlife Reserve corridor (Plumptre et al. 2003).

No escarpment vegetation is expected to be lost as a direct result of the construction of the production facility, which includes the CPF, camps, extension of existing well pads, construction of new well pads and ancillary infrastructure. However, some vegetation loss is expected at the safety check station construction site. The facility will cover approximately 0.4ha of land previously occupied by a construction camp for the escarpment road. The escarpment road has been licensed and built on the basis of an earlier Environmental Impact Assessment (AWE, 2014c), and habitat loss and other impacts typical of road construction are not considered in this ESIA, except as a part of the Cumulative Impact Assessment in Volume 5[18]. The total area of escarpment habitat that has been permanently lost as a result of the road is 12.8 ha. A further 3.6 ha has been temporarily disturbed along the edges of the road and 4.5 ha temporarily lost at the escarpment road construction camp. The former camp location will be utilised for construction of the safety check station. As indicated, the safety check station will cover a much smaller footprint than the road construction camp.

The CNOOC construction phase traffic on the road is not expected to further impact on the representativeness of the escarpment habitats, over and above the impacts that presently exist, and impact significance will be **low**.

7.2.1.3.2 Impacts on Ecosystem Composition

Vehicle traffic on the escarpment road could result in road deaths of some wild animals crossing along the corridor but it is unlikely that this could have a material impact on species diversity or abundance in the corridor. The magnitude of the impact of the operational phase is likely to be minor, which combined with medium receptor sensitivity will result in an impact of **low** significance.

7.2.1.3.3 Impacts on Ecosystem Configuration

The wider Murchison Falls National Park-Budongo-Bugoma-Kagombe-Itwara Forest Reserves-Semliki/Toro Wildlife Reserve corridor is recognised as an important wildlife refuge for threatened species in the face of climate change adaptation (Ayebare et al. 2013), and as part of a much broader set of corridors running the length of the Albertine Rift. In the vicinity of the project, this corridor is very narrow compared to its extent elsewhere and is recognised as being important for savannah species (Plumptre et al. 2010).

Roads, and especially sealed roads, are known to be significant barriers to a range of wildlife from small ground-dwelling mammals to reptiles, amphibians and insects. They are not generally a constraint affecting the movement of birds. They may affect or prevent seasonal migrations of some species. For those animals that attempt to cross the road, mortalities are a risk.

The road to the Buhuka Flats will be the only major access crossing the escarpment in the south-eastern part of Lake Albert, that is, the only major road within the wildlife corridor from the southern end of the lake to the Kabwoya Wildlife Reserve. Construction traffic on the road is expected to be significant. CNOOC estimates that an average of 56 trucks per day will be needed to supply the construction of the production facility, over a 3 year period. Including the return trip, this is 1 truck every 5 minutes, assuming transport during 10 hours of daylight. This will limit the risks of road deaths of nocturnal animals that cross the road along the vegetation corridor at night.

The frequency of traffic on the road is probably not sufficient to prevent most animals from crossing, although cumulatively, together with other road users the number of vehicles may be more restrictive. The populations of highly mobile wildlife that may depend on the corridor are also severely depleted in the RSA. In particular,

[18] [18] *For this study, the direct physical effects of building the road are considered to be construction impacts associated with the road, which include any long term consequences that could continue after the construction phase is completed, but are not related to the use of the road by CNOOC. Direct impacts of construction traffic to the production facility and indirect effects, such as increased harvesting pressures due to migration into the area, either because of better access to existing resources or because of opportunities provided by the oil industry, are considered to be operational impacts which are driven by the access provided by the road and are therefore included as construction impacts in this section.*

most of the terrestrial species that could utilise this corridor, such as large ungulates, predators, and primates are very rare in the area. Impacts will be long term, largely irreversible, local and of low magnitude. In the context of medium receptor sensitivity, the impact is considered to be of **low medium** significance.

7.2.1.3.4 Mitigation and Monitoring

The following mitigation and monitoring is proposed:

- Limit vehicle speeds on the escarpment road;
- Include appropriate signage showing speed limits and enforce the speed limits;
- Prohibit night driving to or from the construction site except in emergencies;
- Educate personnel and suppliers about wildlife impacts caused by road traffic; and
- Monitor road kills of medium and large mammals in the escarpment section of the route.

Subject to the implantation of this mitigation, the significance of impact on ecosystem configuration of escarpment vegetation is expected to be reduced to **low.**

7.2.1.3.5 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 7-23 does not take into account the induced effects of population influx on escarpment vegetation corridors; those impacts are assessed separately in Section 7.2.3.

Table 7-23: Construction phase impacts on the escarpment vegetation corridors

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Representativeness	2	2	1	4	Low 20	2	2	1	2	Low 10
Ecosystem composition	2	2	2	4	Low 24	2	2	1	2	Low 10
Ecosystem configuration	4	4	2	4	Low Medium 48	2	4	4	2	Low 20

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.2.1.4 Impacts on Wetlands and Drainage Lines

7.2.1.4.1 Impact on Representativeness

The RSA supports approximately 1157.9 ha of wetlands, made up of permanent wetlands (1072.6 ha, or 93%) and seasonally flooded grasslands (85.3 ha, or 7%). Wetlands in the LSA are associated with drainage off the escarpment, which is seasonal in varying degrees. On the Buhuka Flats, there are approximately 151 ha of wetlands, comprised of permanent wetlands (83 ha) and seasonally flooded grasslands (69 ha). The shallow gradients across the Buhuka Flats encourage wetland formation, although the only wetlands directly affected by construction of the production facility and associated works will be along the Kamansiniga River, which is associated with fringing wetland vegetation and seasonally flooded grasslands. The Kamansiniga River is hydrologically linked to the Bugoma Lagoon, the large papyrus-fringed wetland south west of well pad 1. The larger Masika River, which is further to the south, will not be impacted by construction activities since Well Pad 5 is no longer under consideration for the current project.

Figure 7-12 shows the main areas of direct impact on the Kamansiniga River and on River 1. Table 7-24 quantifies the impact based on the area of physical disturbance during construction and the long term impact after construction. The flowlines require a 20 m - wide construction right of way. After construction, the physical loss of wetland, subject to effective rehabilitation of the flowlines, will be minor. The infield access roads have already been licensed and built, but are considered in relation to cumulative losses. The construction right of way for these roads was also 20 m wide, while the permanent right of way is 5 m wide.

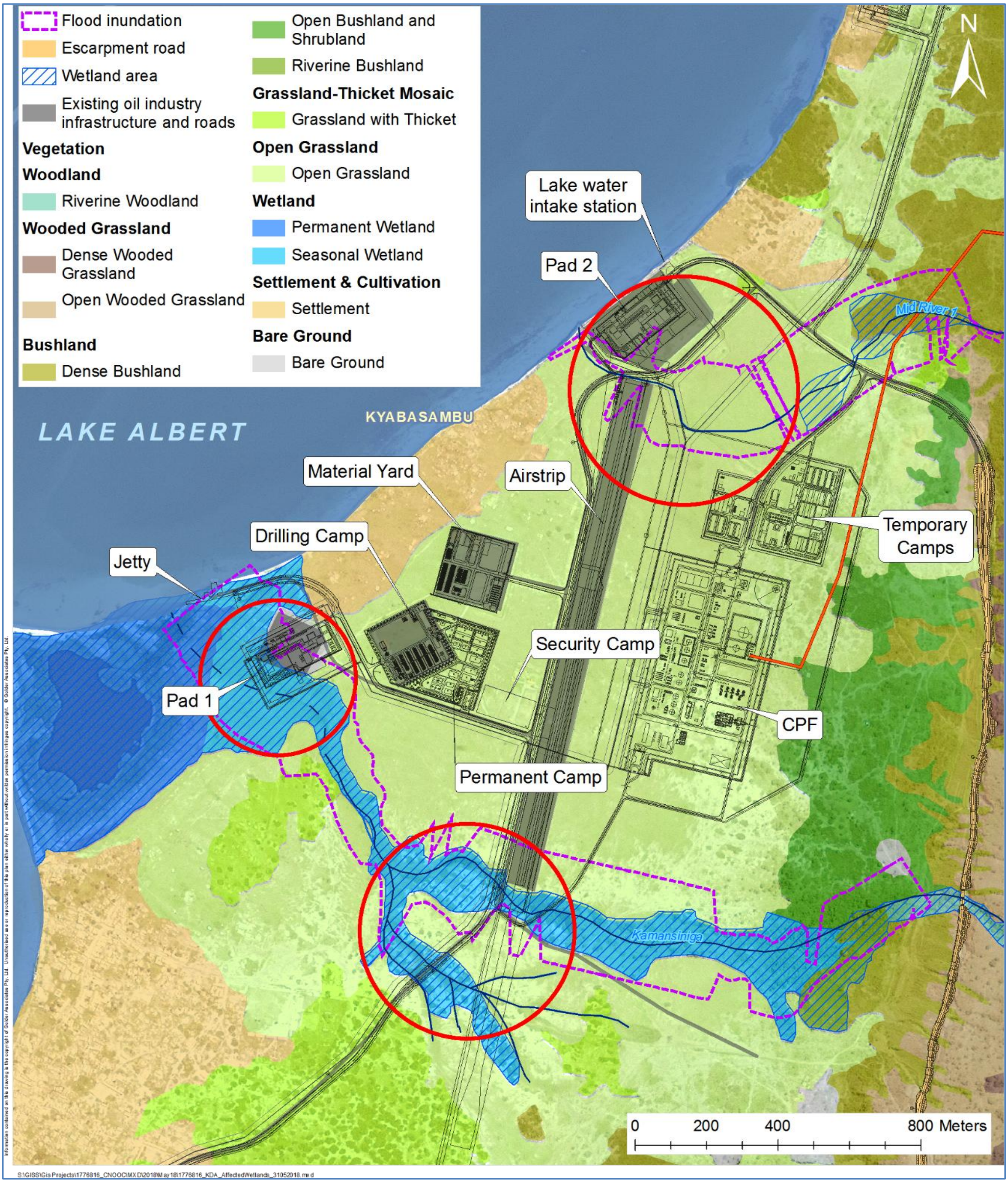

Figure 7-12: Wetlands and drainage lines directly impacted by construction of the production facility (red circles)

Table 7-24: Area of Kamansiniga wetlands temporarily or permanently lost due to construction of the production facility and associated infrastructure

Project Infrastructure Name	Wetland Area Affected (ha)*	Proportion of Buhuka Flats Wetlands (%)
Infield Access Road**	1.5	0.99%
Infield Flowline	0.5	0.33%
Well Pad 1	2.7	1.78%
Total	4.7	3.11%

* *Blue cells show temporary habitat loss. White cells show long term habitat loss*

*** Licensed and built*

**** River 1, shown in Figure 7-13, is not associated with wetlands*

From Table 7-24 the long term wetland loss due to construction of the production facility is 2.7% of the seasonal wetland area on the Flats. The flowline impacts will be temporary and short term (subject to appropriate construction management) and reversible. While long term wetland habitat loss is caused by well pad 1 and the access roads, which will be only partly reversible, the small area covered results in low impact magnitude. The impact will be **high medium** significance.

7.2.1.4.2 Impact on Ecosystem Composition – Habitat Loss and Disturbance

Impact of In-field Roads

The in-field roads to well pads 1 - 4 have already been assessed (Eco & Ptns, 2014), authorized by the Ugandan environmental regulator and built. Construction phase impacts on habitat loss are therefore not considered in this ESIA, except as a part of the Cumulative Impact Assessment in Volume 4.

Impact of Flowline Construction

The flowlines across the seasonal streams in the LSA will all be buried below the depth of the active scour zones in the river channels and are unlikely to obstruct surface water flow. The backfill into the trench is not normally cemented or compacted, which for small diameter pipelines minimizes the risk of impact on subsurface flow[19]. The risk to wetland function is mainly due to the disruption of wetland vegetation and soils by heavy machinery, particularly when tracked vehicles are used that have greater impact on soil structure and the soil profile is overturned due to careless construction management. This may result in long term changes in vegetation composition. Impact will be long term, largely irreversible and of moderate magnitude, which will result in impacts of **high medium** significance.

Habitat loss due to the extension of Well Pad 1

The extension of the well pad will involve the loss of some 1.6 ha of seasonal wetland, in the floodplain areas of the Kamansiniga River. Vegetation comprises moist grassland, generally heavily grazed by stock. Typical wetland species such as bulrushes and reeds, dependant on permanent surface water, are not present. The magnitude of physical loss of wetland habitat will be low, resulting in local, long term impacts, largely reversible, of **high medium** significance.

7.2.1.4.3 Impact on Ecosystem Composition - Water Quality

Impact of Erosion and Sedimentation

Drainage volumes during storms are expected to increase (due to the removal of vegetation and the compaction of ground surfaces), and due to discharges from the camp sewage treatment works. This will increase peak flows. The concentration of storm flows and treated sewage effluent via canals into River 1 will significantly increase the risk of channel incision. The magnitude of this impact will be exacerbated by the soils, which are dispersive and prone to gulley erosion. A storm flow assessment of drainage from the CPF

[19] *In some cases, particularly where pipelines intercept hillslope wetlands, the trench may act as a drain, but this is not the case with direct perpendicular crossings of bottomland wetlands*

during the construction phase shows that the increased drainage discharging into River 1 is likely to cause gulley erosion. Increased erosion may also be expected at the borrow pits, the safety check construction site and elsewhere in the work areas where vegetation has been denuded and the Kamansiniga catchment is expected to be affected as well. Large construction sites of this scale generally cause significant erosion sedimentation in local drainage lines in the absence of mitigation. Impact will be long term, local and highly probable, resulting in impacts of **low medium** significance.

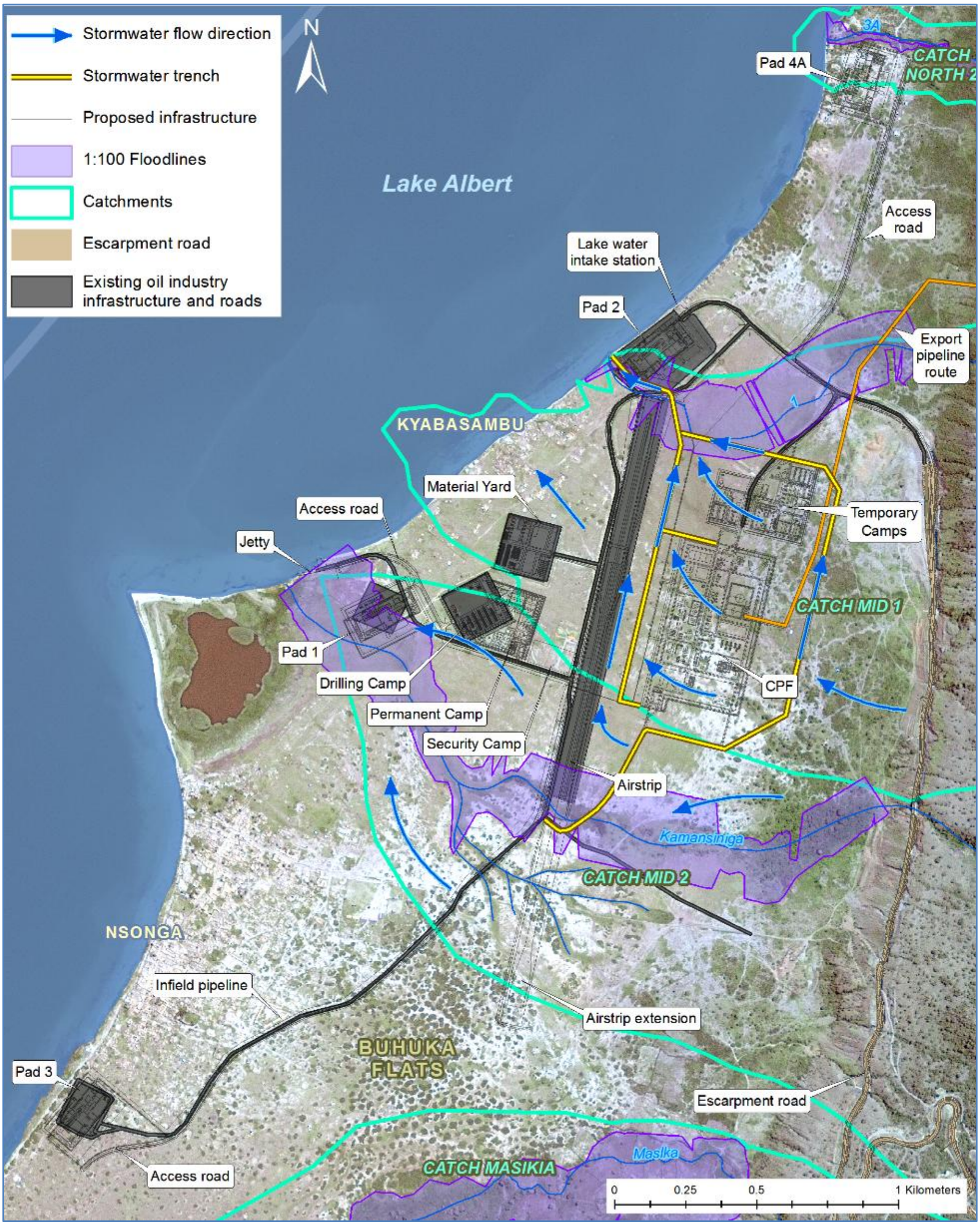

Figure 7-13: Direction of storm flows from the construction sites

Impact of Hydrocarbon and Chemical Spills

Small accidental spillages are likely during the construction of the production facility and associated infrastructure (notably the safety check station). These may be entrained by stormwater entering River 1 and the Kamansiniga River.

Small spillages of hydrocarbons and other chemicals are possible at the CPF, where the most complex construction activities will take place over a period of 3 years, involving a wide range of potentially toxic materials (refer to Specialist Study 5). On the well pads, there is the possibility of contaminated drainage from drilling being washed into the wetlands by stormwater. Contaminated stormwater runoff from the safety check station construction site may also end up in the streams that cross the escarpment into Lake Albert. While management systems are proposed to prevent contaminated stormwater and washwater from escaping from the CPF and well pads, occasional non-compliance with the Ugandan standards is possible. On the well pads, the presence of drilling crews for periods approaching a year, using large quantities of potentially hazardous drilling fluid and other hazardous materials, increases the risk of escape of contaminated drainage. Drilling impact on wetlands are most likely on well pad 1, which will be enlarged, and most of which will be within the perimeter of the seasonally wet grasslands associated with the Kamansiniga River. At other well pads, any impacts are more likely to directly affect Lake Albert.

The concentrations of hydrocarbons and other industrial pollutants in the wetlands of the LSA are presently below levels that cause harm in the aquatic environment. Some invertebrate species (such as aquatic snails, described in Araujo et al. 2012), mayflies (Savić et al. 2011)) and juvenile fish (Agamy 2013) are particularly sensitive to these pollutants. The proximity of the main areas of construction to wetlands on the Flats provides little buffer in the event that spillages escape from the work areas, which increases the risk of impact. In the absence of daily monitoring and management of site activities by competent personnel, impact significance will be **high medium**.

Impact of Discharge of Hydrotest Water

The commissioning of pressure vessels and flowlines involves hydrotesting, in which the vessels are filled with water and pressurised to verify their integrity. CNOOC does not plan to use biocides and corrosion inhibitors, consequently this water should be acceptable for discharge to the environmnent on completion of a test.

However, should it become necessary that biocides and / or corrosion inhibitors be added to the water, the release of such water could present a severe risk in the aquatic environment, resulting in mortality of downstream fauna and flora resulting in impacts **of high medium** significance. Such water containing biocides / corrosion inhibitors would need to be handled as a waste.

Impact of Disposal of Treated Sewage Effluent

Treated sewage effluent in excess of 300 m^3/day will be discharged for much of the construction phase. The effluent will be treated to meet the Ugandan effluent quality discharge standard, in which total nitrogen may not exceed 10 mg/l and total phosphates may not exceed 10 mg/l. It is proposed that the effluent from the temporary camp will be discharged into River 1, north of the camp. The effluent from the drilling camp will continue to be used to irrigate the lawns at the camp (as has been the case for the exploration phase), within 500 m from Lake Albert.

Wetlands are efficient nutrient sinks and have been used in both controlled and uncontrolled conditions to polish sewage effluent. River 1 is likely to be tolerant of the additional daily flow and the addition of nutrients, which will promote the growth of emergent wetland vegetation. Impact magnitude will be low, short-term and of local geographic extent, resulting in impacts of **low medium** significance. However, while the wetland systems themselves may tolerate this discharge, there is insufficient residence time between the project infrastructure and the receiving lake for this effluent not to find its way rapidly into the lake water environment with a possible associated risk of local eutrophication.

Impact of Overturning of Acid Sulphate Soils

While acid sulphate soils may be present in the permanent wetlands along the Masika River to the south and in the Buhuka Lagoon, they are not expected (improbable) in the seasonal wetlands that will be affected by construction of the production facility and the toxic effect of acid generation associated with their disturbance should not arise. Impact magnitude would be high with potentially long term effects, but given the low probability, impact significance will be **low.**

7.2.1.5 Impact on Ecosystem Configuration

The construction of the Kingfisher camps/parking lots/materials yards, CPF, crusher plant/spoil area A, new well pads, the safety check station and associated infrastructure will not directly lead to changes in the ecosystem configuration of wetlands on the Buhuka Flats. Direct impact will be caused only by the road crossing of the Kamansiniga River. This is discussed under wetland structure above.

Roads are known to be significant barriers to, or can alter behaviours, of a range of wetland wildlife, from amphibians (for example, Pontoppidan et al. 2013); to turtles (for example, Langen et al. 2012). At the Kamansiniga wetland crossing, construction phase traffic may discourage species movement across the road. Upgrade works on the in-field road crossing the Kamansiniga may temporarily interfere with the flow of water from upstream to downstream regions of the affected wetland and drainage lines, causing dessication and potentially erosion downstream of the crossing. This impact is expected to be of moderate magnitude, short-term duration, and will definitely occur, resulting in local impacts. The unmitigated impact significance will be **low medium**.

7.2.1.5.1 Mitigation and Monitoring

The following impact mitigation and monitoring is recommended:

- Undertake pre-clearance surveys for wetland species of concern within and near the project footprint, such as nesting and foraging sites of the Grey Crowned Crane. Implement measures to ensure that the risk to these species is minimised;
- Develop a detailed method statement for the wetland flowline crossing of the Kamansiniga River to well pad 3; defining the requirements to contain construction equipment within the construction footprint, to minimise compaction of wetland soils, to reinstate any clay layers and replace soils in the correct order and to return the wetland to the same profile that existed before construction;
- In upgrading the existing access road to Well pad 3, install additional culverts under the access road to reinstate flow across the full width of the wetland area (currently a single culvert with wetland crossing width of approximately 100 m)
- Minimise wetland vegetation cleared for the Kamansiniga flowline crossing to the smallest possible footprint;
- Demarcate the construction right of way across the Kamansiniga wetland to prevent inadvertent damage outside of this footprint;
- Preferably undertake the flowline crossing across the Kamansiniga wetland in the dry season;
- Prohibit access to personnel outside of the defined project work sites and access roads. Train personnel to understand the sensitivity of the local environment in induction and ongoing tool box talks;
- Specifically prohibit project personnel from access to the Bugoma swamp, which is resource of exceptionally high ecological and cultural value. The Bugoma swamp is a part of the Kamansinig wetland system, all of which is regarded as sensitive;
- Ensure that erosion protection measures are in place during construction to minimise runoff from disturbed areas into the rivers and wetlands;

- Ensure that all vehicles and machinery are in sound mechanical order, do not have any oil leaks and are fitted with appropriate mufflers to minimise nuisance affecting wildlife;
- Ensure that any pumps, generators or other equipment containing oil used to manage water at the wetland crossing are located on impervious plastic sheeting or drip trays;
- Prohibit any refuelling of equipment within 100 m of a wetland, with the exception of within the contained areas of Well pads in relation specifically to equipment in use at the well pads;
- Prohibit the use of backfill into the wetland intended to provide firm footing for vehicles. If support is necessary, employ matts;
- Ensure that treated sewage effluent meets the project water quality standard for release into the environment. Re-use treated sewage effluent on roads for dust damping, other working areas where dust control is required, and recreational areas (eg: soccer field) created for contract employees. Sanitary wastewater that meets the project standard but is not re-used is to be disposed into Drainage line 1, which enters the lake immediately south of well pad 2;
- Manage all hazardous products and wastes to minimise the risk of escaped outside of controlled areas; and
- Adjust the final design of the canals channelling stormwater and treated sewage effluent from the CPF so that the drains remain outside of the seasonally wet areas associated with River 1 (Figure 7-13). From the culvert onward it may be necessary to canalise the flow to the lake. Use open cross section swales for this purpose (not concrete canalisation), reinforced if necessary and grassed. Finalise the canal design and the alignment of the stormwater drains with the assistance of a wetland ecologist.

7.2.1.5.2 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 7-25 does not take into account the induced effects of population influx on wetlands; those impacts are assessed separately in Section 7.2.3.

Table 7-25: Construction phase impacts on wetlands – habitats and ecosystem integrity

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Representativeness	4	5	2	5	**High Medium 55**	2	3	1	2	**Low 12**
Ecosystem composition – Habitat Loss and Disturbance										
- Flowline construction	6	4	2	5	**High Medium 60**	6	3	1	3	**Low 30**
- Well Pad 1	4	5	2	5	**High Medium 55**	4	5	1	5	**Low Medium 50**
Ecosystem composition – water quality										

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
- Erosion and sedimentation	6	4	2	4	**Low Medium 48**	4	3	1	2	**Low 16**
- Hydrocarbon and chemical spills	6	5	2	5	**High Medium 65**	6	2	1	2	**Low 18**
- Discharge of hydrotest water	7	2	2	5	**High Medium 55**	1	1	2	2	**Low 8**
- Disposal of treated sewage effluent	4	2	2	4	**Low Medium 32**	4	2	2	2	**Low 16**
- Overturning of acid sulphate soils	8	4	2	1	**Low 14**	8	4	2	1	**Low 14**
Ecosystem configuration	6	2	2	5	**Low Medium 50**	4	2	1	3	**Low 21**

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.2.1.6 Impact on the Bugoma Central Forest Reserve

This section includes a habitat level assessment of construction phase impacts on the Bugoma Central Forest Reserve (BCFR). Impacts on species of concern are described in Section 7.2.2.

The Ugandan Government will be responsible for upgrading the roads that the oil industry will need for access. Scheduled 'oil industry' road upgrades to support the KFDA development include those shown in Figure 7-14. While not CNOOC's responsibility, the overall impact will be as a consequence of the KFDA development and is therefore relevant in this ESIA.

The R5 linking Rwera Kisooba to Kaseeta, and the P1 from Kabwoya to Nsozi, impact directly on the Bugoma Central Forest Reserve (BCFR). They are unsealed and relatively narrow, and become impassable from time to time in the wet season. No traffic data are available for the roads. The R5 passes through the centre of the BCFR in a north-south direction.

The BCFR is one of the last stands of tropical semi-deciduous forest in the region, supporting known populations of the Endangered Nahan's Francolin and Eastern Chimpanzee (Plumptre et al. 2011); the Endangered Madagascar Pond Heron (see Section 6.3.3.1); elephants and a host of other threatened and irreplaceable species. The total area of the BCFR is ~39,992 ha (399 km^2). Loss of habitat to widen the P1 road corridor will be approximately 9.7 ha (based on approximately 4.8 km of the current Kabwoya-to-Ikamiro road traversing dense forest habitat, and a conservative clearing width of 10 m either side of the current road); and a further 20 ha, based on the same degree of clearing along the R5 road. The combined loss (29.7ha) represents 0.074% of the forest habitat in the RSA. While this is a small loss in relation to the total available forest area, being of local geographical extent, permanent duration and low magnitude; when combined with the high sensitivity and vulnerability of this forest environment, it will still result in impacts of **high medium** significance.

Photograph 7-3: The P1 road through Bugoma Central Forest Reserve

Indirect impacts caused by construction traffic could affect many animal species within the forest. CNOOC estimates that an average of 56 trucks per day will be needed to supply the construction of the production facility, over a 3 year period. Including the return trip, this is 1 truck every 5 minutes, assuming transport during 10 hours of daylight. The distribution of the heavy vehicle traffic between the R5 and the P1 has not been determined, but it can be assumed that both roads will carry substantial construction traffic loads. Road collisions will be a material risk, and shy, diurnal, species may be discouraged from crossing the road, limiting their available habitat. The impact will be medium term, partly reversible and of moderate magnitude, which would result in impacts of **high medium** significance.

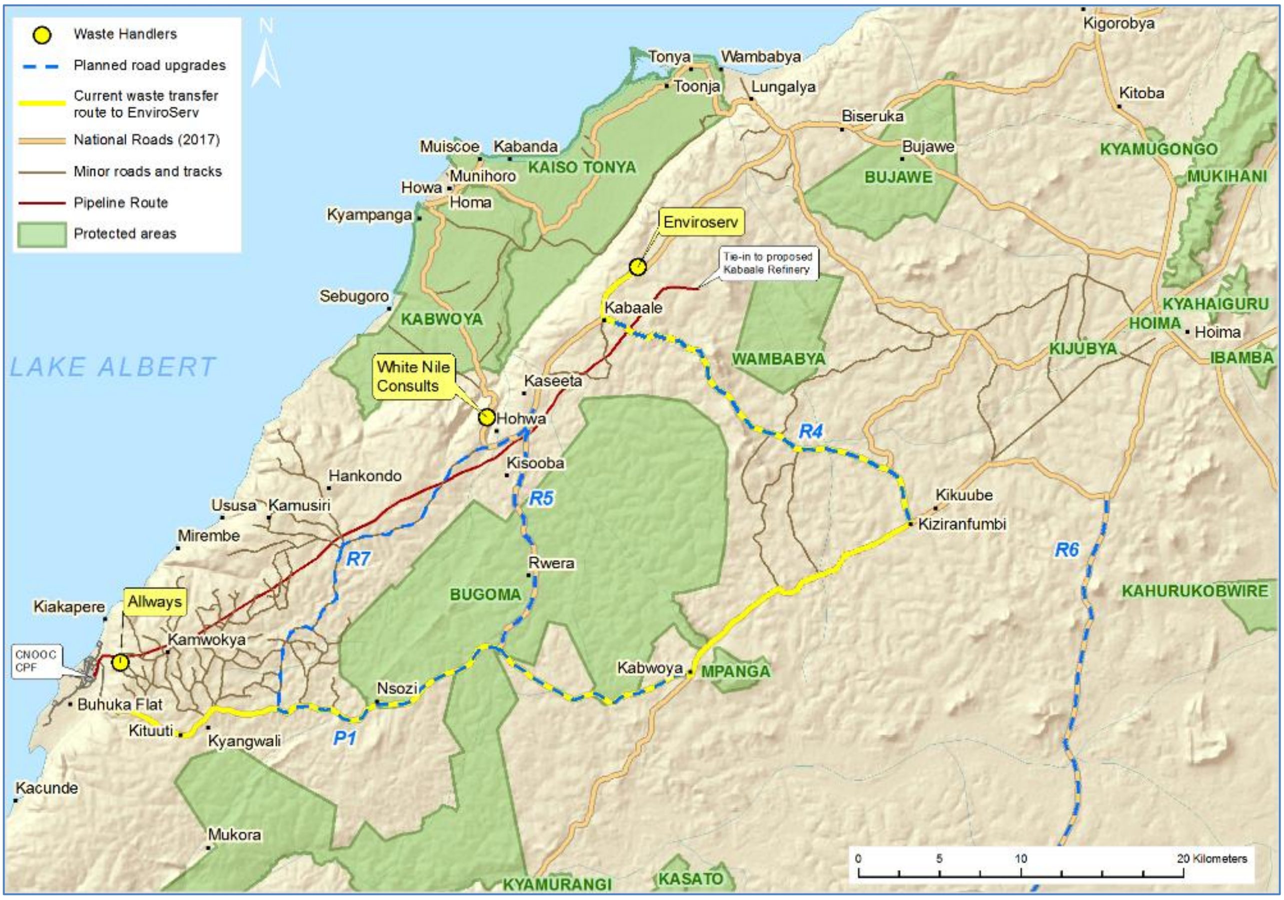

Figure 7-14: Proposed road upgrades in the RSA

7.2.1.6.1 Mitigation and Monitoring

The following impact mitigation and monitoring is recommended:

- De-list the R5 from the proposed oil road upgrades. CNOOC has confirmed that it does not need this road, either for construction or operational purposes. The Ugandan Government has been formally notified. CNOOC will use the P1 as the major haul road during the construction phase and, if upgraded in time, the R7;
- Limit vehicle speeds to 40 km/h along the road in the section from Mpanga to Nsozi. Monitor and enforce vehicle speed limits;
- Prohibit transport of construction materials in the area of the forest at nigh, except in case of emergenciest;
- Widen the P1, on the non-forest side of the road in order to minimise forest habitat loss; and
- Ensure that all EPC contract transporters are fully aware of the risks to wildlife in the Bugoma Forest.

7.2.1.6.2 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 7-26 does not take into account the induced effects of population influx on Bugoma CFR; those impacts are assessed separately in Section 7.2.3.

Table 7-26: Construction phase impacts on the Bugoma Central Forest Reserve (BCFR)

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat loss (direct impact)	4	5	2	5	High Medium 55	2	5	1	3	Low 24
Collision and nuisance and harassment of wild animals	6	3	2	5	High Medium 55	6	2	2	4	Low Medium 40

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.2.2 Species of Concern

7.2.2.1 Impact on the Mud Snail (Gabbiella candida)

The Mud Snail (*Gabbiella candida*) is a Critically Endangered and range restricted species. Currently, the only known populations occur around Butiaba, which is on the eastern shore of Lake Albert approximately 90 km north of the LSA. This species could occur in the near-shore habitats of the RSA, based on its known habitat preferences, and a precautionary approach has been adopted assuming that is does.

The indicators used to assess impacts of the construction of the project on the Mud Snail are habitat quantity and quality, and habitat connectivity. Very little information is available for this species. It has generally been found in the same locations as two sister species, *G. humerosa* and *G. walleri*, and the habitat preferences for these species have therefore been used as the basis for assessing the suitability of habitat for *G. candida*.

7.2.2.1.1 Habitat Quantity and Quality

The two sister Mud Snail species described above have been collected from bottom substrates in the open sandy shore habitats of Lake Albert in the LSA. These habitats are characterised by a gently sloping lake bed extending from the shore line to deeper water. The substrate is typically comprised of sand and finer sediments (Wandera and Balirwa 2010) and constitutes approximately 10.5 km of the RSA, most of which is located within the LSA.

Section 7.2.1 describes the impact of construction works on the nearshore environment of Lake Albert in terms of general ecological risk. These impacts will also apply to the Mud Snail. Habitat loss is expected as a direct result of excavation for the jetty rehabilitation and the water intake construction. Approximately 1.1% of potential habitat for the Mud Snail in the RSA would be affected. Sediment deposition in the lake may also result from the construction works for the jetty and water intake, as well as other construction activities onshore, due to the exposure of soils to rainfall and consequent sediment-laden stormwater runoff. This impact will be short term, occurring only during storms, of limited geographic extent, reversible over time and of low magnitude. Nevertheless, given the critically endangered status of *G. candida*, the resulting impacts would be of **high medium** significance.

Accidental spillages of small quantities of fuels and chemicals during the construction of the project (not including significant/catastrophic spillages, which are described in Section 10) could report to the near-shore habitats of the RSA. Without a high degree of control over construction management, there is a material risk in this regard, from general construction activities at the CPF, the upgrading of the jetty, the construction of the water intake facilities, the safety check station, extraction of materials at the borrow pits and the drilling on well pads 1, 2 and 3. Control systems are proposed to manage contaminated stormwater and wash-water from construction activities, but the absence of buffers between the work areas and the lake increases the risk of even small spills reaching the lake. This impact is described in relation to the general ecology of the lake in Section 9.2.1.1.3, and it applies in the same or greater measure to *G. candida,* which like other aquatic snails, is highly sensitive to chemical pollutants, particularly hydrocarbons (Araujo et al. 2012). Without a very high level of control of day-to-day construction activities and appropriate spill prevention and clean-up measures in place, accidental spillages of fuels and chemicals could, depending on the volume spilt, result in impacts of **high** significance on this threatened Mud Snail.

7.2.2.1.2 Habitat Connectivity

The construction of the Project is expected to last for three years (the construction of the intake works will less than a year). Besides the upgrading of the jetty and the water intake works, it is unlikely that construction activities could substantially alter the habitat connectivity of the near-shore habitats in the CHAA. Section 9.2.1.2 describes the general impact of the project on sediment drift, which is recognised as an important driver in shoreline ecosystems, contributing to the nutrient cycling that supports phytoplankton, zooplankton and fish communities (Parks et al. 2013). The jetty has caused an observable impact on the movement of sediment along the lake shore (a build-up of sediment on the northern shore, and erosion to the south); however, since the upgrade of the jetty have not resulted in changes to the previous jetty footprint and subsequently the open sandy shore habitat in the vicinity of the jetty, the magnitude of the potential impact of the jetty upgrade and the new water intake on sediment transport, and hence on *G. candida,* is considered to be minor, resulting in impacts of **low** significance.

7.2.2.1.3 Mitigation and Monitoring

The following impact mitigation and monitoring is recommended:

- Undertake targeted, once off, specialist surveys for the mud snail before construction starts at the sites where construction disturbance will occur within Lake Albert (water intake); and
- Minimise disturbance of shoreline sediment during construction of the water intake station.

7.2.2.1.4 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 7-27 does not take into account the induced effects of population influx on *G. candida*; those impacts are assessed separately in Section 7.2.3.

Table 7-27: Construction phase impacts on the Mud Snail, *G. candida*

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat quality and quantity (habitat loss and sedimentation)	4	5	2	5	**High Medium 55**	4	5	1	5	**Low Medium 50**
Habitat quality and quantity (contamination)	8	5	5	5	**High 90**	2	1	1	2	**Low Medium 8**
Habitat connectivity	2	2	1	2	**Low 10**	2	2	1	2	**Low 10**

KEY

Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.2.2.2 Impact on Nahan's Francolin

Nahan's Francolin is an endangered and range restricted species. It has a very restricted distribution, being found only in north-east DRC and western and south-central Uganda; in particular, the forests of Budongo, Bugoma and Mabira (McGowan and de Juana 1994). It has been recorded within Bugoma Central Forest Reserve within the RSA. This species triggers IFC Tier 1 critical habitat[20].

7.2.2.2.1 Habitat Quantity and Quality

The Government's plans to build roads to support oil industry activities are shown in Figure 7-14. The R5 and P1 upgrades are directly in support of the KFDA. While the responsibility for road developments to

[20] *Tier 1 habitats are considered to be very sensitive, and, therefore, if a project is located in such a habitat, the IFC considers it unlikely that the client will be able to comply with the provision of Performance Standard 6 (PS6), in particular paragraphs 17, 18 and 19 (IFC 2012a). In summary, a project will not be developed in Tier 1 habitat unless: no other viable alternatives exist; and, the project does not lead to measurable and irreversible adverse impacts to the valued component that triggered critical habitat; and, the project does not lead to a net reduction in the global and/or national/regional population of the triggering species (such as Nahan's Francolin and Eastern Chimpanzee) over a reasonable period of time; and, a robust, appropriately designed, and long-term biodiversity monitoring and evaluation programme is part of the project's Environmental and Social Management System (ESMS). A Biodiversity Action Plan (BAP) will be developed to achieve net gain for the affected species.*

provide access for the oil projects are not within CNOOCs direct control, the impacts the roads cause are directly related to the development of the project.

The potential loss of forest habitat due to the widening of the R5 and P1 is estimated in Section 7.2.1.6 to be 29.7 ha, which is 0.074% of the area of the BCFR. This loss is a small fraction of the total available habitat and, while permanent, the more significant impacts on habitat quantity and quality may be due to the effects of nuisance caused by construction traffic. With high construction traffic volumes (estimated to be 60 incoming truck loads per day (including return trips), the potential for nuisance is high. Birds are known to be sensitive to land use and habitat alteration (Lussier et al. 2006). Many studies have reported a reduction in breeding success attributable to human disturbance (for a review, see Hill et al. 1992). Mechanisms include increased rates of predation, nest abandonment and reduced time at the nest, either incubating or feeding. Clearly, a reduction in breeding could impact on the population of the species.

How tolerant Nahan's Francolin may be to noise and vibration is unknown, but being a shy, forest dependent, species, it is likely that it will avoid the construction traffic on the upgraded roads. It is assumed that the noise impact of the traffic could extend for 200 m into the forest on either side of the road, which results in an effective loss in habitat of 795 ha. While this is a small proportion of the total available habitat in the BCFR, resulting in an impact of low magnitude, the receptor sensitivity is high and the impact may affect the regional population, therefore the impact significance will be **low medium.**

7.2.2.2.2 Habitat Connectivity

The R5 and P1 are existing roads. Traffic may already be a barrier to the movement of Nahan's Francolin to a greater or lesser degree. However, current traffic volumes are expected to be low on both roads, particularly on the R5 through the centre of the BCFR. The volumes of construction traffic routed to and from the CNOOC production facility will be an order of magnitude greater than existing traffic, which is likely to be cause nuisance-related impacts, as a result of noise and vibration. As discussed above, it is uncertain whether Nathan's Francolin will completely avoid the roads because of the nuisance caused by the regular passage of heavy vehicles, If so, the available habitat for birds with ranges divided by the roads will be reduced.

Based on existing knowledge of this francolin's habits, it is expected that the magnitude of construction traffic impact on habitat connectivity would be low, which, taking into consideration the vulnerable and range-restricted status of the francolin, and uncertainty around the probability of the impact occurring as predicted, would result in impacts of **low medium** significance.

7.2.2.2.3 Abundance and Distribution

Nahan's Francolin is reported to be relatively common in the Bugoma Central Forest Reserve (Plumptre et al. 2011) although its distribution within this habitat is unknown. If as is indicated in Sections 7.2.2.2.1 and 7.2.2.2.2, the francolin avoids the vicinity of the roads carrying heavy construction traffic, there will be a change in distribution of the species, and abundance within the sub-optimal zones along the road corridor will drop. Alternatively, if the birds attempt to cross the roads in order to forage within their usual range, they will risk collision with construction traffic. Although the impact magnitude is expected to be low, the impact significance will be **low medium**, given the uncertainty around the probability of the impact occurring as predicted.

7.2.2.2.4 Survival and Reproduction

The Nahan's Francolin's degree of vulnerability to direct disturbance, particularly during the breeding season, is not well understood. This francolin is reliant on large trees, with appropriate buttresses, for breeding sites (Sande et al. 2009a). The road widening is expected to have a negligible direct impact on the availability of nesting sites for the birds. Nuisance-related effects on the birds' breeding success may be of more significance, if they respond negatively to the impact of construction traffic noise and vibration. In this instance, the roads may cause reduced breeding success for those individuals within the noise impact zones of the road, an impact of low magnitude and **low medium** significance, taking into consideration the Vulnerable status of the species.

7.2.2.2.5 Mitigation and Monitoring

The following impact mitigation and monitoring is recommended:

- Implement the mitigation set out under Section 7.2.1.6; and
- Develop and implement a long term research and monitoring programme to improve understanding of the behaviour and status of Nahan's Francolin in Bugoma Forest (this recommendation is developed further in Volume 5, Cumulative Impacts).

7.2.2.2.6 Impact Significance Rating

It should be noted that the impact significance rating depicted Table 7-28 does not take into account the induced effects of population influx on Nahan's Francolin; those impacts are assessed separately in Section 7.2.3.

Table 7-28: Construction phase impacts on Nahan's Francolin

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat quality and quantity	4	2	3	4	Low Medium 36	2	2	2	3	Low 18
Habitat connectivity	4	2	3	5	Low Medium 45	2	2	2	3	Low 18
Abundance and distribution	4	2	3	5	Low Medium 45	2	2	2	3	Low 18
Survival and reproduction	4	2	3	4	Low Medium 36	2	2	2	3	Low 18

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.2.2.3 Impact on the Eastern Chimpanzee

The Eastern Chimpanzee is an Endangered species. A population occurs in the Bugoma Central Forest Reserve. The species triggers IFC Tier 1 critical habitat.

7.2.2.3.1 Habitat Quality and Quantity

Chimpanzees' vulnerability to disturbance is reasonably well known (Parren and Byler 2003, Rabanal et al. 2010, Thompson and Wrangham 2013). The land around the BCFR is intensively settled, and the chimpanzees living in the forest have some experience of humans. Groups of chimpanzees are known to forage in the cultivated lands around the BCFR (McLennan 2008). Typical sounds associated with rural communities will be familiar to them as will the sound of traffic along the Kabwoya-Ikamiro (P1) road. There is presently little traffic on the R5 through the centre of the reserve (refer to Figure 7-14).

Plumptre et al. (2010) have shown that chimpanzee nesting sites are widely distributed through the BCFR, except in the vicinity of the P1 road, where nesting frequency is much lower. This suggests that the chimpanzees within the BCFR actively avoid the disturbance of the road at night, an observation supported by Parren and Byler (2003). Evidence of chimpanzees avoiding industrial activity, like earth moving, varies. Parren and Byler (2003) recorded chimpanzees leaving their range as a result of logging activities heard from a distance of 5 to 10 km, and they suggested that this could cause lasting avoidance of disturbed areas. This may explain why chimpanzee densities were consistently lower in logged areas in Kibale National Park, compared to unlogged areas, although avoidance of hunting as a result of logging activity may also have been a factor (Chapman and Lambert 2000. Rabanal et al. (2010) did not find large-scale spatial responses to oil and gas related noise disturbance in Loango National Park, Gabon; although chimpanzees avoided sites where explosives were used for exploration for a period of four months after the activity had ceased (Rabanal et al. 2010).

The chimpanzees within the BCFR are, therefore, likely to show localised patterns of avoidance in response to increased vehicle noise and other human activity. Heavy vehicle activity along the R5 and P1 roads will increase, both prior to and during the construction phase of the KFDA project. Initially, these roads will have to be upgraded, involving logging teams and bulldozers to clear the trees for the additional right of way, followed by the use of other noisy road-building activity. Once project construction starts on the Buhuka Flats, traffic loads on the R5 and P1 will increase by orders of magnitude. CNOOC estimates heavy vehicle traffic loads of around 65 vehicles per day over the 3-year construction period (130 vehicles per day including return trips). The magnitude of traffic noise, and the frequency of noisy events, will increase significantly, together with other 'new' noises that the chimpanzees may associate with danger. It is likely that they will avoid these roads to a greater degree than at present, probably (based on evidence of chimpanzee sensitivity provided by Parren and Byler 2003, Rabanal et al. 2010) by up to 500m on either side of the road. Applying this buffer to both roads in the sections where the pass through or abut the BCFR, the habitat lost or reduced habitat quality will be approximately 485 ha (1.2%). Taking into account the increasing threats to this species due to habitat loss, and the fact that its conservation status renders impacts to this species at an international scale, the overall impact of reduced habitat quantity and quality is considered to be of **high medium** significance.

7.2.2.3.2 Habitat Connectivity

While the Bugoma Central Forest Reserve chimpanzees are accustomed to some human activity, including occasional road traffic, and they are known to regularly cross roads within their range, the magnitude of the impact caused by construction activities (both road building and CNOOC construction traffic) is likely to be significantly greater than is currently experienced. The split between construction traffic on the R5 and the P1 is not known, nor is the extent of avoidance behaviour by the chimpanzees to increasing degrees of nuisance and perceived threat. However, it is reasonable to assume that the order of magnitude increase in traffic will materially affect the behaviour of the animals, and will discourage regular road crossings, resulting in an impact which will extend over 3 years and will be of moderate magnitude. Taking into account the increasing threats to this species due to habitat loss, its international threat status, its vulnerability is high and the overall impact significance of habitat fragmentation is considered to be **high.**

7.2.2.3.3 Abundance and Distribution

The BCFR supports one of the four largest Eastern Chimpanzee populations in Uganda, with between 450 and 850 individuals (Plumptre et al. 2010). It is expected that some of them regularly cross the R5, and there is evidence that groups of animals forage outside of the reserve, so they may cross the P1 also.

Construction traffic will increase to frequencies where interaction between vehicles and animals crossing the road could be likely on occasions. How the chimpanzees would behave in the face of an oncoming vehicle is unknown. The probability of collisions and the potential magnitude of this impact is still thought to be low, but it is no longer negligible, as is the case at present where traffic volumes are limited. Taking into account the endangered status of the Eastern Chimpanzee, the impact significance will be **high medium.**

7.2.2.3.4 Survival and Reproduction

As mentioned, the chimpanzees within the forest appear to currently avoid the road corridor for night-time nesting and other activities. Furthermore, given that the chimpanzees within the forest are more than likely used to human activities in and around the forest, they are predicted to adapt to most of the sensory disturbance arising from the construction activities. The survival and reproduction of the Eastern Chimpanzees within the Bugoma Central Forest Reserve are not expected to be affected as a result of the road upgrade construction works; however, the increased traffic associated with the Project's construction presents an increased collision risk and risk of injuries and mortalities.

In the event that the chimpanzees need to cross the upgraded road, the increased traffic associated with the Project's construction could present an unacceptable collision risk and subsequent injuries/mortality of chimpanzees. A threshold of 10% for this species' survival and reproduction in the CHAA is reasonable, and it is highly unlikely that this number of individuals in the local population within BCFR will be affected through direct mortality or severe sensory disturbance; nevertheless, a single incidence of mortality or injury to any individual of this Endangered species is considered unacceptable. Therefore, the magnitude of the effects of increased traffic on the P1 associated with the construction of the Project on the survival and reproduction of the Eastern Chimpanzee is high and taking into account the global conservation importance of the species, the impact significance will be **high**. Following the application of the recommended mitigation measures, the impact significance is expected to remain **low medium**, primarily because the increased risk of mortality caused by additional construction traffic, even with controls, cannot be entirely eliminated.

7.2.2.3.5 Mitigation and Monitoring

The following impact mitigation and monitoring is recommended:

- Implement the mitigation set out under Section 7.2.1.6; and
- Supprot the development and implement of a long term research and monitoring programme to improve understanding of the behaviour and status of the Eastern Chimpanzee in Bugoma Forest (this recommendation is developed further in Volume 5, Cumulative Impacts).

7.2.2.3.6 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 7-29 does not take into account the induced effects of population influx on Eastern Chimpanzee; those impacts are assessed separately in Section 7.2.3.

Table 7-29: Construction phase impacts on the Eastern Chimpanzee

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat quality and quantity	4	2	5	5	High Medium 55	4	2	3	3	Low 27
Habitat connectivity	6	5	5	5	High 80	2	2	3	3	Low 21
Abundance and distribution	4	2	5	5	High Medium 55	1	2	5	3	Low 24
Survival and reproduction	8	4	5	5	High 85	6	2	3	3	Low Medium 33

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.2.3 Impacts of Population In-Migration

Habitats and ecosystem integrity and species of conservation concern are both likely to be affected by an influx of population into the study area, caused by people seeking work and other opportunities that will spin off from the project. This is borne out by the dramatic in-migration onto the Buhuka Flats over the past 10 years, with people seeking opportunities offered by fishing in Lake Albert. In cases, settlements have increased by over 100%. Recently, a further marked change has resulted from the construction of the escarpment road, with markets on the Buhuka Flats now operating daily, where previously they were a weekly event.

The lure of jobs in the oil industry is likely to attract further influx, both on the Buhuka Flats and in the area above the escarpment around the Bugoma Central Forest Reserve (BCFR). The magnitude of this change is difficult to predict but is likely to be material given the shortage of jobs in Uganda and surrounding countries like Rwanda and the DRC.

7.2.3.1 Impact on Habitats and Ecosystem Integrity

The indirect impacts of in-migration are expected to include the following:

- Impact on the near-shore environment of Lake Albert. The induced impact of the escarpment road (built in support of the future construction of the CNOOC KFDA on Buhuka Flats) has already resulted in a sharp escalation in commercial fishing, driven from Kampala, and now part of daily life. Near-shore fish stocks are decreasing as a result of the intense fishing pressure, with catches of only very small fish becoming more common. These pressures will increase as populations on the Buhuka Flats grow.

Other impacts on the near-shore environment of the lake will result from changes in water quality, induced by overstocking and increased soil erosion on the Buhuka Flats, increasingly poor sanitary conditions associated with the growing lakeside population pollution caused by fuels, human and livestock waste, fish waste and litter;

- Impact on wetland habitats on Buhuka Flats. All of the wetlands, including those on the Masika River south of the construction work areas are likely to experience increased pressure due to harvesting of fibre for house construction and grazing of livestock;
- Impact on terrestrial habitats on the Buhuka Flats. Grazing pressures are expected to increase to unsustainable levels. Soils on the Flats are highly erodible and a reduction in vegetation cover will cause increasing habitat degradation due to erosion. Increasing demand for fuel wood will result in harvesting of the remaining woody species. Changes in plant species composition are likely, with hardier pioneer species becoming more dominant and invasive weed species more prevalent. A permanent reduction in the carrying capacity of the Flats may occur due to soil loss;
- Impact on fauna on the Buhuka Flats: All species are likely to be under increasing pressure due to habitat degradation and mammals and bird populations will be reduced by increased hunting for bush meat. Remaining populations of bushbuck and duiker are likely to be locally exterminated;
- Impact on the escarpment vegetation corridor. Grazing pressures will force stock into the accessible areas on the escarpment, where erosion risks are high. Demand for fuel wood is also likely to affect the escarpment habitats, with trees and woody vegetation being harvested for fuel wood. Faunal populations and species diversity will be affected by increased hunting for bush meat; and
- Impact on the Buhuka Central Forest Reserve (BCFR). Wittemyer et al. (2008) have shown that population growth and encroachment around protected areas is significantly higher than the average population growth in rural areas - mainly due to the migration of people into these areas because of the perceived increased availability of opportunities, natural resources and potential jobs. The pressure on the BCFR from surrounding populations is already evident. The land around the forest has been largely transformed for agricultural and subsistence, resulting in increasingly scarce natural resources.

  Recently, more than 1,500 people were evicted from the BCFR after illegally settling in the forest (Mugerwa 2013). The improved road infrastructure associated with the oil industry will further encourage the influx of migrants. Materially heightened risk to the BCFR is likely, due to both increased incursions into the forest reserve for medicinal plants, wood harvesting, charcoal manufacture and hunting, and encroachment and forest clearing by new settlers.

Figure 7-15: Intensive subsistence agriculture around the BCFR and incursions into the forest in the centre of the photograph (this intensity of rural settlement and cultivation is typical of the areas surrounding the BCFR)

7.2.3.2 Species of Conservation Concern

All species of conservation concern in the Regional Study Area are likely to face increased threats due to in-migration:

- The critically endangered **Mud Snail** could be impacted by increasing sediment generation and near-shore pollution caused by growing populations along the shore of Lake Albert;
- The endangered **Grey Crowned Crane** will be affected by the the impact of increasing human populations and stock on the Flats. Habitat degradation, nuisance, the increased threat of hunting, and the capture of crane chicks for sale on the open market are likely to cause the loss of the small crane population currently resident on the Buhuka Flats;
- Increasing pressure on critically endangered **Nahan's Francolin** would be possible both as a result of deforestation in the BCFR, which could have some impact on available habitat for breeding of the francolin, and due to increased nuisance and levels of illegal hunting and trapping in the forest; and
- For the population of endangered **Eastern Chimpanzees**, resident in the BCFR, the risks would be due to increasing habitat loss as a result of settlement on the perimeter of the forest, escalation of hunting in the forest for bush meat and ritual killings and the possibility of diseases introduced into the chimpanzee populations as a result of closer proximity to humans. Proximity between humans and chimpanzees increases the risk of introducing diseases into the chimpanzee populations. Human diseases can be directly transmitted to chimpanzees (Lonsdorf et al. 2011) particularly communicable respiratory diseases such as tuberculosis, influenza and acute upper and lower respiratory infections. Disease is recognised as one of the main threats to chimpanzee populations, and, because chimpanzees and humans are so similar, chimpanzees succumb to many human-borne diseases (Oates et al. 2008).

  Increased defecation in forest undergrowth by migrants could indirectly lead to spread of intestinal diseases, such as *Clostridium perfringens*, which can be fatal to chimpanzees (Fujita 2011). In the past

15 years, Ebola haemorrhagic fever has killed chimpanzees in Côte d'Ivoire, and repeated epidemics have caused dramatic declines of ape populations in remote protected areas in Gabon and the Republic of Congo (Oates et al. 2008). Uganda has experienced outbreaks of Ebola in the past, with the most recent in Kibaale in 2012 (WHO 2104). This impact could be potentially fatal for numerous animals, should a disease spread.

7.2.3.3 Mitigation and Monitoring

It is recommended that the measures set out in the Influx Management Strategy and Framework Plan for the project are implemented (refer to Specialist Study 11 for details). The objectives of the Influx Management Strategy and Framework Plan are for Government, donors, CNOOC, Tullow and Total, as well as other stakeholders, to develop measures to:

- Avoid or reduce influx of work seekers to the project area and those seeking to take advantage of Project related economic opportunities;
- Avoid or reduce influx of opportunity seekers that that will not contribute to development and upliftment of local communities;
- Proactively attract skilled people such as teachers, health workers, and experienced traders and entrepreneurs; and
- Manage such undesired influx as cannot be avoided through support to existing Government and donor initiatives for planning and development of the Hoima and Kikuube Districts, and the protection of habitats and ecosystem integrity and species of conservation concern.

There is a considerable effort still required to set up the details of a working plan in this regard. With respect to biodiversity, long term monitoring plans must be developed for the valued environmental components potentially affected by in-migration, including the habitats of the Buhuka Flats, Escarpment Corridor and the Bugoma Central Forest Reserve, and all of the species of conservation concern. Monitoring of settlement around the BCFR will be necessary to provide data in support of actions to minimise impacts on the forest habitat and the potentially affected threatened species within it.

The potential magnitude of the described impacts prior to mitigation is uncertain, as the scale of population influx to the region and the consequences of this are difficult to ascertain but may be very high, resulting in impacts of **high** significance. While the implementation of the Influx Management Strategy and Framework Plan is expected to reduce migration into the area, it is unlikely that impacts can be reduced to low levels of significance. Residual impacts are still likely to occur and are expected to be of **high medium** significance.

7.2.3.4 Impact Significance Rating

Table 7-30: Construction phase impacts on habitats and ecosystem integrity and species of conservation concern caused by in-migration

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on habitats and ecosystem Integrity	10	4	2	5	**High 80**	6	4	4	4	**High Medium 56**
Impacts on species of conservation concern	10	4	3	5	**High 85**	6	4	5	4	**High Medium 60**

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.3 The Socio-Economic Environment

7.3.1 Overview

This section describes the socio-economic impacts associated with the project as it pertains to the construction phase of the KFDA production facility.

While land take and the resulting physical and/or economic displacement is a direct result of specific project infrastructure (and can therefore be calculated with respect to project components in the construction phase), most other socio-economic impacts arising from the operation of the project cannot sensibly be distinguished in this way. These impacts are described for the construction of the entire project production facility.

7.3.2 Construction Workforce-Related Impacts

Various socio-economic impacts are expected to arise because of the creation of employment opportunities during construction. These impacts are further discussed below.

7.3.2.1 Impact on Employment

Employment Opportunities

As at April 2018, CNOOC employed 60 Ugandan Nationals, 35 Expatriates and 21 Contractor team members (engineering, drilling and completion) whose nationalities have not been specified. Project - related casual short-term jobs are presently allocated equally to residents of local villages through a registration process that involves the LC1s, with approximately 200 jobs created to date.[21] The CNOOC recruitment policy for casual labour is based on a lottery/raffle system that allows all villagers who apply for work an equal but random chance of being appointed, depending on the number of labour 'slots' or openings available per village. This additional requirement has been introduced to preclude LC1 bias in favour of selected applicants. In the construction phase, job creation in the EPC and drilling contracts will ramp up to between 1,000 and 2,000 at peak, tailing off towards the end of the 3-year construction period. Drilling jobs

[21] *ESIA Presentation of the CNOOC Kingfisher Development (December 2017)*

will continue into the operational phase of the project (Chapter 8). Based on its agreements with the Ugandan Government, CNOOC will employ local people.

Employees will be sourced from various areas, from the villages in the LSA on the Buhuka Flats, to Kikuube and Hoima Districts, to the national labour market and even internationally. CNOOC has a recruitment policy which stipulates the procedure according appointments are undertaken, taking into account Ugandan legislation in this regard. The casual labour policy reserves at least 60% of casual jobs for local communities in the areas of its operations, and this is expected to apply to the construction phase of the project as well. Employment will be provided through a selection process that includes all affected villages. In addition, the EPC contractor may employ casual workers from the villages around the project ad hoc for short-term work, like bush clearing. Given the incidental nature of this work, it is not possible to quantify it.

Given the population size of villages within the Buhuka Parish as well as villages on top of the escarpment, there appears to be an available workforce. This workforce will be capable of unskilled and some semi-skilled tasks. Employment creation in the local area and wider region is therefore considered to be an important positive socio-economic impact. It will be short term and the benefits will quickly work their way out of the economy, but taking into consideration the need for cash income, the impact significance will be **medium**. With the implementation of the recommended measures to enhance construction employment impacts, the overall significance rating can be increased to a **high**.

Skills Development/Training

An important constraint affecting the local take up of semi-skilled and skilled appointments relates to a lack of specific education and, to a lesser degree, scarce and critical skills in the oil and gas industry. CNOOC has developed an employment and recruitment policy which guides the recruitment and employment process for internal, local, national and international recruitment. Internal succession, apprentice, trainee and graduate as well as contract labour programmes have been designed for the project. The skills development strategy, which is planned for employees, is designed to improve the capability of the local labour pool by investing in technical, managerial and administrative skills of the workforce. Individual career development plans, setting out areas of competence for development would need to be designed in order to effectively implement career and skills growth for any employees during their term of employment.

Training and skills development will provide a positive impact in developing the construction workforce skills and qualifications and in expanding the human capital available within the local and regional economy. The impact will involve a relatively small number of people, resulting in a rating of low magnitude, but will be permanent, but, in the context of the great need for skills development in Uganda, the overall impact significance will be **medium.**

Loss of Income due to Layoff of Casual Labour

Layoff of most of the local casual workers hired during construction will accelerate as the construction phase reaches an end. This could be between 1,000 and 1,500 temporary jobs. Most of these people will not find employment in the operational phase which has much fewer opportunities for casual workers. This may impact on food security among local families who have become dependent on the income from the lost jobs. This is a well-known problem affecting large construction projects, and has sometimes been accompanied by work stoppages and violent protests, particularly if the terms and conditions of casual employment have not been properly explained to the workers. Without appropriate control, the magnitude of impact could be very high, given the vulnerability of the affected workers, and the potential for deteriorating relationships between the company and workers. The residual effects will extend beyond the construction phase into the medium term. The unmitigated impact will be negative and of high **medium** significance.

7.3.2.2 Impact on Accommodation on the Workforce

CNOOC policies concerning employment include preferential hiring of local residents/communities and advertising employment opportunities within the local fishing villages (local labour market), who can continue to live with their families as they offer their services to the project. It is anticipated that a range of accommodation options will be offered to employees by the EPC contractor to ensure that no group of potential employees is excluded from employment in the project because of their lifestyle and accommodation preferences. This will be particularly important given the tightening labour market for skilled labour and experienced employees in oil and gas.

Appropriate accommodation and catering facilities will be provided for all contract workers living in the contractor's temporary camp and catering will be provided for all workers, including day workers. Accommodation is expected to meet IFC PS1 requirements. The impact will be positive and of **high** significance.

7.3.2.3 Impact on Employee Health and Safety

General Safety Impacts

Local Ugandan statistics for the causes of injury in the construction industry are not readily available. However, the Labour Force Management Plan for Contractors and Subcontractors (CNOOC, 2015:29) outlines a number of broad categories of oil and gas related workplace hazards. These are:

- Physical hazards that include contact injuries and accidents, UV radiation, falling from height and fire;
- Chemical hazards, in particular related to contact with dangerous chemicals that may lead to various health problems;
- Biological hazards leading to infections and parasitic diseases among workers that are the result of contamination from living organisms or their by-products such as bacteria, moulds, parasites and dust; and
- General hazards, including radiation, noise, vibration and extreme temperature.

These hazards may all be aggravated by specific behaviours, such as working in areas without adequate lighting; carelessness or tiredness affecting attention to the task; inadequate, incorrect, or non-existent use of Personal Protective Equipment (PPE); failure to use rotating machinery with the necessary safeguards, general ignorance of, or failure to follow, recognised and documented safety procedures, dehydration and working on potentially hazardous tasks while alone.

Any of the above hazards and behaviours may lead to occupational accidents, illness or disease that could have chronic consequences, preventing the individual from continuing work. The Rapid Health Impact Assessment (Volume 4, Specialist Study 10, Appendix B) highlights the following issues regarding work - related illness and injuries as important considerations, particularly during the construction phase:

- A significant proportion of the workforce will be sourced from a low skill labour pool and would potentially be unaware of workplace-based health and safety requirements, making them more prone to high risk behaviour and accidents during the construction phase;
- Ugandan labour laws, associated enforcement of health and safety regulations and compensation for occupational injuries and disease lag behind international best practice standards. Disability management and appropriate compensation standards and regulations are limited and are not aligned with IFC and other international standards and requirements; and
- There is a limited emergency response system in the broader study area and indeed district.

In the absence of a highly regulated OH&S environment, with appropriate safety training and a zero tolerance management approach towards unsafe practices, the probability of disabling or fatal injuries (impacts of high magnitude) during the construction phase will be high, with potentially permanent consequences and with a **high** significance rating. With strict implementation of a high standard of health and safety management, injuries can be reduced to minor non-disabling accidents which are short term and of **low** significance.

Driver and Mobile Equipment Safety

The main causes of accidents involving project - related vehicles and movable equipment on and off site are:

- Failure to drive cautiously and defensively;
- Disregard of speed limits;
- Failure to wear seat belts;
- Use of cell phones while driving;
- Careless driving and/or driving / equipment operation by insufficiently trained personnel;
- Failure to maintain the lights and audible reversing signals on construction vehicles and equipment;
- Night driving; and
- Driver/operator fatigue.

As for other aspects of work on a large construction site, the use of vehicles and heavy construction equipment may result in significant safety hazards in the absence of a highly regulated OH&S environment. Without appropriate driver training and a zero tolerance management approach towards unsafe practices, the risk of disabling or fatal injuries (high magnitude) caused by construction vehicles and moving equipment will be high, with a **high** significance rating. As in the case of general safety issues, these risks can be minimised by good practice, and injuries can be reduced to minor non-disabling (short term) accidents which are short term and of **low** significance.

Graft & Exploitation

During all phases of the project, CNOOC will need to remain alert to the potential for graft and exploitation that foreign (non-Ugandan) employees and service providers may experience. There have been incidents in which foreigners (particularly Chinese people) have been accosted by the Department of Home Affairs in the project area, being forced to go to the Passport Centre to prove that they have work permits in place. People with a relatively poor command of English may feel sufficiently intimidated to offer money to be left alone. Locals keen to find employment have, as well, been subjected to graft and exploitation through unscrupulous role-players who pretend to recruit on behalf of CNOOC. Unsuspecting victims are required to pay a “registration fee” to be included on the recruitment roll. Impacts may affect uninformed locals on the one hand and CNOOC foreign personnel on the other hand, and will be of low **medium** significance.

Alcohol and Drug Abuse

National statistics on substance abuse in the workplace and associated safety incidents and accidents are currently unavailable, although alcohol and drug abuse is often prevalent in construction camps and this spins off into safety in the workplace., Of concern is that Uganda has the highest prevalence of consequences associated with alcohol consumption, and thus the highest reported rate of alcohol-related burden in the world. This includes the burden of alcohol related workplace-based accidents and injuries (Graham et al., 2011).

According to the 2014 Global Status Report on Alcohol and Health, Uganda’s pure alcohol per capita annual consumption is 9.8 litres which places it amongst the highest globally. Per capita consumption of pure alcohol in the over 15 years old age group is, on average, 23.7 litres! As comparison, the WHO notes that the African average per capita consumption rate of pure alcohol is approximately 6.2 litres per capita per annum (WHO, 2014).

The unmitigated risks are highly significant, with a strong correlation between workplace accidents and the use of these substances. In the absence of appropriate management and monitoring, the risks of severe (permanent) injury or mortality due to substance abuse will be high, and impact significance will be **high medium**.

Vector-Related Diseases

Malaria in Uganda can have significant negative impacts on worker health and productivity. In the vicinity of the project, there is a paucity of accurate data about vector typology and behaviour, exact prevalence of malaria and indicators related to knowledge, practices and behaviours. This limits the ability to monitor impacts or interventions from a clear point of departure. However, from the data that is available, as set out in the HRIA, the proposed production facility environment is expected to be a high risk malarial area, supporting numerous breeding sites that are conducive to the promotion of disease transmission. According to the Rapid Health Impact Assessment (RHIA) undertaken for the project, malaria is the most prevalent health concern in the area, with the disease accounting for 35-54% of all outpatient visits in the study area Health Clinics (Volume 4, Specialist Study 10, Appendix B). Malaria case rates are also described as being on the increase, and that the illness is commonly associated with misconceptions and poor prevention behaviour. There is limited capacity within the Local Study Area for the support of malaria and vector control preventive initiatives. The magnitude of malaria impacts on the workforce, without appropriate interventions, will be potentially high, permanent (potentially life threatening), local and of **high medium significance.**

Sexually Transmitted Diseases

The potential spread of sexually transmitted disorders (STDs), including HIV/AIDS, must be regarded as a serious potential impact on the workforce, with the risk of the spread of the diseases due to interaction between construction workers and local communities. Typically, the presence of a large number of well-paid predominantly single males in construction camps encourages sex workers from local communities and further afield, with a resultant risk of the spread of HIV/AIDS and other STDs among construction workers due to unprotected sex. Without a high degree of management, this workforce impact will be long term or permanent, only partly reversible (depending on the availability of treatment), of very high magnitude, regional scale (spread to other areas when construction worker leave) and **high** significance. Stringent management will reduce unsafe practices, but is unlikely to that it can be fully controlled in the construction phase and the residual impact will remain low **moderate.**

Sanitary and Hygiene - Related Diseases

Maintaining hygienic conditions in a large workforce unaccustomed to requirements in respect of sanitation and hygiene will require ongoing education and management. In addition to the provision of appropriate sanitary facilities for human and food wastes, personal hygiene must be taught and enforced.

Food waste must be disposed of in a proper manner (incineration, burial or taken off site and disposed of in sanitary landfill sites) to prevent the proliferation of pests. CNOOC plan to remove food waste from site as part of the site general waste management practice. This waste will be transported to a registered disposal site by the waste contractor.

Without proper management in place, outbreaks of diseases caused by poor sanitation and hygiene are highly likely, causing negative health impacts in the workforce and lost man-hours. The magnitude of the impact is potentially high, with local, medium term, effects, resulting in impacts of high **medium** significance.

7.3.2.4 Impact Mitigation / Enhancement and Monitoring

CUL is required to comply with the objectives of the National Oil and Gas policy and legal framework with regard to oil and gas development and benefits to the citizenry. CUL has set out to meet relevant National laws and regulations, policies and action plans, and international best practice to ensure that it complies with a high standard in the management of its labour force. CNOOC Limited is a member of the UN Global Compact, and therefore all its global operations, including CUL, are committed to comply with the principles in the Compact related to labour rights.

The following plans will apply to CUL's functioning across all phases, including construction:

The following plans will apply to CUL's functioning across all phases, including construction:

- CUL (updated). Labour Force Management, currently under preparation by the Consultants; and
- ESIPPS (2015). Labour Force Management Plan for Contractors and Subcontractors. Final Plan, prepared on behalf of CUL, February, 2015.

The Labour Force Management Plan (LFMP), while focussing more specifically on casual labour which will be characteristic of much of the unskilled labour employment during the construction phase of the production facility, nevertheless applies to a wide range of issues that will be equally applicable to other, permanent, employees. CNOOC requires that all EPC contractors adopt the Casual Labour Recruitment Guidelines as well as the Labour Force Management Plan. As well, in order to minimise the possibility of misunderstandings or potential conflict related to local employment, it is an additional requirement that contractors are fully briefed on the Guidelines and the Plan by the relevant lead department prior to the commencement of contract execution.

The LFMP commits CUL to a range of specific actions designed to ensure that its labour practices are fair, transparent and in compliance with Ugandan policy and law and best practice standards, including IFC PS2. The LFMP deals with a wide range of issues, including recruitment and retention of employees, terms and conditions of employment, wage rates, minimum wages, timeliness of payment, entitlements and benefits (work hours, weekly rest, public holidays etc.), repatriation of workers, termination of services, workplace health and safety, HIV Aids policy and prevention, health and welfare arrangements, first aid facilities, measures against biological hazards (insects, pests, virus's, parasites, bacteria), training and development, freedom of association, equal treatment, employment of women, forced labour, grievance management, local content and migrant workers, damage to property and management of contractors and subcontractors.

For the purposes of the EISA, the following additional recommendations are made, drawn from the specialist studies. In some instances, there is overlap between the recommendations in the LPMF and the recommendations below:

Impact on Employment

Employment Opportunities:

- Implement the actions set out in the ESIPPS (2015) Labour Force Management Plan (LFMP). Ensure that all contractors employed during the construction phase of the project are aware of and comply with the management framework for casual labour set out in this document;
- Ensure that the framework is fully applicable to CNOOCs full time construction staff;
- Preferentially hire local people, in accordance with CNOOC policies and agreements with Government. Advertise employment opportunities within the local fishing villages (local labour market) so that many people are employed who can continue to live with their families as they offer their services to the project. Directly project-affected people should be given priority to win construction phase jobs, subject to their meeting the necessary employment requirements;
- Ensure that permanent employment is done via CULs Kampala head office in order to discourage job seekers at the gate of the production facility. Widely advertise the employment process for the construction phase so as to ensure local understanding of employment criteria and processes;
- Ensure that all labour hired to site are of an adult age; and
- Develop and implement training and skills development programmes in the construction workforce to expand the human capital available within the local economy.

Skills Development:

- Align the CNOOC Education and Training related support initiatives as well as in-house training and competency development of Ugandan nationals with the critical and scarce skills requirements of the Oil and Gas sector;
- Consider promoting a process of Recognition of Prior Experience (RPE) and Recognition of Prior Learning (RPL) in collaboration with tertiary technical training institutions that will allow the accrual of credit for informal and non-formal skills development into the formal skills development sector for unskilled but experienced construction workforce;

- Provide basic financial literacy training to construction workforce who are employed for longer than 4 months; and
- Provide all necessary SHE training to construction workforce.

Layoff of Casual Labour:

- Ensure that labourers fully understand their conditions of contract with respect to its temporary nature; and
- Train the elected office bearers (LC1's) to ensure that they understand and communicate appropriate information to their communities about the temporary nature of construction employment.

Impact of Workforce Accommodation

- Ensure that construction workforce accommodation meets all IFC PS 2 requirements, including the putting in place and implementing policies related to quality and management of the accommodation and provision of basic services;
- Ensure that construction worker rights to freedom of movement or of association are balanced with the need to prevent detrimental construction workforce related impacts on the general well-being and health, safety and security of settlements in proximity to the workforce accommodation services. The current CNOOC practice of sequestering workers who reside in the camp to the camp site from 19:00 at night assists in minimising the potential interaction between workers and villagers;
- Ensure that the contractor provides on-site catering for all personnel (including day workers);
- Ensure provision is made for sufficient housing to avoid overcrowding at the EPC and Drilling contractors' temporary camps; and
- Refer to recommendations for recreational health under alcohol and drug abuse.

Impact on Employee Health and Safety

General Health and Safety:

- Comply with the Occupational Health and Safety standards established by the Government of Uganda, as well as the requirements in place in respect of the IFC;
- Incorporate veterinary concerns into the OHS management plan to include appropriate waste management to mitigate against feral dogs and an awareness of the risk of snake bites and other wild animal threats;
- Create awareness of all Occupational Health and Safety requirements from and measures for workers that include adequate orientation as well as ongoing/routine training and sensitisation on OSH;
- Adopt a zero tolerance approach to employees who transgress health and safety rules;
- Ensure effective management of camp facilities. Consider a closed camp status;
- Implement health education programmes for employees in order to disseminate information regarding general social pathologies and spread of disease;
- Properly design the accommodation and other facilities in the personnel camp to prevent overcrowding and need to use rented accommodation available in communities;
- Ensure adequacy of welfare and amenities, including the supply of adequate drinking water as per WHO recommended 5 litres per day, cloak rooms, sanitary facilities separate for men and women, adequately furnished eating places, hand wash rooms/areas and proper meals;

- Develop effective management of emergencies, illness and injuries through adequate medical provision, equipped first aid points at the workplace and as needed in the field and the availability of emergency response facilities;
- Ensure that the CNOOC Emergency Response and Exposure Control Plans are understood by all workers, including labourers undertaking routine construction related tasks, and not only by first responders, and that adherence is strictly enforced under all circumstances and conditions;
- Screen local employees/contractors for TB at recruitment and provide adequate care and treatment programmes from the Project's workplace medical service while complying with the requirements of the national TB programme;
- Develop a site-based TB management programme;
- Evaluate the origin of any incoming contracted construction workers (especially from high burden TB countries) and understand TB and MDR risks in this group. Ensure effective TB screening in the external contracted workforce prior to final appointment and mobilization as part of the Project's Fitness to Work (FTW) procedures to ensure that diseases are not introduced in the study area;
- Develop a vaccine preventable disease programme for all employees, and visitors based on risk for travellers and at-risk occupations. All employees and contractors residing in close contact in camps should receive the quadrivalent meningococcal meningitis vaccine;
- Support a HBV vaccination campaign/ or antibody testing on employee who may have not been vaccinated as a child;
- Develop nutritional programmes that promote proper nutritional practices at the workplace to prevent obesity and related health impacts, including education programmes in the workforce on financial management and support of the household units in employees that have traditionally followed a subsistence lifestyle;
- Train employees to ensure that they are aware of the requirements of the Occupational Health and Safety standards established by the Government of Uganda; and
- Provide ongoing monitoring of worker health through a dedicated Employee Health Assessment Programme with the following key focus areas:
  - Malaria control and prevention programme.
  - Tuberculosis control and prevention program.
  - Vector surveillance and control.
  - Clinical operations.
  - Food safety.
  - Water safety.
  - Camp hygiene and sanitation.
  - Industrial hygiene.

Driver and Mobile Equipment Safety:

- Implement driver and mobile equipment training programmes in accordance with internationally recognised guidelines for workplace safety; and
- Prohibit all drivers (permanent employees, contractors and suppliers) from giving lifts to the local community.

Graft and Exploitation:

- Ensure that CNOOC puts in place and meticulously implements all required anti-corruption, business ethics related and internal compliance Policies and Programmes, including the CNOOC Limited Code of Commercial Behaviour and Conduct of Employees, the Procedures for Handling Violation of Rules of CNOOC Limited Employees as well as its Guidelines for Overseas Operation with Compliance of CNOOC;
- Ensure that all expat employees, contractors and sub-contractors appointed during the construction phase comply with the labour and work visa requirements as necessary, and have copies of all appropriate documents available and at hand;
- Ensure that all employees, contractors and sub-contractors are alert to situations where they may become the victims of crime or targets for corrupt practices, including that perpetrated by government officials;
- Ensure that there is a protocol in place for reporting and managing incidences of intimidation and/or corruption. This protocol should include a coherent process for supporting persons who are unable to communicate fluently in English; and
- Ensure massive sensitisation of communities regarding CNOOCs policies, programmes and procedures in a manner that will ensure that they are alert to situations where they may become the victims of crime or targets for corrupt practices.

Alcohol and Drug Abuse:

- Develop a programme to address education about and management of non-communicable diseases related to use of drugs and alcohol issues;
- Implement the CUL policy of prohibiting the possession and use of drugs and alcohol at all of its camps and construction worksites and those of its contractors and the associated routine search of vehicles and bags to ensure that unauthorised substances are not taken into the camps facilities; and
- Ensure that there is sufficient provision for worker recreation in order minimise the lure of substance abuse and use of external sexual services and facilities. While it is understood that it is extremely difficult to ensure prevention, it will be necessary for CNOOC to put very specific measures in place to address such issues.

Vector Related Diseases:

- Develop an integrated workplace malaria and vector control programme to include source reduction and environmental management of breeding sites, routine inspections of accommodation units, appropriate IEC programmes for the workforce and contractors prior to secondment and for use in country, policies and programmes related to use of protective clothing and the use of malaria chemoprophylaxis and surveillance programmes between the workplace medical service and vector control team to determine the likely origin of, and root cause of malaria cases;
- Reduce potential human vector contact and control of breeding sites of disease vectors such as mosquitoes. Continually monitor activities on site to ensure adequate drainage and management of storm water to minimise breeding in the area; and
- Ensure that all accommodation units in the permanent camp are proofed against mosquitoes.

Sexually Related Diseases:

- Develop a clear HIV policy and programme in the workplace which includes ensuring that there is adequate accommodation capacity at the temporary personnel camps to eliminate the need for contractors or visitors to seek accommodation in the local villages;

- Screen for STDs and hepatitis B/C virus as part of pre-employment fitness to work process. Treatable causes should be managed, and chronic carriers excluded from employment until managed;
- Develop a code of conduct that actively discourages sexual relationships between the workforce and the local community;
- Work with the village and traditional leaders to manage truck stops, as well as district authorities to report any increase in high-risk sexual behaviour from elements of the workforce, including the collection of baseline data;
- Develop and implement an HIV and STI management programme in the construction workforce, to include awareness and education, treatment services that link to the public health service, provision of free condoms, access to counselling, proper provisioning of the work camps to dissuade workers travelling into communities for entertainment and support of family friendly accommodation in the camps;
- Develop and implement an HIV and STI prevention programme for suppliers, which is to include awareness and education about STI's. The design and placement of rest stops for drivers transporting goods and materials to and from the production facility should be away from local communities and properly subsidised for cheap food / entertainment; and
- Prohibit all drivers (permanent employees, contractors and suppliers) from giving lifts to the local community.

Sanitary and Hygiene - Related Diseases:

- Ensure that the construction camp has all required and adequate amenities such as water supply, sanitation and waste management;
- Provide adequate medical infrastructure and facilities at camp to address any potential risk to workers' health;
- Ensure that human waste is managed via proper disposal and treatment facilities to avoid seepage (which may contaminate water sources);
- Ensure that food waste is disposed of in a proper manner (incineration, burial or taken off site and disposed of in sanitary landfill sites) to prevent the proliferation of pests within the camp; and
- Encourage good personal hygiene through ongoing training throughout the construction contract.

7.3.2.5 Impact Significance Rating

Table 7-31: Construction phase impacts on the workforce

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on employment										
- Employment opportunities	6	2	3	5	High Medium +55	8	2	3	5	High Medium +65
-Skills development and training	6	5	3	5	High Medium +70	7	5	3	5	High +75

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
-Layoff of casual labour	8	3	3	4	High Medium 56	4	2	3	4	Low Medium 36
Impact of workforce accommodation	6	2	3	5	High Mediium +55	8	2	3	5	High Mediium +65
Impact on Employee Health and Safety										
-general safety	10	5	2	4	High Medium 68	2	2	2	4	Low 24
-driver safety	10	5	2	4	High Medium 68	2	2	2	4	Low 24
-graft and exploitation	7	2	2	3	Low Medium 33	4	2	2	3	Low 24
-alcohol and drug abuse	10	5	2	4	High Medium 68	2	2	2	4	Low 24
-vector related diseases	9	5	2	4	High Medium 64	2	2	3	4	Low 28
- sexually related diseases	10	5	3	5	High 90	4	2	3	5	Low Medium 45
- sanitary and hygiene - related diseases	8	3	2	4	Low Medium 52	2	2	3	3	Low 21

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.3.3 Economic Impacts

The project will have impacts in the local, regional and national economy through direct and indirect economic benefits. Whilst it falls beyond the scope of this study to conduct a comprehensive macro-economic assessment, general economic impacts are discussed below.

7.3.3.1 National, Regional and Local Economic Development

National and Regional Economic Growth

The expansion of the resource industry in Buhuka Flats will have a beneficial cumulative impact in the region. This will include revenue for the government, employment opportunities at local, regional and national level and a direct and indirect effect on business development. Increased household income and expenditure will result. On its own and combined with the effect of the other oil industry developments, CNOOC's Kingfisher Field Development Area (KFDA) is likely to generate significant economic multipliers[22]. Research for other oil development projects has shown that economic multipliers of about 2.33 for value added[23] and between about 2.88[24] and 3.03 for labour income[25] apply. While these studies were undertaken for oil and gas developments in the USA and the ratios do not necessarily hold true for developing economies, the general effect is clear.

The increase in work opportunities provided by project construction will result in growth in the proportion of Ugandans with higher incomes, at least over the period of construction, which is 3 years. CNOOC has indicated that it maximises the purchase of its goods and services from suppliers and contractors in Uganda, which number more than 100 providers to date. The Company also trains local suppliers to meet oil and gas quality, safety and other standards and learn the tendering and bidding process. This will also support the district and central government initiatives intended to improve the social capital of Buhuka Parish, Kyangwali Sub-county, Hoima and Kikuube Districts. While data are not available yet, the construction Contractors will be expected to follow CNOOCs procurement policy, including in respect of the utilisation of local goods and services where these are available, it can logically be anticipated that local (Ugandan) purchases are likely to increase substantially during the construction phase once the contractors are appointed. Given the number of oil and gas projects under consideration in the sector, there will be a continued and expanding demand for skilled labour. Wages for skills needed in the oil industry are likely to increase. Employment in the oil industry will generate government revenue, deducted from salaries through Pay As You Earn (PAYE).

This economic impact will be positive and of high magnitude (a significant number of Ugandan people benefitting from economic growth, as a result of the project), and will be permanent and extend to people and businesses at regional and national level, resulting in a **high medium** significance rating. Benefits can be further increased with the implementation of the recommended measures to enhance good governance and investment in local infrastructure and services.

Local Economic Development

The Kingfisher Field Development Area will stimulate demand for goods and services in the local area, which in turn will have a direct and indirect impact on employment in the Ugandan economy. However, while CNOOC has a local (Ugandan) procurement policy, as described in the section above, little of the benefit from procurement of goods and services during the construction phase is likely to accrue to businesses on the Buhuka Flats. Economic benefits for these communities are more likely to be the result of a burgeoning informal sector around the project, which will benefit from expenditure by local residents who obtain unskilled jobs on the construction project. The overall benefits to local businesses (both direct as a result of local project expenditure and indirect as a result of the growth of the informal business sector) will be of medium magnitude, will have short duration (opportunities will dwindle once the cash injection from people employed on the contracts ends), will be local and of **medium** significance.

Human Capital Development

There is a strong relationship between available human capital and the ability to attain social and economic growth and development. It is recognised that the development and promotion of human capacity will be achieved most effectively through a coherent process of investment in the people of Uganda.

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[22] An multiplier is the factor by which gains in total output are greater than the change in spending that caused it
[23] Macroeconomic subgroup, 2011
[24] Pennsylvania Economy League of Southwestern Pennsylvania, 2008
[25] Macroeconomic subgroup, 2011

Uganda has a low comparative world ranking on the Human Capital Index, being currently ranked 106th out of 122 countries on the overall Human Capital Index (WEF, 2013:13), and 118th out of 122 countries in respect of the Educational Pillar of the Human Capital Index Ibid, p14).

The Business, Technical and Vocational Education and Training (BTVET) Strategic Plan 2011 – 2020 (MoGLSD, 2011) for Uganda, identifies the absence of and the urgent need for a comprehensive process to develop occupationally relevant skills and competencies, including skills for the oil and gas sector. The Oil and Gas Policy (MEMD, 2008:27) emphasises the provision of support for the development and maintenance of national expertise, including planning for the development of formal and industrial training and broadening the national education curricula in preparation for putting the necessary oil and gas workforce in place in the country.

The Industrial Baseline Survey, undertaken by CNOOC in collaboration with Total and Tullow (Hamman, 2014:29) states that it is evident that Uganda is currently unable to meet the manpower demands of the oil and gas sector and recommends, inter alia, that oil and gas operators such as CNOOC (i) in partnership with government work towards strengthening the educational system; (ii) offers direct support to existing training institutions of repute; and (iii) facilitates the establishment of a technical and vocational education and training (TVET) centre, aimed at providing competence development for, inter alia, craftsmen (civil) and mechanical and electrical technicians required by the oil and gas industry. CNOOC is directly involved in this process.

Given the relatively short period envisaged for the construction phase of the project, beneficial human capital development is likely to be limited, unless specific training programmes are put in place, and even with enhancement will only be of low **medium** significance**.**

7.3.3.2 Impacts Retarding Economic Development

Competition for Experienced Labour

The construction phase of the project is likely to exacerbate the current shortage of experienced labour at local and district level. Sourcing experienced workers from the local area will drain available skills away from existing businesses, increasing scarcity of skilled labour in Kikuube and Hoima Districts and increasing the cost of labour. While this is a benefit for already-skilled labourers, who will have increased demand for their services and potentially higher earnings, it will create a shortage of labour which cumulatively impacts on the entire Albertine region. Without mitigation, the magnitude of this impact will be medium, and it will be regional in scale, short term (reversible at the end of construction) and highly probable, resulting in impacts of low **Medium** significance.

Impact on Land and Property Rates

Local knowledge of the proposed Kingfisher Field Development Area has resulted in speculation for land, where individuals move into the area and claim land for themselves. According to villagers on the Buhuka Flats, these speculators sometimes have title deeds which have been acquired fraudulently[26]. This practice has been successfully challenged at least once, with a prominent government official being jailed for fraudulent transactions. Despite this, it is reported that speculators continue to try to trade up the price of land in the local area[27]. The formation of the Buhuka Communal Land Association (BCLA) also referred to as BUCOLA, in accordance with the Land Act of 1998 and the land regulations, aims at managing this situation. This should significantly mitigate against further land speculation if it is successful in engaging the land issue. If this does not happen then, without mitigation, this impact is likely to escalate during the construction phase of the project, impacting on people living on the Flats who can least afford it. Coupled with a struggling land management system, issues about the ownership of land are likely to increase beyond that noted in section 3.5.11[28]. This impact could reach a point at which increasing levels of hostilities will begin to emerge.

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[26] Minutes of the Stakeholder Meeting with the Kyabasambu, Kyakapere and Nsonga Communities (2017)
[27] Ibid
[28] Based on the Socio-Economic Household Survey (2013) 21% of households have had land conflict or pressure over landownership, with disputes arising mainly about ownership (40% of cases) and disputes about boundaries (44% of cases.

Impact magnitude is expected to be high at local scale, short term (largely reversible after construction), with a high probability of occurrence and high **medium** significance.

Disruption of Livelihoods

Based on the extent of land-take on the Buhuka Flats, households will face a reduction in available grazing land for cattle. Table 7-34 shows that 8.4 % of the available grazing land on the Flats will be taken up by the CNOOC construction footprint. Whilst this will be compensated for, individuals may find it extremely difficult to source sufficient affordable alternatives for feeding livestock. This could result in a disruption of livelihood-related activities or even their suspension, with associated increased levels of poverty.

This magnitude of the impact is potentially high, with long term consequences for the affected individuals. The impact will be local (restricted to the Buhuka Flats and highly probable, resulting in high **medium** significance.

7.3.3.3 Impacts due to in-migration

The influx associated with the escarpment access road is already causing tension within and between communities on the Buhuka Flats. With a steady population influx into the area in response to expectations about work and business opportunities associated with the construction activities, the demand for land and price speculation is expected to continue increasing throughout the construction phase. Tensions are also expected to escalate as migrants settle in the area and compete with local people of natural resources and for jobs on the construction contract. In countries with high levels of unemployment and politically unstable neighbours, economic migration in response to perceived opportunities can be highly significant. the numbers of migrants settling on the Buhuka Flats cannot be predicted with any certainty, but if the expected levels of migration occur, the magnitude of the impact will be very high (taking into account the high levels of joblessness and resource poverty), it will affect local communities, will be medium term (only partly reversible since many migrants may not return to their place of origin), and of **high** significance. While some degree of mitigation is feasible through interventions by Government, it is unlikely that this impact can be reduced to **low** levels of significance.

7.3.3.4 Impact Mitigation and Monitoring

The following impact mitigation is recommended:

National, Regional and Local Economic Development

National and Regional Economic Growth and Business Development:

- Give preference to goods and services which are rendered by Ugandan citizens and companies;
- Create a detailed and specific local procurement policy (LPP) that will provide benefits to the local community by prioritising sustainable business opportunities with local enterprises, particularly SMMEs. The LPP should set out the steps that will be taken to work with and build the capacity of local suppliers to become more competitive and profitable. This may include the provision of external training and support, aimed at improving their operational, safety, environmental and technical standards to a standard that allows them to compete effectively for contract opportunities. From an internal perspective, the LPP should integrate real measures to identify local procurement opportunities, to communicate the business case to all relevant stakeholders and to put incentives and opportunities in place that will incentivise a supply chain process committed to ethical local procurement;
- Support educational and vocational training reform that will develop the range of skills necessary for Uganda to benefit more fully from the sector; and
- Develop a transparent community development and contribution policy; and

Human Capital Development:

- Identify unskilled construction workers who demonstrate the necessary experience and aptitude for potentially becoming part of a valued workforce, and introduce a directed in-service mentoring and capacity building support programme;

- Promote STEM at school level by incorporating support to the development of science laboratories at schools, strengthening education in maths and science at schools and the development of well-stocked school libraries as a specific focus of CNOOC Corporate Social Responsibility (CSR);
- Consider offering bursaries or internships to promising students (refer to discussion on the community development impacts) to build a sustainable and educated future workforce;
- Collaborate with the Petroleum Authority of Uganda (PAU), which is tasked with establishing, maintaining and operating a national human capacity register for the petroleum sector to ensure that CNOOC contributions in the form of bursaries and scholarships support the development of an appropriately skilled labour force; and
- Support initiatives that will promote and strengthen the levels of competence of master artisans and crafts persons within the Technical Education and Training (TVET) system, and design mechanisms that will support the entrance of female scholars into TVET institutions.

Impacts Retarding Economic Development

Competition for experienced labour:

- Develop and implement training and skills development programmes for the construction workforce to expand the human capital available within the local economy; and
- Create opportunities for supporting and up-skilling suitable candidates from the temporary unskilled construction workforce so that their experience and competence is built in a manner that aligns their competencies with workforce skills needs.

Impact on Land and Property Rates:

- Support work to develop comprehensive land policies. This includes support for Government capacity to do strategic, long-term land use planning that protects small holder farmers and helps balance multiple uses of land, including for oil and gas extraction.

Government Revenue Losses due to Corruption:

- Publicly disclose the material payments made to the Ugandan Government. This should be in accordance with IFC anti-corruption guidelines. CNOOC should continue to follow its internal anti-corruption prevention and management system to minimise corruption and malpractice cases, or to deal with these when they do occur; and
- Comply with the objectives of the National Oil and Gas policy and legal framework with regard to oil and gas development and benefits to the citizenry, and meet relevant National laws and regulations, policies and action plans, and international best practice, to ensure compliance with a high standard in the prevention of graft and corruption. CNOOC Limited is a member of the UN Global Compact, and therefore all its global operations, including CUL, are committed to fully comply with Principle 10 of the Compact related to anti-corruption, which stipulates the requirement that it must work against corruption in all its forms, including that related to bribery and extortion.

Disruption of Livelihoods:

- Implement the Livelihoods Action Plan and the Community Development Plan.

Impacts due to In-Migration

- Engage closely with government to monitor land ownership and changes thereto surrounding the project development;
- Implement the recommendations of the Influx Management Strategy and Framework Plan (Volume 4, Specialist Study 11); and

- Prepare to accommodate the changes arising from the population influx by sensitising the LC system. This is particularly important, as it is at this level that the stability of a village is decided, including the establishment of checks and balances for maintaining individual rights and responsibilities, and for managing crime.

7.3.3.5 Impact Significance Rating

Table 7-32: Construction phase economic impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
National, regional and Local Economic Development										
- National and Regional Economic Growth	6	2	4	5	High Medium +60	8	2	4	5	High Medium +70
-Local Economic Development	4	2	2	5	Low Medium +40	7	2	2	5	High Medium +55
-Human Capital Development	3	5	2	3	Low +30	5	5	3	4	Low Medium +52
Impacts Retarding Economic Development										
-competition for experienced labour	6	2	3	4	Low Medium 44	3	2	2	4	Low 28
-land and property rates	10	2	2	4	High Medium 56	4	2	2	4	Low Medium 32
-disruption of local livelihoods	10	4	2	5	High 80	4	2	2	4	Low Medium 32
Impacts due to In-Migration	10	4	2	5	High 80	6	4	2	4	Low Medium 48

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.3.4 Community Health, Safety and Security Impacts

The Health Impact Assessment for the project (Volume 4, Specialist Study 10, Appendix B) provides a systematic evaluation of the 12 Environmental Health Areas (EHAs) of project-triggered health impacts. The EHA framework is used in the 2007 IFC Guidance Notes for Performance Standard No. 4, Community Health, Safety, and Security.

7.3.4.1 Impact on Diseases

Vector-Related Diseases

Malarial risks on the Buhuka Flats communities may increase as a result of the construction of the project, mainly due to the creation of areas where seasonal ponding can occur. Flooded or open trenches during construction, in particular during the rainy season, will create additional mosquito breeding grounds for the malaria vector, by providing habitats with reduced predation. Nevertheless, this problem is already ubiquitous in the local villages due to many suitable breeding areas for the vectors, including fresh water points, stagnant water pools in ditches and depressions, as well as marshy areas. The impact will affect local communities on the Buhuka Flats, will be of low magnitude (adding little to the existing malarial risks) and medium term (assuming the effects persist for some time after construction ends), and will result in impacts of **low** significance.

Sexually Transmitted Diseases

Contractors and workers are commonly perceived as being wealthy by the local population, especially in rural settings such as the escarpment villages along the proposed pipeline route. Previous experience of infrastructure development projects, described by village elders, has shown that these circumstances encourage cash-strapped people to sell sex as a commodity, to generate vital income. Adolescent girls are often the victims of these practices. Members of an external workforce who are allowed to mingle at will with inhabitants from settlements are likely to father children with local women. Given the temporary nature of the work, once the construction activities cease, it is common that both the women and children are abandoned when the workers move on, leaving single female-headed households. The presence of large construction accommodation camps may also attract sex workers from further afield, which further increases the risk of the spread of sexually transmitted diseases.

There is already evidence of increased risk as a result of the behaviour of drilling camp personnel on site. Villagers from Nsonga and Kyabasambu say that CNOOC/drilling staff have been directly involved in acquiring the services of prostitutes, particularly in Nsonga. Although CNOOC practices strict curfews in respect of employees and contractors who are accommodated on site, villagers say that some of the workers who are on leave do not go home, remaining instead, in rented accommodation in the villages and purchasing the services of prostitutes during this period.

Without a high degree of management, , this type of behaviour will continue and probably increase once large numbers of contract personnel are on site, resulting in the further spread of STDs, both locally and potentially back to the home villages of workers who do not live in the area (regionally). Although CNOOC has implemented a programme for HIV testing and counselling for Contractors and the community, these have been short term. The unmitigated impact will be long term, being only partly reversible depending on the availability of treatment, of high magnitude and **high** significance.

Soil and Water Borne Diseases

Water related diseases such as cholera and typhoid remain a constant problem within the Study Area. The project construction teams will be provided with clean water and sanitation services. The spread of infectious diseases by construction teams could therefore be caused only in the event that personnel defecate or urinate in the field, particularly in water courses. This is likely if appropriate field facilities are not available to personnel working outside of the controlled areas and also if field teams are not properly trained. Without management control, and in the context of vulnerable rural communities with limited access to health infrastructure, the magnitude of this impact will be medium, duration will be medium term (the impact may persist after construction depending on the availability of treatment), and impact significance will be **low medium.**

Non Communicable Diseases

The introduction of large numbers of newcomers into what has been, until recently, a 'sheltered' area, may contribute to the current disease burden in communities in the Local and Regional Study Areas. Differences in lifestyle between incoming individuals and groups, may alter the incidence of non-communicable diseases, such as diabetes, hypertension and cardiovascular disease. Should this happen, local health services will be ill equipped to offer appropriate infrastructure or services. The impact will be short term, of medium significance and will extend to health facilities in the District. Impact significance will be **low medium.**

Housing and Respiratory Diseases

The traditional wattle-daub or mud-block constructed houses found in the villages characteristically do not have windows. The associated poor ventilation can cause respiratory health problems that are exacerbated in the presence of damp and mould. An additional factor that negatively impacts air quality is the number of persons sharing the (usually) single room dwelling.

In the case of relocation, new homes provided by CNOOC are well ventilated, multi-roomed and offer general and specific health benefits, including factors that impact respiratory conditions and may be regarded as a positive, permanent, impact of **high** significance for the resettled families.

7.3.4.2 Impact on Water Pollution

Hydrotesting

The discharge of hydrotest water from the flowlines will be the only emission that is generated during construction and released into the local environment, other than domestic sewage emissions from the personnel camps. Before commissioning of the flowlines, their integrity is tested by filling them with water and pressurising them. Water used for hydrotesting will be passed through a snad filter to remove any debris and then discharged to the environment after testing . CNOOC do not plan to make use of biocides or corrosion inhibitors. It is assumed that some of the water may be discharged into River 1 and Kamansinig River.

Treated Sewage Effluent

Treated sewage effluent in excess of approximately over 300 m^3/day will be discharged from a sewage treatment plant at the EPC camp, while a smaller quantity of around 50 m^3/d will be discharged from the existing drilling camp. Treated sewage effluent from this camp is presently used on the lawns and gardens at the camp. The camp effluent will be required to meet the project standard for domestic effluent, which is based on the Ugandan legal standard. Details are not available at present but it is likely that the final effluent, after chlorination, will be delivered into River 1 north of the EPC camp. Section 7.2.1.5.1 describes the potential biological response to increased nitrogen and phosphorous entering the lake just south of well pad 2, and the possibility of creating algal blooms (particularly water hyacinth) in the nearshore environment around the discharge point. From a social perspective, this could decrease access to the water to local fisherman on the Buhuka Flats, creating more difficult fishing conditions. It could also have some impact on fish stocks, although this would be very localised. In the absence of mitigation, the magnitude of impact on local food security will be medium, short term while construction is ongoing, and of **low medium** significance. However, to mitigate the risk associated with treated sewage effluent discharge directly to the river (and hence entering the lake).

Hazardous Materials and Wastes

The hazardous materials that are likely to be used during the construction phase of the project are described in Section 7.1.2.3 and in Volume 4, Specialist Study 5. As stated in Section 7.1.2.3, the risk of occasional spillages of hazardous materials outside of the controlled areas of the construction sites is high in the absence of stringent management control. In the context of the Buhuka Flats, where large numbers of people live around the construction sites, any spills would be likely to impact on them or their domestic animals. Without mitigation, even small spills may cause local impacts extending beyond the construction phase into the medium term, with high magnitude and high **medium** significance. These impacts can be reduced to low magnitude and **low** significance by appropriate construction management of hazardous materials and wastes.

7.3.4.3 Impact on Community Safety

Traffic and Pedestrian Safety

Heavy vehicle traffic in the construction phase of the production facility is expected to peak at some 56 trucks per day, over a 3-year period. Including the return trip, this is 1 truck every 5 minutes, assuming transport during 10 hours of daylight. While the traffic increase will not materially impact on traffic volumes on the main regional roads, incoming roads such as the P1 from Kabwoya to the KFDA site are likely to experience a significant increase in heavy traffic. Traffic increases will therefore extend far beyond the local study area.

This traffic will create safety risks, both for pedestrians and other road users. Combined with poor road conditions and uneven surfaces in places, and the limited understanding of road safety among many pedestrians and local drivers, the volumes of heavy construction traffic are likely to result in injuries and fatalities, which are impacts of major significance. Areas of particular risk will be villages where schools, clinics and other community facilities attract pedestrians and vehicle traffic and where children are likely to be found walking along the roads. Children, women and elderly people are often at higher risk of traffic-related accidents. On the Buhuka Flats themselves, there will be a constant threat to pedestrians and stock, who are highly likely to use the construction roads to the wells and other infrastructure as convenient access. Until recently, with the construction of the escarpment road, many villagers (including adults) on the Flats had never been exposed to vehicles and traffic (Figure 7-16 shows the proximity of households on the Flats to the construction sites and access roads).

CNOOC has introduced specific road safety awareness programmes along the KFDA access road, and has targeted trading centres within the operational area. Overall, however, without a high level of management, construction traffic accidents could lead to damages, injuries and fatalities in local communities both on the Buhuka Flats and along the incoming roads, particularly the P1 from Kabwoya. The impact will be of medium magnitude, regional in extent, long duration (potentially resulting in long term or permanent injuries or fatalities) and **high** significance.

Violence and Crime

There is already a reported increase in crime on the Buhuka Flats, attributed mainly to ‘foreigners’ making use of the recently built escarpment road, which provides opportunities to commit crimes like stock theft, and to escape without detection. While the road has already been permitted, negative impacts that result from its use are induced effects of the project. In addition, escalating levels of alcohol-related violence and crime is of concern.

There is a likelihood of some construction workers causing violent incidents in local communities, particularly if it is fuelled by drug use or alcohol. Arrogant attitudes displayed by construction workers, who are generally wealthy compared with community members, may also spark violent confrontations. These issues can generally be managed by a management approach which does not tolerate aggression and violence among construction workers, but in unmanaged conditions can be an important concern. Incidents are probable in the absence of mitigation, causing impacts of high magnitude, local extent and potentially long duration, with overall high **medium** significance.

Fires

The construction teams work with welding equipment and other heat sources creating a risk of accidental fires escaping from the project working areas onto community land. CNOOC reports that bush and grass fires have occurred on the Buhuka Flats and close to oil wells, particularly during the dry season. This poses a risk to anyone unable to escape and to stock. Housing is clustered close together and most homes have roofs that are thatched. Particularly in dry, windy conditions the risk of fire is an important concern. Based on experience, incidents are probable in the absence of mitigation. The magnitude would be high, causing long term, local impact of high medium significance.

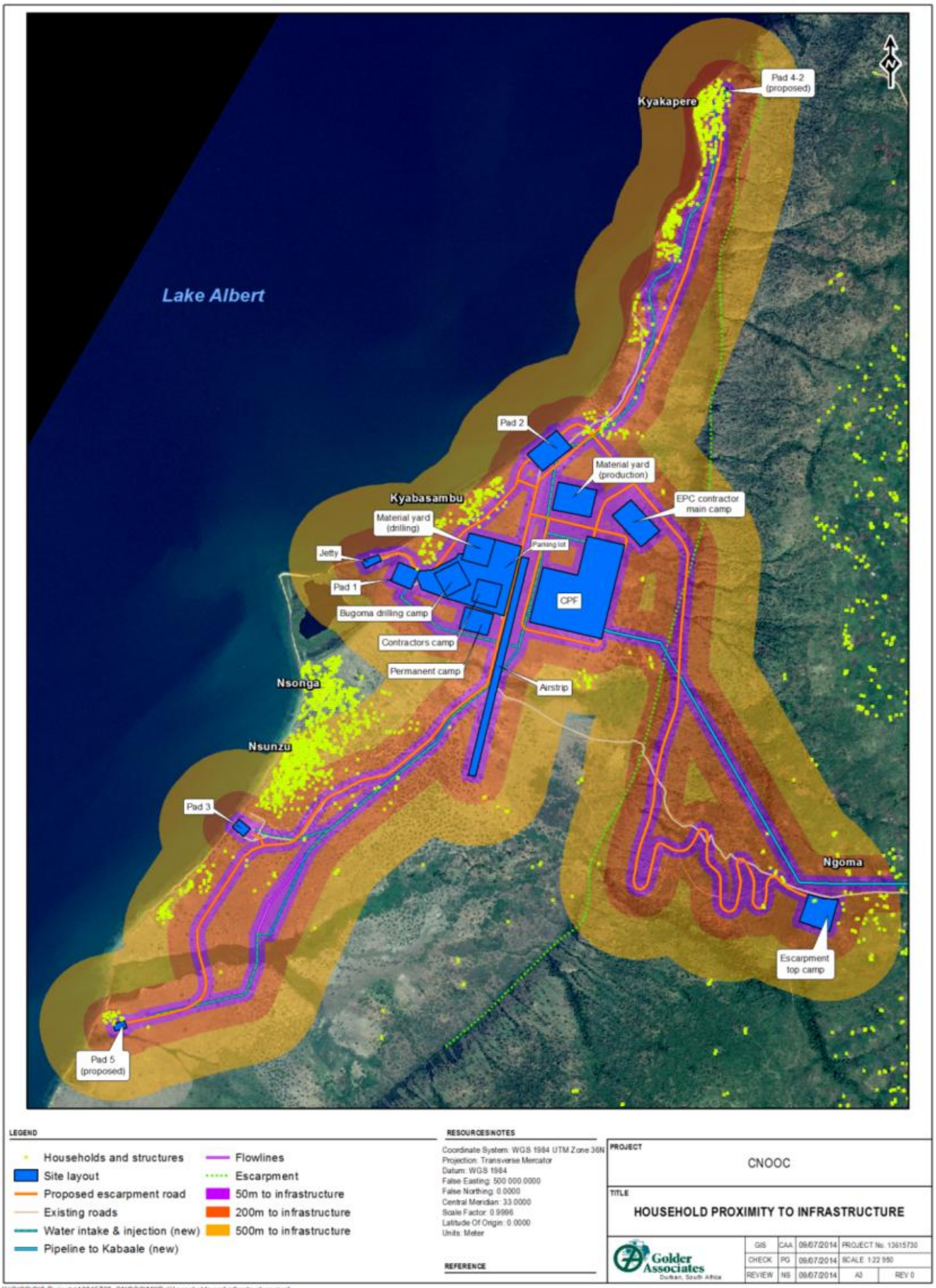

Figure 7-16: Locations of households in proximity to project infrastructure

7.3.4.4 Impact on Nuisance

Noise nuisance and dust nuisance are considered in Sections 7.1.1 and 7.1.3 and in the absence of mitigation are both rated as being of major significance, affecting the Buhuka Flats communities.

7.3.4.5 Major Accidents

Major accidents could cause highly significant impacts in surrounding communities, resulting in injuries, impact on livelihoods (spillage affecting the Lake Albert), or other major effects. Although there are no specific data available in respect of CNOOC transport related accidents, international research and experience over more than a decade, as documented by the National Institute for Occupational Safety and Health (NIOSH[29],[30],[31][32]) provides statistics on work-related vehicle accidents specifically in respect of the oil and gas industry. Based on the research over time, vehicle accidents are the leading cause of oil and gas extraction worker fatalities, with roughly forty percent of on-the-job directly attributable to this. The vast majority of such accidents appear to be directly related to level of specific experience and/or non-compliance with stated safety and health systems and procedures in place within the workplace.

7.3.4.6 Impacts of In-Migration

The migration impacts into the local area that will be experienced during the construction phase of the project are expected to continue in the operational phase. Population increases on the Buhuka Flats will have a wide range of consequences for community health, safety and security, all of which will be negative. Impacts will include:

- Vector-related diseases: Migrants are likely to cause a significant increase in vector-related disease as a direct result of a number of factors. These include disturbances in soil and water bodies that will increase breeding sites for vectors as well as the number of hosts;
- Sexually transmitted diseases: Foreign migrants, particularly single males, often cause an increase in STDs in the areas in which they reside;
- Water borne diseases: Water on the Flats is presently sourced either from the lake or from the gravity flow scheme. Above the escarpment most potable water comes from boreholes. Cholera and typhoid are already constant problems due to poor sanitary practices. Where outdoor toilets exist they are generally unhygienic and do not prevent the leaching of organic pollutants into local groundwater and surface water. Households dispose of solid waste and waste water beyond the homestead, including into the lake, which is also used for bathing and drinking water. Increasing population pressures and even poorer sanitation typically associated with migrants' habitation will aggravate the existing problems on the Flats and above the escarpment, and sanitation is virtually non-existent;
- Health Services: Migrants will increase pressures on health services, causing a further decrease in the already limited capability;
- Crime: There is already an increase in crime which is attributed by local people to 'foreigners' migrating into the LSA. The opening of the escarpment road has allowed easy access to and from the Flats which facilitates opportunities for crime such as stock theft. Gender crime has become a major issue. Women are subjected to high levels of sexual assault and rape, with female child defilement seen as a particularly severe problem in the villages along Lake Albert.[33] Representatives from the Bunyoro Kitara Kingdom, as well as from the Hoima District Police Department Division for Child and Family Care believe that migrants into the area has served as major exacerbating factor. Child marriages are

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[29] *National Institute for Occupational Safety and Health (NIOSH) (2012) Fatal Facts, Oil Patch No. 1-2012*
[30] *NIOSH (2004) Report on fatalities attributable to a vehicle hazards*
[31] *NIOSH (2012) Census of Fatal Occupational Injuries*
[32] *NIOSH (2004) Publication No. 2004-136, Statistics on work-related vehicle accidents and prevention options for employers accessed at https://www.osha.gov/ SLTC/oilgaswelldrilling/safetyhazards.html*
[33] *Kyabasumbu Women's Group (2017) Public Consultation Process*

prevalent in Uganda, particularly in traditionally rural areas such as the Flats and concern has been expressed that in-migration will increase this practice, particularly if parents of potential child-brides believe that there may be financial benefit attached to such an arrangement;

- Fire risks: The proximity of thatched housing to each other, coupled with the frequent use of wood fuel fires, creates the danger of localised household fires spreading rapidly through villages, which will be exacerbated by in-migration and further densification of the villages. The settlements along Lake Albert are characterized by dense mixed housing combinations of traditional round thatched huts, rectangular mud and wattle structures with tin roofs and 'flat roofs' or 'long houses' (brick buildings with flat corrugated iron roofing). Wattle and mud structures and flat roofs are frequently rented out, with single room accommodation for up to four families per structure. In some instances, a single (long house) structure may provide rental accommodation for up to 40 people. In an environment such as this, the risks of mortality due to a fire are extremely high;

- Food and Nutrition-related Diseases: Increased use of natural resources and medicinal plants causing shortages for the existing local community; and

- Zoonotic diseases: The increasing incidence of livestock grazing on the Flats brought in by migrants may pose an additional burden of zoonotic diseases, such as increased exposure to ticks. Historically, the livestock on the Flats has remained generally free of ticks in part through elements of natural resistance as well as through isolation from other herds.

Overall, health safety and security impacts due to in-migration will be of high magnitude, potentially long term and of **high** significance.

7.3.4.7 Impact Mitigation and Monitoring

The following mitigation/ enhancement measures are proposed in respect of the community health, safety and security impacts identified:

General

- Develop a Community Health, Safety and Security Plan and an Emergency Response Plan as required to meet IFC performance standard 4;

- Develop an induction programme, including a Code of Conduct, for all workers directly related to the project. A copy of the Code of Conduct is to be presented to all workers and signed by each person. The Code of Conduct must address the following aspects:

  - respect for local residents and customs.

  - zero tolerance of bribery or corruption.

  - zero tolerance of illegal activities by construction personnel including prostitution, illegal sale or purchase of alcohol, sale, purchase or consumption of drugs, illegal gambling or fighting.

  - zero tolerance policy of drunkenness on the ROW and no alcohol and drugs policy during working time or at times that will affect ability to work or within accommodation camps or acquired from outside the camp whilst accommodated in the camp.

  - a programme for drug and alcohol abuse prevention and random testing that is equivalent in scope and objectives to the policies prescribed in the Code of Conduct.

  - description of disciplinary measures for infringement of the Code and company rules. If workers are found to be in contravention of the Code of Conduct, which they signed at the commencement of their contract, they must face proportionate disciplinary procedures.

- Partner with the Ugandan Human Rights Commission, and consider partnering with other civil society advocay groups, to investigate and address any claims related to human rights violations, and to sensitise communities regarding their rights and obligations;
- Publicise the Code of Conduct in settlements potentially affected by the construction camps, as part of the community relations plan. This will help ensure that the local residents are aware of the expected behaviour of construction staff. Posters with the Camp Rules should also be posted in neighbouring settlements or lodged with the LC1 of each village;
- Provide entertainment and recreation facilities for workers at the construction accommodation camp and establish clear rules for conduct during leisure time as well as the need to remain within the camp boundaries during leisure time; and
- Implement a grievance procedure that is easily accessible to the local community, through which complaints related to CNOOC contractor or employee behaviour that infringes on the health, safety or security of community members can be lodged and responded to (see issues in this regard in **Box 7-1**). CNOOC must respond to such complaints in a considered manner, including:
  - Circulation of contact details of community liaison officers or, if separate, of 'grievance officers' or other key contact.
  - Circulation of details of the Witness NGO as well as the mechanisms to access the NGO;
  - Raising of awareness amongst the local community regarding the grievance procedure and how it will work.
  - Establishment of a grievance register that is continuously updated and maintained by CNOOC.
  - Provision of a mechanism to provide feedback to individuals, groups and village councillors regarding actions that **have been taken in response to complaints lodged.**

Box 7-1: Existing Problems with respect to the use of the Grievance Mechanism

According to IFC's Performance Standard 1, if ongoing risks to or adverse impacts on project-affected communities are anticipated, the Project Sponsor is required to "establish a grievance mechanism to receive and facilitate resolution of the affected communities' concerns and grievances about the client's environmental and social performance" (IFC, 2006, p. 5). To respond to this requirement, CNOOC need to appoint a Witness NGO to provide oversight, to receive grievances and to oversee the process to address these concerns.

The CNOOC Grievance Mechanism, which is already in use, is not thought to be effective by many villagers. The general perception is that CNOOC has not taken grievances sufficiently seriously and that villagers are powerless to have issues that they believe are important addressed, if CNOOC does not regard them to be important. There is also no evidence that a critical Witness NGO had been appointed to provide oversight of resettlement and compensation discussions between CNOOC and villagers. Although grievances are received by CLOs at the Kingfisher Camp, the CNOOC office in Hoima and when visiting communities, and there are oil and gas advisory committees within every parish, community members still hold the opinion that they are not being heard. The expectation that subsistence stakeholders should either wait for a CLO to visit the village, or should present themselves to the CNOOC Hoima office if they have failed to obtain satisfaction related to issues of concern, is neither realistic nor fair given the costs of transport. This is a critical issue, and will need to be addressed by CNOOC. Failure to ensure that villagers believe that they are actually being 'heard' will negatively impact on the company's Social Licence to Operate.

Impact on Diseases

- Develop a Communicable Diseases Action Plan as an essential tool in managing disease related impacts.
- Develop an Employee Health Awareness Policy and ensure its implementation among CNOOC personnel and its contractors or sub-contractors. The policy must provide for:
  - Expansion and intensification of the current CNOOC programme for HIV testing and counselling for Contractors and the community and allow for HIV/AIDS related advocacy, factual data provision, awareness creation as well as behaviour change issues around the transmission and infection of HIV/AIDS that provides linkages with the Government of Uganda HIV/AIDS related initiatives;
  - Health awareness training for workers including communicable diseases at induction and then periodically throughout construction;
  - Awareness raising on communicable diseases for communities close to camps (via posters, leaflets, through health clinics, community meetings); and
  - Liaison with local health authorities.
- Implement interventions aimed at reducing the impacts of vector borne diseases through mechanisms such as sanitary improvements and minimising areas where water is impounded as a result of construction activities.

Impact on Water Pollution

- Ensure that no waste whatsoever, including construction waste is dumped in watercourses or at any site that impacts on villagers or their land use;
- Ensure that the use of water does not disturb public water availability and that sources of water are carefully selected;
- Ensure the development of a water and hygiene code of conduct that prohibits open defecation/urination, stresses proper water use, water conservation, hygiene and sanitation to prevent pollution of community water sources; and
- Re-use treated sewage effluent, on roads for dust damping, other working areas where dust control is required, and recreational areas (eg: soccer field) created for contract employees. Sanitary wastewater that meets the project standard but is not re-used is to be disposed into Drainage line 1, which enters the lake immediately south of well pad 2.

Impact on Community Safety

Traffic and Pedestrian Safety:

Ensure the adoption and implementation of the CNOOC driving and vehicle management plan during initial activities which will be adopted for the construction phase. Based on this, CNOOC must adopt the best transport safety practices with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public, as well as creating awareness among the local people and villages about road safety. Other mitigation should include:

- Labelling all vehicles on the sides with stickers which have recognisable, easy to recall numbers, to assist with ease of identification and subsequent reporting, in case of road safety violations and/or accidents;
- Emphasizing safety aspects among project drivers, specifically ensuring that drivers respect speed limits through busy and built up areas;

- Ensuring the roster and shifts structure for the project allows employees plenty of opportunity for sleep and rest between shifts and on their days off;
- Adopting a proactive approach to managing driver fatigue, based on adequate hours of rest to avoid overtiredness;
- Drivers to follow routes agreed through an approved Journey Management Plan and to avoid driving at night except in cases of emergency;
- Positioning traffic guides at children crossings to control driver speeds and seeking cooperation with local educational facilities (school teachers) for road safety campaigns;
- Implementing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions and children crossings;
- Provision of alternative transport (bus) for the construction workforce;
- Ensuring contractors regularly maintain vehicles to minimize potentially serious accidents such as those caused by brake failure commonly associated with loaded construction vehicles;
- Ensuring contractors compile a list of service schedules of all equipment deployed on site;
- Minimising interaction of pedestrians with construction vehicles through collaboration with local communities and responsible authorities (e.g. police) to improve signage, visibility and overall safety of roads particularly along stretches located near schools or through busy areas;
- Construction of pedestrian walkways, parallel to project roads on the Flats, to minimise risks to pedestrians and stock on the roads in and around the construction sites at the production facility and well pads;
- Providing road safety awareness campaigns along the transport routes, particularly at centres and market areas, school zones and health facilities;
- Considering additional warning tape at accident-prone stretches and sensitive locations (schools & hospitals) if identified as required; and
- Collaborating with local communities about education about traffic and pedestrian safety (e.g. one road safety campaign at a nearby location once a month).

Transport and Storage of Hazardous Materials and Waste:

- Ensure that appropriate management plans are in place and implemented in respect of the Transport, Storage and Handling of Hazardous Materials and Waste; and
- Ensure that there is timely public notification of planned transport of hazardous materials and suitable arrangements for support vehicles.

Violence and Crime:

- Sensitise and build the capacity of local governance systems (village chairperson and councillors at settlement level), including the establishment of checks and balances for maintaining individual rights and responsibilities and for managing crime;
- Identify mechanisms for constructively incorporating traditional (clan) leaders into processes for promoting stability and moral ‘regeneration’ at village level;
- Promote the development of a disciplined policing forum for the area, in collaboration with appropriate civil society organisation as well as the Districts’ Police Department and Sub-county anti-crime institutions and systems;

- Ensure the development of appropriate mechanisms as part of the Community Health, Safety and Security Plan; and
- Partner with the Ugandan Police Force Community Liaison Officers to allow sensitisation of communities on issues related to crime.

Fires:

- Manage the risks of fire through specific management requirements for hot works and through education of personnel about careless behavior in respect of cigarette smoking; and
- Promote awareness amongst members of the settlements about potential fire hazards, and mechanisms for promoting household safety from fires.

Impact of In-Migration

- Contribute to infrastructure development in the LSA as part of the Community Development Plan/Corporate Social Responsibility initiatives. Work with Government to create community infrastructure and support that improves the living conditions of project-affected people.

7.3.4.8 Impact Significance Rating

Table 7-33: Construction phase community health, safety and security impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on diseases										
-Vector related diseases	4	3	2	4	Low Medium 36	3	2	2	4	Low 28
-Sexually transmitted diseases	10	4	3	5	High 85	5	4	3	4	Low Medium 48
-Soil & waterborne diseases	6	3	2	4	Low Medium 44	2	2	2	4	Low 24
-Non-communicable diseases	5	2	3	4	Low Medium 40	3	2	2	4	Low 28
- Housing and respiratory diseases	8	5	2	5	High +75	8	5	2	5	High +75
Impact on Pollution										
- Hydrotesting	10	3	2	4	High Medium 60	4	2	2	3	Low 24
-Treated sewage effluent	6	2	2	4	Low Medium 40	4	2	2	2	Low 16

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
- Hazardous materials and wastes	10	3	2	4	**High Medium 60**	4	2	2	2	**Low 16**
Impact on Community Safety										
- Traffic and pedestrian safety	6	4	4	4	**High Medium 56**	4	4	4	2	**Low 24**
- Violence and crime	8	4	2	4	**High Medium 56**	4	4	2	2	**Low 20**
- Fires	10	4	2	4	**High Medium 64**	4	3	2	2	**Low 18**
Impact of In-Migration	10	4	2	5	**High 80**	6	4	2	4	**Low Medium 48**

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

7.3.5 Impact on Housing, Land and Natural Resources

Under international standards, IFC PS5 (land acquisition and involuntary resettlement) (amongst other international standards) stipulate principles regarding the loss of land and the associated physical and/or economic displacement. The key principles under IFC PS5 are:

- Involuntary resettlement should be avoided;
- Where involuntary resettlement is unavoidable, all people affected by it should be compensated fully and fairly for lost assets;
- Involuntary resettlement should be conceived as an opportunity for improving the livelihoods of the affected people and undertaken accordingly;
- All people affected by involuntary resettlement should be consulted and involved in resettlement planning to ensure that the mitigation of adverse effects as well as the benefits of resettlement are appropriate and sustainable; and

- Displacement and involuntary resettlement generally are highly sensitive impacts to communities, and without adequate planning and effective mitigation, such displacement and resettlement may result in severe impoverishment of communities.

The KFDA development will impact on housing and land, including impacts caused by land acquisition for the production facility, well pads and associated infrastructure and impacts on land and housing rates. Indirect impacts caused by an expected influx of people and livestock into the LSA will also increase pressures on this limited resource base.

7.3.5.1 Housing and Land Loss

The loss of housing, community infrastructure and land as a result of the construction of the production facility, wells and associated infrastructure on the Buhuka Flats is shown in Figure 7-16, and in Figure 7-17. The data on housing impacts is based on documentation provided to the Consultants by CNOOC's resettlement team[34], while the data on grazing land lost is based on GIS analysis. The table shows details of losses that will occur as a result of all activities - much of the land loss associated with the KFDA development has already taken place and has been approved in other applications.

Loss of land as a result of the KFDA project has been one of the most significant concerns of the Buhuka Parish community. CNOOC land take including all infrastructure will comprise just over 106 ha (7.4%) of the grazing area of 1,430 ha available on the Buhuka Flats. Some of this (roughly 76 ha) will be returned to community use after construction is completed.

From a pastoralist perspective, Ugandan legislation requires that compensation is paid for lost grazing land[35]. The Buhuka Flats are already heavily overgrazed, and the direct loss of grazing land to project infrastructure will increase the pressure on the remaining land. Regionally, intensive rural settlement and cultivation above the escarpment has reduced the available natural grazing, and it is unlikely that replacement land for grazing can be found there.

Distrust and lack of understanding of resettlement and compensation procedures has dogged ongoing discussions. The purported high levels of corruption and intimidation associated with the acquisition of land has fuelled community suspicion - particularly of government role-players - aggravated by a lack of readily available information about land ownership and transactions.

Box 7-2 describes the criteria that have been put in place for fair and transparent compensation. CNOOC is responsible for compensation for housing loss, property damage and loss of amenities within the designated project construction and permanent use areas. A Resettlement Action Plan (RAP) is being finalised with the specific aim of mitigating social as well as economic impacts caused by the proposed production facility, wells and associated infrastructure. Despite this protracted process and the eventual resolution of the matter of how compensation should be paid, not all members of the affected villages are happy with the arrangement and there continues to be mutual distrust (among members) as well as distrust of CNOOC and government role-players about compensation procedures. Many villagers who live near the project infrastructure feel that they ought to be resettled even if they are not within the project footprint, due to the other impacts caused by the project, including in-migration (described separately in Section 7.3.5.4), and are dissatisfied that only those who are directly affected will benefit from physical resettlement. Other issues raised include the following:

- Land owners who may inadvertently or deliberately have oppressed the rights of bona fide occupants and/or users;

[34] Resettlement planning is being undertaken independently of the ESIA.

[35] Resettlement Policy Framework (2018) which requires that affected pastoralists should be afforded alternatives and/or compensation decided through consultation with and participation of all.

- Complaints from PAPs that the RAP process was not properly understood and that there are still a significant number of questions and concerns (from village members as well as PAPs) that have not been addressed;
- Unconfirmed but worrying reports that PAPs had been intimidated into signing off on inaccurate household asset registers and/or that such registers had been compiled in English and were therefore not understandable to PAPs and/or that illiterate or functionally illiterate PAPs were uncertain about the exact nature of the documentation that they had been given to sign; and
- Risks associated with offering PAPs the option of cash compensation (in accordance with Ugandan law) as an alternative to compensation in kind for housing, infrastructure and land losses.

Box 7-2: History of Land Negotiations on the Buhuka Flats

Several court cases were already ongoing between individual landowners and community members from various villages[36] at the time when oil exploration initiatives yielded positive results. Subsequently, a Community Land Association was formed and CNOOC was required to pay compensation for land into a trust fund. Although the Association had not been properly constituted, the perception that CNOOC was delaying payment into the fund resulted in the launch of a court case as well as the initiation of a comprehensive boycott of CNOOC activities in 2014.

Since this date, the Ministry of Land, Housing and Urban Development (MLHUD) begun to provide technical assistance, advice and support to community members residing on the Buhuka Flats. In July 2016, a general meeting was called by the MLHUD in collaboration with the Hoima District Local Government and local leaders, including CNOOC and community members, to address the stalemate that had been reached. This meeting resolved that, in accordance with the Land Act of 1998 and the land regulations, members from the Nsonga, Kyabasambu, Kyakapere, Nsunzu and Kiina villages should form the Buhuka Communal Land Association (BCLA). The members of the erstwhile Community Land Association would become members of the BCLA. It was the intention of the participants that this Committee will receive the money paid for compensation and administer the funds paid specifically for the land (but not for developments and user rights which accrue directly to the owner) on behalf of the registered members of the Association.

Box 7-3: Criteria for Compensation and Resettlement[37] (for full details, see Volume 4, Specialist Study 10)

Housing and Building Infrastructure: Depending on the nature of the infrastructure affected, compensation may be in kind, cash or a combination of in kind and cash. In some instances, a disturbance allowance and a transport allowance is paid. Cash payment is typically at full replacement cost. Compensation for incomplete buildings is on a percentage completion basis.

Housing Land: Compensation for lost residential land is paid in cash, where in-fill resettlement is possible on the remainder of the affected parcel of land or within the existing community, or where the household owns land for residential use elsewhere which they choose to occupy as primary residence, compensation in cash for surveyed land at agreed rates. Alternatively, where in-fill resettlement on the remainder of the affected parcel of land or within existing community is not possible, provision is made for a standardized housing plot on a planned resettlement site. In this case, settlers will be given the same security of tenure as their displaced land, but a Customary Certificate of Ownership (CCO) as a minimum.

Cultivated Land: A package to empower farmers to find their own replacement agricultural land of same size is provided, or an amount of land with equivalent productive value is found. In this case, land will be brought to same level

[36] *Minutes of the Meeting held with the Buhuka Community Land Association (2017)*
[37] *KFDA RAP Project 2016 – Phase 1 Resettlement Action Plan*

of preparedness as at time of crop survey. For fallow land, a compensation support package will be provided to identify suitable fallow land of the same standard.

Permanent Grazing Land: Compensation of the value of the land at full replacement cost.

Permanent Loss of Natural Resources or Access to Natural Resources: The Project will attempt to find resettlement sites that maintain access to natural resources. If resources cannot be replaced communities will receive additional livelihood improvement or alternative livelihood support.

Perennial Crops: Cash compensation at full replacement cost at agreed rates determined annually by the District Land Board or based on full replacement cost determined by formal market studies. Alternatively, access to agricultural improvement package consisting of labour and mechanical inputs to bring land to same level of preparedness and inputs for 1 year such as improved seeds, pesticides, training, equipment if replacement agricultural land has been secured.

Annual Crops: Where sufficient notice is given (90 days) tor farmers to harvest their annual crops, the project will not pay for annual crops. Where annual crops cannot be harvested due to a reduced notice period, damaged crops will be compensated as mature crops at agreed rates determined annually by the District Land Board. Alternatively, other in-kind options may be considered including participation in livelihood improvement programmes

Fruit and Economic Trees: Cash compensation will be paid at full replacement cost, including the cost of forfeited economic benefits, for all agreed fruit and economic trees, shrubs (e.g. coffee) and plants (e.g. cassava) at agreed rates determined annually by the District Land Board or based on full replacement cost determined by formal market studies. Where cash compensation is not preferred for fruit and economic trees, two (2) replacement saplings for every damaged tree of a crop variety suitable for the identified replacement farm land.

Temporary Loss of Land or Assets: The project will pay a rental amount equivalent to the value of income lost due to lost access to land or assets for duration of the impact.

Table 7-34: Housing and land take on the Buhuka Flats

No.	Facility	Location	Total (temporary) Land Take (Ha)	Total (permanent) Land Take (Ha)
1	CPF	Kyabasambu & Kyakapere	20.0	20.0
3	Pad 1	Kyabasambu	4.6	4.6
4	Pad 2	Kyabasambu	3.8	3.8
5	Pad 3	Nsunzu	4.6	4.6
6	Pad 4A	Kyakapere	4.1	4.1
7	Lake Intake Pump Station	Kyabasambu & Kyakapere	0.12	0.12
8	Jetty	Kyabasambu	0.2	0.2
9	Airstrip	Kyabasambu & Nsonga	12.6	12.6
10	Security Camp	-	1.2	1.2
12	Drilling Camp	Kyabasambu	3.5	-
14	Permanent Camp	Kyabasambu	3.7	3.7

No.	Facility	Location	Total (temporary) Land Take (Ha)	Total (permanent) Land Take (Ha)
15	Contractor's Camp	Kyabasambu	7.1	-
16	Infield Pipelines	Kyabasambu, Nsonga, Nsunzu, Kyakapere	23.0	-
17	Internal Roads	Kyabasambu, Nsonga, Nsunzu, Kyakapere	14.0	14.0
18	Material Yard	Kyabasambu	3.7	3.7
19	Safety Check Station	Ngoma	0.4	0.4
Total			**106.7**	**76.6**

Table 7-35: Assets affected by permanent CNOOC infrastructure on the Buhuka Flats

Category affected	Number of assets	Summary of impact or loss
Residential structures (owners)	13	Permanent loss of structures/loss of accommodation. Displaced persons need to relocate – physical relocation
Residential structures (tenants)	8	Loss of accommodation, displaced persons needs assistance with resettlement
Residential structures/business for rental income	3	Permanent loss of structures/ income from the rental units
Residential structures but not living on plot	7	Permanent loss of structures
Loss of crops	2 households gardens affected	These include cash and food crops at different maturity level. Temporary loss of food sources and/or income or profit while re- establishing farming activities
Loss of trees	4 households with trees	These are mainly shelter trees but could be used in construction of houses. There is potential loss of income
Graves	5	The graves are located at the households and there is one person buried in every demarcated grave.
Annexed structures	2	These structures include a latrine and a dish rack. Their loss will not affect the main structures. Compensation will be required to move these structures.

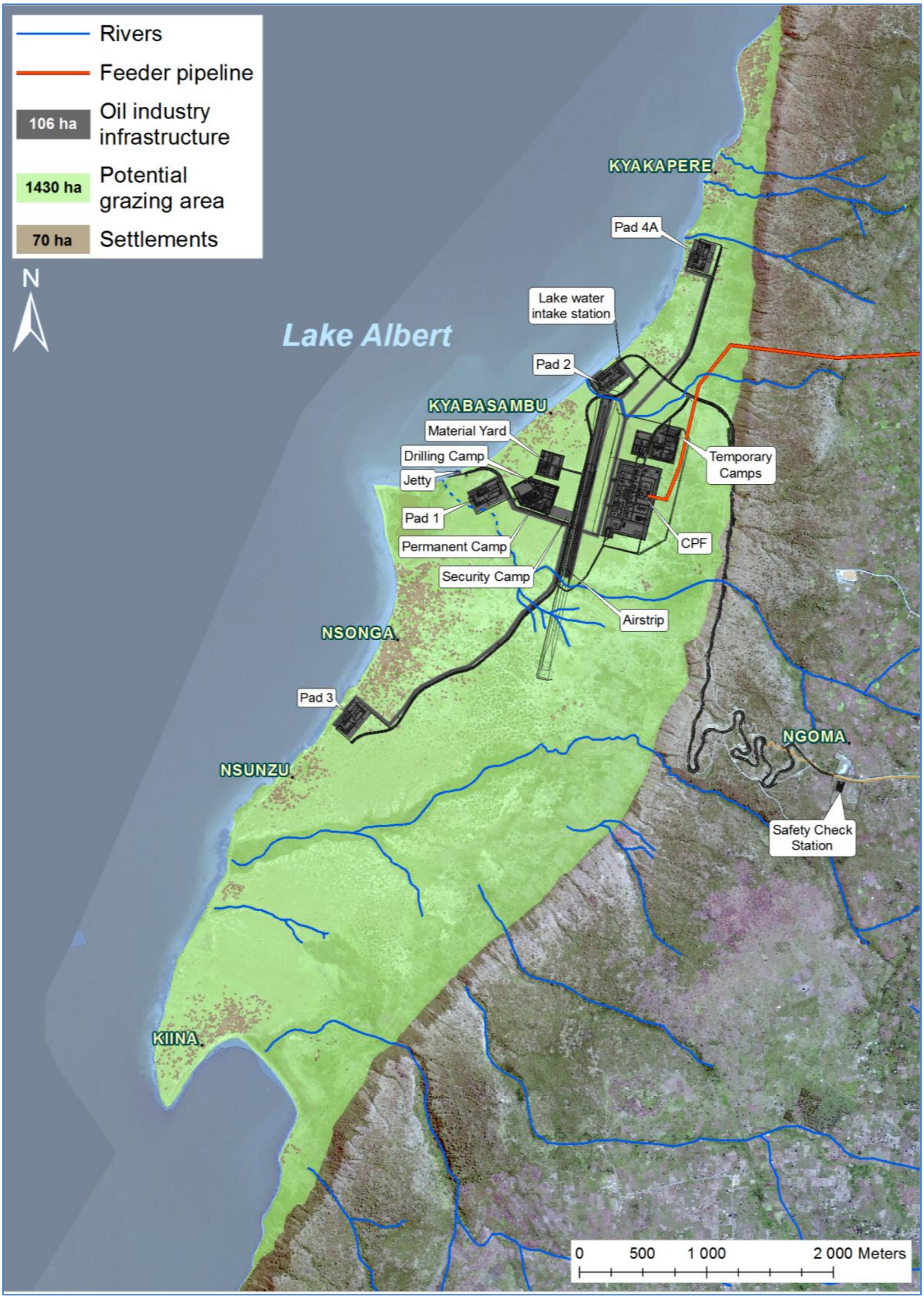

Figure 7-17: Area of land take by oi industry infrastructure on the Buhuka Flats

These issues will need to be handled with extreme caution. While the housing losses (both present and past) are relatively small, taking only the direct project footprint of the project into account, the land losses are more significant given the area affected and the existing pressures on grazing land. In addition, the wider issues associated with a large industrial project in close proximity to rural subsistence communities are numerous, and in the absence of an effective plan for development on the Buhuka Flats, are likely to result in ongoing community demands for compensation for the disruption of the cultural fabric of their villages, increased health risks, nuisance and a whole range of other issues described in Section 7.3.4.

Unmitigated impact significance is expected to be negative and high both for housing loss and land loss. For housing, the construction of replacement housing in the immediate area will convert the negative impact to a high positive impact for the beneficiaries, who will be resettled in a modern weatherproof house. Inhabitants who have seen the examples of the replacement housing are all keen to be resettled as a result, wherever or not they are on the schedule. Photograph 7-4 shows a prototype of the proposed replacement housing. For land loss, the impacts will be intractable – while compensation will be paid through the Buhuka Communal Land Association (BCLA), this is unlikely to fully compensate the affected people over a long period, and once the cash compensation is exhausted the affected communities will be left with a shortfall of 7.4% of their grazing land.

Photograph 7-4: Typical replacement house that will be built by CUL for resettled families on the Buhuka Flats

7.3.5.2 Damage to Property Outside of the Defined Project Areas

There is a potential for damage to land, property and infrastructure outside of the defined project-affected areas, involving amongst other things:

- clearing of land beyond the project working areas for which compensation has not been paid;
- vehicles or project personnel straying outside working areas and causing damage to land, infrastructure and crops;
- vibration damage to houses or other buildings located close to the construction corridor and/or to access roads due to the passage of heavy vehicles and equipment; and
- adverse effects of construction-generated dust.

Without mitigation, these impacts have the potential to sour relationships between CNOOC and local communities and could be long term (largely irreversible in terms of damage to relationships and therefore extending far beyond the construction phase), of high magnitude, local extent and **high** significance. Careful management, open communications and the transparent implementation of a fair grievance procedure should reduce the impacts to **minor** significance.

7.3.5.3 Impact on Property Prices and Rentals

Local knowledge of the proposed Kingfisher Field Development Area has resulted in speculation for land, where individuals move into the area and claim land for themselves. According to villagers on the Buhuka Flats, these speculators sometimes have title deeds which have been acquired fraudulently. This practice has been successfully challenged at least once, with a prominent government official being jailed for fraudulent transactions. Despite this, it is reported that speculators continue to trade up the price of land in the local area. While some people will benefit from increased rental, the majority will not, and will be faced with unaffordability where accommodation is needed, resulting in local impacts of high magnitude and medium to long term duration (extending well beyond the construction phase), with **high medium** significance.

7.3.5.4 Impact of In-Migration

Migration onto the Buhuka Flats has already been significant as a result of the access created by the escarpment road. The continued influx of migrants as well as opportunistic and uncontrolled cattle grazing and fishing practiced by local villagers and people from outside of the Buhuka Parish, including commercial fisherman from Hoima, Kikuube and even Kampala, has resulted in overgrazing and overfishing, negatively affecting the livelihoods of local households. Fish trade appears to be conducted across the lake into the DRC (e.g. at Panyimur, Bwera and Ntoroko), while vast quantities of silver fish of fingerling size are harvested and sold (primarily as poultry feed) within Uganda as well as in Kenya. To add to the resource depletion burden, there is extensive deforestation taking place along the escarpment, with accelerating rates of charcoal manufacturing exacerbating the impacts of wood harvesting practiced by villagers from the Buhuka Flats for cooking purposes.

There is discontent among the communities on the Flats about the influx of migrants and over-exploitation of resources. Communities blame CNOOC and the Government for this. While the escarpment road has been subject to a separate environmental authorization and has not been CNOOC's responsibility, the Buhuka Flats communities do not make legalistic distinctions in this regard and they correctly perceive it to have been built in support of the future oil industry. It is also likely that once the construction of the production facility starts, there will be a further influx of settlers onto the Flats and surrounding areas above the escarpment which will be directly related to perceptions about jobs and opportunities derived from oil industry development. The resource-related impacts as a whole are expected to be far greater than the direct impact of CNOOC's activities themselves. Land speculation is also expected to accelerate on the Buhuka Flats and above the escarpment, with an increase in land and rental prices during the construction phase of the project. While this may be a positive impact for landowners, it is negative when associated with in-migration, since it interferes with the natural balance in the land markets and generally increases rentals for those members of the community who are poorest and must rent land themselves. Unease about rising land prices due to expectations about the project is already evident in the project-affected communities.

Overall, land and resource impacts due to in-migration are expected to be negative, long term and possibly extend beyond the Buhuka Flats into the sub-region. The impacts are considered to be highly probable (while acknowledging some uncertainty about the numbers of people). Taking a conservative view, the probability is high or definite, resulting in impacts of **high** significance.

7.3.5.5 Impact Mitigation and Monitoring

Housing and Land Loss

- Ensure that there is a process to identify all stakeholders (rights holders) of any land take process. While this will mean engaging the individual who indicates that he/she is the rightful land owner, the identification process should consider information from a broad a consultation group. Secondary PAPs, who may not have been immediately identified, but who have utilised the land in some way for a period of up to two decades and longer. This includes the loss of dwellings of secondary PAPs, loss of crops and assets such as mango trees and resultant loss of income;

- Undertake a full investigation of the allegations that PAPs have been forced to sign documentation and if any allegations are valid, address them comprehensively; and
- Ensure that the RAP comprehensively addresses all aspects of physical and economic displacement experienced by impacted communities, in accordance with the IFC performance standard 5 which addresses the involuntary resettlement and compensation impacts in the project-affected communities (refer to Box 7-4).

Box 7-4: Standard Measures to Ensure that Resettlement and Economic Displacement are Effectively Managed

- Quality of life of resettled people and host communities should not be compromised;
- The resettlement program has to be adequately financed by the relevant party through the Local Government, to ensure that local commitment and newly occupied resettlement land will have the same production characteristics of the expropriated ones;
- Support should be provided to avoid that resettled persons will negatively impact on the life standards of host communities;
- Both resettled persons and host communities should actively participate in the resettlement planning process;
- The transition period should be short, and project construction activities should not proceed until the affected persons have been resettled;
- The host areas must be close to the current site;
- Resettlement planning must ensure that families, communities and social/cultural groups are kept together to maintain social networks;
- Resettled people should be adequately and equitably compensated for the value of their land. In land-based livelihoods, land should ideally be replaced with land of equal or greater value; and
- Appropriate livelihood restoration strategies developed to restore livelihoods of affected persons.

- Provide compensation for lost agricultural productivity (lost grazing and cultivation) during the construction period. Although there has been extremely limited agricultural activity on the Buhuka Flats, adequate notice of the production facility construction schedule must be provided to PAPs so that they don’t unnecessarily lose crops. Cash compensation must be provided based on the cost of planting, labour and fertiliser inputs required to bring the tree or vine to maturity, plus the cost of the lost production for the period it will take a sapling to reach the production level of the tree/vine at the time it is lost to the project;
- Ensure that the Livelihoods Restoration Plan, as well as the Community Development Plan, provide practical mechanisms and mitigation strategies for the loss of grazing land on the Buhuka Flats as a buffer against out-migration as well as in respect of cultivated land. The extent of household reliance on subsistence food sources should be taken into consideration in this process;
- Ensure that land temporarily used during the construction phase is reinstated to at least the condition it was in prior to construction. This would include all agricultural land, except that needed permanently for the ROW. Agricultural land must be left graded and tilled ready for re-planting. Where land must be re-planted in order to prevent erosion, the regime must be agreed with the landowner; and

- Implement a precautionary approach to offering cash compensation as an alternative to payment in kind for housing, infrastructure and land losses. CNOOC is aware of the vulnerabilities that could be caused by cash compensation, and has instituted a number preconditions prior to moving forward with the payment of compensation. These have included (i) the requirement that men are not able to negotiate cash settlements without their spouses being present during the negotiation and being in voluntary agreement (ii) payment of the compensation into a bank account (where the amount is sufficiently large to warrant this) and where the account has been opened in the name of the husband as well as the wife and where withdrawals require the permission and signature of both spouses and (iii) training of PAPs in financial literacy and business entrepreneurship;
  While this mechanism is a responsive approach to the problems of cash payments, a side effect has been an increase in household violence. In particular, this has led to incidents of assault by husbands where their wives have been reluctant to give approval for intended spending. Based on incident reports, the main reason for CNOOC-related incidents of spousal abuse have stemmed from this cause. While CNOOC cannot take sole responsibility for this phenomenon, additional measures, such as (i) engaging in sensitisation exercises related to domestic violence prevention and associated gender equity principles with PAPs and (ii) ensuring collaboration between LC1s, the Uganda Human Rights Commission, Kikuube District, the Hoima Police Department Family and Child Services Division and traditional leaders must be considered to address general social as well as intra-household violence and disruption.

Damage to Property Outside of the Defined Project Area

- Emphasise to the EPC and other contractors the contractual obligation to remain within the construction areas designated for the project. No activity outside of these areas is to be permitted without CNOOC consent, and without prior discussion with the affected community representatives;
- To cater for inadvertent damages outside of the defined project areas, reach agreement with community representatives as to how this should be handled;
- Identify key fixed photographic reference points for the Buhuka Flats and prepare seasonal (wet and dry season) reference photographs before the construction contractor establishes on site. Use these photographs to assist in resolving disputes in the event of disagreements about damages;
- Monitor construction activity daily as a means of rapidly identifying and acting upon any inadvertent damages. To achieve this, competent CLOs will need to be on site from the start of construction establishment; and
- Ensure that all contract personnel are trained, both during induction and subsequent follow-up training, to minimise their impact on surrounding communities and to remain within the designated construction areas.

Impact on Property Prices and Rentals

- Ensure that CNOOC construction staff who reside outside the LSA are required to return to their place of residence during periods of leave to avoid potential use of rental property in the area; and
- Provide accommodation for all personnel who do not reside in the LSA and are not brought in on a BIBO or FIFO basis.

Impact of In-Migration

- Implement the strategy for minimising in-migration defined in the Influx Management Strategy and Framework Plan (Volume 4, Specialist Study 11). This will need a combined effort by Government and all oil industry partners.

7.3.5.6 Impact Significance Rating

Table 7-36: Construction phase impact on housing, land and resources

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Housing Loss/ Replacement	10	5	2	5	High 80	8	5	2	5	High +75
Land Loss	10	5	2	5	High 80	3	4	2	5	Low Medium 45
Damage to Property Outside of the Defined Project Areas	8	4	2	4	High Medium 56	4	2	2	3	Low 24
Impact on Property Prices and Rentals	8	4	2	4	High Medium 56	6	4	2	4	Low Medium 48
Impact of In-Migration	10	4	3	5	High 85	4	3	2	5	Low Medium 45

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.3.6 Impact on Community Infrastructure and Services

7.3.6.1 Impact of Project use of Community Infrastructure and Services

The construction of the production facility will employ between a thousand and two thousand people over a 2.5 year period, who will be resident in the temporary camps, or living at home in cases where employees are from the local area. During this phase of the project, CNOOC is unlikely to directly impact on health and welfare, education or emergency services in the local area and district, for the following reasons:

- Construction workers will be served by a fully provisioned clinic, with trained medical staff, to cater for any injuries, emergencies or general health issues experienced by personnel working on the project;
- Families and children will not accompany construction workers and no additional services in respect of education will be needed; and

- The EPC and drilling contractors will provide their own emergency services for smaller incidents and will have access to international emergency services in the event of a major accident. At all times, a fully equipped fire truck will be available along with self-contained breathing apparatus; and rescue equipment will be available for vertical rescue, general rescue and emergency management.

The magnitude of the direct construction - related impacts on existing infrastructure and services will be very low, local and short term, resulting in **low** impact significance. Impacts on infrastructure and services emanating from in-migration of potential job-seekers have been discussed in further detail in Section 7.3.6.3 of the Report.

7.3.6.2 Impact of Access Provided by the Regional Road Upgrades

The upgrading of the Kabwoya-Buhuka (P1) road and the extension of this road down the escarpment onto the Buhuka Flats has brought significant benefits to the Buhuka Flats villages in respect of access to community services. Where previously access to Parish and District services involved a long journey on foot, the communities can now gain access by vehicle. Together with improvements in other regional roads (the R7 and R4), this is expected to facilitate a general improvement in the health and education in the local population. While the road benefits have been separately considered and authorized, and are the responsibility of the Uganda Government, they are included here for completeness, since they have been built in support of the coming oil industry developments. The accessibility benefits will be local (applying to people on the Buhuka Flats), permanent, and will have a material effect on the ability of people to access essential services (high magnitude), resulting in an overall impact of **high** significance.

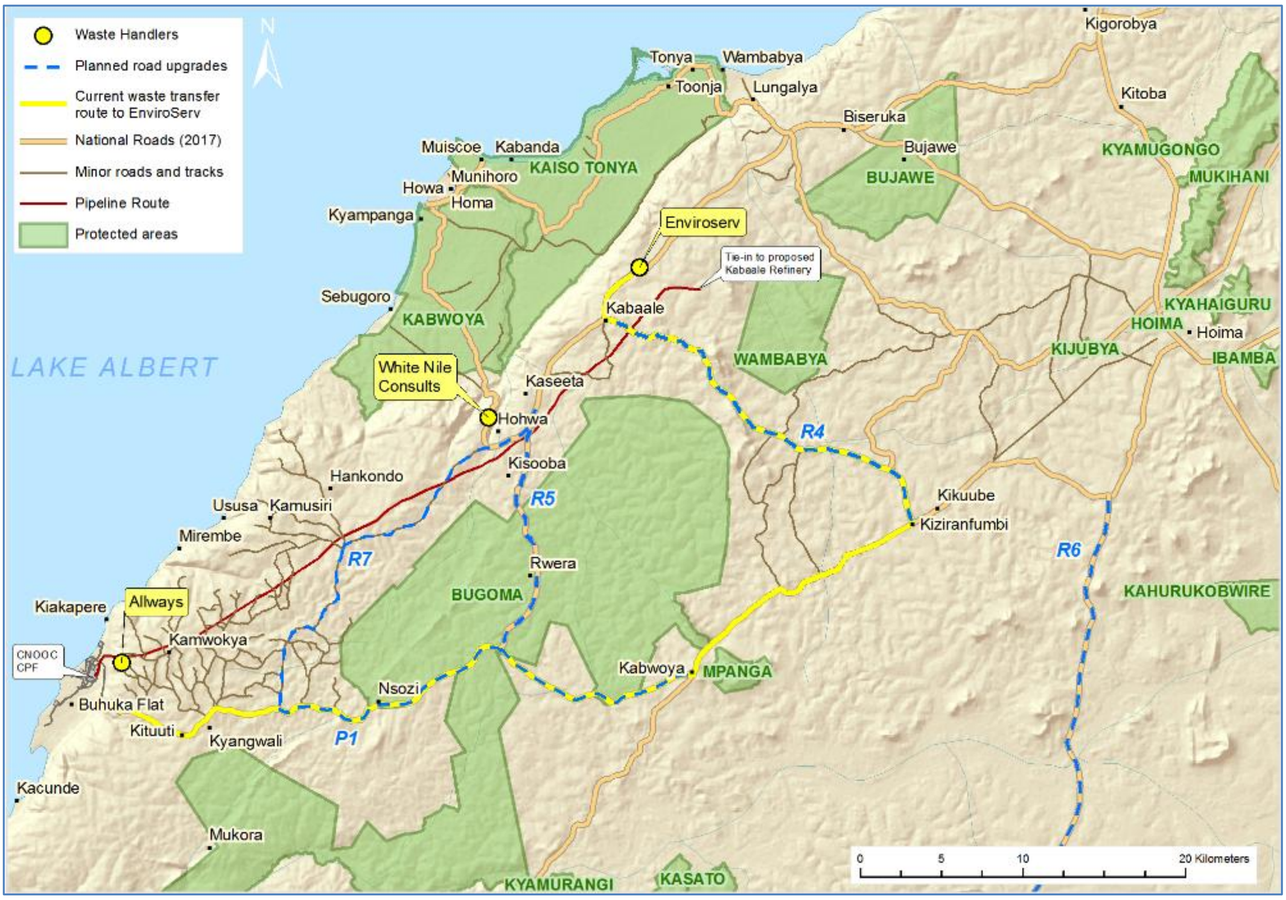

Figure 7-18: Regional road upgrades proposed above the escarpment

7.3.6.3 Impact of In-Migration

Construction phase impacts of the Kingfisher Field Development Area on infrastructure and community services will be largely as a result of the indirect effects of in-migration. Currently, Hoima and Kikuube Districts as a whole are experiencing population growth attributable to high birth rates and in-migration. In-migrants typically originate from other countries such as the DRC and Sudan, with a substantial presence of refugees from these countries contributing to the total influx.

The recent upgrade of a section of the Kbwoya-Buhuka road and the construction of the road down the escarpment onto the Buhuka Flats has improved accessibility to the lake, encouraging settlers who have capitalised on fishing and other activities made possible by improved access. Based on the results of the household surveys and focus group discussions, migrants appear to originate largely from the DRC, as a large proportion of the trade in fish is across Lake Albert. Apart from a very high number of Congolese (estimated to be upwards of 70%[38]), villages in the Buhuka Parish already house a multitude of ethnic groups, with the Alur tribe being the largest.

While some people are benefitting financially, the in-migration is contributing to pressures on community infrastructure and services, including the following:

- Schooling: The government schools in the parish are currently facing significant challenges, with increasing demand being placed on existing limited services. Private schools have exploited the gap that demand has created, but are of varying quality. The private schools here, and elsewhere, are currently under scrutiny by the Department of Education which has indicated increased vigilance in respect of quality control and standards. At the same time, in the absence of adequate government-supplied educational infrastructure, demand will continue to exceed supply. Recruitment and retention of teachers is challenging due to lack of decent accommodation in the area, as well as relatively low salaries being offered. In-migration will increase pressure on schooling availability generally, and with a shortage in supply will probably drive private schooling prices up;
- Health and welfare services: Local health services are already experiencing impacts from the additional non-resident and resident populations associated with the project, including health care services (specifically related to children and maternity health), emergency housing support; and family support services;
- Emergency services: These services are not readily extended to the Buhuka Parish despite the improved access. Increased populations will increase pressure on those services that exist; and
- Water supply: Communities have indicated that one of their main development needs is water supply. Population influx has already served to exacerbate this situation and it is expected to worsen with increasing populations.

The construction phase of the Kingfisher Field Development Area is expected to result in a further wave of migration into the LSA and RSA. Whilst Hoima town and Kikuube will probably serve as one of the major hubs of potential influx (due to it already being a well-established urban centre and having a substantial population size), villages closer to the Buhuka Flats, above the escarpment, and on the Flats themselves, are also likely to experience population influx. This will be driven by opportunity seekers selling goods and services to the large number of construction workers on site, or seeking direct employment with CNOOC and its contractors, while also engaging in fishing activities (or related economic activities) for subsistence or sale. The CNOOC Influx Management Plan (2015) provides a typology of migrants, setting out key characteristics and motivating factors in respect of various types of migrants into the area.

The influx will stimulate economic growth in the area - which in turn is expected to attract more people. Considering this, the impacts may be both positive and negative - as the additional population will bring new

[38] *Personal Communication, (2017) Village LC1s for the Buhuka Parish*

skills and expertise into the area and result in economic growth, but will also increase the strain on social services, amenities and infrastructure for existing inhabitants.

Overall, in the absence of Government and CNOOC interventions, the impact of in-migration is likely to overwhelm the capability of the infrastructure and community services available to Buhuka Parish communities. Negative impacts are also likely to be experienced by the poorest members of the communities, who will be less able to take advantage of economic opportunities but will experience the negative effects of burgeoning growth. With regard to community infrastructure and services, the following outcomes are likely:

- A dilution of local Government influence, as newcomers into the area are typically unfamiliar (or indifferent about) local Government rules and leadership structure. This has already started causing tension within and between communities on the Buhuka Flats and this trend will be aggravated by further migrants; and
- The price of rented accommodation is likely to rise sharply. During the project’s construction phase, migrants in search of work may look for rental accommodation rather than purchase new housing. As additional demand for housing emerges, there will be a sustained increase in rental prices. While this will benefit the owners of accommodation, it will make rental costs for existing tenants (particularly poor tenants) unaffordable.

Impacts are likely to be of sub-regional geographic extent, long term and potentially high magnitude resulting in **high** significance.

7.3.6.4 Impact Mitigation and Monitoring

The following impact mitigation and monitoring is proposed:

- Sensitise the LC system and prepare to accommodate changes arising from the population influx. This is particularly important, as it is at this level that the stability of a village is decided, including the establishment of checks and balances for maintaining individual rights and responsibilities and for managing criminal elements;
- Promote the creation of social connections between the incoming permanent resident workforce and the existing community such as holding of sports days, to strengthen existing levels of community cohesion and assist in the long-term staff retention. Through its CLOs, CNOOC should seek opportunities to partner with and support services that provide support to families in crisis, particularly domestic violence and financial investments which strengthen capacity and cohesion; and
- Implement the strategy for minimising in-migration defined in the Influx Management Strategy and Framework Plan (Volume 4, Specialist Study 11). This will need a combined effort by Government and all oil industry partners.

7.3.6.5 Impact Significance Rating

Table 7-37: Construction phase impact on Community Infrastructure and Services

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of Project Use of Community	1	2	2	4	Low 20	1	2	2	4	Low 20

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Infrastructure and Services										
Impact of Access Provided by the Regional Road Upgrades	8	5	2	5	High +75	8	5	2	5	High +75
Impact of In-Migration	8	4	3	5	High 75	4	4	3	5	High Medium 55

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

7.3.7 Individual, Family and Community Life

7.3.7.1 Disruption of Social Networks

Where people are resettled, they could suffer the following permanent or long-term disruption:

- troubled, discontinuous or fragmented social ties;
- dismantled production systems;
- individual/household impoverishment resulting from the loss of productive assets or income sources;
- relocation of individuals/households to alternative environments where their productive skills may be less applicable and the competition for resources greater;
- dispersion of kin groups; and
- Loss or diminishment of supportive networks, mutual assistance and cultural identity.

These impacts will especially manifest among PAP's that involuntarily move to new or distant locations from their original area of abode. At the same time, PAPs who voluntarily take up a cash compensation option may, inadvertently, place themselves in the same position. Without sensitive handling, the impact will be long term and irreversible, of high magnitude and major significance. Even with careful mitigation and monitoring it is likely that these impacts will persist, and will not be eliminated or reduced to minor or negligible levels.

7.3.7.2 Impact of Social Fragmentation

In urban sociology, fragmentation refers to the absence or the underdevelopment of connections between the society and the groupings of some members of that society on the lines of a common culture, nationality, race, language, occupation, religion, income level, or other common interests.

Although the Buhuka Parish is rural by nature of its setting, it has developed a distinctly non-rural nature with strong commercial activity along the main village roads. Apart from Kyabasambu, villages such as Nsonga and Kyakapere have a proliferation of bars, gambling and gaming institutions and a flourishing trade in sex workers. Particularly over the past three years, all lakeside villages have shown rapid growth of migrants from other parts of Uganda, Rwanda, South Sudan and especially the DRC. This has resulted in overbuilt and unplanned construction and severely constrained infrastructure and services. While there is some evidence of significant “hidden” wealth (mainly attributed to illegal smuggling to and from the DRC[39]), there is also evidence of a poor quality of life for a significant proportion of village members who are dependent on natural resources (mainly wood, grass and fish) as part of a subsistence livelihood.

The opening of the escarpment road has played a significant role in this influx process. At the same time, it is clear that the vast majority of non-Ugandan people originate from the DRC[40]and have gained access to the Buhuka Flats via Lake Albert.

The lake-side villages clearly demonstrate a trend in which there is a disintegration of the collective sense of belonging and the coherent set of values and normative behaviour that characterise more stable communities. This is especially evident in Kiina, Nsonga and Kyakapere where relatively weak local management capacity exists. While some community members describe the changes as ‘progress’[41] many others feel helpless, angry and victimised in that they have lost their former social and psychological refuge. High levels of uncertainty about what the future will hold, confusion about what exactly to expect and associated hindered decision-making, conflict between individuals and groups (and with CNOOC itself) and feelings of distrust are commonplace. There is a perception that questions asked and issues raised in ongoing engagement with CNOOC are not fully understood. This distrust and sense of inability to resolve conflict with CNOOC in a constructive manner precipitated the court case lodged against CNOOC by the land owners association.

Increasingly, there is also a manifestation of unequal distribution of costs and benefits associated with changes caused by the project amongst the villages on Buhuka Flats. Some residents are perceived to have benefitted from the presence of CNOOC, mainly because they are seen to have managed to “escape” being trapped as a direct result of the relocation / compensation process. Inevitably, those interviewed expressed a desire to be relocated and to receive compensation as well. There is already evidence of a group (village) related sense of entitlement and advantage which disregards principles of reasonableness, equity and fairness. As an example, the large youth contingent from Kiina village indicated that they “demand that at least 60% of job opportunities from CNOOC should be provided” to them. Additionally, they demand that CNOOC increases the daily wages paid to members of the Kiina community to ensure that they earn more than they could if they spent the time fishing[42]. Kiina is well beyond the southern boundary of the direct physical impact that will be caused by the construction and operation of the KFDA production facility.

Without interventions by both CNOOC and Government, the impact of the construction phase of the project is expected to further exacerbate the social fragmentation that is already evident on the Flats causing local, long term, impacts of high magnitude and **high** significance. Even with careful mitigation and monitoring it is likely that these impacts will persist, and will not be eliminated or reduced to **low** levels of significance.

39 Eco & Partner Fieldworkers in conversation with local lakeside villagers (2017) Personal Communication
40 LC1s for Nsonga, Kiina and Kyakapere (2017) Personal Communication
41 Kiina Village Elder (2017) Group discussion, Public Consultation Meeting.
42 Kiina Village Youth (2017) Group discussion, Public Consultation Meeting

7.3.7.3 Loss of Sense of Place

During the construction phase, residents on the Buhuka Flats (and in particular residents from Kyabasambu, who live close to or overlook significant parts of the proposed project site) will experience ongoing and significant changes in their immediate environment and their associated sense of place. Prior to the development, the view of villagers was of Lake Albert on the one side and grasslands and the escarpment on the other. This view will be altered significantly to a combination of oil related developments, construction sites characterised by exposed earth, construction materials, and machinery. Outsiders making use of the escarpment road to access the area will create changes in social cohesion. The nature of the living environment will change from a tranquil, isolated, rural setting to one characterised by industrial development, dominated by non-residents. Noise and other intrusions will exacerbate the situation, affecting all dimensions that have made the Buhuka Flats unique – a resulting in an impact of **major** significance.

This change will be extremely difficult to mitigate directly. Even with the effective implementation of the key direct mitigation measures proposed (for example, minimising the effects of visual disturbance and noise, as set out in Sections 7.1.3 and 7.1.4); the impacts associated with sense of place will remain of major negative significance unless impacted households are provided with development alternatives to counteract any sense of inequity. The effect will be short term, local but of high magnitude, resulting in impacts of **high medium** significance.

7.3.7.4 Impact Mitigation and Monitoring

Disruption of Social Networks

Set up an accessible and local “one-stop shop” in the community for all issues concerning the construction process to handle aspects such as the provision of basic information, a contact point for emergencies and grievances (whether the concern is related to CNOOC, its contractors or sub-contractors) about work on the project. As part of this process, provide a resource person (potentially a community liaison officer) who is able to provide on-site information to communities on the RAP and associated processes, property and land issues during construction, to monitor and assist the construction contractor’s pre-entry agreement procedure and final re-instatement sign-off with owners and users and for resolving outstanding issues.

Provide comprehensive dispute resolution mechanism linked into a coherent two-way communication system (either as part of the ‘one-stop shop” or aligned with it, with associated feedback mechanisms that will be readily accessible and available to all villagers and PAPs). This could be community liaison officers who could be the main point of contact for queries, questions and concerns on property and land issues, as well as directly related to the CNOOC process and programme.

Impact of Social Fragmentation

The following impact mitigation and monitoring is proposed:

- Ensure that consideration of conflict issues - latent, existing and potential – is built into all phases and aspects of the construction phase;
- Monitor and track responses to risks and impacts, involving workers and communities;
- Continue to implement the Community Relations Strategy (CRS) and establish a formalized communication forum. The forum should be open to representatives from villages (including but beyond the formalised governance system provided by LC1s), CSOs, NGOs, FBOs as well as traditional clan chiefs (or representatives) and other stakeholders as identified. Ensure regular meetings at local level, hosted by CNOOC, aimed at:
  - communicating with stakeholders to build understanding and demonstrate transparency and accountability.
  - strengthening channels for the provision of further information that may be needed.

  - promoting mechanisms for understanding real issues and concerns related to the project and impacts being experienced from direct (unmitigated), indirect and cumulative impacts.
  - publicly and transparently debating options for sharing out benefits at local level that will take account of the negative impacts experienced locally, including the costs and benefits of different options, their management implications and their role in supporting wider economic development.
- Develop - in consultation with all relevant stakeholders - a Community Development Action Plan (aligned with the Districts and Kyangwali Sub-county Development Plans) for implementation of activities aimed at:
  - promoting strategic Corporate Social Responsibility (CSR) projects which will not require CNOOC to usurp the government's role or act as substitute government agent in fulfilling human rights related delivery.
  - planning and implementing projects, in partnership with government, that will serve to alleviate existing challenges to the survival, livelihood and dignity of the people of the Buhuka Flats in a sustainable manner. This could include engaging NEMA as well as relevant authorities in implementation of effective solid waste management and associated recycling programmes;
  - planning and establishing adequate sports facilities for schools as well as for youth, in partnership with government and the Bunyoro Kitara Kingdom.
  - planning and achieving critical objectives set out in the project Livelihoods Restoration Plans.
  - planning and implementing immediate measures that will assist in earning and maintaining CNOOC's social license to operate.
  - taking collective action to address environmental, social and human rights issues.
- Facilitate and financially support the establishment of a district/area-wide Development Organisation, with a formalised legal structure (such as a Foundation or a Community Development Agency). Such an organisation or agency would:
  - address issues related to human security, as an approach that brings together development, human rights, and peace and security (as defined by the United Nations General Assembly, 2012).
  - allow the identification and redress of widespread challenges to the survival, livelihood and dignity of villagers on the Buhuka Flats and beyond in a sustainable manner.
  - draw together the financial and human resources of the private and public sectors, the traditional leadership and other stakeholder bodies as well as donor and aid organisations.
  - develop issue-based action plans, including business plans for donor funding in respect of various focus areas of need that will address identified human security issues and concerns.
  - allow CNOOC to use its own budget to leverage significant additional budget from other role-players (including international 'GoFundMe' initiatives) and aid organisations with a specific mandate (e.g. the distribution of mosquito nets) to address specific problems encountered at village level.

Loss of Sense of Place

- As far as is possible, provide natural screening through the use of trees and other landscaping interventions to reduce the visual and aesthetic impacts emanating from construction activities as well as intrusion impacts such as noise and light pollution (refer to Section 7.1.4);
- Minimise noise impacts in accordance with the recommendations of Section 7.1.3;

- Engage the households within Kyabasambu as well as other settlements where there is a direct negative aesthetic impact from CNOOC construction activities in planned development initiatives that address areas of need to allow the development of a sense of equity specifically related to the loss of sense of place; and
- Promote partnerships between directly impacted households and legitimate NGOs that have a successful track record in local economic and enterprise development, including micro financing programmes to allow households access to economic opportunities. This would offer a key mechanism for counteracting feelings of being “trapped” by the development.

7.3.7.5 Impact Significance Rating

Table 7-38: Construction phase impact on Individual, Family and Community Life

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Disruption of Social Networks	1	2	2	4	Low 20	1	2	2	4	Low 20
Impact of Social Fragmentation	9	4	2	5	High 75	4	4	2	5	Low Medium 50
Loss of Sense of Place	8	2	2	5	High Medium 60	4	4	2	5	Low Medium 50

KEY

Magnitude	Duration	Scale	Probability
10 Very high/ don’t know	5 Permanent	5 International	5 Definite/don’t know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

7.4 The Socio-Cultural Environment

‘Cultural heritage’ refers to realities that communities, groups and individuals recognize and cherish as part of their lifestyle. Heritage items can be tangible such as artifacts, traditional dress or intangible such as language, oral traditions, customs, music, dance and rituals. Specialist Study 12 divides cultural heritage sites into two broad categories and twelve sub-categories. These are **archaeological / historic** (made up of bone sites, lithic archaeological sites, metal sites, quarry sites and historic sites); and **cultural** (made up of religious sites, cemeteries, ritual sites, ritual objects, sacred rivers, sacred trees, cultural trees, cultural landscapes and medicinal plants).

Construction Phase activities that will cause direct impact on cultural heritage resources will include the following:

- Ground clearance, levelling and compaction of all temporary and permanent project sites;
- Excavation and laying of the foundations for components of the plant, flowlines, well pads and other infrastructure; and
- Linking of support infrastructure (access roads and water supply) to respective facilities.

Heavy machinery (such as bulldozers, excavators, dump trucks, vibrating rollers, cranes and other equipment and machines) will be used. Construction activity in locations where archaeological and cultural/sacred sites exist is likely to result in their destruction and, therefore, their material value. Construction activity may also result in ground compaction or vibration impacts that may directly affect a known site's context. Since construction activities are rarely confined to the exact footprint of the infrastructure, a buffer of 15 m around all infrastructure is considered a reasonable basis for determining the limit of direct impacts. Direct impacts will affect all categories of cultural heritage.

Indirect impacts will affect cultural sites[43], including all of the nine categories listed above. Indirect impacts may result from the dust, noise, and visual impacts associated with construction; changing the atmosphere of the site, affecting intangible practices associated with it and hence the value of the site to communities. A cultural site, although not directly impacted by the development footprint, may be close enough to a number of proposed project components to experience indirect impacts from multiple sources. A buffer of 250 m from the nearest project infrastructure is set as a basis for assessing indirect impacts on these sites.

The exact coordinates of the cultural heritage sites are known but are not included in Figure 7-19. Details are set out in Specialist Study 12 or in some instances (where they are confidential), are omitted and will be made available to the Ugandan environmental regulator and CNOOC, as required, to manage impacts.

7.4.1 Impact on Tangible Cultural Heritage

Thirty two archaeological / historic sites lie within the boundaries of the proposed footprint of the project (plus 15 m buffer), which includes the CPF, temporary and permanent camps, laydown yard, well pad, jetty, water intake, access roads and airfield). Eighteen sites are within the project footprint while the remaining sites are within the buffer. These sites are mapped in Figure 7-19, with the colour coding showing the type of site and its rated sensitivity.

The sensitivity of the archaeological / historic sites and the expected impact significance of project construction activities on them is briefly described below:

- The 'BO' (bone) sites are all faunal remains, none of which are fossilised. The remains are not expected to be of significant antiquity, research potential and site sensitivity are very low. Two sites are directly affected by the project footprint (BO-14 and BO-18) and will be lost and the record will be lost when the sites are destroyed (permanent duration). Impact will be local and impact magnitude will be low. Due to the permanent loss of information, even though the magnitude of the impact is low, impact significance will be **high medium;**
- The 'LI' sites are lithic archaeological sites from the Stone Age. A total of six sites are directly affected by the project footprint. LI-39 lies within the CPF footprint and may be associated ME-04, a metals site, possibly associated with an ancient burial. LI 39 has high sensitivity and its loss will cause impacts of high magnitude and **high** significance. Four of the other sites, directly affected by the temporary and permanent camps and well pad 4A, are middle and late Stone Age lithic scatter (LI-37, LI-38, LI-45, LI-46) with medium sensitivity, having some National research potential, impacts are of medium magnitude, but coupled with the permanent loss of research information, in the unmitigated case, will still result in impacts of **high** significance, although less than LI-39. Site LI-36 at the materials yard is scattered and has low sensitivity, but its destruction and the permanent loss of information will be of **high medium** significance in the absence of mitigation;

[43] *Indirect impacts do not affect historic and archaeological sites – therefore none of these sites are included in the 250 m buffer*

- The five LI sites within the 50 m buffer and 4 sites within the 50 m to 100 m buffer all have low sensitivity, being undated, scattered, material providing little research potential. The likelihood of physical construction damage or loss within the buffer zones is low and the overall impact significance is therefore low;
- The ‘ME’ site (ME-04) is a location where a bangle fragment has been found. This site is directly impacted by the footprint of the CPF and has high sensitivity, providing a rare example of metal objects and evidence of past metal production in the region. Together with LI-39, it relates to a possible ancient burial site. Regional research potential is high, and may be of National significance. The destruction of this site due to construction will result in the permanent loss of information at local scale, resulting in an impact of high magnitude and high significance; and
- The ‘PO’ sites consist of undated pottery scatter. Twenty-nine sites were found within the project footprint of well pad 4A, well pad 3 (and associated road infrastructure), and the materials yard. The seven sites at well pad 4A are Iron Age pottery scatter, with some research potential and medium sensitivity and magnitude. The destruction of the sites will result in the permanent loss of research potential, causing impacts of high significance. Well pad 3A affects a large concentration of Roulette tradition (late Iron Age) pottery scatter (PO 197–216), including decorated pottery. This is the most important pottery found on the Buhuka Flats, rated as highly sensitive, and its loss will result in impacts of high magnitude and **high** significance.

7.4.1.1 Management and Mitigation

The following impact mitigation and monitoring is recommended:

- There is potential for the disturbance of previously unidentified archaeological material (i.e. accidental damage or chance finds). Prepare a project-specific, ‘site ready’, Chance Find Procedure. This is a priority since preparation works and environmental studies are ongoing at the project site where highly sensitive artefacts have now been recorded. The Chance Find Procedure must be updated during the course of construction to make provision for a course of action in the event that any cultural heritage artefacts are recovered. It must also be provided to all contractors and consultants on the project site during all pre-construction and construction activity and incorporated within the project’s ‘site induction’ process. It must remain in place throughout construction. The Chance Find Procedure is to be a component of a detailed Cultural Heritage Management Plan (CHMP) (as required by IFC PS 8);
- Hold an urgent discussion with CNOOC to determine strategies for avoidance of those potentially highly sensitive archaeological sites identified within, or in close proximity to, the project footprint, which include sites within the Central Processing Facility; Pads 3 and 4A; the materials yard / the camps; and the jetty area;
- Undertake a further stage of cultural heritage study, as a priority, to verify the association (if any) of those surface artefacts recovered and potential sub-surface archaeological features indicative of settlement/industry. This would comprise shallow, targeted, hand-dug test pits (e.g., 1 m x 1 m in size) through which the archaeological potential could be firmly established and any further material analysis undertaken. This excavation programme will seek to eliminate the risk of archaeologically-induced delays during the construction phase;
- Implement a programme of pre-construction mitigation in the event that these targeted sites yield archaeological material. Avoidance (preservation *in situ)* is preferred but where this is not possible, “preservation by record” through systematic recording (e.g., archaeological excavation) is the only recourse. Such work, where required, must be described in appropriate detailed work programmes and specifications to be prepared by the cultural heritage specialist. To meet the requirements of Ugandan law this work should be carried out by a suitably qualified person under a licence for archaeological survey as issued by the Minister. In the event of artefact recovery, all materials should be surrendered to the National Museum; and

- Monitor the impact of construction on archaeology in the form of a 'watching brief', if necessary, once the test pitting exercise has better established or dismissed the extent of any below-ground archaeological potential. The watching brief will occur during all ground intrusive activity which form part of the construction phase and include an archaeologist in attendance. The watching brief will involve monitoring soil removal / land take for the presence of cultural heritage material. The archaeologist must have the authority to stop construction work in the event that significant materials (e.g., burial sites, iron furnaces) are exposed. These sites will be recorded in full employing 'preservation by record'. The results of the watching brief must be presented to the relevant local authority. Provisions should be made to exhibit materials to interested stakeholders, including the local community.

7.4.1.2 Impact Significance Rating

Table 7-39: Impact on tangible cultural heritage

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Bone Scatter: BO-14, BO-18	4	5	2	5	High Medium 55	2	1	2	4	Low 20
Lithics: LI-36	4	5	2	5	High Medium 55	4	1	2	4	Low 28
Lithics: LI-45, LI-46	8	5	2	5	High 75	5	1	2	5	Low Medium 40
Lithics: LI-37, LI-38, LI-39	9	5	2	5	High 80	5	1	2	5	Low Medium 40
ME 04	9	5	2	5	High 80	5	1	2	5	Low Medium 40
Pottery Scatter: PO-75, PO-85	4	5	2	5	High Medium 55	4	1	2	4	Low 28
Pottery Scatter: PO-197, PO-198, PO-199, PO-201, PO-202, PO-204, PO-205, PO-208, PO-210, PO-216	9	5	2	5	High 80	5	1	2	5	Low Medium 40
Pottery Scatter: PO 185 -189, PO-192	8	5	2	5	High 75	5	1	2	5	Low Medium 40

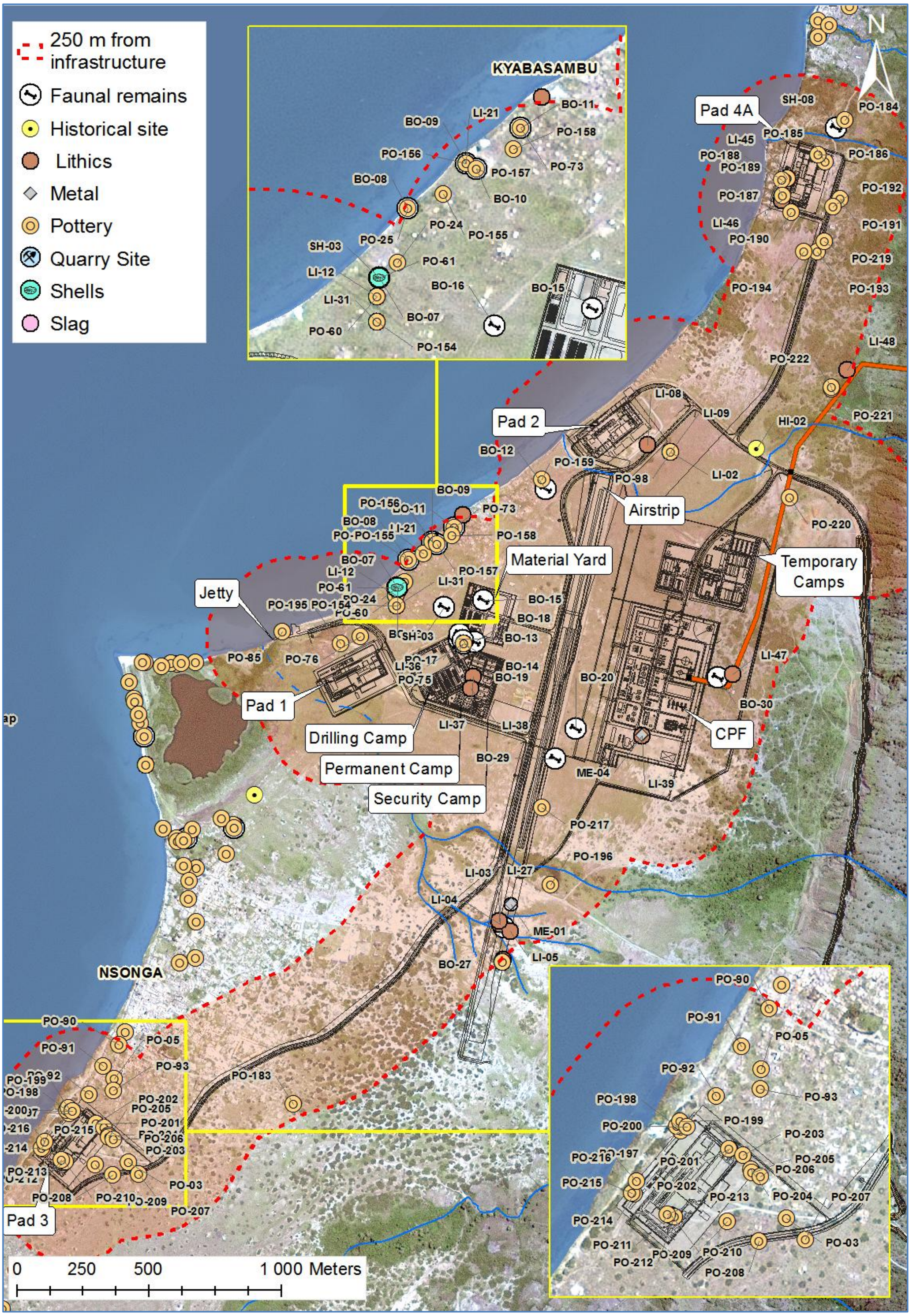

Figure 7-19: Archaeological heritage sites directly affected or potentially affected within 250 m of the project footprint

7.4.2 Impact on Intangible Cultural Heritage

According to the 2003 ‘Convention for the Safeguarding of the Intangible Cultural Heritage’ (UNESCO), the intangible cultural heritage (ICH) – or living heritage – is the mainspring of humanity's cultural diversity and its maintenance a guarantee for continuing creativity. In the context of the Project area intangible heritage is defined as the traditional practices, cultural norms and knowledge transmitted from one generation to the next, which communities or individuals recognise as part of their cultural heritage. These elements are recognised by Uganda’s Cultural Policy (2006).

The spiritual life of local communities on the Flats is likely to be affected by a range of factors associated with the presence of the project, none of which depends solely on physical damage to valued sites. Seventeen cultural sites lie within the boundaries of the proposed footprint of the project 9or within 15 m of the boundaries), which includes the CPF, temporary and permanent camps, laydown yard, well pad, jetty, water intake, access roads and airfield). A further 36 sites are in close proximity, within the 250 m buffer. These sites are mapped in Figure 7-20, with the colour coding showing the type of site and its rated sensitivity. The sensitivity of the cultural sites and the expected impact significance of project construction activities on them is briefly described below:

- The ‘CE’ sites are cemeteries that are all highly sensitive. They are associated with ancestors, present families and/or settlement founders and are frequented by the communities for longstanding cultural purposes. There are four CE sites that will be directed impacted by well pad 4A and associated flowline. Impact magnitude will be high, with the destruction of the grave causing permanent loss for the local family. Impact significance will be **high.** There is also a risk of damage to or nuisance affecting seven other sites within the 250 m buffer around well pad 3 and the airfield. In these cases, the impact magnitude will still be high but the probability of impact will only be medium, reducing the significance to **high medium**;
- The ‘CH’ sites are churches. None of these will be directly affected by the construction footprint but twenty three are within the 250 m buffer zone of well pads 3 and 4A, the materials yard and the flowlines / new road segments (Figure 7-20). The magnitude of impact on churches is considered to be medium since they are used by the local community (individual villages) and can be rebuilt in another location (relocated) if required. Impact will therefore be short term and impact significance **low medium.**
- The ‘CL’ sites are cultural landscapes. Three areas of cultural landscape (**CL-01** - **CL-03**) were identified which have been recognised with reference to the UNESCO definition of an ‘associative cultural landscape’: “…*justifiable by virtue of the powerful religious, artistic or cultural associations of the natural element*”. Lake Albert (CL-01), the Escarpment (CL-02) and the viewpoint (CL-03), on the escarpment road, are iconic features of the natural landscape, defining the local (communal) sense of place and apparent (traditional) cultural associations with the natural environment (rivers, lakes, trees). These sites are highly sensitivity and impact magnitude will be high. They may be impacted by increased noise, dust and visual disturbance. Indirect impacts are likely although the probability of the impact is uncertain, resulting in an overall significance rating of **high**;
- The ‘RS’ sites are ritual sites with high sensitivity, one of which is within 15 m of proposed project infrastructure and is therefore vulnerable to damage or destruction during construction. This is the Afrocreed Swamp site (**RS-08**) (for the extraction of holy water) which could be directly impacted by preparation for the flow line to well pad 3. Other sites that are within 250 m of project infrastructure and could be impacted by dust, noise and other construction-related nuisance, are the Eye of the Lake (Luzira) (**RS-02**), which is associated with the Bukoma lagoon, RS-01 and RS-03 (Kasonga beach sites between the jetty and Nsonga), and RS-09 and RS-10 (known as the Coet/Kuwait site). Sites RS-02 and RS-03 have been particularly noted by all communities on the Buhuka Flats as being important. These sites are considered to be ‘non-replicable’ (and potentially immovable) cultural heritage sites as defined by IFC (PS 8, 2012). If they are affected by nuisance, the impacts would be of high magnitude. The probability of the impact is uncertain, resulting in an overall significance rating of **high**; and

- The ‘SR’ sites are sacred rivers. The Kamansinig River (SR-02), south of the airstrip and in proximity to Well Pad 1 and the Jetty upgrade site is of high value and sensitivity, mainly in the area of the lagoon. This site may be indirectly affected during site construction works, particularly due to noise, visual and dust impacts. Impact magnitude is potentially high, if the site are impacted, and with an uncertain probability of occurrence impacts will be of **high** significance.

It is difficult to predict how and when changes to intangible heritage will occur during project construction. Some cultural change is inevitable. The influx of people seeking work or other indirect socio-economic benefits, together with any loss of access or changes in environmental setting of sites used for traditional activities, is likely to have an impact. Determining the severity of this impact is subjective with deviation from the local cultural norm perceived as either positive or negative by different people. An influx of migrants may either strengthen or weaken local cultural practices over the project lifetime. If impacts were to occur they would be of unknown/long term and potentially of medium magnitude and major significance.

Particularly sensitive sites that are outside of the 250 m buffer zone but could still be indirectly affected are the sacred River Masika (SR-01) and the site of the Nsunzu Sacred Tree (ST-01), with its many associated myths and taboos.

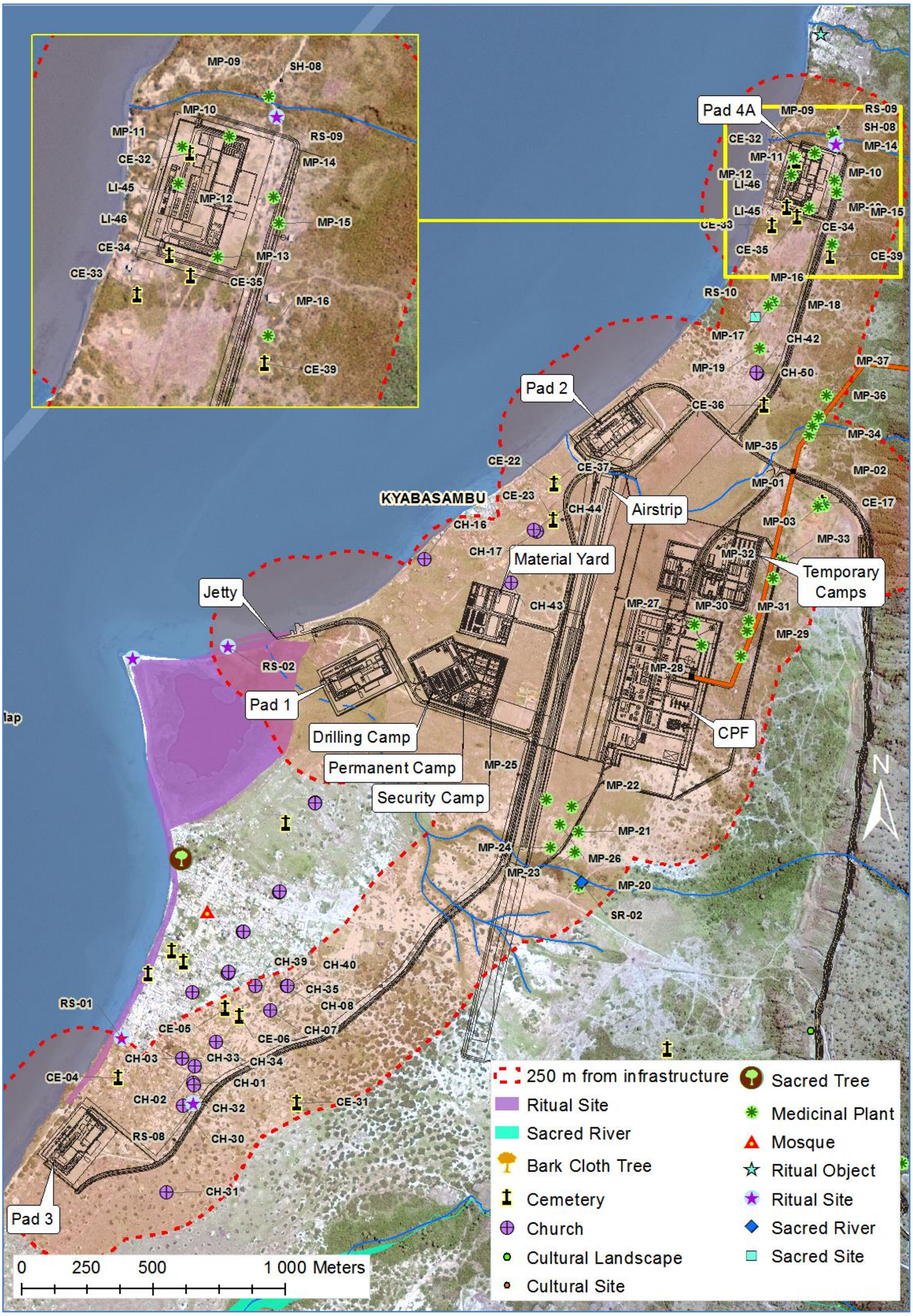

Figure 7-20: Intangible cultural heritage sites directly affected or potentially affected within 250 m of the project footprint

7.4.2.1 Impact Mitigation and Monitoring

A number of highly sensitive, unique, cultural and sacred sites exist in the KFDA. The following mitigation is recommended:

- Prepare a 'site ready' Cultural Heritage Management Plan (CHMP) for the Project area. The CHMP is to highlight the presence of culturally significant places to contractors at an early stage and specify further management necessary (e.g., demarcation/ signage) as required for individual sites;
- Seek to manage and mitigate the identified impacts on cultural resources throughout the construction phase in participation with local communities and identified site guardians. Regular platforms for community liaison are recommended in this regard. This will help to prevent any further (accidental) loss of sensitive cultural assets throughout the pre-construction and construction phases;
- Facilitate respect for local intangible cultural heritage, tradition and taboo through induction and ongoing education of construction personnel - regular platforms for community liaison are recommended in this regard (and detailed within the CHMP);
- Set out a strategy for maintaining community access to sacred sites and facilitating respect for local intangible cultural heritage, tradition and taboo, to ensure that the negative socio-cultural effects are effectively mitigated;
- Avoid all affected cemetery sites as the preferred mitigation. Where avoidance is not possible, a full mitigation strategy should be developed in conjunction with affected communities and the guardians of those sites. If the cemetery sites are found to be adjacent (rather than within) the areas of proposed activity appropriate signage and demarcation is recommended to protect these sites. It will remain important, as the project progresses, to consult with local communities about potential further impacts to other cultural sites in the vicinity;
- Demarcate other sacred sites that have been identified within the project area and make provision for site-specific monitoring as the Project is finalised. These sites may be affected by (as yet undefined) project access routes. Where a change in a site's setting is anticipated, planting (e.g., screening) may be considered to minimise adverse visual impacts. Any mitigation measures must be agreed with the affected community;
- Enhance or protect the environmental setting of selected cultural heritage sites in consultation with the local community e.g. through planting/screening;
- Demarcate areas that should be avoided at certain times of the week/year by construction activities that cause nuisance, so as to minimise disturbance of nearby traditional ceremonial activities; and
- Highlight the presence of culturally significant places to contractor at any early stage and further manage these (e.g., demarcation/ signage) as required. Provide for this should be incorporated into the CHMP.

7.4.2.2 Impact Significance Rating

Table 7-40: Construction phase impacts on intangible heritage

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Church (CH): CH-01, CH-02, CH-03, CH-07, CH-08, CH-16, CH-17, CH-30, CH-31, CH-33, CH-34, CH-35, CH-39, CH-32, CH-33, CH-34, CH-35, CH-39, CH-40, CH-42, CH-43, CH-44, CH-50	6	2	2	5	**Low Medium 50**	5	1	2	3	**Low 24**
Cemetery (CE): CE-32*, CE-34*, CE-35*, CE-36*	8	5	2	5	**High 75**	2	1	2	5	**Low 25**
Cemetery (CE): CE-04, CE-05, CE-06, CE-31, CE-22, CE-23, CE-37	8	5	2	5	**High 75**	2	1	2	5	**Low 25**
Cultural Landscapes (CL): CL-01, CL-02	10	5	2	5	**High 85**	5	2	2	5	**Low Medium 45**
Ritual Sites (RS): RS-01, RS-02, RS-03, RS-08*, RS-09, RS-10	10	5	2	5	**High 85**	5	2	2	5	**Low Medium 45**
Sacred River (RS): SR-01	10	5	2	5	**High 85**	5	2	2	5	**Low Medium 45**
Sacred Tree (ST): ST-01	8	5	2	5	**High 75**	4	4	2	5	**Low Medium** 50

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

8.0 OPERATIONAL IMPACTS

The impact of the CPF and associated infrastructure is discussed in a series of five chapters that address impact and mitigation during construction (Chapter 7), operational (Chapter 8) and decommissioning (Chapter 9) of the CPF and associated infrastructure, a discussion on unplanned events (Chapter 10) and a discussion of the alternatives which were considered in development of the CPF and associated infrastructure (Chapter 11).

The current chapter, Chapter 8, describes the impacts associated with operation of the CPF and associated infrastructure

In this section, operational impacts are divided into biophysical, socio-economic and socio-cultural impacts. Physical impacts that have social consequences, such as noise and visual aesthetics, are included under socio-economic and socio-cultural impacts. Where impacts have biodiversity and social consequences (for example, impacts on surface water or groundwater), they are discussed under both sections.

Impact evaluation is in accordance with the general methodology described in Section 6. Where more detailed interpretation of the methodology is required, for a particular impact category, this is described in the relevant section.

8.1 The Physical Environment

8.1.1 Air Quality

8.1.1.1 Methodology

The assessment of operational phase air quality impacts considers the impacts of the operational activities at the CPF and associated infrastructure as well as the impacts of drilling, which will continue in parallel with the operation of the plant for around 5 years. Air quality impact in the operational phase will last for 25 years, based on current estimates of the lifespan of the project.

Figure 8-1 provides a simple illustration of the sequence of steps taken to determine air pollution impacts.

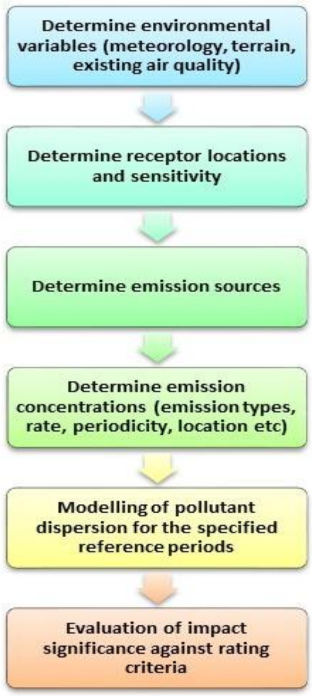

Figure 8-1: Steps involved in the air quality assessment

Existing meteorological data was obtained from the Penn State University (PSU) / National Centre for Atmospheric Research (MM5 data) for the Buhuka Flats for the period 01 January 2011 to the 31 December 2013 (3 years). The data was confirmed to be representative of the actual meteorological conditions in the study area. The existing airshed was assumed to be unaffected by any pollution.

Air pollutants assessed in Specialist Study 1 included nitrogen dioxide (NO_2), sulphur oxides (SO_X), carbon monoxide (CO) and particulates (TSP, PM_{10}, $PM_{2.5}$ and dust fallout). Additional pollutants that were considered included hydrogen sulphide (H_2S); volatile organic compounds (methane and ethane; BTEX; glycols; and polycyclic aromatic hydrocarbons). Source emissions data were obtained from international references based on CNOOC's description of equipment types. Emission rates and location for specified equipment were obtained from the project description.

To assess the potential air quality impacts associated with the project, standard internationally accepted evaluation criteria were used. These were derived from the maximum permissible air quality limits set by the IFC (2007) and other international air quality guidelines. While Draft Ugandan air quality standards were published in 2005 (NEMA, 2005) these are less stringent than the IFC guidelines and have not been promulgated into law.

Following the general ESIA impact rating guideline described in Section 4.5, impact significance is determined by a combination of magnitude, duration, geographical extent and probability of occurrence, combined numerically. In the present case, the magnitude rating in Table 8-1 is based on air quality guideline values set out by the IFC (2007). Hence Table 8-1 shows that impact magnitude is a simple relationship between intensity (percentage in relation to the guideline value), and the number of resident people affected (in the final case, where the guideline value is exceeded, the number of people affected is no longer material). As a general rule, the IFC suggests 25% percent of the applicable air quality standards as a limit to allow additional, future sustainable development in the same airshed. The value of 25% is therefore a reasonable threshold distinguishing impacts of negligible magnitude from those that are more substantial.

Table 8-1: Ratings used to determine the magnitude of air pollution impacts

Criterion	Rating	Definition
Magnitude	negligible	Pollutant concentration ≤ 25% of guidelines, very little human exposure[1]
	low	Pollutant concentration >25% and ≤ 50% of guidelines, mainly community land and grazing areas
	medium	Pollutant concentration >50% and ≤ 100% of guidelines, some settlement
	high	Pollutant concentration >100% of guidelines, any degree of human use

While the dispersion of most of the gaseous pollutants referred to above was mathematically modelled for the operational phase of the project, only NO_2 is described in this section, **since it is the only modelled pollutant where ground level concentrations at the nearest receptors approach the 25% guideline threshold** (Table 8-1). Specialist Study 1 provides details of the assessment of the other pollutants. The NO_2 emissions were conservatively assumed based on EPA emission factors. These are higher than the IFC emission guideline limits but provide for a conservative assessment. In reality, it is likely that most of the new

[1] *As a general rule, the IFC General EHS Guideline suggests 25% percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed.*

combustion equipment that is installed will meet the IFC guidelines and the NO_2 concentrations in surrounding communities will be lower than predicted in Section 8.1.2.2.

The IFC guidelines for NO_2 are shown in Table 8-2.

Table 8-2: IFC guideline limits for nitrogen dioxide (NO_2)

Parameter	Period	Unit of Measurement	Standard
Nitrogen dioxide	Max hourly (99th percentile)	µg/m^3	200
	Max annual	µg/m^3	40

Note: For the dispersion simulations, 3 years of recent meteorological data were used to allow for seasonal and annual variations. For ***maximum hourly average values (99th percentile):*** *there will be 365 x 24 x 3 = 26 280 values for each receptor, the 99th percentile of the 26 280 values is reported. For* ***maximum annual values****: there will be 3 values for each receptor (calculated by averaging 365 x 24 = 8760 hourly values for each year); the highest of the three annual values is reported.*

For the dispersion modelling, the Penn State University (PSU) / National Centre for Atmospheric Research (NCAR) meso-scale model (version 2) model was used. This internationally recognized model takes into consideration a wide range of parameters including the location of the emission source(s), the emission rates and concentrations, the height of the source(s), atmospheric dispersion potential (factors like air buoyancy and mixing potential), wind speed and direction and terrain. It was assumed that all of the fuel gas produced at the plant would be burned, either to supply the plant power demands, for export or as a result of flaring. Modelling was based on normal operating conditions.

A variety of model outputs can be generated showing pollutant concentrations with increasing distance from the source(s). The figures presented in Section 8.1.2.2 below provide a colour coded representation of impact, shown in relation to the guideline value.

8.1.1.2 Impact of Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a pollutant generated by combustion (e.g.: vehicles, gas and diesel-driven generators). Figure 8-2 and Figure 8-3 present the expected NO_2 concentrations at the nearest receptors during the operational phase. The key sources on the well pads are the generators driving the drilling rigs. At the CPF, the sources are were the gas engines driving the power generators and fugitive emissions from the oil storage tanks. Beyond the CPF and well pads, other sources include heavy vehicles and a diesel-driven generator at the safety check station. For ease of reading, Figure 8-2 and Figure 8-3 show the consolidated impacts of drilling on the four well pads combined with the operational impact of emissions from the CPF and associated infrastructure- the impacts will, in fact, not occur simultaneously since there will be only one drilling rig on site at any time. Nevertheless, drilling is a continuous (day and night) activity, and the drilling of multiple oil and reinjection wells on the same well pad will mean that the emission source in one location will continue over an extended period. In sequence, the drilling during the operational phase is expected to be as follows:

- Well Pad 2 (540 days);
- Well Pad 1 (165 days);
- Well Pad 3 (465 days); and
- Well Pad 4A (615 days).

The IFC thresholds for hourly and annual exposure have been applied.

The following is concluded from Figure 8-2 and Figure 8-3:

- None of closest residents to the CPF or the well pads in Kyabasambu, Nsonga and Nsunzu will experience maximum hourly NO_2 concentrations that exceed the threshold between negligible and low magnitude (25% of the guideline value, which is a concentration of 50 ug/m^3). Combined with the long term effect of the CPF drilling emission sources (the worst case - drilling impacts will be short term) and the local scale, the impact significance will be **low**; and
- None of closest residents to the CPF or the well pads in Kyabasambu, Nsonga and Nsunzu will experience maximum annual NO_2 concentrations that exceed the threshold between negligible and low magnitude (25% of the guideline value, which is a concentration of 10 ug/m^3) and most will not exceed 10%. Impact magnitude will therefore be negligible. Given the long term and local scale, the impact significance will be **low.**

8.1.1.3 Impact of Particulates

Particulate dispersion (PM_{10}, $PM_{2.5}$) caused by combustion emissions were modelled for the operational phase but are not mapped since the concentrations beyond the plant boundaries were negligible. Fugitive particulate emissions are also not included here since earthworks will have been completed during construction and are not a factor during the operational phase of the project.

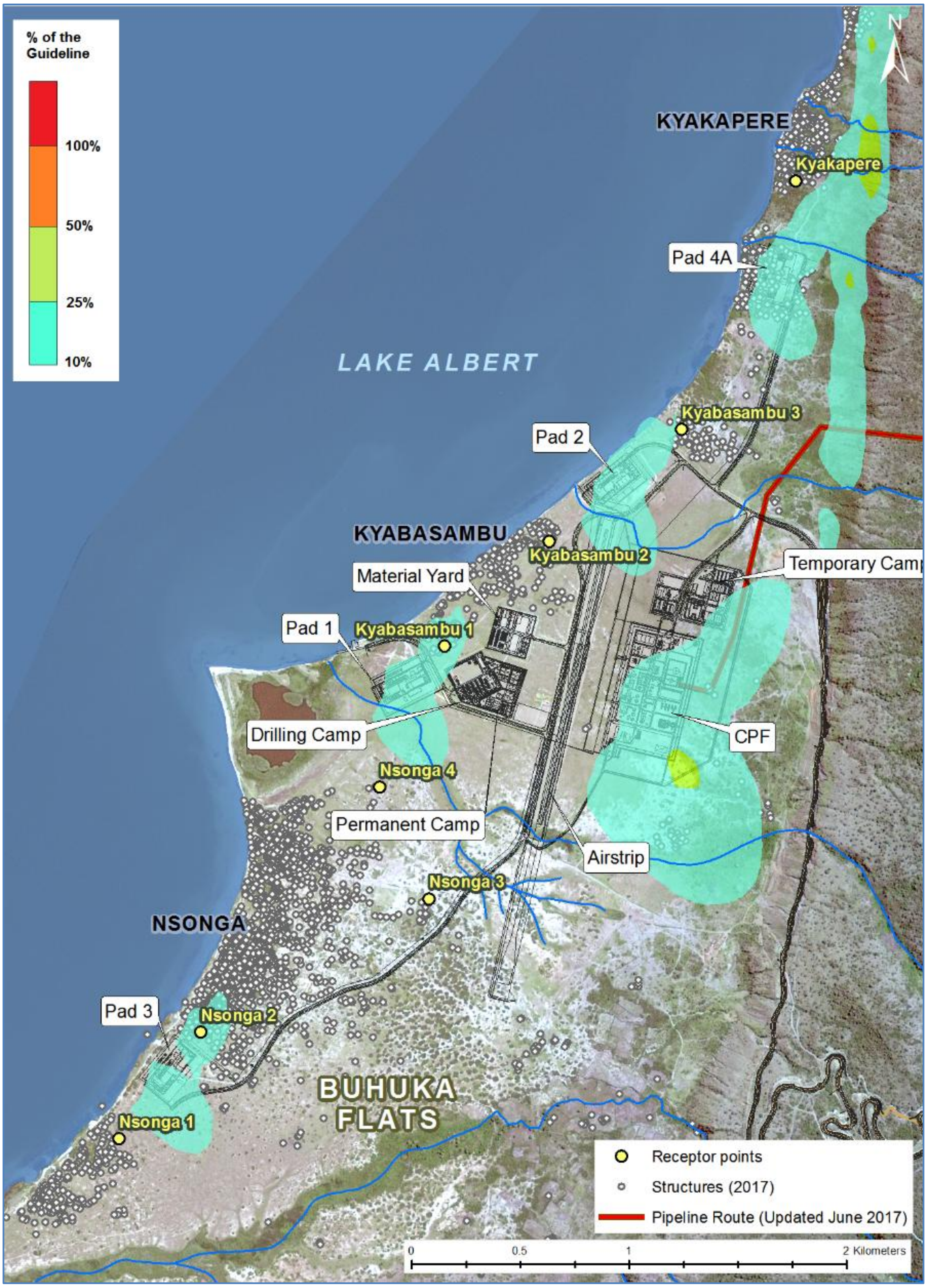

Figure 8-2: Consolidated map showing maximum hourly concentrations of NO_2 resulting from emissions at the CPF and from well pads 1, 2, 3 and 4 during the operational phase (note that emissions on the well pads are short term and will not all occur at the same time)

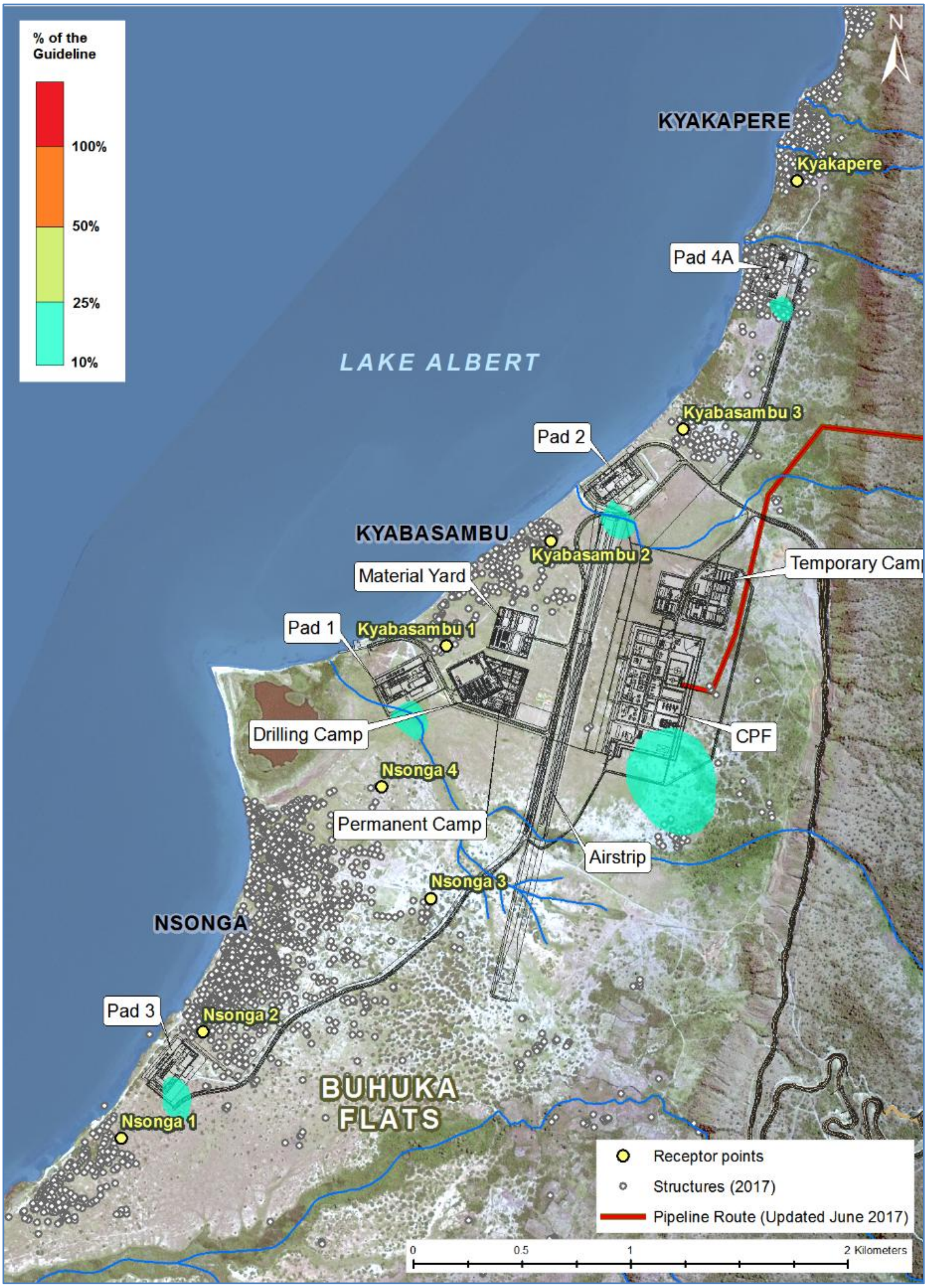

Figure 8-3: Consolidated map showing maximum annual concentrations of NO_2 resulting from emissions at the CPF and from well pads 1, 2, 3 and 4 during the operational phase (note that emissions on the well pads are short term and will not all occur at the same time)

8.1.1.4 Impact of increased Domestic use of Fuel Wood and Charcoal

The project is expected to cause a continuing increase in populations on the Buhuka Flats, due to migration of people into the area in search of work. The magnitude of this increase cannot easily be estimated but without mitigation is expected to be significant. A large increase has already been experienced due to the construction of the access road, which is directly linked to the project (while having been approved under a separate application). Air quality impacts caused by cooking fires (PM_{10}, NO_2) could become significant, exceeding guideline limits for short and long term exposure, particularly during periods of temperature inversion. This impact will be long term, largely irreversible, and of medium and possibly even high magnitude (causing exceedance of the guideline limits for large numbers of people on Buhuka Flats). The resulting impacts will be of **high** significance.

8.1.1.5 Mitigation and Monitoring

Recommended mitigation and monitoring for air quality impacts on the Buhuka Flats are as follows:

For particulates (as per the construction phase):

- Use wet suppression and wet misting should materials handling activities take place;
- Use wet suppression on any unpaved roads with water or a suitable dust palliative to achieve 50% control efficiency or better (note: water alone will only achieve a 75% control efficiency);
- Wind speed reduction through or wind breaks for open exposed areas prone to wind erosion. Wind breaks can be temporary screens or shade cloth barriers on exposed areas until such time as such areas revegetate;
- Cover stockpiles and keep stockpile heights as low as practicable to reduce their exposure to wind erosion and dust generation;
- Reduce unnecessary traffic;
- Control vehicle speeds and institute traffic calming measures to reduce vehicle dust entrainment;
- Train all personnel who operate heavy equipment to be aware of and minimise dust generation;
- Monitor dust generation through visual observation and by means of dust samplers for PM_{10} and dust fallout. Include a background monitoring station at a location representative of the local area but unaffected by any dust generated by the project; and
- Act immediately on any dust episodes that are clearly resulting in nuisance in adjacent communities. This implies competent, effective, and full time environmental personnel at the CPF.

For NO_2:

- Maintain and service all vehicles and diesel generators regularly to ensure that exhaust particulate and trace gas emissions are kept to a minimum with post-combustion control measures;
- Use low sulphur fuels to minimise SO_2 emissions;
- Consider emission technology for gas engines that meets the IFC emission requirements;
- Implement annual emission testing of the main emission sources;
- Develop and maintain a site-wide emissions inventory for the project;
- Continue to operate and maintain the site-specific particulate monitoring and trace gas monitoring network established during the construction phase;

- Re run the air dispersion model to verify the operational ambient air quality impacts on surrounding receptors every 5 years or when a significant change to operations takes place. Calibrate the dispersion model using actual emission data and measured results from the monitoring network;
- Audit and optimise the air quality monitoring network annually to ensure that it is maintained in accordance with best practice and is relevant to the key emission sources on the ground.
- Update the air quality management plan every 5 years, based on the accumulated results.

For impacts caused by population increases:

- Develop and implement a plan to supply all inhabitants on the Buhuka Flats with basic services, including electric power (Government responsibility with CNOOC participation).

8.1.1.6 Impact Significance Rating

Table 8-3: Operational phase impacts on air quality

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Nitrogen dioxide (NO_2) - Hourly	1	4	2	4	Low 28	1	4	2	4	Low 28
Nitrogen dioxide (NO_2) - Annual	1	4	2	4	Low 28	1	4	2	4	Low 28
Particulates	1	4	1	4	Low 24	4	2	2	5	Low 24
NO_2 and Particulates (indirect impact due to in-migration)	9	4	2	5	High 75	2	4	2	4	Low 28

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

8.1.2 Surface and Groundwater

8.1.2.1 Impact on Water Levels in Lake Albert

The project will use approximately 390 m^3 of water per hour, drawn from Lake Albert. This will not impact significantly on water levels in the lake, even when considered in relation to the cumulative effect of water abstraction for the other oil projects (see Section 16 for the consideration of alternative water supply schemes). Impacts will be long term and of negligible magnitude, but due to the regional scale will result in impacts of **low medium** significance.

The project will not draw water from local streams nor from local groundwater sources. Direct impacts on community water supplies, due to competing project use, will therefore not occur.

8.1.2.2 Impact on Surface and Groundwater Quality

8.1.2.2.1 Erosion and Sedimentation

During the operational phase, exposed soils resulting from construction will have been rehabilitated and should not be a significant source of additional sediment into local drainage lines. During this phase of the project, the more likely source of sediment into Lake Albert will be erosion in the drainage lines, caused by the concentration of stormwater runoff. The soils of the Buhuka Flats are dispersive and highly erodible, with active soil erosion already evident in places. Increased stormwater runoff is likely to cause channel erosion in River 1, north of the CPF, where most of the intercepted drainage from the production facility will be routed, as well as the drainage from the CPF itself (Figure 8-4). The Kamansiniga River may also experience increased stormwater flows, and a higher risk of channel erosion and sedimentation. Some of the sediment-laden stormwater may be trapped by the vegetation in the river floodplains, but it is expected that erosion and sediment deposition into Lake Albert via the above two drainage lines will increase, contributing to measurable increased turbidity during and after storms.

A further effect which is already being experienced is the influence of road drainage on flow in the local stream channels, causing back up above the culverts and increased areas of stagnant water. This is a source of complaint among villagers. This is discussed in more detail under impacts on wetlands (Section 8.2.1.3).

Overall, the project is expected to cause local impacts of medium magnitude on erosion, sedimentation and flow in the drainage lines of the Buhuka Flats, which in the context of the long term will result in **low medium** impact significance.

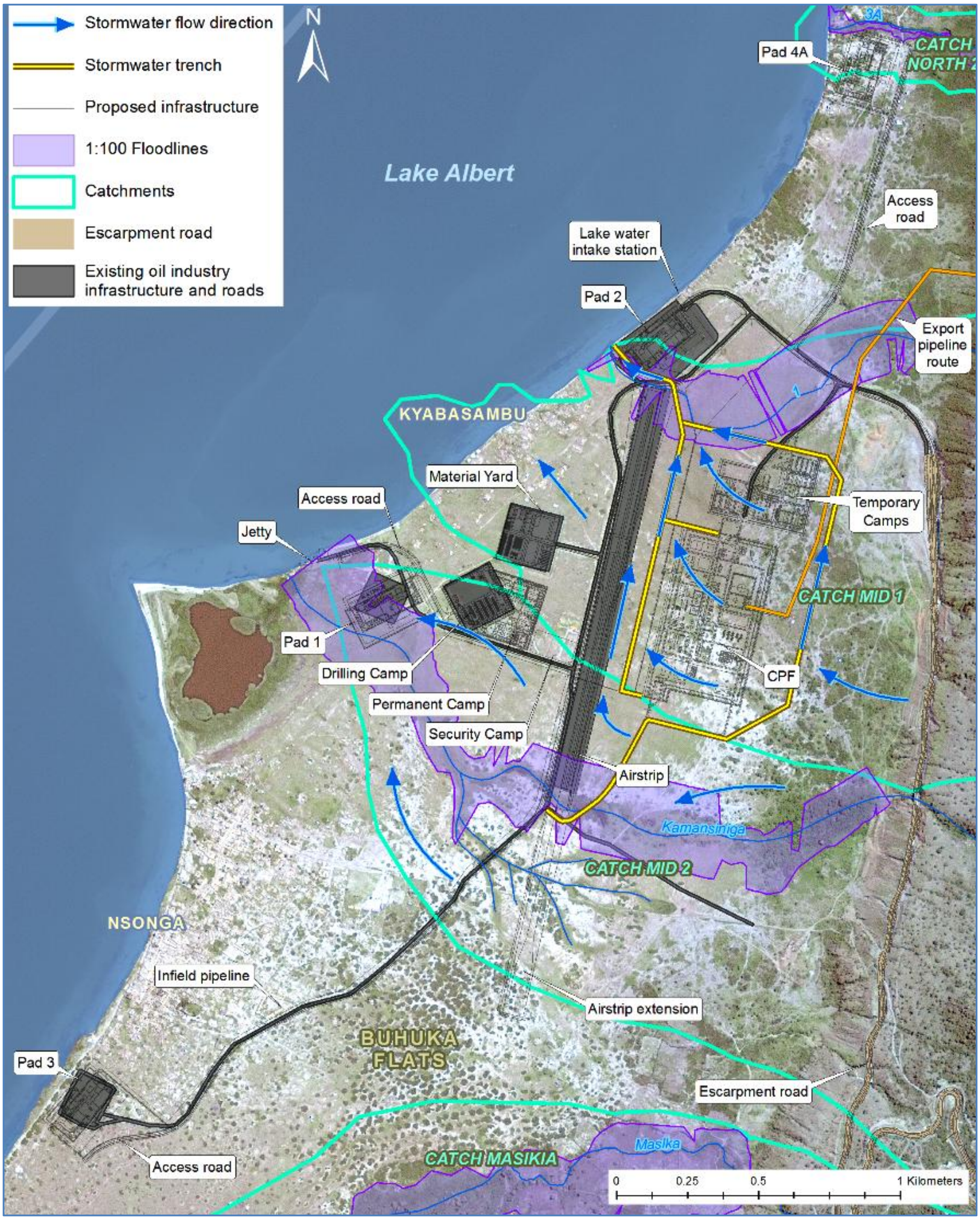

Figure 8-4: Direction of drainage from the operational areas

8.1.2.2.2 Oil and Chemical Pollution

Oil and chemical pollution of Lake Albert could be caused by the discharge of contaminated process effluents, the discharge of oil-contaminated stormwater or by poor hazardous product and waste management, resulting in the escape of contaminants into the surrounding drainage lines and the lake, with impacts on the wetland and aquatic biota in the streams and lake and the human communities dependent on them.

The potential sources of pollution will be located at the well pads, where drilling will continue for the first 5 years of the operational phase; at the CPF, where all of the production-related waste and effluent management will take place; and at the safety check station, where vehicle inspections and minor repairs will take place.

Pollution Control at the Well Pads

The project base case provides for the separation and capture of potentially contaminated stormwater on the well pads, to be treated to the required project specification of 10 mg/l oil and grease before release into the environment. All drilling waste is to be contained in impermeable storage facilities before being removed by a waste contractor to approved disposal facilities. Photograph 8-1 shows the current arrangements for the storage of drill cuttings and waste fluids. This approach may be modified in the design of the drilling phase for the production wells in order to improve dewatering and re-use of drilling fluids. Regular removal of drilling wastes, stored in skips, is also being considered as a means of reducing the total inventory of waste held on site and thus minimising the risk of accidents.

Photograph 8-1: Current arrangements for the temporary storage of drilling waste on the Buhuka Flats

Pollution Control at the CPF

The project is designed to eliminate the release of any process effluents from the CPF into the natural environment. The major hazardous effluent stream will be produced water, which contains hydrocarbons. This water will be separated from the oil and cleaned at the CPF by means of staged oil separators to meet the project standard, after which it will be pumped to the well pads and disposed down the reinjection wells. This is recognized best practice for the disposal of produced water, avoiding the risk of large quantities of potentially off-specification oil-contaminated effluent being discharged to surface waters. Section 2 provides details of the methodology.

Hydrocarbon sludges collected by the oil separators will be collected, contained within the hazardous areas of the plant, and removed by a hazardous NEMA-certified waste contractor to a registered hazardous waste disposal site.

Potentially Oil Contaminated (POC) stormwater or spillages generated in the defined hazardous areas of the CPF will be collected in the open drain system for delivery to the API oil separator. API separators are designed to separate gross amounts of oil and suspended solids from the water. The first 15 minutes of any storm will be captured and routed through the API separator, before being delivered to the secondary treatment section of the produced water treatment system for further treatment and disposal with produced water. A maximum 15-minute stormwater runoff value of 120 m^3 (equivalent to runoff of 478 m^3/hr) is provided for. The balance of any stormwater will be captured in a stormwater pond, tested and released into the environment, if it meets the discharge specification of 10 mg/l. All stormwater from designated non-hazardous areas of the plant will be released directly from the open drains, without testing.

A wide range of hazardous and non-hazardous wastes will be generated during the operational phase of the CPF. The typical wastes expected during the operational phase are described in Section 2 and in Specialist Study 5 and in the mitigation for waste set out in Table 8-4. Much of this will be regarded as petroleum waste, based on the definition in Schedule 2 of the Ugandan Draft Petroleum Waste Act (2006). Other hazardous wastes will be contained, in some cases drummed, and temporarily stored in designated hazards and non-hazardous holding areas at the CPF for collection by waste contractors, or in the case of recyclable / reusable wastes, for removal in accordance with any agreements between CNOOC and local recyclers in this regard.

Pollution Control at the Safety Check Station

Potentially oil contaminated stormwater from the parking area and flushing area at the safety check station will be directed through perimeter drains to an oil separator (‘oil water pit’) located at the northwestern corner of the station perimeter.

Impact of Oil and Chemical Pollution

While these embedded control systems are designed to minimize the risk of hydrocarbons escaping from the CPF, well pad and safety check station environs, the absence of a buffer between the well pads and the lake, and the small buffer between the CPF and the lake, coupled with the large volumes of effluent and solid waste handled, makes it probable that hydrocarbon-contaminated drainage above the specified limits of 10 mg/l could occasionally be discharged into River 1 or the Kamansinig River and/or reach the near-shore habitats of the lake, unless there is a very high level of control of day-to-day effluent and waste management activities.

This impact is assessed in the context of the sensitivity of the near-shore environment to oil and chemical contamination. The concentration of hydrocarbons in the wetlands and lake water is currently below levels that could cause harm in the natural environment. Some invertebrate species such as aquatic snails (Araujo et al. 2012), mayflies (Savić et al. 2011) and juvenile fish (for example, Agamy 2013) are highly sensitive to chemical pollutants, particularly hydrocarbons. The critically endangered mud snail, *Gabbiella candida*, which possibly occurs in the sediments along the lake shore at the Buhuka Flats, is likely to be similarly sensitive to hydrocarbon pollution. In the absence of fail-safe mechanisms to prevent pollution, this will result in a local impact of high magnitude. The probably of an occasional event of a release of hydrocarbon - contaminated water into River 1, the Kamansinig River and / or Lake Albert at concentrations exceeding the project standard is uncertain (but is considered ‘definite’, as a conservative estimate), resulting in **high** impact significance**.**

8.1.2.2.3 Treated Sewage Effluent Discharge

The permanent camp will be fully sewered, with raw sewage and grey water from kitchens, bathrooms and administration areas being delivered to a sewage treatment plant. Sewage from the safety check station will be collected from a septic tank and transferred to the sewage treatment plant at the existing drilling camp. Sewage from the CPF will be routed via conservancy tanks to a regulating tank at the permanent camp, from where it will be treated in a Membrane Bioreactor sewage treatment works. Options for final disposal of treated sewage effluent include the base case (discharge into perimeter drains around the permanent camp, leading into River 1 and Lake Albert, irrigation onto land in the buffer area around the CPF and at the personnel camp lawns and gardens, and discharge into an artificial wetland or sustainably managed plantation.

The capacity of the plant will be ~45 m^3/day, sized to meet peak operational demands when 135 personnel plus a contingency are on site. Backup sewage treatment capability will be provided by the sewage treatment plant built to supply the drilling camp, which has spare capacity for an additional 90 people. The plant will be designed to comply with the Ugandan Government effluent discharge standards, or where appropriate, IFC standards where these are more stringent. Key parameters for domestic wastewater are oil and grease (10 mg/l), total nitrogen (10 mg/l), phosphate (10 mg/l), total phosphorous (2 mg/l), soluble phosphorous (5 mg/l), BOD (30 mg/l) and total suspended solids (50 mg/l).[2] Treated sewage effluent that meets these criteria will be discharged according to one of the methods described above.

Sewage plants associated with remote industrial plants often perform poorly. Typically, this is due to a lack of appropriate plant management, the wrong selection of plant technology for a remote area, and/or under-capacity of the plant. In CNOOC's case, the project specification is designed to accommodate the maximum personnel compliment during construction, thus any non-compliance would be more likely to be due to management issues or inappropriate selection of sewage treatment technology. For this assessment, it is assumed that occasional non-compliance with the standards is likely to occur in the unmitigated case. In such cases, elevated nitrogen is often a key non-compliance, together with high COD and BOD, due to incomplete digestion of the sewage at the sewage treatment works.

Out-of-specification sewage effluent discharged into Lake Albert will increase the risk of eutrophication and aquatic invasive weeds in the near-shore lake habitats. This will be exacerbated if the treated effluent is released into River 1, which is largely canalized at its lower end, resulting in a point source discharge. Impacts are likely to be of medium magnitude, long term and local scale) with little risk of accumulation due to the size of Lake Albert and dispersion by currents. The impact is highly probable, resulting in an overall rating of **low medium** significance, indicating that alternatives or other management measures should be considered.

8.1.2.3 Mitigation and Monitoring

The following mitigation and monitoring is recommended to minimize the risk of operational impacts on water quality. Requirements for management of pollution risk during the drilling of wells are included in Section 7.

General:

- Develop and enforce a culture of zero tolerance for pollution during the operational phase of the project;
- Provide a high level of competent environmental oversight during operation of the CPF. Responsibilities of the environmental manager should include the establishment of a liquid and solid waste management system, to be fully defined before the start of operations, covering personnel, training, lines of responsibility, immediate action requirements in the event of spills, on-site spill kits, and all other factors necessary to ensure there is a provision for effective preventative and corrective action during all stages of operations;
- Provide thorough induction training to all operational personnel regarding pollution management, and ongoing refresher training throughout the operational phase of the project;
- Provide management training to staff responsible for the oversight of pollution control systems;
- Develop specific biological and social performance indicators, in respect of water pollution, as a part of the operational EMP;
- Ensure structured, daily, monitoring of pollution control systems at the CPF to minimise the risk of inadvertent spills and to respond quickly and effectively to any spills that occur. Emphasis must be on preventative measures; and

[2] Quoted standards are the more stringent of the Ugandan and IFC standards. There is no common phosphorus standard, so all three Ugandan/IFC standards are quoted. Both standards have the same value for total nitrogen. The Ugandan standard includes various forms of nitrogen, namely nitrate, nitrate and ammonical nitrogen, but it calls for a more stringent nitrate standard than total nitrogen, which is a contradiction - hence only total nitrogen is used for the project standard, which matches the IFC requirement.

- Maintain accurate, long term, records of all aspects of pollution control, consolidated to show trends for ease of reference and management.

Work outside of Controlled Environments (CPF, well pads, permanent camp and safety check station):

- Provide sufficient, maintained, toilets around the work areas for personnel and enforce their use;
- Ensure that all vehicles and machinery are in sound mechanical order and do not have any oil leaks;
- Prohibit any refuelling of equipment outside of the controlled areas at the well pads and CPF and within 100 m of a wetland or drainage line;
- Prohibit the servicing of vehicles and equipment outside of the controlled areas of the well pads, CPF and safety check station; and
- Place all portable equipment, such as generators, on drip trays to avoid oil leaks and spillages entering the environment.

Management of Erosion and Sediment Generation:

- Adjust the final design of the canals channelling stormwater from the CPF to remain outside of the seasonally wet areas associates with River 1, crossing the river channel just upstream of the road culvert (Figure 8-4). From the culvert onward it may be necessary to canalise the flow to the lake. Use open cross section swales for this purpose (not concrete canalisation), reinforced if necessary and grassed. Finalise the canal design and align the stormwater drains with the assistance of a wetland ecologist; and
- Prohibit access to personnel outside of the defined project work sites and access roads, particularly the operators of earth moving equipment and large vehicles. Train personnel to understand the sensitivity of the local environment in respect of water pollution in induction and ongoing tool box talks.

Management of Sewage Effluent:

- Select the sewage treatment plant for the project with a view to reliability in a remote environment, taking into account the final effluent water quality requirements. An activated sludge plant should be considered in preference to a membrane bioreactor plant.
- Use treated sewage effluent to provide irrigation water for the lawns and gardens at the permanent camp. If a football field is provided irrigate this as well, using treated sewage effluent.
- If excess treated sewage effluent is available, consider using it to irrigate natural pastures around the CPF (possible location shown in Table 8-5). This is an alternative intended to minimise the risk of localised eutrophication in the near shore around the discharge point of River 1.

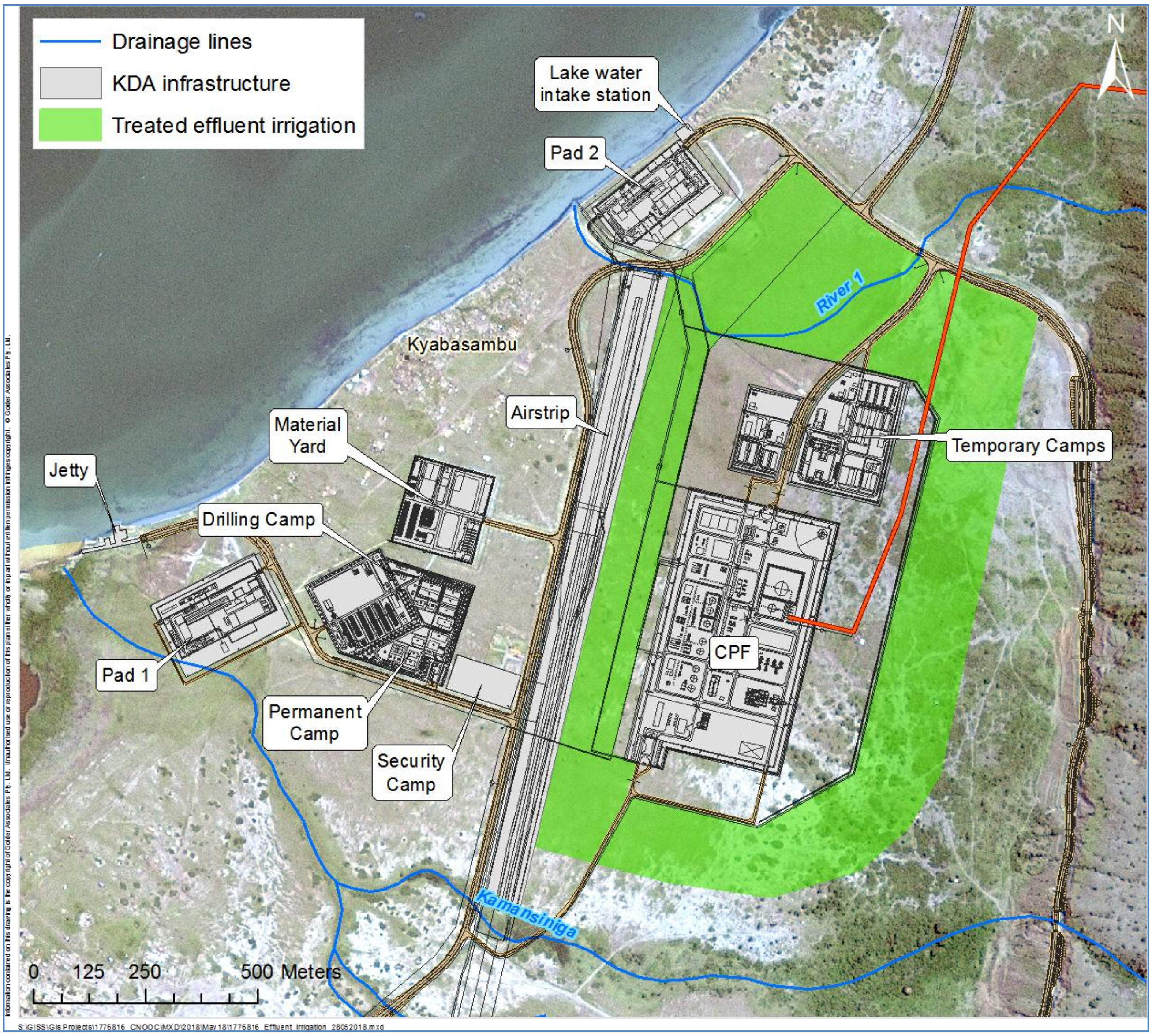

Figure 8-5: Possible areas for irrigation of treated sewage effluent

Management of Hazardous and Non-Hazardous Wastes at the CPF and on the drill pads:

- Comply with the requirements of the CNOOC Waste Management Philosophy (2016), which includes the commitment to manage all wastes in accordance with the Ugandan waste standards and best practice, as determined by the application of the waste hierarchy;

- In accordance with the requirements of the waste hierarchy, undertake the following:
  - Update the inventory of hazardous and non-hazardous wastes that will be generated at the CPF, provided in Specialist Study 5.
  - Confirm the expected quantities of waste generated.
  - Finalise options for the management of each waste stream, taking into consideration the requirements to avoid, minimize, segregate, reuse and recycle wastes (with reference to Table 8-4).
  - Make provision for areas for sorting and segregation of recycleable waste.

- Confirm that the design includes for sufficient suitably sized, impervious, bunded, containment (roofed to prevent rainfall ingress) for temporary storage of all hazardous and non-hazardous wastes to be transported off-site by the NEMA-certified waste contractors.
- Ensure that manifests of waste transported and received are maintained and regularly reviewed for the purposes of audit.

It is noted that while options for waste treatment off-site are set out in Table 8-4 as examples of best practice, CNOOCs principle responsibilities, for the purposes of this EIA, are related to front-end waste management, being waste minimization, segregation, re-use and recycling and safe temporary storage for collection by the independent waste contractor.

Table 8-4: Best available technology for non-hazardous and hazardous waste types

Non-hazardous Solid Wastes	
Food & Vegetable Wastes	■ Avoid, reduce, reuse, source - segregate and collect all food wastes generated. Also source-segregate any hazardous waste from the food and vegetable wastes. ■ Preferentially treat all food, kitchen and vegetative wastes via Anaerobic Digestion using low cost, high-tech fabric. Where this is not possible, aerobic composting should be applied. ■ Use the digestate slurry from anaerobic digester for landscaping, or direct to the wastewater treatment plant. Direct the biogas generated from the anaerobic digester to the camp kitchen for use as a cooking fuel.
Plastics	■ Avoid, reduce, reuse, source-segregate and collect all plastic wastes generated. Also, source-segregate any hazardous waste from the plastic wastes. ■ Recycle all the readily recyclable plastics. ■ Incinerate any residual plastics via a NEMA-certified waste contractor, or dispose at a NEMA-certified non-hazardous landfill if incineration is not possible. ■ Minimise the use of plastic water bottles by installing water dispensers at convenient locations for use by project personnel
Paper	■ Avoid, reduce, reuse, source-segregate and collect all paper wastes. Also, source-segregate any hazardous waste from the paper wastes. ■ Bale and recycle all the dry, non-blue paper. ■ Incinerate any residual wet or blue paper via a NEMA-certified waste contractor or dispose at a NEMA-certified non-hazardous landfill if incineration is not possible.
Metal	■ Avoid, reduce, reuse, source-segregate and collect all metal wastes generated. Also, source-segregate any hazardous waste from the metal wastes. ■ Recycle all the readily recyclable metal.
Glass	■ Avoid, reduce, reuse, source-segregate and collect all glass waste generated. Also, source-segregate any hazardous wastes from the glass waste. ■ Dispose any residual glass waste at non-hazardous landfill.
e-Waste	■ Recycle, remove offsite to certified e-waste facility, dispose of residual through licenced facility
Rubber	■ Avoid, reduce, reuse, source-segregate and collect all rubber waste generated. Also, source-segregate any hazardous waste from the rubber wastes. ■ Incinerate any residual rubber waste via a NEMA-certified waste contractor or dispose at a NEMA-certified non-hazardous landfill if incineration is not possible.
Wood	■ Avoid, reduce, reuse, source-segregate and collect all wood waste generated. Also, source-segregate any hazardous waste from the wood wastes. ■ Recycle all the readily recyclable wood. ■ Incinerate any residual wood waste via a NEMA certified waste contractor, or dispose at a NEMA certified non-hazardous landfill if incineration is not possible.

C&D wastes	■ Source-segregate any hazardous waste from the C&D wastes. ■ Recycle all the readily recyclable C&D waste. ■ Dispose any residual C&D waste at a NEMA-certified non-hazardous landfill.
Miscellaneous wastes (e.g. used insulation, used tyres, hoses, textiles)	■ Source-segregate any hazardous waste from the assorted wastes. ■ Reuse and recycle any readily reusable/recyclable wastes. ■ Incinerate any residual incinerable wastes via a NEMA-certified waste contractor or dispose at a NEMA certified non-hazardous landfill if incineration is not possible.
Non-Hazardous Liquid Wastes	
Grey Water	■ Avoid /Reduce. ■ Reuse/recycle. ■ For the waste water that cannot be reused without prior treatment, treat via the sewage effluent treatment plant. ■ Use sludge generated from the treatment process in manure application if it meets manure requirements; if it does not meet requirements, treat at a waterworks facility via a NEMA-certified waste contractor
Boiler Blowdown Water	■ Avoid /Reduce. ■ Reuse/recycle in the feed water tank. ■ If the water cannot be reused without treatment, treat via Physico-chemical and Biological Effluent Treatment Plant. ■ Dispose of sludge at a landfill via a NEMA-certified waste contractor.
Storm Water	■ Separate uncontaminated and potentially oil contaminated (POC) stormwater ■ Test POC stormwater, and treat in API separators, as necessary ■ Treat all stormwater from hazardous areas of the plant in API separators ■ Avoid /reduce stormwater discharge by using underground storage tanks as a rain water harvesting mechanism. ■ Any water that is not harvested should be directed into drainage outlets that connect to existing drainage networks (refer to recommendations for the management of stormwater discharged into River 1)

Hazardous Wastes

Waste category	Waste type	International BPEO	Currently Available BPEO		
			Option 1	**Option 2**	**Option 3**
Drill cuttings		Biodegradation	Biodegradation[3]	Cement Kiln[4]	Landfill
Drilling fluids	WBDFs / NADFs	Ultrafiltration-Reverse Osmosis / Flocculation-Coagulation[5]	Ultrafiltration-Reverse Osmosis / Flocculation-Coagulation	-	-
Associated hazardous waste	Batteries (wet and dry)	Recycling (wet only)	Recycling (wet only)	Landfill (dry only)	-
	Chemicals residue	Return to manufacturer	Incineration	Landfill	-

[3] *Modification of conventional biodegradation process may be required to extract or immobilize elevated levels of heavy metals in the treated materials. This may include for example, using acids, augmented bacteria, stabilization or Dispersal Chemical Reaction.*
[4] *Subject to feasibility study and pilot project.*
[5] *Process changes may be required to adequately treat NADFs.*

Hazardous Wastes					
Waste category	**Waste type**	**International BPEO**	**Currently Available BPEO**		
			Option 1	**Option 2**	**Option 3**
	Completion and well work-over fluids	Ultrafiltration-Reverse Osmosis / Flocculation-Coagulation	Ultrafiltration-Reverse Osmosis / Flocculation-Coagulation	-	-
	Contaminated containers (e.g. oil drums)	Re-use of containers[6]	Incineration	Landfill	-
	Contaminated hydrotest water	Ultrafiltration-Reverse Osmosis / Flocculation-Coagulation	Ultrafiltration-Reverse Osmosis / Flocculation-Coagulation	-	-
	Contaminated personal protective equipment (PPE)	Cement Kiln	Cement Kiln	Incineration	Landfill
	Contaminated scrap metal	Recycling[7]	Recycling	Landfill	-
	Electrical / electronic waste	Refurbishment / recycling	Landfill	-	-
	Foam	Ultrafiltration-Reverse Osmosis / Flocculation-Coagulation	Ultrafiltration-Reverse Osmosis / Flocculation-Coagulation	-	-
	Medical waste	Cement Kiln	Cement Kiln	Incineration	
	Oil contaminated soil	Biodegradation	Biodegradation	Cement Kiln	Landfill
	Oily rags, filters etc.	Cement Kiln	Cement Kiln	Incineration	Landfill
	Tank Cleaning waste	Cement Kiln	Cement Kiln	Incineration	Landfill
	Oily sludges (from the bottom of vessels)	Cement Kiln	Cement Kiln	Incineration	Landfill
	Pigging wastes	Cement Kiln	Cement Kiln	Incineration	Landfill
	Paint residue (solid and liquid)	Return to manufacturer	Incineration	Landfill	-
	Pipe dope	Incineration	Incineration	Landfill	-
	Sewage	Sewage Treatment Plant	Sewage Treatment Plant	-	-
	Spent fluorescent tubes and lamps	Recycling	Landfill	-	-

6 Requires cleaning to remove chemical and oily residues.
7 Requires cleaning to remove chemical or oily residues.

Hazardous Wastes					
Waste category	Waste type	International BPEO	Currently Available BPEO		
			Option 1	Option 2	Option 3
	Spent welding rods, epoxy coatings, grinder wheels, visors, shot blast etc.	Landfill	Landfill	-	-
	Used aerosol cans;	Recycling	Landfill	-	-
	Used fabrication material (e.g. paint, cement, insulation);	Landfill	Landfill	-	-
	Used lubricating / hydraulic oil, grease, solvents and absorbent materials;	Solvent recovery / Central Processing Facility	Cement Kiln	Landfill	-
	Expired chemicals (toxic);	Return to manufacturer	Return to manufacturer	Incinerate	-
	Excess drilling materials.	Return to manufacturer	Return to manufacturer	Incinerate	Landfill

8.1.2.4 Impact Significance Rating

Table 8-5: Impact on surface and groundwater

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on water levels in Lake Albert	1	4	3	4	Low Medium 32	1	4	3	4	Low Medium 32
Impact on water quality										
- Erosion and sedimentation	6	4	2	4	Low Medium 48	1	4	2	4	Low 28
- Oil and chemical pollution	9	4	2	5	High 75	2	4	2	3	Low 24
- Treated sewage effluent discharge	6	4	2	4	Low Medium 48	1	4	2	4	Low 28
KEY										

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

8.1.3 Noise

8.1.3.1 Methodology

The assessment of operational phase noise impacts concerns noise generated by the plant at the CPF (and associated infrastructure) and the drilling rigs. Drilling is considered to be a joint operational impact because it will continue for 5 years into the operational phase before all of the production and reinjection wells are completed. Nevertheless, drilling noise is evaluated on the basis of construction phase rating criteria, which discount the significance of the noise to some extent due to its temporary nature. The basis for this methodology is described in Section 7.1.3.1.

The operational noise from the production facility is long term and is evaluated in accordance with the IFC targets for a daytime maximum LAeq of 55 dBA and a nighttime maximum of 45 dBA. IFC criteria also include a more onerous requirement to evaluate noise impact in relation to the increase above the existing background- a threshold value of 3 dBA is set which marks above which there is measureable impact is 3 dBA

8.1.3.2 Impact of Production Noise at the CPF

Noise generated at the CPF and associated infrastructure during the operational phase will include the operation of gas engines, diesel-powered generators and other plant. Details of emission sources are included in Specialist Study 6. No households will exceed the maximum recommended daytime or nighttime limit of 55 dBA and 45 dBA respectively, due to noise caused by the production facility. Three buildings (households) will be resettled since they are within the footprint of the CPF. Five buildings that are close to the eastern and south-eastern boundaries of the CPF will experience sound levels that exceed the existing ambient by more than 3 dBA. Impact magnitude for the people occupying these buildings will be medium (see Figure 8-6). Impact will be long term and impact significance will be **low medium**. For all other households, impact magnitude and impact significance will be **low.**

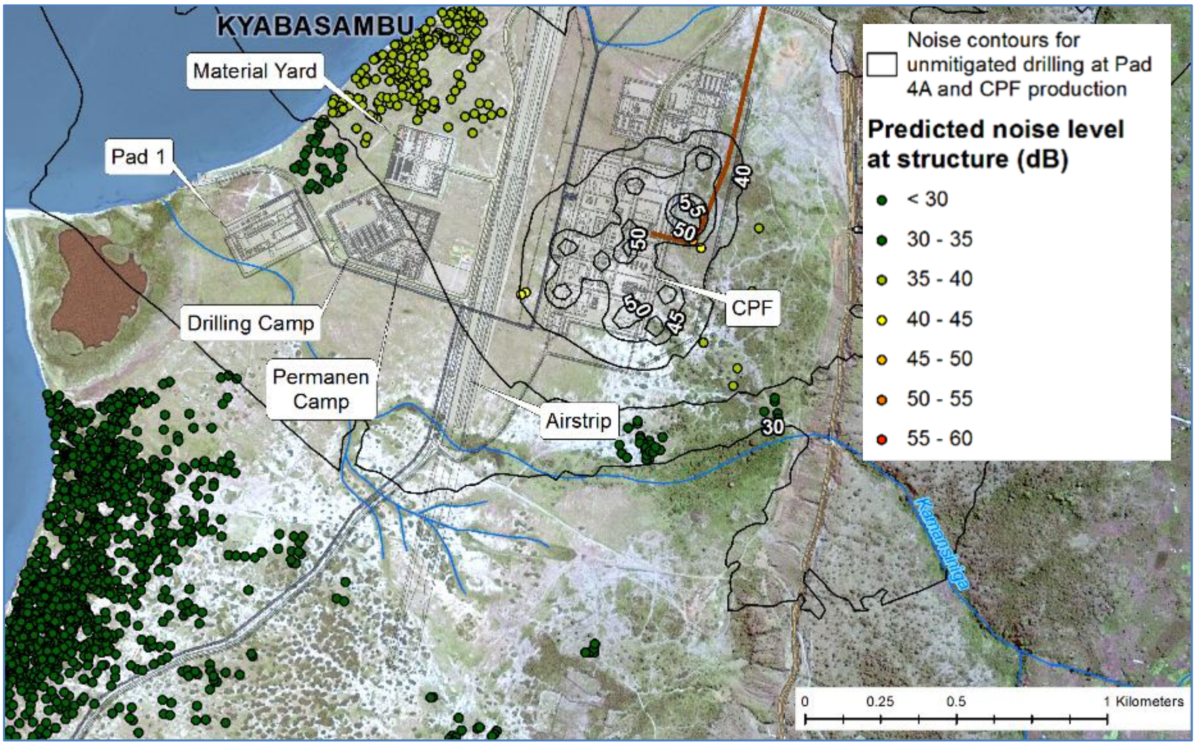

Figure 8-6: Operational noise impact of the CPF – unmitigated case

8.1.3.3 Impact of Drilling Noise

The main noise impacts during the first five years of the operational phase will be caused by drilling. Drilling noise is generated on the platform and by the motor on top of the mast, at an elevation of around 40 m above the ground. Drilling is a 24/7 activity, and while there will be only one drilling rig on site, which moves from well pad to well pad, the drilling of multiple oil and reinjection wells on the same well pad will mean that the noise in one location will continue over an extended period. The drilling during the operational phase is expected to be as follows:

- Well Pad 1 (165 days);
- Well Pad 2 (615 days);
- Well Pad 3 (465 days); and
- Well Pad 4A: (615 days).

These periods of noise exposure are far beyond what would be regarded in noise guidelines as transient (a few weeks). Reference is made to the methodology for assessing construction phase impacts referred to in Section 8.1.3.1.

Figure 8-7 provides a graphic illustration of the effect of drilling noise at well pad 4A (plots for other well pads are included in Specialist Report 6). Table 8-6 shows the magnitude of the noise impact in the villages affected by drilling noise in relation to the number of building structures affected[8]. Figure 8-7 cannot be directly compared with Table 8-6 since it only includes the impact on buildings affected by well pad 4A, whereas Table 8-6 shows the combined impact of the drilling on all well pads.

[8] *Plots of drilling noise impacts on other well pads are included in the Specialist Report on Noise*

Many households are above the project's target threshold for daytime (blue shading) and nighttime (brown shading) construction noise. Assuming a relationship of roughly 4.5 people per building, approximately 972 and 6,485 villagers will be exposed to daytime and night time noise levels respectively that exceed the project's target thresholds. Table 8-6 shows that in the daytime, most people are impacted by sound levels within 5 dBA of the 55 dBA target threshold. During the nighttime, with the more stringent requirements for quiet, larger numbers of people will experience higher levels of noise, with around 15% of the affected people being more than 10 dBA above the 45 dBA target. Broken down, the nighttime impact significance in the unmitigated case will be as follows (refer to Table 8-9):

- **High** significance (>55 dBA): 972 people (216 building structures) exposed to higher noise levels of greated that 55dBA;
- Low **Medium** significance (50-55 dBA): 2,556 people (568 building structures) exposed to moderate noise levels of between 50-55dBA, and
- **Low** significance (45-50 dBA): 2,957 people (657 building structures) exposed to lower noise levels of between 45-50dBA.

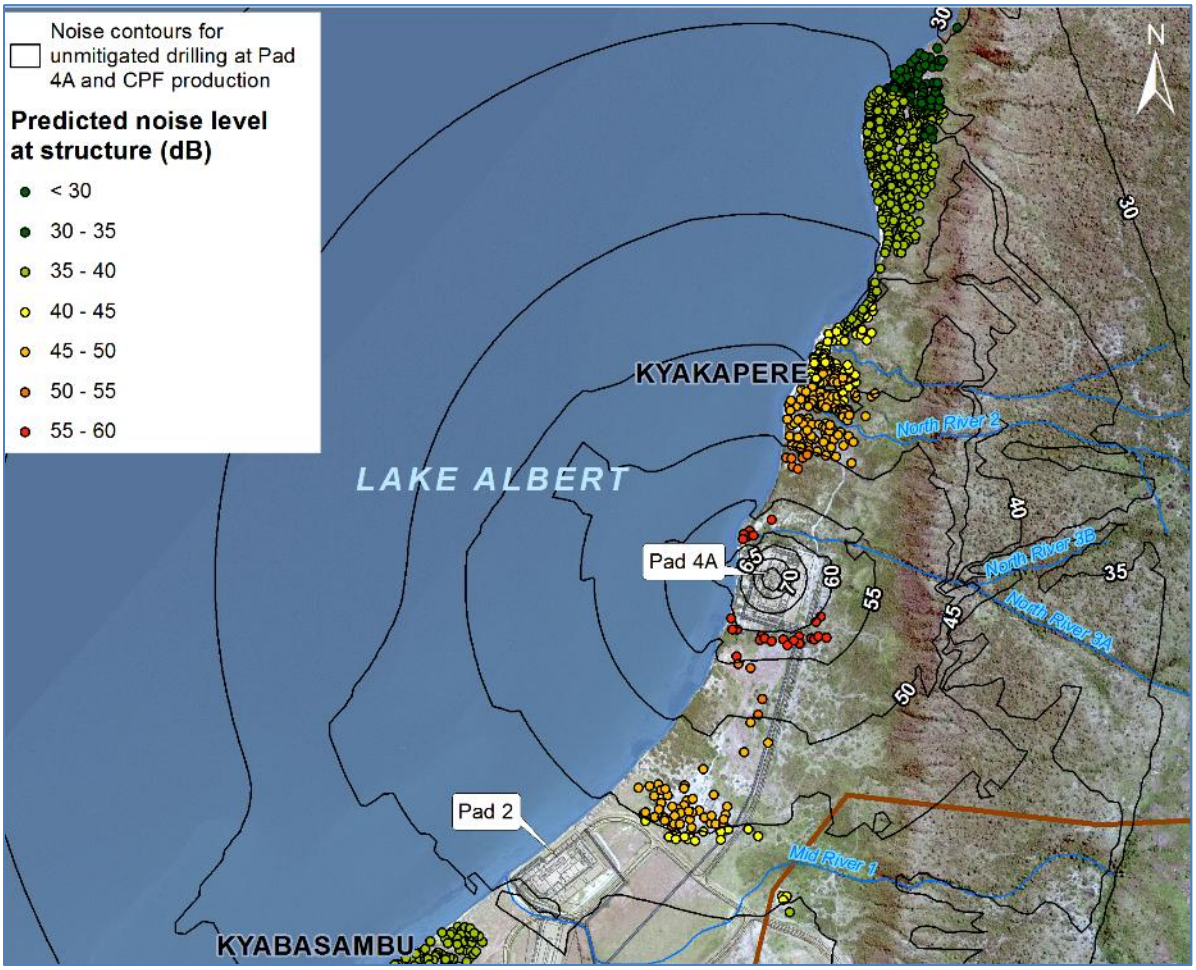

Figure 8-7: Noise impact of drilling on well pad 4A – unmitigated case

Table 8-6: Household exposure to drilling noise during the operational phase of the project and exceedance of the daytime and nighttime project standard – unmitigated case

Village (and adopted background noise levels)	Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the **daytime** project standard are highlighted in blue)								Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the **nighttime** project standard are highlighted in brown)							
	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	60-65 dBA	>65 dBA	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	60-65 dBA	>65 dBA
Kyabasambu South *Daytime: 25 dBA* *Nighttime: 33 dBA*					19	22	12						19	22	12	
Nsonga North *Daytime: 37 dBA* *Nighttime: 32 dBA*			153	257	6						153	257	6			
Kyakapere South *Daytime: 30 dBA* *Nighttime: 38 dBA*			3	17	46						3	17	46			
Kyabasambu North *Daytime: 37 dBA* *Nighttime: 32 dBA*				23	75	20						23	75	20		
Nsonga South *Daytime: 31 dBA* *Nighttime: 35 dBA*			32	164	344	129	30	1			32	164	344	129	30	1
Nsunzu North *Daytime: 31 dBA* *Nighttime: 42 dBA*		2	15	99	64	2				2	15	99	64	2		
Kyakapere Village *Daytime: 37 dBA* *Nighttime: 32 dBA*	127	90	101						127	90	101					
Nsonga East *Daytime: 31 dBA* *Nighttime: 35 dBA*	4	53	10	19					4	53	10	19				
Nsonga *Daytime: 31 dBA* *Nighttime: 35 dBA*		1	37	68						1	37	68				
Kyabasambu East *Daytime: 37 dBA* *Nighttime: 32 dBA*				10	14							10	14			

Note: The boundaries of the villages may be seen from the Baseline section of the report. This table presents a consolidated assessment of construction at the CPF on all four well pads plus the operational noise at the CPF

8.1.3.4 Mitigation and Monitoring

For the mitigation of production equipment noise during the operational phase at the CPF:

- Specify acoustic enclosures and noise attenuation measures to fixed plant at the CPF to reduce sound power level of each noise source to a maximum of 75 dB(A);

- Monitor noise regularly around the battery limit of the CPF, around the battery limit of the well pads and at key selected receptors. Develop and maintain records and trends in this regard;
- Maintain equipment to ensure that the noise emissions generated remain in accordance with their design standard;
- Train personnel about the importance of minimising unnecessary noise that affects surrounding communities;
- Monitor, log and respond to noise complaints from members of surrounding communities. Provide communities with details of the staff member responsible for dealing with community concerns and complaints; and
- Consider Corporate Social Investment (CSI) in local communities, as recommended under Section 8.3, to offset the residual impacts of noise.

Mitigation measures will reduce CPF operational noise impact to **low** significance**.**

For the mitigation of drilling noise:

- Erect acoustic barriers (noise 'curtains') around the drilling rig, screening to above the drilling platform, and 5m high screens above ground level around the perimeter of the site.
- Separate the top drive and the blower fans and install the fans at ground level.

Estimates based on data provided by vendor show that up to 10 dBA of source attenuation could be achieved. Table 8-7 shows the change in affected building structures that will result from the decrease in noise. During the daytime, impact significance will be **low**, with only 1 building structure (roughly 5 people) affected by noise exceeding the 55 dBA target. At night, 973 people (216 buildings) will be affected by noise above the 45 dBA target. Of these, most (60%) will reside in Nsonga South, which is affected primarily by the drilling of wells on well pad 3. The significance of residual impact for nighttime noise will be as follows (refer to Table 8-7.

- **High** significance (>55 dBA): 5 people (1 building structure);
- **Medium** significance (50-55 dBA): 189 people (42 building structures); and
- **Low** significance (45-50 dBA): 779 people (173 building structures).

While the temporary nature of the noise permits higher acceptable noise levels, people around the drilling rigs will be exposed to residual noise (particularly at night) which is far above the existing ambient. Additional mitigation should be considered for the approximately 972 people who will be exposed to noise exceeding the nighttime target threshold. This may include temporary housing for the period in which the drilling rig is located in the area.

Table 8-7: Household exposure to drilling noise at well pads during the initial 5-years of operation and exceedance of the daytime and nighttime project standard - mitigated case

Village (and adopted background noise levels)	Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the **daytime** project standard are highlighted in blue)								Number of structures exposed to sound levels (dBA) (structures exposed to sound levels exceeding the **night time** project standard are highlighted in brown)							
	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	60-65 dBA	>65 dBA	30-35 dBA	35-40 dBA	40-45 dBA	45-50 dBA	50-55 dBA	55-60 dBA	60-65 dBA	>65 dBA
Kyabasambu South *Daytime: 25 dBA* *Nighttime: 33 dBA*		35	18							35	18					
Nsonga North *Daytime: 37 dBA* *Nighttime: 32 dBA*																
Kyakapere South *Daytime: 30 dBA* *Nighttime: 38 dBA*		54								54						
Kyabasambu North *Daytime: 37 dBA* *Nighttime: 32 dBA*		75	29							75	29					
Nsonga South *Daytime: 31 dBA* *Nighttime: 35 dBA*		282	110	17						282	110	17				
Nsunzu North *Daytime: 31 dBA* *Nighttime: 42 dBA*		54	1							54	1					
Kyakapere Village *Daytime: 37 dBA* *Nighttime: 32 dBA*		11	32	26	19	11	2	1		11	32	26	19	11	2	1
Nsonga East *Daytime: 31 dBA* *Nighttime: 35 dBA*																
Nsonga *Daytime: 31 dBA* *Nighttime: 35 dBA*																
Kyabasambu East *Daytime: 37 dBA* *Nighttime: 32 dBA*		21	3	35	18					21	3	35	18			

Note: The boundaries of the villages may be seen from Figure in the Baseline section of the report. This table presents a consolidated assessment of construction at the CPF on all four well pads

8.1.3.5 Impact Significance Rating

The impact significance ratings for the drilling and the CPF operational noise are separated, being based on different methodologies, particularly with respect to the rating of duration.

Table 8-8: Operational phase impacts of noise caused by the CPF and associated infrastructure

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of the CPF Operation	3	3	2	5	Low Medium 40	1	3	2	5	Low 30

KEY			
Magnitude	**Duration**	**Magnitude**	**Duration**
10 Very high/ don't know	5 Permanent	10 Very high/ don't know	5 Permanent
8 High	4 Long-term (impact ceases after closure of activity)	8 High	4 Long-term (impact ceases after closure of activity)
6 Medium	3 Medium-term (5 to 15 years)	6 Medium	3 Medium-term (5 to 15 years)
4 Low	2 Short-term (0 to 5 years)	4 Low	2 Short-term (0 to 5 years)
2 Minor	1 Transient	2 Minor	1 Transient
1 None/Negligible		1 None/Negligible	
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

Table 8-9: Impacts of drilling noise during the operational phase of the project (first 5 years of operations)

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Daytime Impact of Drilling Noise	1 structure (5 people)				High	-				NSI
	42 structures (189 people)				Medium	-				NSI
	173 buildings (779 people)				Low	1 structure (5 people)				Low
Nighttime Impact of Drilling Noise	216 buildings (223 people)				High	1 structure (5 people)				High
Nighttime Impact of Drilling Noise	568 buildings (2556 people)				Medium	42 structures (189 people)				Medium
Nighttime Impact of Drilling Noise	657 buildings (2956 people)				Low	173 structures (779 people)				Low

KEY (Note: The standard rating scale does not apply to drilling noise – refer to the methodology in Section 7.1.3.1)			
Magnitude	**Duration**	**Scale**	**Probability**
10 Very high/ don't know	4 Permanent	5 International	5 Definite/don't know
8 High	3 Long-term (>6 months)	4 National	4 Highly probable
6 Medium	2 Medium-term (1-6 months)	3 Regional	3 Medium probability

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

4 Low	1 Short-term (<1 month)	2 Local	2 Low probability
1 Minor		1 Site only	1 Improbable
			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +. NSI No Significant Impact			

8.1.4 Visual Aesthetics

8.1.4.1 Methodology

The assessment of visual impact follows a specific methodology described in Figure 8-8. The method is based on an international approach to Visual Impact Assessment (VIA) while also conforming to the general impact assessment methodology for the CNOOC ESIA as a whole. Reference is made to this methodology throughout the section below.

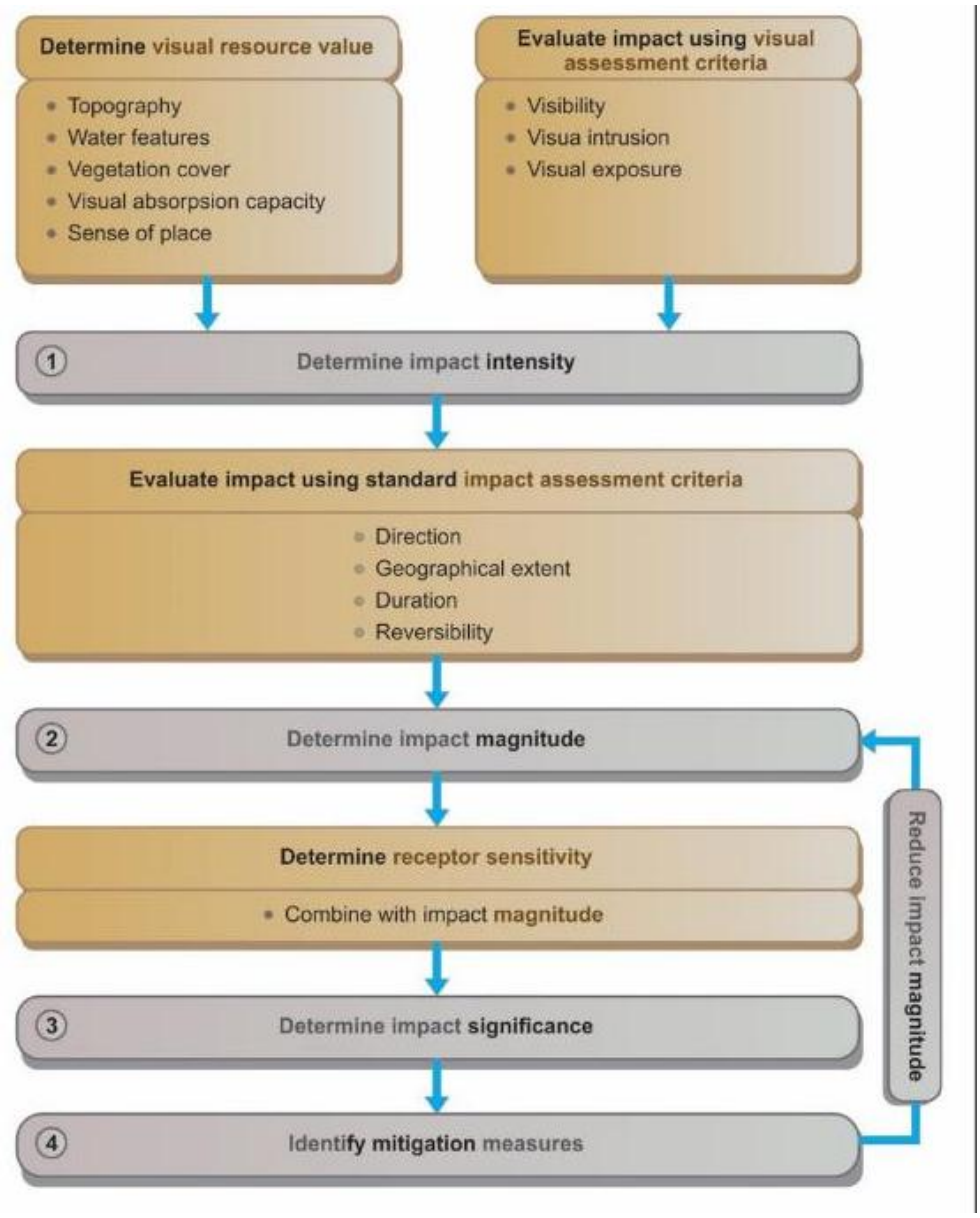

Figure 8-8: Methodology for assessing visual impacts

8.1.4.2 Impact on Visual Resources – Daytime

8.1.4.2.1 Visual Resource Value

Details of the visual resource are provided in Section 6, and in Specialist Study 7. Many studies have shown human preferences for specific types of landscapes. Typically, people prefer more complex landscapes to homogenous ones. The study area has most of the attributes that contribute to a resource of high value. These include:

- Dramatic changes in topography between the escarpment, the Buhuka Flats, Lake Albert and the distant mountains in the DRC;
- Extensive water bodies (Lake Albert); and
- Vegetation cover which varies between grasslands on the flats, low thickets along the drainage lines and woody vegetation on the escarpment.

Grassland vegetation is not always rated highly in respect of visual resource value, being fairly uniform, but in the context of the escarpment and Lake Albert, and the varying colours and textures of the vegetation on the plains and the steeper slopes, it contributes to a strongly defined sense of place. The stark juxtaposition between the prominent, linear relief of the escarpment and the vast, near-flat, surface formed by the peninsula and adjacent water body creates the unique and highly recognisable character of the study area, which is irreplaceable.

Photograph 8-2: The view across the Buhuka Flats to the escarpment

8.1.4.2.2 Visibility, Visual Intrusion and Visual Exposure of Project Construction Activities

Visibility concerns how much of the facility is seen from the receptor. Visibility was determined using viewshed analysis. Visual exposure is related to the distance of project infrastructure from the visual receptor - the further the receptor from the impact source, the less the exposure. At distances beyond two kilometres, most visual features become indistinct.

Specialist Study 7 presents a number of viewsheds, from both the position of the ‘receiver’ (the villages) and the ‘impactor’ (either the CPF or the well pads). Figure 8-9 shows the combined viewshed of the CPF and well pad 4 (i.e.: the view from these ‘impactors’), taken from a level of around 5 m above the ground, which is the mid-level of most CPF infrastructure. Table 8-10 summarise the visibility and exposure of the main villages in the study area to the construction sites. This varies, with views from Kyabasambu most affected, followed by Nsonga North. Visibility of and exposure to project infrastructure at the other villages, by comparison, is low.

It is noted, however, that people on the Flats are not restricted to their villages, which are used in the visual assessment simply as convenient reference points. Inhabitants of the Flats will be acutely aware of the operation of the KFDA facility as they go about their daily lives. There will be regular, ongoing, traffic operating in and around the KFDA work areas, at the CPF, well pads and ancillary infrastructure. Many personnel (around 400 while wells are still being drilled and 135 once this is complete) will be on site. Site infrastructure will include facilities of the following heights:

- Production towers 20 m;
- Oil storage tanks 18 m; and
- Drilling rigs 40 m.

Table 8-10: Visibility and visual exposure ratings of villages (receptors) and impactors (CPF and well pads)

Village	Visibility	Visual Exposure
Kyakapere	Most project infrastructure obscured except for well pad 4, which is less than 500 m from the village. Overall visibility rating of project infrastructure is low	Low
Kyabasambu	Located near the centre of the study area. Most of Production complex at the CPF will be visible as well as well pads 1, 2 and 4. Well pad 2 will be within 500 m of the village. Overall visibility rating of project infrastructure is high.	High
Nsonga North	Located just south of the centre of the study area. Parts of the CPF and supporting infrastructure and well pad 1 will be visible. All of the project infrastructure is more than 500 m from this village. Overall visibility rating of project infrastructure is medium.	Medium
Nsonga South	Located in the south of the study area. Parts of the CPF and supporting infrastructure and well pad 1 will be visible. Most of the CPF will be hidden but the village will be fully exposed to well pad 3 at distances less than 500 m. Overall visibility rating of project infrastructure is low.	Low
Ngoma	Located at the top of the escarpment at the site of a decommissioned construction camp. The safety check station will be visible to people living at the top of the escarpment, but hidden from villages on the Buhuka Flats. Given its relatively small footprint (3,750 m^2) and smaller number of resident receptors, the overall visibility rating is low.	Low

Visibility Ratings: *High means more than half the study area is visible from the receptor. Medium means between a quarter and half of the study area is visible. Low means less than a quarter of the study area is visible.*

Visual Exposure Ratings: *High means views over a distance of 500 m or less. Medium means views of between 500 m and 2000 m. Low means views of greater than 2000 m*

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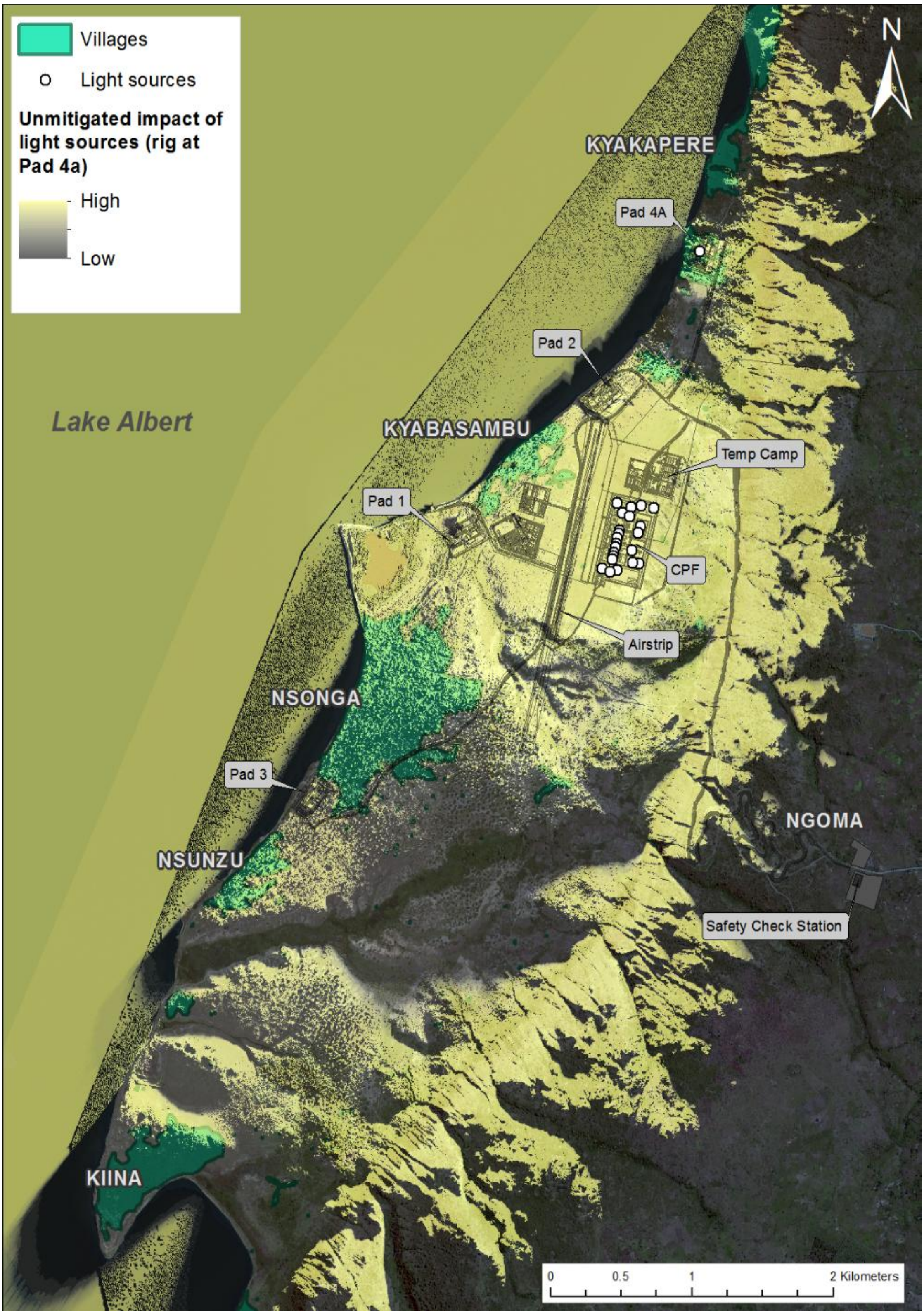

Figure 8-9: Example of a viewshed from the CPF and well pad 4 (impactor-based) at night (refer to Specialist Study 7 for other viewsheds)

Daytime visual intrusion (how intrusive the industrial infrastructure is in the context of the pre-existing environment) will be medium, based on a large industrial facility operating in a predominantly rural environment. The greatest degree of visual intrusion is expected to occur at night when the production facility will be brightly lit (Figure 8-10). The effect will be particularly severe when viewed from elevated locations, such as along the escarpment.

Based on the above evaluation the day-time visual intrusion of the project infrastructure and associated changes in site topography and loss of vegetation cover is rated as moderate, whereas the nighttime level of visual intrusion is rated as high.

8.1.4.2.3 Visual Impact Magnitude and Significance (daytime)

Combining the visual resource value with visibility, visual exposure, and visual intrusion, the magnitude of visual impact will be high. The significance of impact (which includes the magnitude and the long term duration of impact and the local geographic extent), will be **high medium.**

8.1.4.2.4 Visual Impact Magnitude and Significance (nighttime)

Figure 8-10 shows a viewshed of the project at night, with the drilling rig at well pad 1 on the left and the production facility on the right. The industrial lighting of the CPF and other infrastructure will be visible over large distances and the magnitude of impact will be very high. Impacts will be long term and impact significance will be **high.**

Figure 8-10: View of night lighting at the CPF production facility and a lit drilling rig on well pad 1

8.1.4.2.5 Mitigation and Monitoring

Visual mitigation can typically be approached in two ways, and usually a combination of the two methodologies is most effective. The first option is to implement measures that attempt to reduce the level of visibility of the source of a visual impact. Thus, an attempt is made to "hide" the source of the visual impact from view, by placing visually appealing elements between the viewer and the source of the visual impact. The second option aims to minimise the degree of visual intrusion of the source of the impact by altering its physical appearance, i.e. shape/profile, colour and/or texture, or by decreasing the size of visual disturbance.

Mitigation possibilities are limited for this project, as a result of functional/operational requirements of the infrastructure, and the visual character of the study area. During the operational phase, the following is recommended:

For dust and general appearance:

- Water down any large bare areas associated with ongoing building activity / murram access roads during the operational phase, to minimize airborne dust. This is expected to be occasional and far less frequent than the construction phase;
- Rehabilitate any temporary bare areas as soon as feasible using appropriate vegetation species;
- Apply chemical dust suppressants if wet dust suppression is insufficient;
- Maintain the dust monitoring system installed during construction and monitor dust levels around the production facility and at a control site unaffected by project activities (refer to Section 8.1.1 on Air Quality for details);
- Maintain the production facility in a neat and orderly condition at all times;
- Create designated areas for material storage, waste sorting and temporary storage, batching, and other potentially intrusive activities;
- Limit the physical extent of areas cleared for material laydown, vehicle parking; and
- Repair project related erosion damage to steep or bare slopes and re-vegetate these areas using a suitable mix of indigenous grass species.

For the design of production facility buildings and infrastructure:

- Where feasible, avoid white or shiny roofing and cladding material (e.g. bare galvanized steel) that causes glare or brightly coloured materials; and
- Paint buildings and workshop exteriors in colours that are complementary to the surrounding landscape, such as olive green, light grey, blue-grey, or variations of tan and ochre.

For night lighting:

Full cut-off shielding in light fixtures is proposed at the CPF for both glare and sky glow. A lamp should send all of its light more or less downwards where the light is intended to be used, and not upward or sideways. "Full cut off" is usually taken to mean that no direct light rays from the fixture shine above the horizon, and that at least 90 percent of the light is blocked in the near-sideways range, from 0° to 20° below the horizontal plane. Light that shines in this near-sideways range impacts on nearby receptors and contributes nothing to most lighting needs, as it merely dissipates u into the distance.

To minimise both direct glare and indirect sky glow or haze, the following measures are recommended:

- Identify zones of high and low lighting requirements, focusing on only illuminating areas to the minimum to allow safe operations at night and for security surveillance;
- Plan the lighting requirements of the facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination;
- Reduce the heights of light posts and develop a lighting plan that focusses on illuminating the required areas through strategically placed individual lights rather than mass light flooding;
- Utilise security lights that are movement activated rather than permanently switched on, where feasible, to prevent unnecessary constant illumination;
- Fit all security lighting with ‘blinkers’ or specifically designed fixtures, to ensure light is directed downwards while preventing side spill. Light fixtures of this description are commonly available for a variety of uses and should be used to the greatest extent; and

- Eliminate any ground-level spotlights as these invariably result in both direct glare and increased sky glow, and cannot be effectively mitigated.

For screening and landscaping:

- Retain existing trees;
- Implement appropriate landscaping using indigenous vegetation within the permanent camp facility as well as entrance areas to other facilities, in order to create a more welcoming overall appearance; and
- Create vegetation screens to interrupt views of the production facility and well pads along key view lines. In order to do this, undertake the following:
  - Identify optimal locations for proposed vegetation screens on site, based on the results of the VIA. The extent and orientation of the individual tree screens should be determined on site by conducting line-of-sight evaluations from the respective villages to the individual project infrastructure sites. Provisional screen locations are shown in Figure 8-11. The night time and daytime effects of screens are shown in Figure 8-12 and Figure 8-13.
  - Conduct trials to identify the most suitable tree and shrub species to be utilised for establishing the vegetative screens. The selection of plant species must be cognisant of local soil conditions and rainfall, maintenance requirements, and expected lifespan and foliage density into consideration. In this regard it is anticipated that *Eucalyptus saligna* will likely be suitable, although management measures would need to be put in place to ensure that the plants do not become invasive and spread beyond the screens.

The establishment of the vegetation screens should be done (if practical, during the construction phase), to minimise the delay before the trees reach a height at which they can act as effective visual barriers. Multiple rows of trees that are coppiced and pruned regularly will be necessary to ensure that sufficient foliage density is achieved. The trees will only become effective screens once they reach a height of 7 or 8 m, which is a number of years of growth, and project infrastructure will not be screened from view during this period. The speed of growth will also depend on a number of factors including the preparation of suitably sized holes, supplementation of soils with organic material, watering during dry periods, particularly when the trees are saplings, and protection from stock and local inhabitants seeking firewood. The latter may be a difficult problem to overcome. It is important that the local villagers be consulted and agree to the screens beforehand, to ensure that the trees are not cut down for firewood.

Construction of earthen embankments and berms should not be considered as visual screening measures, as they will cause additional visual impact due to their geometric, linear, shapes. Furthermore, these artificial landforms may not be fully rehabilitated after closure, which will result in a permanent impact on the study area's sense of place.

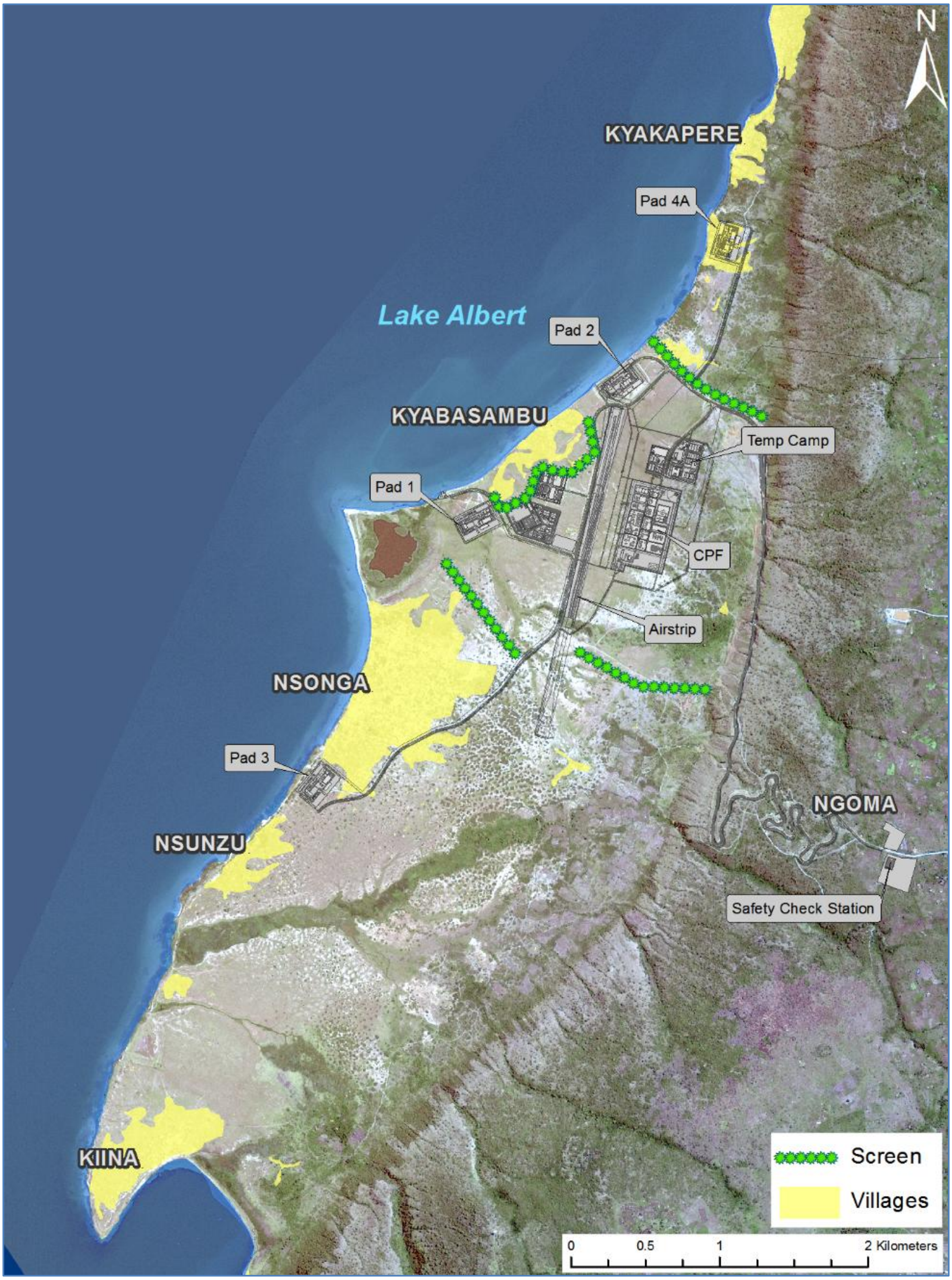

Figure 8-11: Provisional location of proposed tree screens

Figure 8-12: Night time view of Drilling Rig 1, the permanent camp and the production facility after screening

8.1.4.3 Impact Significance Rating

Figure 8-13: Daytime view of a tree screen viewed from the north-west back towards the CPF (screened CPF oil tanks in the far right)

Table 8-11: Operational phase impacts on aesthetics in the LSA

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Daytime impact on local inhabitants	8	3	2	5	High Medium 65	5	3	2	5	Low Medium 50
Nighttime impact on local inhabitants	10	3	2	5	High 75	5	3	2	5	Low Medium 50

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

KEY							
Magnitude		**Duration**		**Magnitude**		**Duration**	
10	Very high/ don't know	5	Permanent	10	Very high/ don't know	5	Permanent
8	High	4	Long-term (impact ceases after closure of activity)	8	High	4	Long-term (impact ceases after closure of activity)
6	Medium	3	Medium-term (5 to 15 years)	6	Medium	3	Medium-term (5 to 15 years)
4	Low	2	Short-term (0 to 5 years)	4	Low	2	Short-term (0 to 5 years)
2	Minor	1	Transient	2	Minor	1	Transient
1	None/Negligible			1	None/Negligible		
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

8.2 The Biological Environment

Operational impacts on the biophysical environment are assessed in two broad categories:

- Impacts on habitats and ecosystem integrity, which include the near-shore environment of Lake Albert, the vegetation corridors along the escarpment, wetlands in the LSA and RSA and the Bugoma Central Forest Reserve. Refer to Section 8.2.1; and
- Impacts on species of concern, specifically the Nahan's Francolin, Crested Crane and Eastern Chimpanzee. Refer to Section 8.2.2.

Within each category, the assessment considers, where relevant, impacts on representativeness, ecosystem composition and ecosystem configuration (Table 8-12).

Table 8-12: Definitions of impact assessment criteria related to habitats and ecosystem integrity

Impact Criterion	Impact Characterisation
Representativeness	Impact on the uniqueness of the ecosystem. This rarity factor is related to the concepts of irreplaceability (rarity or uniqueness in the landscape) and vulnerability (the degree of threat).
Ecosystem Composition	Impact on diversity and complexity of the ecosystem - what is there and how abundant it is
Ecosystem Configuration	Impact on the linkages between habitats of the same or different ecosystems. Natural linkages provide an important 'playing field' for ecological processes and enable the goal of their persistence. These linkages are in contrast to a highly-fragmented landscape where patches of natural habitat are effectively isolated.

It is noted that Lake Albert, the Bugoma Central Forest Reserve and the threatened species listed above are all potential triggers of Critical Habitat, in accordance with the IFC definition in Performance Standard 6 and impacts on them are assessed in the context of a defined Critical Habitat Area of Analysis (CHAA), which corresponds to the Regional Study Area (RSA). The boundaries of this area are shown in Figure 6-23.

8.2.1 Habitats and Ecosystem Integrity

Operational impacts on the biological environment are assessed in two broad categories:

- Impacts on habitats and ecosystem integrity, which include the near-shore environment of Lake Albert, the vegetation corridors along the escarpment, wetlands and drainage lines in the LSA and RSA and the Bugoma Central Forest Reserve. Refer to Section 7.2.1. Within each category, the assessment considers, where relevant, impacts on representativeness, ecosystem composition and ecosystem configuration (Table 8-13).
- Impacts on species of concern, specifically the Mud Snail, Nahan's Francolin, Grey Crowned Crane and Eastern Chimpanzee.

Table 8-13: Definitions of impact indicators related to habitats and ecosystem integrity

Impact Criterion	Impact Characterisation
Representativeness	Impact on the uniqueness of the ecosystem. This rarity factor is related to the concepts of irreplaceability (rarity or uniqueness in the landscape) and vulnerability (the degree of threat).
Ecosystem Composition	Impact on diversity and complexity of the ecosystem - what is there and how abundant it is
Ecosystem Configuration	Impact on the linkages between habitats of the same or different ecosystems. Natural linkages provide an important 'playing field' for ecological processes and enable the goal of their persistence. These linkages are in contrast to a highly-fragmented landscape where patches of natural habitat are effectively isolated.

8.2.1.1 Impact on the Near-Shore Environment of Lake Albert

8.2.1.1.1 Impact on Representativeness

The operation of the KFDA production facility will not cause the direct loss of near-shore aquatic habitat in addition to that already removed during the construction phase. Changes to representativeness are predicted to be within the expected range of natural change, and impact magnitude will be negligible. Even in the context of high receptor sensitivity, any impact will be of **minor** significance.

8.2.1.1.2 Impact on Ecosystem Composition - Sediment Transport

Sediment drift is recognised as an important driver in shoreline ecosystems, contributing to the nutrient cycling that supports phytoplankton, zooplankton and fish communities (Parks et al. 2013). The jetty will be upgraded but given that material changes to its dimensions are not planned, the upgrade should not further alter the geomorphological processes and sediment drift that currently govern the shoreline ecosystem at the Buhuka Flats (additional to the sediment deposition and erosion on either side of the jetty that has already taken place). The water intake station will extend a similar distance (~20 m) into the lake as the jetty but will be an open lattice structure which allows for the movement of sediment along the shore.

The magnitude of this impact is expected to be low, notwithstanding the long duration and the high sensitivity of the lake ecosystem, and the significance of the jetty upgrade and the new water intake on lakeshore species due to sediment drift is expected to be **Low-Medium**.

8.2.1.1.3 Impact on Ecosystem Composition - Water Quality

Operational impacts on water quality are an important element of risk to the biota of Lake Albert. These impacts are described in Section 8.1.2.2 under Surface and Groundwater. Impacts are rated under the general headings described in Table 8-14 below.

Table 8-14: Significance rating of surface water pollution risks during operation of the project

Category	Significance Rating
Erosion and sedimentation	Low medium
Oil and chemical pollution	High
Sewage treatment	Low medium

8.2.1.1.4 Impact on Ecosystem Composition - Invasive Species

The likelihood of introducing invasive species into Lake Albert will reduce in the operational phase, after the main earth moving and construction are completed. Moving activities affecting Invasive aquatic species will be an ongoing risk through the operational phase of the project, although Invasive species usually have potential to spread further once there is disturbance. There are various ways through which invasive species may be introduced into Lake Albert, such as being carried on vehicle tyres or in construction materials such as gravel or aggregates. The near-shore environment of Lake Albert is already heavily infested with water hyacinth (*Eichhornia crassipes).* It is possible that construction vehicles, equipment and materials could introduce/spread other invasive aquatic species into the lake, including *Pistia stratiotes,* which is locally abundant in some wetlands on the Buhuka Flats. The impact of operation will be long term and local and of medium magnitude. Combined with high receptor sensitivity and the possibility of spreading of the weed regionally across the lake, impact significance without mitigation would be **High medium.**

8.2.1.1.5 Impact on Ecosystem Configuration

The CPF is planned to operate for 25 years. Drilling during the production phase will continue on the individual well pads for a period of 5 years. Besides the upgrading of the jetty and the construction of the water supply infrastructure, it is unlikely that operation of the project could substantially alter the movement of or interaction between species in Lake Albert or interrupt habitat linkages or corridors. Under normal operating conditions, the main interaction between the project and the lake will be abstraction of large quantities of water for use by the project. This is expected to have a negligible impact on water levels in the lake (refer to Section 11 for details). Operational impacts on ecosystem configuration are predicted to be indistinguishable from the expected range of natural disturbances. Impact magnitude will be negligible and although receptor sensitivity is high, the overall impact significance will be **Low.**

8.2.1.2 Mitigation and Monitoring

The following mitigation and monitoring is recommended to minimize the risk of operational impacts on the ecosystem composition of Lake Albert.

The following impact mitigation measures are recommended to minimise the risks of spillages affecting lake biota:

- Make provision for the designs of well pads to be checked by pollution control experts to ensure that the risks of spillage/overflow associated with drilling pollution management systems are minimised;
- Establish a pollution management system, to be fully defined in the Contractor’s contractual commitments, covering personnel, training, lines of responsibility, immediate action requirements, on-site spill kits, and all other factors necessary to ensure there is a provision for effective preventative and corrective action during all stages of construction and drilling;
- Inspect all machinery and vehicles prior to entering the construction site for weed propagules. Issue clearance certificates for each piece of machinery and equipment;
- Develop a culture of zero tolerance for pollution during the construction phase of the project;
- Provide a high level of competent environmental oversight during drilling of wells and construction of the CPF;
- Provide for thorough induction training of all construction personnel regarding pollution management, and ongoing refresher training throughout the construction/drilling contracts;
- Provide specific training to staff responsible for the oversight of pollution control systems; and

Ensure structured, daily, monitoring of pollution control systems on the well pads and at the CPF to minimise the risk of inadvertent spills and to respond quickly and effectively to any spills that occur. Emphasis must be on preventative measures.

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
- Water quality (erosion and sedimentation)	4	3	2	5	**Low Medium 45**	2	3	2	3	**Low 21**
- Water quality (oil (and chemical pollution)	8	4	3	5	**High 75**	2	3	2	3	**Low 21**
- Water quality (sewage treatment)	6	4	2	4	**Low Medium 48**	4	2	2	3	**Low 24**
- Invasive species	8	4	2	4	**High Medium 56**	4	4	2	3	**Low 30**
Ecosystem configuration	2	4	2	2	**Low 16**	2	4	2	1	**Low 8**

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

8.2.1.4 Impact on the Escarpment Vegetation Corridor

8.2.1.4.1 Impacts on Representativeness

The escarpment road and safety check station are the only elements of the production facility (and associated infrastructure) that directly impact on the escarpment vegetation corridor. The road has already been licensed by the Ugandan environmental regulator[9] and built. The safety check station will be built at the same time as the production facility. The direct operational impact of the production facility on the escarpment vegetation corridor will be limited to the potential impact of road traffic entering and leaving the site along the road. This will not impact on the representativeness of the vegetation communities and the significance of the impact will be **minor**.

[9] *For this study, the direct physical effects of building the road are considered to be construction impacts associated with the road, which include any long term consequences that could continue after the construction phase is completed, but are not related to the use of the road by CNOOC. Indirect effects, such as increased harvesting pressures due to migration into the area, either because of better access to existing resources or because of opportunities provided by the oil industry, are considered to be operational impacts which are driven by the access provided by the road and are therefore included in this Section*

8.2.1.4.2 Impacts on Ecosystem Composition

Vehicle traffic on the escarpment road could result in road deaths of some wild animals crossing along the corridor but it is unlikely that this could have a material impact on species diversity or abundance. The magnitude of the impact of the operational phase is likely to be very low, which combined with medium receptor sensitivity will result in an impact of **low medium** significance.

8.2.1.4.3 Impacts on Ecosystem Configuration

The wider Murchison Falls National Park-Budongo-Bugoma-Kagombe-Itwara Forest Reserves-Semliki/Toro Wildlife Reserve corridor is recognised as an important wildlife refuge for threatened species in the face of climate change adaptation (Ayebare et al. 2013), and as part of a much broader set of corridors running the length of the Albertine Rift. In the vicinity of the project, this corridor is very narrow compared to its extent elsewhere and is recognised as being important for savannah species (Plumptre et al. 2010).

Roads, and especially sealed roads, are known to be significant barriers to a range of wildlife from small ground-dwelling mammals to reptiles, amphibians and insects. They are not generally a constraint affecting the movement of birds. They may affect or prevent seasonal migrations of some species. For those animals that attempt to cross the road, mortalities are a risk.

The road to the Buhuka Flats will be the only major access crossing the escarpment in the south-eastern part of Lake Albert, that is, the only major road within the wildlife corridor from the southern end of the lake to the Kabwoya Wildlife Reserve. The average daily traffic on the road during the production phase is not known. It will be less than the construction phase and CNOOC is unlikely to permit access to the production facility at night. This will limit the risks of road deaths of nocturnal animals that cross the road along the vegetation corridor at night.

The frequency of traffic on the road is probably not sufficient to prevent most animals from crossing. The populations of highly mobile wildlife that may depend on the corridor are also severely depleted in the RSA. In particular, most of the terrestrial species that could utilise this corridor, such as large ungulates, predators, and primates are very rare in the area. Impacts will be long term, largely irreversible, local and of medium magnitude. In the context of the receptor sensitivity and potential for regional effects on the escarpment vegetation’s role as a corridor, the impact significance is considered to be **high medium**.

8.2.1.5 Mitigation and Monitoring of Impact

The following mitigation and monitoring is proposed:

- Limit vehicle speeds on the escarpment road;
- Include appropriate signage showing speed limits;
- Enforce speed limits;
- Prohibit night driving to or from the production facility except in emergencies;
- Educate personnel and suppliers about wildlife impacts caused by road traffic; and
- Monitor road kills in the escarpment section of the route.

8.2.1.6 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 8-16 does not take into account the induced effects of population influx on the escarpment vegetation corridor; those impacts are assessed separately in Section 8.2.3.

Table 8-16: Operational phase impacts on the escarpment vegetation corridor

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Representativeness	2	5	2	3	Low 27	1	5	2	2	Low 14
Ecosystem composition	4	5	2	3	Low Medium 33	4	5	1	2	Low 30
Ecosystem configuration	6	5	3	5	High Medium 70	4	5	3	4	Low Medium 48

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

8.2.1.7 Impacts on Wetlands and Drainage Lines

8.2.1.7.1 Impact on Representativeness

Once the construction impacts of the project are rehabilitated, the operation of the project is unlikely to cause ongoing loss of representativeness of wetlands in the RSA, or ongoing impacts to the permanent wetlands and the seasonally flooded grasslands on the Buhuka Flats. Impact magnitude will be low and impact significance **low medium.**

8.2.1.7.2 Impact on Ecosystem Composition – wetland structure and function

Project infrastructure on the Buhuka Flats will affect wetlands and drainage lines in three places:

- The flowline and road to well pad 3 which cross the seasonally wet grasslands associated with the Kamansiniga River, due south of the laydown area, over a distance of approximately 100 m over the main stream channel and the tributary; and
- Well pad 3 itself will be extended into the floodplain of the Kamansinig River (Figure 8-15).

The flowlines to well pads 2 and 4 will cross River 1, which is a seasonal drainage line that is not associated with wetlands at the crossing point south east of well pad 2.

8.2.1.7.3 Impact of Roads

The in-field roads to well pads 1 - 4 have already been assessed (Eco & Ptns, 2014), authorized by the Ugandan environmental regulator and built. The road to well pad 3 crosses the Kamansiniga River and its tributaries twice, over an approximately 100 m segment of wetland at each crossing. The road design provides for drainage beneath the road through one culvert at each crossing point (Photographs 8-3 and 8-4).

Photograph 8-3: Road culvert across the main channel of the Kamansinig River

Photograph 8-4: Road culvert across the subsidiary channel of the Kamansinig River

While the road design is intended to cater for floods, it effectively narrows the floodplain to a single discharge point across the formation. This is likely to have structural impacts on the wetland, with possible channel incision downstream of the culvert due to the concentrated flows and subsequent changes in wetland structure. Increased peak stormwater flows caused by runoff from the construction works would exacerbate this problem. The long-term impacts of the flow impediment include encroachment of terrestrial and exotic plant species in the areas of the wetland that have become desiccated, and changes in vegetation community upstream – from seasonally flooded grassland communities to plants more characteristic of permanently saturated conditions, such as *Phragmites* sp. and *Typha* sp. The effect of the existing road on the wetland is indicated in Photograph 8-5 in which the drying out of the downstream wetland is clearly evident.

Impact of the design and operation of the Kamansinig road crossing is expected to be long term, only partly reversible and of medium high magnitude. Taking into consideration the high sensitivity of the Kamansinig wetlands, and wetlands in general, the impact significance will be **high**.

Photograph 8-5: Impact of a poorly designed road on the Kamansinig Wetland

8.2.1.7.4 Impact of Flowlines

The flowlines across the seasonal streams in the LSA will all be buried below the depth of the active scour zones in the river channels and their operation is unlikely to obstruct surface water flow. The backfill into the trench is not normally cemented or compacted, which for small diameter pipelines minimizes the risk of impact on subsurface flow[10]. The risk to wetland function is mainly in the construction phase due to the disruption of wetland vegetation and soils by heavy machinery, particularly when tracked vehicles are used that have greater impact on soil structure and the soil profile is overturned due to careless construction management. Operational impact will be long term, largely reversible and of minor magnitude, resulting in impacts of **low medium** significance.

8.2.1.7.5 Impact of Well Pad 1

The extension of well pad 1 will impact directly on wetland functioning in the lower reaches of the Kamansinig River. The existing well pad is within the northern edge of the seasonally wet grasslands associated with the river. The expanded well pad will extend the impact on the wetland well towards the centre of the floodplain (a further 1.64 ha). The darker colour of the wetland in the satellite image in

[10] In some cases, particularly where pipelines intercept hillslope wetlands, the trench may act as a drain, but this is not the case with direct perpendicular crossings of bottomland wetlands

Figure 8-14 shows its position in relation to the well pad. The magnitude of this impact is considered to be medium, with the possibility of long term interference with subsurface flow and surface flow during floods, only partly reversible. The vegetation within these seasonally flooded grasslands is adapted to seasonal inundation, and, therefore, is dependent upon the cycle of wet and dry for survival. The location is also contrary to Ugandan legislation (Uganda Wildlife Act, 2000), and other best practice standards and guidelines, such as IFC Performance Standard 6. Coupled with the high sensitivity of this system, with its hydrological interconnectivity to the Bukoma lagoon, the impact significance will be **high.**

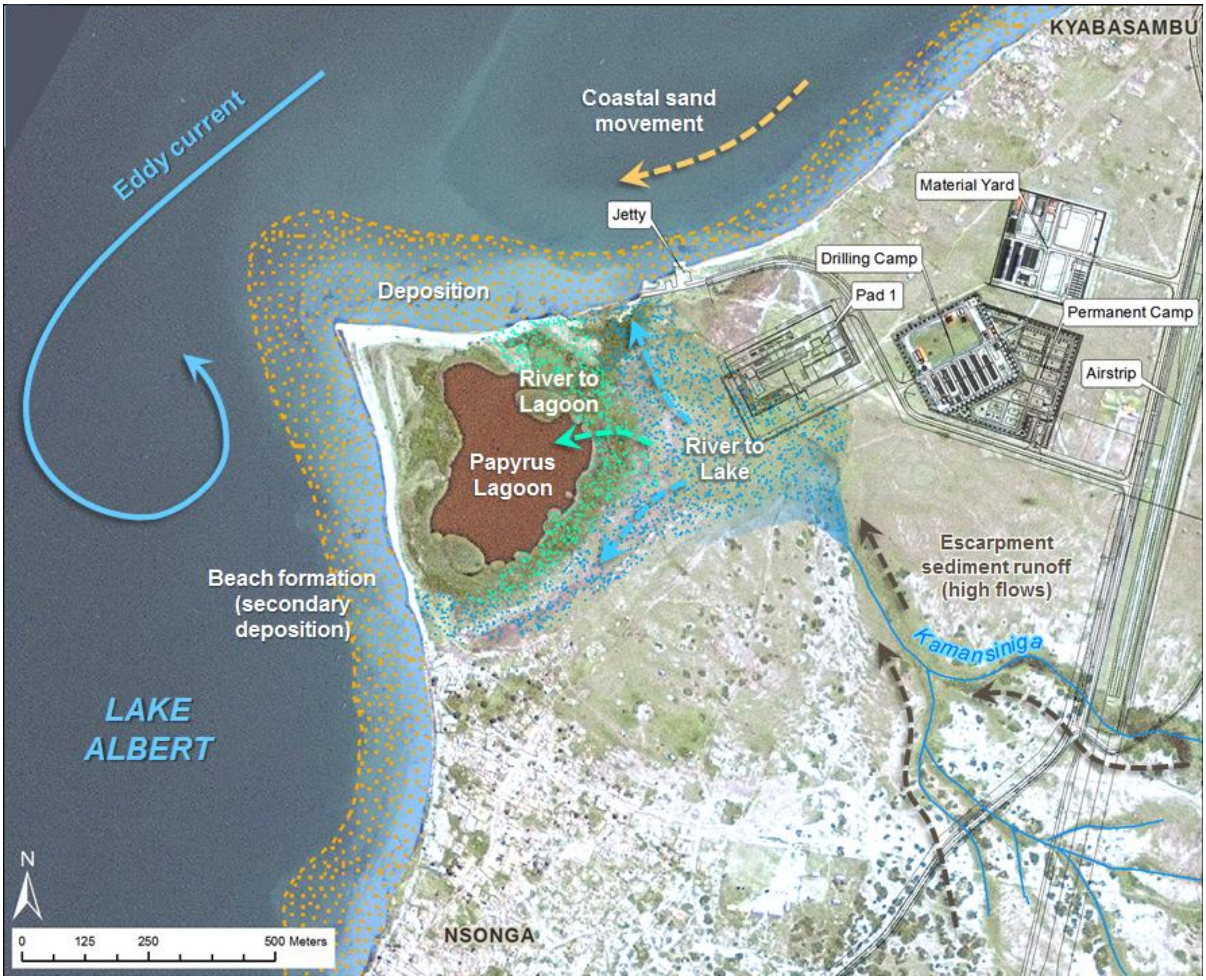

Figure 8-14: Details of well pad 1, showing its location within the lower reaches of the Kamansinig River wetlands and the expansion into the seasonal wetland

<u>Impact of stormwater drainage on River 1</u>

Drainage volumes during storms are expected to increase (due to the increase in hard surfaces and the concentration of flows), and due to discharges from the camp sewage treatment works. The peak storm flows and treated sewage effluent via canals into River 1 will significantly increase the risk of channel incision downstream of the CPF. The magnitude of this impact will be exacerbated by the soils, which are dispersive and prone to gulley erosion. A storm flow assessment of drainage from the CPF shows that the increased drainage discharging into River 1 is likely to cause gulley erosion.

Impact will be local, long term and largely irreversible, resulting in low impact magnitude. Receptor sensitivity is medium, given that this seasonal stream is already affected by approved project infrastructure in its lower reaches and is not associated with significant fringing wetlands. Impact significance will be **low medium.**

8.2.1.7.6 Impact on Ecosystem Composition - Water Quality

Operational impacts on water quality are an important element of risk to the biota of the LSA wetlands. These impacts are described in Section 8.1.2.2 on Surface and Groundwater. Impacts are rated under the general headings described in Table 8-17 below. The ratings are repeated in the impact significance rating table for wetlands (Table 8-17).

Table 8-17: Significance rating of impact on surface water quality during operation on the project wetlands

Category	Significance Rating
Erosion and sedimentation	Low medium
Oil and chemical pollution	High
Sewage treatment	High medium

8.2.1.7.7 Impact on Ecosystem Configuration

Roads are known to be significant barriers to, or can alter behaviours, of a range of wetland wildlife, from amphibians (for example, Pontoppidan et al. 2013) to turtles (for example, Langen et al. 2012). Depending on the species, the presence of roads may affect individuals in many direct and indirect ways. For example, roads may inhibit seasonal migration and may cause an effective loss of habitat due to avoidance. The operation of the in-field roads through the wetlands of the Buhuka Flats are not expected to be major barriers to movement for those species inhabiting them. These roads are only 5 m wide and are during the operational phase, once drilling is complete, will carry limited daily traffic volumes. They are not expected to be major barriers. Impacts will be local and long term, and impact magnitude will be medium. The sensitivity of species to the operation of both the roads and flowlines is medium. Impact significance will be **high medium.**

8.2.1.8 Mitigation and Monitoring of Impact

The following impact mitigation and monitoring is recommended:

- Re-evaluate the drainage across the in-field road to well pad 3 across the Kamansinig River, taking into account additional storm flow from the production facility and the maintenance of drainage across the seasonal floodplain. Install additional drainage as required to minimize obstruction of wetland flow;
- Adjust the final design of the canals channeling stormwater and treated from the CPF to remain outside of the seasonally wet areas associates with River 1, crossing the river channel just upstream of the road culvert (Figure 8-14). From the culvert onward, it may be necessary to canalise the flow to the lake. Use open cross section swales for this purpose (not concrete canalisation), reinforced if necessary and grassed. Finalise the canal design and align the stormwater drains with the assistance of a wetland ecologist;
- Manage all products and wastes (including hazardous products and wastes) to minimise the risk of their escaping from controlled areas (management according to measures recommended under Section 8.1.2);
- Prohibit access to personnel outside of the defined project work sites and access roads. Train personnel to understand the sensitivity of the local environment in induction and ongoing tool box talks;
- Specifically prohibit project personnel from access to the Bugoma swamp, which is resource of exceptionally high ecological and cultural value. The Bugoma swamp is a part of the Kamansinig wetland system, all of which is regarded as sensitive;

- Ensure that all vehicles and machinery are in sound mechanical order, do not have any oil leaks and are fitted with appropriate mufflers to minimise nuisance affecting wetland biota; and
- Prohibit any refueling of equipment within 100 m of a wetland.

8.2.1.9 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 8-18 does not take into account the induced effects of population influx on wetlands; those impacts are assessed separately in Section 8.2.3.

Table 8-18: Operational phase impacts on wetlands

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Representativeness	4	4	2	4	Low Medium 40	2	4	1	2	Low 14
Ecosystem composition										
- Wetland structure and function (roads)	8	5	2	5	High 75	6	5	2	2	Low 26
- Wetland structure and function (flowlines)	2	4	2	4	Low Medium 32	2	4	2	3	Low 24
- Wetland structure and function (well pad 1)	8	5	2	5	High 75	6	5	2	2	Low 26
- Wetland structure and function (stormflow from CPF)	4	1	2	5	Low Medium 35	2	1	2	2	Low 8
- Water quality (erosion and sedimentation)	4	4	2	5	Low Medium 50	2	3	2	3	Low 21
- Water quality (oil (and chemical pollution)	8	4	3	5	High 75	2	3	2	3	Low 21
- Water quality (sewage treatment)	6	4	2	4	Low Medium 48	1	4	2	4	Low 28
Ecosystem Configuration	6	4	2	5	High Medium 70	4	4	2	3	Low 30

KEY

Magnitude	Duration	Scale	Probability
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

8.2.1.10 *Impact on the Bugoma Central Forest Reserve*

This section includes a habitat level assessment of operational phase impacts on the Bugoma Central Forest Reserve (BCFR). Impacts on species of concern are described in Section 8.2.3. The BCFR is one of the last stands of tropical semi-deciduous forest in the region, supporting known populations of the Endangered Nahan's Francolin and Eastern Chimpanzee (Plumptre et al. 2011); the Endangered Madagascar Pond Heron (see Section 6.3.3.1); elephants and other threatened and irreplaceable species. The total area of the BCFR is ~39,992 ha (399 km^2).

The Ugandan Government will be responsible for upgrading the roads that the oil industry will need for access. Scheduled 'oil industry' road upgrades to support the KFDA include those shown in Figure 8-15. While not CNOOC's responsibility, the overall impact will be as a consequence of the KFDA and is therefore relevant in this ESIA.

The R5 linking Rwera Kisooba to Kaseeta, and the P1 from Kabwoya to Nsozi, impact directly on the Bugoma Central Forest Reserve (BCFR). The R5 passes through the centre of the BCFR in a north-south direction. The P1 is routed from north-east to south west, mainly along the southern border of the BCFR, but crossing the reserve at its narrowest point between the northern and southern sections (Figure 8-15).

Indirect habitat loss due to the disturbance caused by traffic will continue after the construction phase into the operational phase[11]. Accurate information about operational phase traffic on the roads to and from the CNOOC CPF is not available. Traffic volumes are expected to be lower than those in the construction phase, but may still be substantial and sufficient to impact on sensitive species. Although the negative effects of roads on wildlife in tropical rainforests, like the BCFR, are poorly understood, indications are that:

- many shy species avoid roads altogether (especially, medium-sized mammals, diurnal, solitary and group living animals, and ungulates); and
- High vegetation cover on the road verges increases crossing probability and the risk of road kills substantially for some species (van der Hoeven et al. 2010). Currently, the roadside vegetation on the Hoima-to-Ikamiro Road would encourage wildlife to cross (Figure 8-15).

The operational traffic impact will be long term, localized and of high magnitude, which combined with high receiver sensitivity would result in impacts of **high** significance. The application of the recommended mitigation measures removes the chance of occurrence and makes the magnitude of any potential impact negligible.

[11] *No additional habitat loss due to vegetation clearance for road widening is expected in the operational phase of the project. These impacts will occur during the construction phase and are described in Section 7*

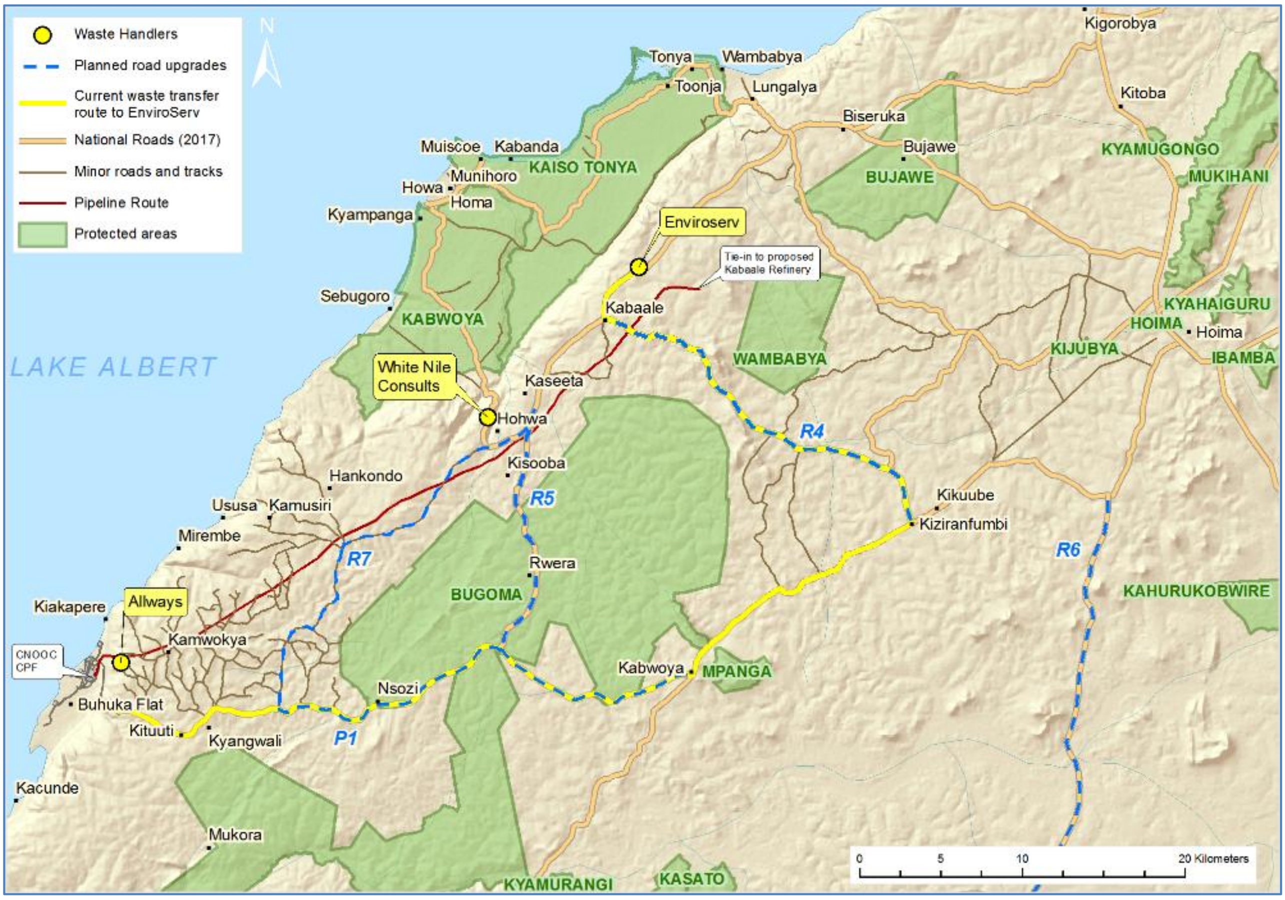

Figure 8-15: Proposed road upgrades in the RSA (the proposed upgrade of the R5 passes through the center of the BCFR)

8.2.1.11 Mitigation and Monitoring of Impact

All of the mitigation for the management of indirect traffic impacts during the construction phase is applicable to the operational phase as well. Refer to Section 7. Recommendations include the following (bullets 1, 2 and 4 are the responsibility of the Ugandan Government):

- De-list the R5 from the proposed oil road upgrades. CNOOC has confirmed that it does not need this road, either for construction or operational purposes. The Ugandan Government has been formally notified. CNOOC will use the P1 as the major access road during the operational phase and, the upgraded R7;
- Limit vehicle speeds to 40 km/h along the road in the section from Mpanga to Nsozi which borders on the BCFR. Monitor and enforce vehicle speeds limits;
- Prohibit transport along the P1 to and from the CPF at night;
- Widen the P1, on the non-forest side of the road in order to minimise forest habitat loss; and
- Ensure that all transporters are fully aware of the risks to wildlife in the BCFR and train their drivers accordingly.

8.2.1.12 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 8-19 does not take into account the induced effects of population influx on Bugoma CFR; those impacts are assessed separately in Section 8.2.3.

Table 8-19: Operational phase impacts on the Bugoma Central Forest Reserve (BCFR)

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat and ecosystem integrity	8	4	4	5	High 80	1	5	4	0	NSI

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low $\leq$30; Low Medium 31– 52; High Medium 53 – 74; High $\geq$75. Positive: +							

8.2.2 Species of Concern

8.2.2.1 Impact on the Mud Snail (Gabbiella candida)

The Mud Snail (*Gabbiella candida*) is a Critically Endangered and range restricted species. Currently, the only known populations occur around Butiaba (see Section 6.2.6.3), which is on the eastern shore of Lake Albert approximately 90 km north of the LSA. This species could occur in the near-shore habitats of the RSA, based on its known habitat preferences, and a precautionary approach has been adopted assuming that is does.

The indicators used to assess impacts of the operation of the project on the Mud Snail are habitat quantity and quality, and habitat connectivity. Very little information is available for this species. It has generally been found in the same locations as two sister species, *G. humerosa* and *G. walleri*, and the habitat preferences for these species have therefore been used as the basis for assessing the suitability of habitat for *G. candida*.

8.2.2.1.1 Habitat Quantity and Quality

The two sister Mud Snail species described above have been collected from bottom substrates in the open sandy shore habitats of Lake Albert in the LSA. These habitats are characterised by a gently sloping lake bed extending from the shore line to deeper water. The substrate is typically comprised of sand and finer sediments (Wandera and Balirwa 2010) and constitutes approximately 10.5 km of the RSA, most of which is located within the LSA.

Section 8.2.1.1 describes the impact of the operation of the CNOOC production complex on the nearshore environment of Lake Albert in terms of general ecological risk. These impacts will affect the Mud Snail. Sediment deposition in the lake may occur due to the direct impacts of channel incision, caused by accelerated stormwater flows, and the indirect impacts of increasing population densities, overgrazing and sheet erosion. The magnitude of this impact is expected to be low, but of **low** significance due to the critically endangered status of the snail.

Accidental spillages of small quantities of hydrocarbons and chemicals during the operation of the project (not including significant/catastrophic spillages, which are described in Section 10) could report to the near-shore habitats of the LSA. Without a high degree of control over operational management, there is a material risk in this regard. Control systems are proposed to manage contaminated stormwater and wash-water from operational activities, but the absence of buffers between the work areas and the lake increases the risk of even small spills reaching the lake. This impact is described in relation to the general ecology of the lake in Section 8.2.1.1, and it applies in the same or greater measure to *G. candida,* which like other aquatic snails, is highly sensitive to chemical pollutants, particularly hydrocarbons (Araujo et al. 2012). Without a very high level of control of day-to-day construction activities and appropriate spill prevention and clean-up measures in place, accidental spillages of fuels and chemicals could, depending on the volume spilt, result in impacts of **high** significance on this threatened Mud Snail.

8.2.2.1.2 Habitat Connectivity

The operation of the Project is expected to last for 25 years. The water intake works consists of an open lattice structure extending into the lake and it is unlikely that it will materially impact on movement of sediment along the shoreline. The magnitude of the impact is expected to be negligible and the impact significance **minor.**

8.2.2.1.3 Mitigation and Monitoring

Impact mitigation and monitoring is as specified under *Impact on the Near-shore Environment of Lake Albert* (Section 8.2.1.1).

8.2.2.1.4 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 8-20 does not take into account the induced effects of population influx on *G. candida*; those impacts are assessed separately in Section 8.2.3.

Table 8-20: Operational phase impacts on the Mud Snail, G. candida

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat quality and quantity										
- Sediment	4	4	5	5	High Medium 65	2	4	2	3	Low 24
- Hydrocarbons and chemicals	8	4	5	5	High 85	6	4	2	3	Low Medium 36
Habitat connectivity	2	4	1	2	Low 14	2	4	1	2	Low 14

KEY

Magnitude	**Duration**	**Scale**	**Probability**
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

8.2.2.2 Impact on the Grey Crowned Crane

The Grey Crowned Crane is an endangered species. It is a regular visitor to the Buhuka Flats and is also likely to be found foraging in the cultivated lands above the escarpment. It may breed in the larger wetlands on the Buhuka Flats (the Masika River) and pair formation has been observed although nests have not been found. Breeding on the Kamansining River is possible but unlikely.

8.2.2.2.1 Habitat Quality and Quantity

The operation of the project is unlikely to result in direct losses of wetland habitat on the Buhuka Flats, over and above those caused by the road crossing of the Kamansinig River and the expansion of well pad 1 in the Kamansinig floodplain. Once construction is completed, disturbed areas that are not a part of permanent project infrastructure will rehabilitate and activities associated with the project will be largely limited to the defined work areas.

The Grey Crowned Crane will tolerate some anthropogenic disturbance (they are found in cultivated lands) but are generally shy and fly away at distances of 100-200 m when approached (Olupot, 2014). How tolerant the foraging /roosting birds may be to indirect disturbances, such as noise, light, vibration and edge effects, is not known. The application of a 200 m buffer around the project infrastructure footprint indicates that approximately 4.6 ha of seasonally flooded wetland habitat will be reduced in quality as a result of sensory disturbance, throughout the operational lifetime of the project. Impacts will be long term and of low magnitude, which in the context of the endangered status of the cranes will result in impacts of **low medium** significance.

8.2.2.2.2 Habitat Connectivity

The effect of the production facility as a barrier to the movement of the Grey Crowned Crane is likely to be adverse. The operation of the plant and drilling rigs will create noise and visual sensory disturbances, which could elicit reduced use or complete avoidance of affected areas over and above the 200 m buffer referred to above, thereby creating movement barriers. Impact magnitude will be low and in the context of the endangered status of the cranes, impacts will be of **low medium** significance.

8.2.2.2.3 Abundance and Distribution

While the operation of the production facility does not involve large amounts of traffic to and from the wells, there will nevertheless be a significant increase in general activity on the Buhuka Flats, which may exceed the tolerance of the birds, and induce them to avoid much of the local area. Impacts will be of low medium significance**.**

8.2.2.2.4 Survival and Reproduction

Direct project impacts on survival and reproduction of the Grey Crowned Crane on the Buhuka Flats will be limited. Generally increased industrial activity on the Flats may reduce the breeding success of any nesting birds, which will flush from their nests on approach, causing increased rates of predation, reduced time at the nest, either incubating or feeding, and ultimately the possibility of nest abandonment. The impact magnitude is expected to be low which in the context of the sensitivity of the cranes will cause impacts **of low medium** significance.

8.2.2.2.5 Mitigation and Monitoring

The following mitigation and monitoring is recommended:

- Ensure rapid recovery of areas disturbed by construction;
- Strictly limit personnel outside of the defined areas of project activity. Permit approvals are to be required for any activity that is not in a recognized work areas;
- Educate all personnel about the sensitivity of the cranes and the importance of not approaching them at distances closer than 200 m or otherwise interfering with them in any way; and
- Monitor the occurrence of the cranes on the Buhuka Flats.

8.2.2.2.6 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 8-21 does not take into account the effects of induced population influx to the study area on Grey Crowned Crane; those impacts are assessed separately in Section 8.2.3.

Table 8-21: Operational phase impacts on the Grey Crowned Crane

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat quality and quantity	4	4	2	5	Low Medium 50	2	4	2	2	Low 16
Habitat connectivity	4	4	1	5	Low Medium 45	2	4	1	2	Low 14
Abundance and distribution	4	4	2	5	Low Medium 50	2	4	2	2	Low 16
Survival and reproduction	4	4	2	5	Low Medium 50	2	4	2	2	Low 16

KEY

Magnitude	Duration	Scale	Probability
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
1 None/Negligible							0 No chance of occurrence			
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +										

8.2.2.3 Impact on Nahan's Francolin

Nahan's Francolin is a vulnerable and range restricted species. It has a very restricted distribution, being found only in north-east DRC and western and south-central Uganda; in particular, the forests of Budongo, Bugoma and Mabira (McGowan and de Juana 1994). It has been recorded within Bugoma Central Forest Reserve within the RSA. This species triggers IFC Tier 1 critical habitat[12].

The Government's plans to build roads to support oil industry activities are shown in Figure 8-17. The R5 and P1 upgrades, which affect the BCFR, are directly in support of the KFDA. While the responsibility for road developments to provide access for the oil projects are not within CNOOCs direct control, the impacts the roads cause are directly related to the development of the project.

8.2.2.3.1 Habitat Quantity and Quality

Impacts on habitat quantity and quality in the BCFR may result from nuisance caused by operational traffic. Operational traffic volumes are not known, and while they are likely to be lower than construction traffic volumes, the potential for nuisance affecting shy species remains high. Birds are known to be sensitive to land use and habitat alteration (Lussier et al. 2006). Many studies have reported a reduction in breeding success attributable to human disturbance (for a review, see Hill et al. 1992). Mechanisms include increased rates of predation, nest abandonment and reduced time at the nest, either incubating or feeding. Clearly, a reduction in breeding could impact on the population of Nahan's Francolin.

How tolerant it may be to noise, vibration and edge effects is unknown, but being a shy, forest-dependent, species, it is likely that it will avoid the operational traffic on the upgraded roads. It is assumed that the nuisance impact of the traffic could extend for 200 m into the forest on either side of the road, which results in an effective loss in habitat of 795 ha. While this is a small proportion of the total available habitat in the BCFR, resulting in an impact of low magnitude, the receptor sensitivity is high and the impact significance will be **high medium.**

8.2.2.3.2 Habitat Connectivity

The R5 and P1 are existing roads. Traffic may already be a barrier to the movement of Nahan's Francolin to a greater or lesser degree. However, current traffic volumes are expected to be low on both roads, particularly on the R5 through the centre of the BCFR. The volumes of operational traffic routed to and from the CNOOC production facility will be an order of magnitude greater than existing traffic and is likely to cause nuisance-related impacts as a result of noise and vibration. As discussed in Section 7.2.2.2.1, it is uncertain whether Nathan's Francolin will completely avoid the roads because of the nuisance caused by the regular

[12] Tier 1 habitats are considered to be very sensitive, and, therefore, if a project is located in such a habitat, the IFC considers it unlikely that the client will be able to comply with the provision of Performance Standard 6 (PS6), in particular paragraphs 17, 18 and 19 (IFC 2012a). In summary, a project will not be developed in Tier 1 habitat unless: no other viable alternatives exist; and, the project does not lead to measurable and irreversible adverse impacts to the valued component that triggered critical habitat; and, the project does not lead to a net reduction in the global and/or national/regional population of the triggering species (such as Nahan's Francolin and Eastern Chimpanzee) over a reasonable period of time; and, a robust, appropriately designed, and long-term biodiversity monitoring and evaluation programme is part of the project's Environmental and Social Management System (ESMS). A Biodiversity Action Plan (BAP) will be developed to achieve net gain for the affected species.

passage of heavy vehicles, If so, the available habitat for birds with ranges divided by the roads will be reduced. If not, the birds may be at increased risk of road deaths.

Based on existing knowledge of this francolin's habits, it is expected that the magnitude of operational traffic impact on habitat connectivity would be low, which, taking into consideration the critically endangered status (and high receptor sensitivity) of the francolin, would result in impacts of **low medium** significance.

8.2.2.3.3 Abundance and Distribution

Nahan's Francolin is reported to be relatively common in the Bugoma Central Forest Reserve (Plumptre et al. 2011) although its distribution within this habitat is unknown. If as is discussed above, the francolin avoids the vicinity of the roads carrying heavy traffic, there will be a change in distribution of the species, and abundance within the sub-optimal zones along the road corridor will drop. Alternatively, if the birds attempt to cross the roads in order to forage within their usual range, they will risk collision with operational traffic. The potential impact is of **high medium** significance.

8.2.2.3.4 Survival and Reproduction

The Nahan's Francolin's degree of vulnerability to direct disturbance, particularly during the breeding season, is not well understood. The francolin is reliant on large trees, with appropriate buttresses, for breeding sites (Sande et al. 2009a). Nuisance-related effects on the birds' breeding success may be significant, if they respond negatively to the impact of traffic noise and vibration. In this instance, the roads may cause reduced breeding success for those individuals within the noise and vibration impact zones of the road, an impact of medium magnitude and **high medium** significance, taking into consideration the vulnerable status of the species.

8.2.2.3.5 Mitigation and Monitoring

The following impact mitigation and monitoring is recommended:

- Implement the recommendations included under Section 8.2.1.4 to de-list the R5, to minimize heavy vehicle risks to fauna along the P1 and to implement the other recommended management and monitoring of truck drivers and driver schedules, intended to minimize CNOOC traffic disturbance along the southern boundary of the BCFR. These measures will significantly reduce the direct impact of CNOOC traffic on the Nahan's Francolin to **minor** levels of significance; and
- Support the development and implemention a long term research and monitoring programme to improve understanding of the behaviour and status of Nahan's Francolin in the BCFR (this recommendation is developed further in Chapter 17, Cumulative Impacts).

8.2.2.3.6 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 8-22 does not take into account the effects of induced population influx to the study area on Nahan's Francolin; those impacts are assessed separately in Section 8.2.3.

Table 8-22: Operational phase impacts on Nahan's Francolin

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat quality and quantity	4	4	3	5	High Medium 55	2	4	2	2	Low 16
Habitat connectivity	4	4	2	5	Low medium 50	2	4	1	2	Low 14
Abundance and distribution	4	4	3	5	High Medium 55	2	4	2	2	Low 16
Survival and reproduction	6	4	2	5	High Medium 60	2	4	2	2	Low 16

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

8.2.2.4 Impact on the Eastern Chimpanzee

The Eastern Chimpanzee is an endangered species. A population occurs in the Bugoma Central Forest Reserve. The species triggers IFC Tier 1 critical habitat. Chimpanzees' vulnerability to disturbance is reasonably well known (Parren and Byler 2003, Rabanal et al. 2010, Thompson and Wrangham 2013). The land around the BCFR is intensively settled, and the chimpanzees living in the forest have some experience of humans. Groups of chimpanzees are known to forage in the cultivated lands around the BCFR (McLennan 2008). Typical sounds associated with rural communities will be familiar to them as will the sound of traffic along the Kabwoya-Ikamiro (P1) road (refer to Figure 8-17). There is presently little traffic on the R5 through the centre of the reserve.

Plumptre et al. (2010) have shown that chimpanzee nesting sites are widely distributed through the BCFR, except in the vicinity of the P1 road, where nesting frequency is much lower. This suggests that the chimpanzees within the BCFR actively avoid the disturbance of the road at night, an observation supported by Parren and Byler (2003). Evidence of chimpanzees avoiding industrial activity, like earth moving, varies. Parren and Byler (2003) recorded chimpanzees leaving their range as a result of logging activities heard from a distance of 5 to 10 km, and they suggested that this could cause lasting avoidance of disturbed areas. This may explain why chimpanzee densities were consistently lower in logged areas in Kibale National Park, compared to unlogged areas, although avoidance of hunting as a result of logging activity may also have been a factor (Chapman and Lambert 2000. Rabanal et al. (2010) did not find large-scale spatial responses to oil and gas related noise disturbance in Loango National Park, Gabon; although chimpanzees avoided sites where explosives were used for exploration for a period of four months after the activity had ceased (Rabanal et al. 2010).

8.2.2.4.1 Habitat Quality and Quantity

The chimpanzees within the BCFR are likely to show localised patterns of avoidance in response to increased vehicle noise and other human activity associated with the R5 and P1. During the operational phase of the project, traffic is likely to be reduced to lower volumes than the construction phase although traffic estimates are not available at present. It remains likely (as in the construction phase) that there will be traffic and other noises that the chimpanzees will associate with danger and that they will avoid these roads to a greater degree than at present, probably (based on evidence of chimpanzee sensitivity provided by Parren and Byler 2003, Rabanal et al. 2010) by up to 500m on either side of the road. Applying this buffer to both roads in the sections where the pass through or abut the BCFR, the habitat lost or reduced habitat quality will be approximately 485 ha (1.2%). This impact will be local (to the BCFR), long term, and of low magnitude. Taking into consideration the increasing threats to the Eastern Chimpanzee due to habitat loss, its vulnerability is high and the overall impact significance of reduced habitat availability or habitat quality is considered to be **high medium**

8.2.2.4.2 Habitat Connectivity

The Bugoma Central Forest Reserve chimpanzees are accustomed to some human activity and will have experience of the construction phase traffic of the project. It is expected that operational phase traffic will have little effect on the behaviour of the chimpanzees, resulting in long term habitat connectivity impacts at local scale (the BCFR) of low magnitude and **low medium** significance.

8.2.2.4.3 Abundance and Distribution

The BCFR supports one of the four largest Eastern Chimpanzee populations in Uganda, with between 450 and 850 individuals (Plumptre et al. 2010). It is expected that some of them regularly cross the R5, and there is evidence that groups of animals' forage outside of the reserve, so they may cross the P1 also.

Operational traffic is likely to be at high enough volumes for there to be occasional interaction between vehicles and the chimpanzees crossing the roads. How the chimpanzees would behave in the face of an oncoming vehicle is unknown. The probability of collisions and the potential magnitude of this impact is unknown, but it is no longer negligible, as is the case at present where traffic volumes are limited. The magnitude of potential impacts on Eastern Chimpanzee abundance and distribution is considered medium; however, any impacts must be assessed at the international scale, given the global conservation importance of this species. Impact significance will be **high**.

8.2.2.4.4 Survival and Reproduction

Proximity between humans and chimpanzees increases the risk of introducing diseases into the chimpanzee populations. Human diseases can be directly transmitted to chimpanzees (Lonsdorf et al. 2011) particularly communicable respiratory diseases such as tuberculosis, influenza and acute upper and lower respiratory infections. Disease is recognised as one of the main threats to chimpanzee populations, and, because chimpanzees and humans are so similar, chimpanzees succumb to many human-borne diseases (Oates et al. 2008).

The increase in traffic along the R5 through the centre of the forest will introduce a new pathway for disease transmission. Defecation in forest undergrowth by truck drivers could indirectly lead to spread of intestinal diseases, such as *Clostridium perfringens*, which can be fatal to chimpanzees (Fujita 2011). In the past 15 years, Ebola haemorrhagic fever has killed chimpanzees in Côte d'Ivoire, and repeated epidemics have caused dramatic declines of ape populations in remote protected areas in Gabon and the Republic of Congo (Oates et al. 2008). Uganda has experienced outbreaks of Ebola in the past, with the most recent in Kibaale in 2012 (WHO 2104). This impact will be long term and is potentially fatal for numerous animals, should a disease spread. The magnitude will be high, which in the context of the very high sensitivity of this endangered species of global conservation importance, results in impacts of **high** significance**.**

8.2.2.4.5 Mitigation and Monitoring

The impact mitigation specified under the construction phase should apply to the operational phase as well (Section 7). The following is recommended:

- Implement the recommendations included under Section 8.2.1.4 to de-list the R5, to minimize heavy vehicle risks to fauna along the P1 and to implement the other recommended management and monitoring of truck drivers and driver schedules, intended to minimize CNOOC traffic disturbance along the southern boundary of the BCFR. These measures will significantly reduce the direct impact of CNOOC traffic on the Eastern Chimpanzee to **minor** levels of significance;
- CNOOC must manage and monitor the behaviour of its suppliers through a code of practice for drivers travelling through the BCFR; and
- Support the development of a long term monitoring programme of the Eastern Chimpanzee populations in the BCFR.

8.2.2.4.6 Impact Significance Rating

It should be noted that the impact significance rating depicted in Table 8-23 does not take into account the induced effects of population influx to the study area on Eastern Chimpanzee; those impacts are assessed separately in Section 8.2.3.

Table 8-23: Operational phase impacts on the Eastern Chimpanzee

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat quality and quantity	4	4	3	5	High Medium 55	2	4	3	2	Low 18
Habitat connectivity	4	4	2	5	Low Medium 50	2	4	2	2	Low 16
Abundance and distribution	6	4	5	5	High 75	2	4	5	2	Low 22
Survival and reproduction	8	4	5	5	High 85	4	4	5	3	Low Medium 39
KEY										

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

8.2.3 Impacts of Population In-Migration

Habitats and ecosystem integrity and species of conservation concern are both likely to be affected by an influx of population into the study area, caused by people seeking work and other opportunities that will spin off from the project. This is borne out by the dramatic in-migration onto the Buhuka Flats over the past 10 years, with people seeking opportunities offered by fishing in Lake Albert. In cases, settlements have increased by over 100%. Recently, a further marked change has resulted from the construction of the escarpment road, with markets on the Buhuka Flats now operating daily, where previously they were a weekly event.

The lure of jobs in the oil industry is likely to attract further influx, both on the Buhuka Flats and in the area above the escarpment around the Bugoma Central Forest Reserve (BCFR). The magnitude of this change is difficult to predict but will be material given the shortage of jobs in Uganda and surrounding countries like Rwanda and the DRC.

8.2.3.1 Impact Habitats and Ecosystem Integrity

The indirect impacts of in-migration are expected to include the following:

- Impact on the near-shore environment of Lake Albert. The induced impact of the escarpment road (built in support of the future construction of the CNOOC KFDA on Buhuka Flats) has already resulted in a sharp escalation in commercial fishing, driven from Kampala, and now part of daily life. Near-shore fish stocks are decreasing as a result of the intense fishing pressure, with catches of only very small fish becoming more common (see Photograph 8-3). These pressures will increase as populations on the Buhuka Flats grow.

  Other impacts on the near-shore environment of the lake will result from changes in water quality, induced by overstocking and increased soil erosion on the Buhuka Flats, increasingly poor sanitary conditions associated with the growing lakeside population pollution caused by fuels, human and livestock waste, fish waste and litter;

- Impact on wetland habitats on Buhuka Flats. All of the wetlands, including those on the Masika River south of the construction work areas are likely to experience increased pressure due to harvesting of fibre for house construction and grazing of livestock;

- Impact on terrestrial habitats on the Buhuka Flats. Grazing pressures are expected to increase to unsustainable levels. Soils on the Flats are highly erodible and a reduction in vegetation cover will cause increasing habitat degradation due to erosion. Increasing demand for fuel wood will result in harvesting of the remaining woody species. Changes in plant species composition are likely, with hardier pioneer species becoming more dominant and invasive weed species more prevalent. A permanent reduction in the carrying capacity of the Flats may occur due to soil loss;

- Impact on fauna on the Buhuka Flats: All species are likely to be under increasing pressure due to habitat degradation and mammals and bird populations will be reduced by increased hunting for bush meat. Remaining populations of bushbuck and duiker are likely to be locally exterminated;

- Impact on the escarpment vegetation corridor. Grazing pressures will force stock into the accessible areas on the escarpment, where erosion risks are high. Demand for fuel wood is also likely to affect the escarpment habitats, with trees and woody vegetation being harvested for fuel wood. Faunal populations and species diversity will be affected by increased hunting for bush meat; and

- Impact on the Buhuka Central Forest Reserve (BCFR). Wittemyer et al. (2008) have shown that population growth and encroachment around protected areas is significantly higher than the average population growth in rural areas - mainly due to the migration of people into these areas because of the perceived increased availability of opportunities, natural resources and potential jobs. The pressure on the BCFR from surrounding populations is already evident. The land around the forest has been largely transformed for agricultural and subsistence, resulting in increasingly scarce natural resources.

  Recently, more than 1,500 people were evicted from the BCFR after illegally settling in the forest (Mugerwa 2013). The improved road infrastructure associated with the oil industry will further encourage the influx of migrants. Materially heightened risk to the BCFR is likely, due to both increased incursions into the forest reserve for medicinal plants, wood harvesting, charcoal manufacture and hunting, and encroachment and forest clearing by new settlers.

Figure 8-16: Intensive subsistence agriculture around the BCFR and incursions into the forest in the center of the photograph (this intensity of rural settlement and cultivation is typical of the areas surrounding the BCFR)

8.2.3.2 Species of Conservation Concern

All species of conservation concern in the Regional Study Area are likely to face increased threats due to in-migration:

- The critically endangered **Mud Snail** could be impacted by increasing sediment generation and near-shore pollution caused by growing populations along the shore of Lake Albert;
- The endangered **Grey Crowned Crane** will be affected by the impact of increasing human populations and stock on the Flats. Habitat degradation, nuisance, the increased threat of hunting, and the capture of crane chicks for sale on the open market are likely to cause the loss of the small crane population currently resident on the Buhuka Flats;
- Increasing pressure on the vulnerable, range-restricted **Nahan's Francolin** would be possible both as a result of deforestation in the BCFR, which could have some impact on available habitat for breeding of the francolin, and due to increased nuisance and levels of illegal hunting and trapping in the forest; and
- For the population of endangered **Eastern Chimpanzees**, resident in the BCFR, the risks would be due to increasing habitat loss as a result of settlement on the perimeter of the forest, escalation of hunting in the forest for bush meat and ritual killings and the possibility of diseases introduced into the chimpanzee populations as a result of closer proximity to humans. Proximity between humans and chimpanzees increases the risk of introducing diseases into the chimpanzee populations. Human diseases can be directly transmitted to chimpanzees (Lonsdorf et al. 2011) particularly communicable respiratory diseases such as tuberculosis, influenza and acute upper and lower respiratory infections. Disease is recognised as one of the main threats to chimpanzee populations, and, because chimpanzees and humans are so similar, chimpanzees succumb to many human-borne diseases (Oates et al. 2008);

Increased defecation in forest undergrowth by migrants could indirectly lead to spread of intestinal diseases, such as *Clostridium perfringens*, which can be fatal to chimpanzees (Fujita 2011). In the past 15 years, Ebola haemorrhagic fever has killed chimpanzees in Côte d'Ivoire, and repeated epidemics have caused dramatic declines of ape populations in remote protected areas in Gabon and the Republic of Congo (Oates et al. 2008). Uganda has experienced outbreaks of Ebola in the past, with the most recent in Kibaale in 2012 (WHO 2104). This impact could be potentially fatal for numerous animals, should a disease spread.

8.2.3.3 Mitigation and Monitoring

It is recommended that the measures set out in the Influx Management Strategy and Framework Plan for the project are implemented (refer to Specialist Study 11 for details). The objectives of the Influx Management Strategy and Framework Plan are to, in consultation with government, donors, the KFDA partners Tullow and Total, and other stakeholders, put in place measures to:

- Avoid or reduce influx of work seekers to the project area and those seeking to take advantage of Project related economic opportunities;
- Avoid or reduce influx of opportunity seekers that that will not contribute to development and upliftment of local communities;
- Proactively attract skilled people such as teachers, health workers, and experienced traders and entrepreneurs; and
- Manage such undesired influx as cannot be avoided through support to existing Government and donor initiatives for planning and development of the Hoima and Kikuube District, and the protection of habitats and ecosystem integrity and species of conservation concern.

There is a considerable effort still required to set up the details of a working plan in this regard. With respect to biodiversity, long term monitoring plans must be developed for the valued environmental components potentially affected by in-migration, including the habitats of the Buhuka Flats, Escarpment Corridor and the Bugoma Central Forest Reserve, and all of the species of conservation concern. Monitoring of settlement around the BCFR will be necessary to provide data in support of actions to minimise impacts on the forest habitat and the potentially affected threatened species within it.

The potential magnitude of the described impacts prior to mitigation is uncertain, as the scale of population influx to the region and the consequences of this are difficult to ascertain but may be very high, resulting in impacts of **high** significance. While the implementation of the Influx Management Strategy and Framework Plan is expected to reduce migration into the area, it is unlikely that impacts can be reduced to low levels of significance. Residual impacts are still likely to occur and are expected to be of **high medium** significance.

8.2.3.4 Impact Significance Rating

Table 8-24: Operational phase impacts on habitats and ecosystem integrity and species of conservation concern caused by in-migration

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on habitats and ecosystem Integrity	10	4	4	5	High 90	6	4	4	4	High Medium 56

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impacts on species of conservation concern	10	4	5	5	High 95	6	4	5	4	High Medium 60
Abundance and distribution	6	4	5	5	High 75	2	4	5	2	Low 22
Survival and reproduction	8	4	5	5	High 85	4	4	5	3	Low Medium 39

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

8.3 The Socio-Economic Environment

8.3.1 Overview

This section describes the socio-economic impacts associated with the project pertaining to the operational phase of the CNOOC KFDA facility.

8.3.2 Operational Workforce Related Impacts

8.3.2.1 Impact on Employment

Employment Opportunities

The operational phase of the project will require fewer personnel than the construction phase, and the associated skills necessary will be largely specific to an oil production facility, including engineering, administrative, health safety and environment, catering, maintenance and support staff. In the operational phase, around 120 full time jobs will be created at the production facility. Drilling jobs will continue in the operational phase of the project for the first five years while the last wells are completed. Based on its agreements with the Ugandan Government, CNOOC will employ as many local people and it is understood that at least 80% will be Ugandans from year 1 of production (CUL LFMP, 2018)

CNOOC has an existing casual labour policy and will employ as many local people. Given the population size of villages within the Buhuka Parish as well as villages on top of the escarpment, there appears to be a locally available unskilled workforce.

CNOOC also has a recruitment policy which stipulates the procedure according to which professional (i.e. non-casual) appointments are undertaken. A major constraint affecting the local take up of most semi-skilled and skilled appointments will be the lack of general education and critical skills in the oil and gas industry. Consequently, the more skilled personnel are likely to be sourced in the national labour market and internationally. It is anticipated that most of the skilled operations workforce will reside in the project camp on the Buhuka Flats, working on a rotational basis. Employees who are local or within the Kikuube or Hoima Districts may be brought in daily on a Bus In Bus Out (BIBO) basis.

Employment creation will be a positive socio-economic impact. It will be long term, resulting in a sustainable impact in the economy, although the local benefits and even benefits at District and National level will be limited by skill constraints. Initially, skilled Ugandan personnel are only expected to take up a small percentage of the jobs and the magnitude of positive impact will only be medium. Taking into consideration the need for employment in Uganda, the impact significance will be **high medium**. With the implementation of the recommended measures to enhance operational employment impacts, the overall positive significance rating can be increased to **high**.

Skills Development/Training Opportunities

CNOOC has a fully developed employment and recruitment policy. Where required, the workforce is sourced through a range of recruitment processes, including internal and local, national and international recruitment. Internal succession, apprentice, trainee and graduate programs and contract labour have been designed as part of the project. CNOOC's Kingfisher field development area (KFDA) aims to implement a skills development strategy for their employees in order to improve the skills of the local labour pool by investing in technical, managerial and administrative skills of the workforce. Career development plans would need to be designed in order to effectively implement career and skills growth during the term of employment.

Training and skills development will be a positive impact, helping to develop the local operational workforce skills and qualifications and expanding the human capital available within the local economy. Given the relatively small number of people who will benefit, the magnitude of this impact will only be medium, but it will be permanent, resulting in a general improvement in skills regionally wherever the beneficiaries are employed in the future. With the shortage of skills in Uganda, it will be of **high** significance.

8.3.2.2 Impact of Accommodation on the Workforce

CNOOC policies concerning employment will include preferential hiring of local residents/communities and advertising employment opportunities within the local fishing villages (local labour market). Employees from these villages can continue to live with their families while employed by the project. Accommodation in the permanent camp will be provided to full time and contract employees, and visitors, who are not locally resident. Accommodation is expected to meet IFC PS1 requirements. Catering will also be provided for all personnel, including day workers. The impact will be positive and of **high medium** significance.

8.3.2.3 Employee Health and Safety

General Safety Impacts

Working on large industrial projects involves a wide range of potential hazards. The principle causes are described in Section 7.3.2.3 under construction impacts. All of the hazards may be aggravated by specific behaviour leading to occupational accidents, illness or disease that could have chronic consequences, preventing the individual from continuing work, or fatalities.

In the absence of a highly regulated OH&S environment, with a zero tolerance management approach towards unsafe practices, the risk of disabling or fatal injuries on the production sites will be high, with potentially permanent consequences and a **high medium** significance rating. Subject to CNOOC's compliance with the Occupational Health and Safety standards established by Ugandan Government and its own Health and Safety policies and procedures, which are in place to meet the Ugandan legal requirements, as well as guidelines and protocols for sensitisation of employees and monitoring systems to verify compliance, this impact can be reduced to **low** significance.

Driver Safety

As for other aspects of work on a large industrial project, the use of vehicles and heavy mobile equipment may result in significant safety hazards in the absence of a highly regulated OH&S environment. Vehicle accidents are the leading cause of worker injuries and fatalities, with the USDoL Census of Fatal Occupational Injuries related to the Oil and Gas sector (BLS, 2016) reporting that 40% of all worker fatalities are directly linked to vehicle incidents. The main causes of work place accidents involving vehicles and movable equipment on industrial sites are typically:

- Failure to drive cautiously and defensively;
- Disregard of speed limits;
- Failure to wear seat belts;
- Use of cell phones while driving;
- Careless driving and/or driving / equipment operation by insufficiently trained personnel;
- Failure to maintain the lights and audible reversing signals on construction vehicles and equipment;
- Night driving;
- Use of alcohol or recreational drugs; and
- Driver/operator fatigue.

Without appropriate driver training and a zero tolerance management approach towards unsafe practices, the risk of disabling or fatal injuries to personnel caused by vehicles and moving equipment will be high, and potentially long term to permanent (disabling or fatal), with a **high medium** significance rating.

Graft & Exploitation

During all phases of the project, CNOOC will need to remain alert to the potential for graft and exploitation that Ugandan nationals as well as foreign (non-Ugandan) employees and service providers may experience. From a Uganda national experience, there have been incidences of misrepresentation where money is extorted from job-seekers who are told that they are paying a placement fee for work at CNOOC. In addition, there have been incidents in which foreigners (particularly Chinese people) have been accosted by the Department of Internal Affairs, being forced to go to the Passport Centre to prove that they have work permits in place. People with a relatively poor command of English may feel sufficiently intimidated to offer money to be left alone. In addition, there have been increasing incidents of criminal attacks, including robbery and assaults on foreigners. Such attacks appear to be most commonly facilitated by the services of prostitutes who work in collaboration with crime syndicates that target foreigners. Impacts will be of **high medium** significance.

Alcohol and Drug Abuse

Alcohol and drug abuse is often prevalent in remote industrial facilities where employees are accommodated on site and this spins off into safety in the workplace. The unmitigated risks are highly significant, with a strong correlation between workplace accidents and the use of these substances. In the absence of appropriate management and monitoring, the risks of disabling injury or mortality (long term effects) due to substance abuse will be high, and impact significance will be **high.**

Diseases

The main disease risks to the project workforce are malaria, illnesses due to unsanitary conditions and behaviour and sexually transmitted diseases caused by unprotected interactions with local sex workers. Tuberculosis is also an issue of particular concern among casual workers with inadequate general health care.

- Malaria is widespread in the study area and may be exacerbated by standing water at the production facility that provides additional breeding sites for mosquitoes. The workforce will be exposed to these risks. According to the Rapid Health Impact Assessment (RHIA) undertaken for the project, malaria is the most prevalent health concern in the project area, with the disease accounting for 35-54% of all outpatient visits in the study area Health Clinics (Volume 4, Specialist Study 10, Appendix B). Malaria case rates are also described as being on the increase, and that the illness is commonly associated with misconceptions and poor prevention behavior;

- Casual labourers employed on the project may be poorly informed about sanitary behaviour which will exacerbate the risk of a range of diseases related to contamination of food;
- Poor ventilation in living quarters and slovenly behaviour in respect of cleanliness may exacerbate diseases such as tuberculosis;
- Sexually transmitted diseases (STDs) typically proliferate in male-dominated industrial environments where workers are removed from their families for significant periods of time. Managing STDs is difficult since it involves altering worker behaviour to comprehensively ensure prevention. The policy of the organization in relation to sex workers in the personnel camps and interactions sexual interactions between personnel and local sex workers has a major influence on the spread of this disease among the workforce; and
- Poor hygiene and camp waste disposal practices may encourage rats and other pests that are disease vectors. Human waste will need to be managed via proper disposal and treatment facilities to avoid seepage (which may contaminate water sources). Food waste must be disposed of in a proper manner (incineration, burial or taken off site and disposed of in sanitary landfill sites) to prevent the proliferation of pests. CNOOC have indicated that food waste will be removed from site by their certified waste cointractor and transported to a licenced landfill.

The impact of disease on the project workforce is potentially severe, with potentially disabling or even life threatening diseases (high magnitude) over the lifetime of the project causing a threat of **high** significance in the absence of the appropriate management.

However, subject to the development of a culture of best health practices among the workforce, vector-related and sanitary and hygiene-related health impacts on the workforce can be reduced to **low** significance. STD's can also be reduced on the basis of the measures proposed under mitigation below, but residual impacts are likely to remain since the management of these impacts is rarely entirely effective.

8.3.2.4 Impact Mitigation/ Enhancement and Monitoring

CUL is required to comply with the objectives of the National Oil and Gas policy and legal framework with regard to oil and gas development and benefits to the citizenry. CUL has set out to meet relevant National laws and regulations, policies and action plans, and international best practice to ensure that it complies with a high standard in the management of its labour force. CNOOC Limited is a member of the UN Global Compact, and therefore all its global operations, including CUL, are committed to comply with the principles in the Compact related to labour rights.

The following plans will apply to CUL's operations:

- CUL (updated). Labour Force Management; and
- The CNOOC (2015) Labour Force Management Plan for Contractors and Subcontractors, prepared on behalf of CUL.

The Labour Force Management Plan (LFMP), while focussing more specifically on casual labour which will be characteristic of much of the unskilled labour employment during the construction phase of the production facility, nevertheless applies to a wide range of issues that will be equally applicable to other, permanent, employees during the production phase of the project. Casual labour employment will also continue throughout the production phase, with Contractor's coming onto site for a wide variety of tasks from time to time. The LFMP therefore applies to contractors working at the production facility during the operational phase and, in many respects, to CUL's permanent workforce in general.

The LFMP commits CUL to a range of specific actions designed to ensure that its labour practices are fair, transparent and in compliance with Ugandan policy and law and best practice standards, including IFC PS2. The LFMP deals with a wide range of issues, including recruitment and retention of employees, terms and conditions of employment, wage rates, minimum wages, timeliness of payment, entitlements and benefits (work hours, weekly rest, public holidays etc.), repatriation of workers, termination of services, workplace health and safety, HIV[13]/AIDS policy and prevention, health and welfare arrangements, first aid facilities, measures against biological hazards (insects, pests, virus's, parasites, bacteria), training and development, freedom of association, equal treatment, employment of women, forced labour, grievance management, local content and migrant workers, damage to property and management of contractors and subcontractors.

For the purposes of the EISA, the following additional recommendations are made, drawn from the specialist studies. In some instances, there is overlap between the recommendations in the LPMF and the recommendations below:

Impact on Employment

- Implement the actions set out in the draft CNOOC (2015) Labour Force Management Plan (LFMP). Ensure that all contractors who work on site during the production phase of the project are aware of and comply with the management framework for casual labour set out in this document;
- Preferentially hire local people, in accordance with CNOOC policies and agreements with Government. Advertise employment opportunities within the local fishing villages (local labour market) so that as many people are employed who can continue to live with their families as they offer their services to the project. Directly project-affected people should be given priority to win operational phase jobs, subject to their meeting the necessary employment requirements;
- Ensure that permanent employment is done via CULs Kampala head office in order to discourage job seekers at the gate of the production facility. Widely advertise the employment process for the production phase so as to ensure local understanding of employment criteria and processes;
- Develop and implement training and skills development programmes in the production workforce to expand the human capital available within the local economy; and
- Consider offering bursaries or internships to promising students (refer to discussion on the community development impacts) to build a sustainable and educated future workforce.

Skills Development

- Collaborate with the Petroleum Authority of Uganda (PAU), which is tasked with establishing, maintaining and operating a National Talent Register for the petroleum sector to ensure that CNOOC contributions in the form of bursaries and scholarships support the development of an appropriately skilled labour force;
- Align the CNOOC Education and Training related support initiatives as well as in-house training and competency development of Ugandan nationals with the critical and scarce skills requirements of the Oil and Gas sector;
- Consider promoting a process of Recognition of Prior Experience (RPE) and Recognition of Prior Learning (RPL) in collaboration with tertiary technical training institutions that will allow the accrual of credit for informal and non-formal skills development into the formal skills development sector;
- Support education at school level and the development of well-stocked school libraries as a specific focus of CNOOC Community Development Plan; and

[13] *The human immunodeficiency virus (HIV) is a virus that causes the HIV infection. Over time, this becomes the Acquired Immuno-Deficiency Syndrome (AIDS).*

- Support initiatives that will promote and strengthen the levels of competence of master artisans and crafts persons within the Technical Education and Training (TVET) system, and design mechanisms that will support the entrance of female scholars into TVET institutions.

Impact on Employee Health and Safety

- Screen local employees/contractors for TB at recruitment and provide adequate care and treatment programs from the Project's workplace medical service while complying with the requirements of the national TB program;
- Develop a site-based TB management programme.
- Evaluate the origin of any incoming contracted construction workers (especially from high burden TB countries) and understand TB and MDR risks in this group. Ensure effective TB screening in the external contracted workforce prior to final appointment and mobilization as part of the Project's Fitness to Work (FTW) procedures to ensure that diseases are not introduced in the study area;
- It is a recommendation of the impact assessment that CNOOC develop a vaccine preventable disease programme for all employees, and visitors based on risk for travelers and at-risk occupations. All employees and contractors residing in close contact in camps should receive vaccines for all immunisable diseases, including the quadrivalent meningococcal meningitis vaccine in order to mitigate risk in case of direct contact with such diseases. CNOOC have indicated that that this will only be applied to permament staff and not casual labour;
- Develop an integrated workplace malaria and vector control programme to include source reduction and environmental management of breeding sites, routine inspections of accommodation units, appropriate IEC programmes for the workforce and contractors prior to secondment and for use in country, policies and programmes related to use of protective clothing and the use of malaria chemoprophylaxis and surveillance programmes between the workplace medical service and vector control team to determine the likely origin of, and root cause of malaria cases;
- Reduce potential human vector contact and control of breeding sites of disease vectors such as mosquitoes. Continually monitor activities on site to ensure adequate drainage and management of storm water to minimise breeding in the area;
- Ensure that all accommodation units in the permanent camp are proofed against mosquitoes;
- Develop a clear HIV policy and programme in the workplace which includes ensuring that there is adequate accommodation capacity at the temporary personnel camps to eliminate the need for contractors or visitors to seek accommodation in the local villages;
- Develop a code of conduct that actively discourages sexual relationships between the workforce and the local community;
- Work with the village and traditional leaders to manage truck stops, as well as district authorities to report any increase in high-risk sexual behaviour from elements of the workforce, including the collection of baseline data;
- Develop and implement an HIV and STI management programme in the workforce, to include awareness and education, treatment services that link to the public health service, provision of free condoms, access to counselling, proper provisioning of the work camps to dissuade workers travelling into communities for entertainment and support of family friendly accommodation in the camps;
- Develop and implement an HIV and STI prevention programme for suppliers, which is to include awareness and education about STI's. The design and placement of rest stops for drivers transporting goods and materials to and from the production facility should be away from local communities and properly subsidised for cheap food / entertainment;

- Implement camp curfews from 19:00 (as is the current CNOOC practice) after which time workers who reside in the camp must be in camp.
- Prohibit all drivers (permanent employees, contractors and suppliers) from giving lifts to the local community;
- Screen for STIs and hepatitis B/C virus as part of pre-employment fitness to work process. Treatable causes should be managed, and chronic carriers excluded from employment until managed;
- Support a HBV vaccination campaign/ or antibody testing on employee who may have not been vaccinated as a child;
- Develop nutritional programmes that promote proper nutritional practices at the workplace to prevent obesity and related health impacts, including education programmes in the workforce on financial management and support of the household units in employees that have traditionally followed a subsistence lifestyle;
- Develop a programme to address education about and management of non-communicable diseases related to use of drugs, alcohol and oral health issues;
- Incorporate veterinary concerns into the OHS management plan to include appropriate waste management to mitigate against feral dogs and an awareness of the risk of snake bites and other wild animal threats; and
- Train employees to ensure that they are aware of the requirements of the Occupational Health and Safety standards established by the Government of Uganda.

8.3.2.5 Impact Significance Rating

Table 8-25: Operational phase impacts on the workforce

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on employment										
- Employment opportunities	6	4	3	5	High Medium +65	8	4	3	5	High +75
-Skills development and training	6	5	3	5	High Medium +70	8	5	3	5	High +80
Impact of workforce accommodation	6	4	2	5	High Medium +60	6	4	2	5	High Medium +60
Impact on Employee Health and Safety										
general safety impacts	8	5	2	4	High Medium 60	2	2	2	4	Low 24
-driver safety	10	5	2	4	High Medium 68	2	2	2	4	Low 24

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
-graft and exploitation	6	4	2	4	Low Medium 48	4	2	2	3	Low 24
-alcohol and drug abuse	8	5	2	5	High 75	3	4	2	3	Low 27
-vector related diseases	9	4	2	5	High 75	2	2	3	4	Low 28
- sexually related diseases	9	4	2	5	High 75	4	4	2	4	Low Medium 40

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

8.3.3 Economic Impacts

The project will have impacts in the local, regional and national economy through direct and indirect economic benefits. While it is beyond the scope of this study to conduct a comprehensive macro-economic assessment, general economic impacts are discussed below.

8.3.3.1 National, Regional and Local Economic Development

Increase in Government Revenue

Direct oil and gas related government revenue is derived from (i) royalties (resource exploitation related levies based on the value of extracted resources); (ii) surface rentals (annual fees in respect of acreage held by oil companies); (iii) taxation (personal and business taxes as well as specific introduced taxes related to 'windfall gains', resource rent and the environment); (iv) bonuses (paid by the oil companies at defined stages during the exploration and production phases, as per their Profit Share Agreement); (v) what is termed 'Profit Oil" (income from excess oil production over that required to meet all cost recovery and payment requirements); and (vi) 'other fees' (contributions to training of government personnel and/or payments in cash in lieu this). As the sector develops, value chain related operations such as refineries and the sale of petroleum products will provide additional opportunities for income from taxation (see Section 17 on Cumulative Impacts).

The specific terms of agreement between CNOOC and the government have not been made public, as is required in terms of the PFM Act 2015. Informed projections indicate that government revenues will remain low for a considerable period of time at current crude prices. Henstridge and Page (2012:28) estimate that it will take at least a decade from the start of production for cumulative oil revenues to climb to 5% of GDP, translating to approximately $9 billion. They see this climbing to $7.3 billion (41% of GDP) within the second decade, $14.9 billion (83% of GDP), and $19.8 billion (111% of GDP) by the end of the fourth decade of production (all based on 2012 $ oil prices).

Despite the slow start in income generation, Henstridge and Page (2012:28) state that the deal implied by the terms is assumed to be a good one for Uganda: "Between 86 percent and 99 percent of the net present value of the combined investments - depending on assumptions about oil price and the time horizon for production - goes to the government through the various sources of tax revenue and dividends on a 15 percent equity share."

The impact in terms of this indictor is expected to be positive, long term, national in coverage (benefitting all levels of Government) and of **high** significance.

National and Regional Economic Growth

The expansion of the resource industry on the Buhuka Flats will have a beneficial cumulative impact in the region. This will include revenue for the government, employment opportunities at local, regional and national level and a direct and indirect effect on business development. Increased household income and expenditure will result. Both on its own and combined with the effect of the other oil industry developments, CNOOC's KFDA is likely to generate significant economic multipliers[14]. Research for other oil development projects has shown that economic multipliers of about 2.33 for value added[15] and between about 2.88[16] and 3.03 for labour income[17] apply. While these studies were undertaken for oil and gas developments in the USA, and the ratios do not necessarily hold true for developing economies, the general effect is clear.

The increase in work opportunities provided by the project will result in growth in the proportion of Ugandan citizens with higher incomes. Given the number of oil and gas projects under consideration in the sector, there is likely to be a continued and expanding demand for skilled labour. Wages for skills needed in the oil industry are likely to increase. Employment in the oil industry will generate government revenue, deducted from salaries through Pay As You Earn (PAYE), as well as through Local Service Tax at local (sub-county) level.

At a regional scale, the magnitude of beneficial impacts will only be medium, but they will be long term. The significance rating is **high medium**. With the implementation of the recommended measures to enhance good governance and investment in local infrastructure and services, the overall significance rating can be increased to that of a **high** positive impact.

Local Economic Development

The KFDA will stimulate demand for goods and services in the area, which in turn will have a direct and indirect impact on employment in the local and regional economy. CNOOC has developed a local procurement policy to support further development of the business supply chain locally and regionally through appropriate purchasing and business development strategies. This will also support the District and Central Government initiatives intended to improve the social capital of Buhuka Parish, Kyangwali Sub-county and Kikuube District.

The Buhuka area in general is experiencing rapid economic development. Since the opening of the escarpment road into the Flats, two large markets have developed, selling various goods and services, which attract an extensive daily clientele. This has resulted in induced and indirect employment opportunities being created. While most of the current trade is not directly linked to the KFDA, being a consequence of the access provided by the escarpment road, it is an indirect benefit since the primary purpose of the road is to serve the KFDA.

The further development of the local economy will be a benefit derived from the presence of the project in the area. It is possible that local economic growth will increase the ability of households to earn a cash-

14 An economic multiplier is the increase in final income that can be derived arising from any new injection of spending, for example $2.33 for every $1 invested or spent. Also termed a 'trickle down' effect of economic growth as those who receive additional income spend that income in shops and businesses, which in turn drives further economic growth

[15] Macroeconomic subgroup, 2011

[16] Pennsylvania Economy League of Southwestern Pennsylvania, 2008

[17] Macroeconomic subgroup, 2011

based income. In this regard, CNOOC has indicated that it purchases as many goods and services from suppliers and contractors in Uganda , which number more than 100 providers to date. The Company also trains local suppliers to meet oil and gas quality, safety and other standards and learn the tendering and bidding process.

In the absence of specific interventions from CNOOC to increase local purchasing and assist local businesses to improve their ability to compete in the market, the benefits will probably by of low magnitude. Nevertheless, they will be long term and are considered to be positive and of **high medium** significance. This can be increased to **high** significance if CNOOC implements a full range of interventions to encourage local business development capability, and steadily increases project spend in the local economy (refer to the mitigation measures below).

Human Capital Development

There is a strong relationship between available human capital and the ability to attain social and economic growth and development and that the development and promotion of human capacity will be achieved most effectively through a coherent process of investment in the people of Uganda.

Human Capital represents the knowledge, skills and abilities that enable people to do their jobs, to be innovative and able to learn and adjust to changing economic and social environments. As such, it refers to the adaptive capacity of people to access opportunities. The process of human capital development concerns the creation of an enabling environment in which people can develop their full potential and lead productive, creative, lives in accordance with their needs and interests.

The definition of human capital stresses the concept as primarily, although not exclusively, centred around human capability and productivity engendered through knowledge and skills acquired from education, training and experience, and facilitated by an enabling environment. It development of human capital implies building an appropriate balance and critical mass of human resources and providing an enabling environment for all individuals to be fully engaged and to contribute to national development efforts.

Uganda has a low comparative world ranking on the Human Capital Index. It is currently ranked 106th out of 122 countries on the overall Human Capital Index (WEF, 2013:13), and 118th out of 122 countries in respect of the Educational Pillar of the Human Capital Index Ibid, p14).

The Business, Technical and Vocational Education and Training (BTVET) Strategic Plan 2011 – 2020 (MoGLSD, 2011) for Uganda, identifies the absence of and the urgent need for a comprehensive process to develop occupationally relevant skills and competencies, including skills for the oil and gas sector. The Oil and Gas Policy (MEMD, 2008:27) emphasises the provision of support for the development and maintenance of national expertise, including planning for the development of formal and industrial training and broadening the national education curricula in preparation for putting the necessary oil and gas workforce in place in the country.

The Industrial Baseline Survey, undertaken by CNOOC in collaboration with Total and Tullow (Hamman, 2014:29) states that it is evident that Uganda is currently unable to meet the manpower demands of the oil and gas sector and recommends, among other things, that oil and gas operators such as CNOOC (i) in partnership with government work towards strengthening the educational system; (ii) offer direct support to existing training institutions of repute; and (iii) the establishment of a technical and vocational education and training (TVET) centre, aimed at providing competence development for, inter alia, craftsmen (civil) and mechanical and electrical technicians required by the oil and gas industry. CNOOC is directly involved in this process.

Apart from this, CNOOC invests in Human Capital Development directly through the introduction of training programmes intended to increase the productivity and effectiveness of personnel (as described earlier). It is, as well, investing in the development of essential knowledge and skills required by the modern economy, including the oil and gas industry. This includes the provision of bursaries, engaging in partnerships with local vocational institutions in Kikuube and Hoima Districts for the expansion of existing skills and vocational training programmes as well as direct support to schools in its area of operation.

Beneficial impacts will be permanent, providing skills that can be used by the beneficiaries throughout their working lives. Job applicants will be sourced regionally, within Uganda, so the benefit will extend beyond the local area. Magnitude (at this geographic scale) will only be low to medium and impact significance will be **high medium**. With the implementation of the recommended measures to enhance key aspects such as TVET and STEM education and training, the overall significance rating can be increased to that of a **high** positive impact.

8.3.3.2 Impacts Retarding Economic Development

Over-dependence on the Oil Sector

There is a risk that the Ugandan economy becomes heavily biased towards the support of the economic sectors that are directly or indirectly linked to and dependent on the oil sector[18]. Given its importance for Uganda, the oil industry is set to become a dominant economic driver, potentially precipitating a “resource push” (also sometimes referred to as a “resource pull”) approach to growing the Ugandan economy. Should this happen, it will trigger development that is economically biased in favour of the oil industry and allied support services with an associated weakening of efforts to build technological capacity and a diversified economy.

Fluctuations in oil prices and Uganda’s longer-term ability to supply oil or decreasing levels of supply could create severe economic hardship for local businesses that are dependent on oil industry expenditure. Impacts will be long term, regional extent, negative and of **high** significance in the absence of appropriate interventions.

Although CNOOC cannot provide the lead in governance related issues, it can act as a persuasive and influential partner in promoting the development of a stable and diversified economy, at least within Kikuube and Hoima Districts. With diversification, this impact could become positive.

Competition for Experienced Labour

The operational phase of the project is likely to exacerbate the current shortage of experienced labour in the Districts and the region as a whole. Sourcing experienced workers from the district will drain available skills away from existing businesses, increasing scarcity of experienced personnel and increasing the cost of labour. While this is a benefit for already-skilled labourers, who will have increased demand for their services and potentially higher earnings, it will create a shortage of labour elsewhere, which will cumulatively impact on the entire Albertine region. Without mitigation, this impact will be long term, of medium magnitude and **low medium** significance.

Impact on Land and Property Rates

Local knowledge of the proposed KFDA has resulted in speculation for land, where individuals move into the area and claim land for themselves. According to villagers on the Buhuka Flats, these speculators sometimes have title deeds which have been acquired fraudulently. This practice has been successfully challenged at least once, with a prominent government official being jailed for fraudulent transactions. Despite this, it is reported that speculators continue to try to trade up the price of land in the local area. Without mitigation, this impact is likely to continue from the construction phase into the operational phase.

Coupled with a struggling land management system, issues about the ownership of land are likely to increase. This impact will extend beyond the construction phase into the operational phase and could reach a point at which hostilities begin to emerge. Impacts will be long term, local (mainly on the Buhuka Flats) of medium magnitude and **medium high** significance without mitigation.

[18] This effect, known as the “resource curse” is widely debated (see Eggert 2001 for detailed review of arguments); this reference is centred on mining, the principles are the same for the oil and gas sector), but there is consensus that large increases in extractive industries can have negative impacts on economic and social performance. This is most common when extractive industries reduce the productivity from other sectors by attracting limited human capital and other productive resources.

Government Revenue Losses due to Corruption

While tax contributions are generally considered to be positive (see above), their impact can have mixed results. Non-transparent payment of taxes, particularly in the extractive industries, has led to corruption and lost benefits when revenues are not paid transparently and monitored. For this reason, since 2007, the IFC has required all of its extractive industry projects to publicly disclose their material payments to host governments (IFC 2006). It is expected that CNOOC will adhere to this requirement.

Raw material exploitation typically generates high "economic rents19" which provides numerous incentives for public and private agents to engage (at times excessively) in "rent-seeking" behaviour. There has already been evidence of a conflict of interest being demonstrated by some politicians and officials who have acquired interests and rights because of privileged knowledge about, for example, the siting of the proposed development and the acquisition of land pre-emptively. Fortunately, the Ugandan governance system, including that related to local and traditional management, has been robust and willing to promote equity. This includes the successful conclusion of legal challenges lodged by community stakeholder groups related to corrupt land acquisitions by civil servants (e.g. on the Buhuka Flats).

Uganda has enacted several pieces of new legislation aimed at promoting extractive sector governance. Nevertheless, there are still opportunities for conflicts of interest in the public sector through – for example – politicians and even public servants holding interests in the construction sector at a time when the scale of public contracts is set to accelerate substantially. Although initially mooted as desirable and legislators under the Parliamentary Forum on Oil and Gas have continued to push, Uganda has not yet signed up for the Extractive Industry Transparency Initiative (EITI). This means that Uganda still stands outside a forum that would expect specific actions to be taken to enhance transparency and mitigate the misuse of natural resource revenues.

Proceeds from the extractive sector pose specific challenges to host governments. Kekembo (2017) states that "the sheer magnitude of revenues, the complexities of the fiscal arrangements as well as the high volatility of revenue flows can be a substantial burden for public financial management". He further states that Ugandan membership of the EITI would, as well, provide an essential "feedback loop between the government and citizens. This increased sector transparency through the EITI disclosure, can discourage corruption and bad governance that has ravaged many resource-rich countries."

It will be important that CNOOC avoids situations where it may be accused of complicity in graft or of embroilment in patronage. The fact that CNOOC is not a supporter company of the EITI and is on record (as partner in Tullow) of declining to publish all its payments to the Ugandan Government has created a sense of unease amongst human rights campaigners. Irrespective of the accuracy of this perception, CNOOC has the opportunity, including through association with initiatives such as the EITI, to exert significant moral persuasion as well as real assistance to government as well as civil society in fighting corruption in the oil and gas sector. Its participation in the UN Global Compact and associated commitment to the 10 Principles of the UN Global Compact, in particular Principle 10, which states that "Businesses should work against corruption in all its forms, including extortion and bribery", would reinforce this potential. Without these measures, this impact has the potential to be negative, with long term, regional consequences of **high medium** significance.

Lack of Funding to District Government

Kikuube and Hoima District Councisl will benefit from the CNOOC development through a number of revenue streams. These include levying local taxes, greater property taxes as well as enhanced economic development and prosperity at district, parish and sub-parish level.

However, the Districts are currently underfunded, and it is unlikely that it will derive enough additional income to service the burgeoning development expected on the Buhuka Flats, particularly if there is a marked increase in population due to in-migration (refer to Section 8.1.1.4). Currently, for example, Hoima is

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[19] The oil and gas industry generates substantial economic rents, in that the commodity value most often exceeds the cost of production by a significant margin. Total economic rents available for sharing among stakeholders is defined as the amount by which the total value of the resource exceeds the total economic cost of producing the natural resource.

allocated a mere 10% of its budget requirements for road maintenance[20] which makes it impossible to adequately manage and maintain existing roads.

The need to establish enabling infrastructure and a service-related environment in communities around the KFDA will exacerbate Kikuube and Hoima districts' government's capacity problems in this regard. The Districts will need to fund infrastructure, service delivery and maintenance (including road maintenance) to create a stable environment around the KFDA. This includes the need to provide adequate water and sanitation services, electricity, policing, regulatory enforcement and other essential services. In the absence of this, CNOOC faces the likelihood of community demands to take responsibility for these services itself, becoming, in effect, the government by default. This could create an extremely volatile situation, with service delivery protests on the Flats and a significant increase in the risk of violence affecting CNOOC personnel.

The impact will be long term and of potentially very high magnitude. The sensitivities are particularly high, given the high probability (perhaps definite) risk of civil unrest if material development benefits do not materialise to offset the cultural and social change that the Flats inhabitants will have to accommodate. Without mitigation, impact significance will be negative and **of high** significance. Alternatively, if Government plans to provide local services are timeously introduced, this impact can be reversed with positive social outcomes in the Buhuka Flats community and surrounding area.

8.3.3.3 Impacts due to In-Migration

The influx associated with the escarpment access road is already causing tension within and between communities on the Buhuka Flats. With continuing population influx in response to expectations about work and business opportunities associated with the KFDA, the land speculation described above is expected to worsen. Increased populations, particularly of foreign inhabitants, will dilute local government influence, as newcomers may be unfamiliar (or disagree) with the existing leadership structure, and may also exacerbate grievances if Government does not commit to and implement development plans on the Buhuka Flats. Under these conditions, the risks of civil protests and violent confrontations will increase. A sign of future relationships is already evident, with some communities in the SIA focus group meetings demanding that CNOOC provide services and preferential treatment regarding future work. Without mitigation, this impact is expected to have very high magnitude, and will be long term, local, definite and of **high** significance.

8.3.3.4 Impact Mitigation and Monitoring

The following mitigation measures are proposed:

National, Regional and Local Economic Development

Increase in Government Revenue:

- Support the implementation of all requirements of the Oil and Gas Revenue Management Policy of the Ministry of Finance, Planning and Economic Development.

National and Regional Economic Growth:

- Promote economic development and infrastructure improvement in the project area and Kikuube and Hoima District in a partnership with central, regional and local government to develop a comprehensive infrastructure, services and local economic development plan; and
- Finalise the development and implementation of the Community Development Plan (CDP), including relevant aspects of livelihoods restoration and resource management planning set out therein, as well as provided for in the Alternative Livelihoods Restoration Plan.

Local Business Development:

[20] *Kikuube and Hoima District Council Officials (2017) Personal Communication*

- Develop comprehensive strategies to build the capacity of local service providers to compete within the local and regional business environment, ideally on a diversified basis that does not only serve the oil industry;
- Develop a local procurement policy and steadily increase project spend in support of local capacity and the further development of the business supply chain through appropriate purchasing and business development strategies;
- Identify and support programmes (including related to micro-financing) in support of vulnerable groups as required (elderly, single women or child headed households) in settlements most directly impacted by the development; and
- Maximise local procurement of goods and services. CNOOC has committed to this principle, which is expected to apply to the construction contractors responsible for the feeder pipeline as well.

Human Capital Development:

- Collaborate with the Petroleum Authority of Uganda (PAU), which is tasked with establishing, maintaining and operating a national human capacity register for the petroleum sector to ensure that CNOOC contributions in the form of bursaries and scholarships support the development of an appropriately skilled labour force;
- Align the CNOOC Education and Training related support initiatives as well as in-house training and competency development of Ugandan nationals with the critical and scarce skills requirements of the Oil and Gas sector;
- Consider promoting a process of Recognition of Prior Experience (RPE) and Recognition of Prior Learning (RPL) in collaboration with tertiary technical training institutions that will allow the accrual of credit for informal and non-formal skills development into the formal skills development sector;
- Support education at school level, including support for the development of well-stocked school libraries as a specific focus of CNOOC Corporate Social Responsibility (CSR); and
- Support initiatives that will promote and strengthen the levels of competence of master artisans and crafts persons within the Technical Education and Training (TVET) system, and design mechanisms that will support the entrance of female scholars into TVET institutions.

Impacts Retarding Economic Development

Over-dependence on the Oil Sector:

- Ensure that the Community Development Plan (CDP) for the Buhuka Flats and surrounding areas includes a focus on mechanisms that will promote an inclusive business development approach, in particular focusing on innovative technologies and solutions for environmental protection.
- Ugandan government to consider investment in broad-based economic development in Kikuube and Hoima Districts, promoting traditional sectors such as agriculture, which will serve to reduce oil-related dependence.

Competition for Experienced Labour:

- Develop and implement training and skills development programmes in the production workforce to expand the human capital available within the local economy; and
- Consider offering bursaries or internships to promising students (refer to discussion on the community development impacts) to build a sustainable and educated future workforce.

Impact on Land and Property Rates:

- It is recommended that the project engages closely with governmental authorities to monitor land ownership and changes thereto surrounding the project development;
- Prepared to accommodate the changes arising from the population influx by sensitising the LC system. This is particularly important, as it is at this level that the stability of a village is decided, including the establishment of checks and balances for maintaining individual rights and responsibilities, and for managing crime; and
- Support work to develop comprehensive land policies. This includes support for Government capacity to do strategic, long-term land use planning that protects small holder farmers and helps balance multiple uses of land, including for oil and gas extraction.

Government Revenue Losses due to Corruption:

- Ensure that CNOOC meticulously implements all anti-corruption, business ethics related and internal compliance Policies and Programmes already in place, including the CNOOC Limited Code of Commercial Behaviour and Conduct of Employees, the Procedures for Handling Violation of Rules of CNOOC Limited Employees as well as its Guidelines for Overseas Operation with Compliance of CNOOC;
- Promote transparency in reporting of all revenue payments to the GoU and, especially, consider becoming a member company of the EITI. Publicly disclose the material payments made to the Ugandan Government. This should be in accordance with IFC anti-corruption guidelines. CNOOC should continue to follow its internal anti-corruption prevention and management system to minimise corruption and malpractice cases, or to deal with these when they do occur;
- Comply with the objectives of the National Oil and Gas policy and legal framework with regard to oil and gas development and benefits to the citizenry, and meet relevant National laws and regulations, policies and action plans, and international best practice, to ensure compliance with a high standard in the prevention of graft and corruption. CNOOC Limited is a member of the UN Global Compact, and therefore all its global operations, including CUL, are committed to fully comply with Principle 10 of the Compact related to anti-corruption, which stipulates the requirement that it must work against corruption in all its forms, including that related to bribery and extortion; and
- Voluntarily collaborate with and support multi-stakeholder forums that engage questions of ethics and corruption in the oil and gas industry, including Civil Society Organisations, NGO coalitions as well as the Uganda Human Rights Commission (UHRC).

Lack of Funding to District Government:

- Contribute to economic development and infrastructure improvement in the project area, in partnership with central, district and local government. Government to finalise, review and implement plans to for structured urban development on the Buhuka Flats; and
- Develop a transparent community development and contribution policy.

In-Migration

- Engage closely with government to monitor land ownership and changes thereto surrounding the project development;
- Implement the recommendations of the Influx Management Strategy and Framework Plan; and
- Prepare to accommodate the changes arising from the population influx by sensitising the LC system. This is particularly important, as it is at this level that the stability of a village is decided, including the establishment of checks and balances for maintaining individual rights and responsibilities, and for managing crime.

8.3.3.5 Impact Significance Rating

Table 8-26: Operational phase economic impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Regional and Local Economic Development										
-Increase in Govt. Revenue	9	4	4	5	High +85	9	4	4	5	High +85
-Impact on national and regional economic growth	6	5	3	5	High Medium +70	8	5	3	5	High +80
-Impact on Local economic development	7	5	2	5	High Medium +70	9	5	2	5	High +80
-Human Capital Development	6	4	3	5	High Medium +65	9	4	3	5	High +80
Factors Retarding Economic Development										
-Overdependence on the oil sector	8	4	3	4	High Medium 60	6	4	3	4	High Medium +62
-Competition for experienced labour	6	4	3	4	Low Medium 52	2	2	3	4	Low 28
-Impact on land and property rates	9	4	2	4	High Medium 60	4	2	2	3	Low 24
- Govt revenue losses due to corruption	8	4	3	4	High Medium 60	4	4	3	2	Low 22
-Lack of funding to District Govt	9	4	2	5	High 75	9	4	2	5	High +75
Impact of In-Migration	9	4	2	5	High 75	4	4	2	4	Low Medium 40

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

8.3.4 Community Health, Safety and Security Impacts

The Health Impact Assessment for the project (Specialist Study 10, Appendix B) provides a systematic evaluation of the twelve Environmental Health Areas (EHAs) of project-triggered health impacts. The EHA framework is used in the 2007 IFC Guidance Notes for Performance Standard No. 4, Community Health, Safety, and Security. These impacts are related to health and safety of communities in and around the project area, and include housing, diseases, accidents and injuries, crime and nuisance.

The impacts described in this section are covered in more detail in Chapter 7, under the Construction Phase, when there will be over 1,200 contract personnel on site. Personnel numbers will reduce during the operational phase to a full-time staff compliment of around 120 personnel, resulting in a decrease in negative health and safety risks in surrounding communities, although these impacts will become long term.

8.3.4.1 Impact of Diseases

Sexually Transmitted Diseases

Fewer personnel on site after decommissioning of construction activities will reduce the potential impact of the project on the local spread of STD's. The implementation of the project's environmental management system is also likely to improve over time, once the construction phase is over. However, without specific management control, there is a continuing risk of the spread of project-related STDs as a result of the operational phase of the project, particularly if CNOOC policies relating to the control of HIV/AIDS and other STDs are not fully implemented. Project personnel with money to spend will be an attraction to young women in the local community with no other way of earning a living. As in the construction phase, in the absence of appropriate control, impacts are expected to be long term, promoting the regional spread of HIV and other sexually transmitted diseases, definite and of **high** significance.

Vector-Based Diseases

Malaria is prevalent in the local community and the project is unlikely to exacerbate the spread of the vector once the construction phase is completed, when the numbers of personnel on site are reduced and disturbed areas where water could pond and provide breeding sites for mosquitoes are rehabilitated. Impact magnitude will remain high, but the likelihood of spreading the disease should reduce, resulting in long term impacts of **low medium** significance. With interventions by CNOOC, the project could contribute positively to the control of malaria in the LSA.

Non-Communicable Diseases

The introduction of large numbers of newcomers into what has been, until recently, a 'sheltered' area, may contribute to the current disease burden in communities in the Local and Regional Study Areas. Differences in lifestyle between incoming individuals and groups may alter the incidence of non-communicable diseases, such as diabetes, hypertension and cardiovascular disease. Should this happen, local health services will be ill equipped to offer appropriate infrastructure or services. This impact will be negative, long term, regional and of **low medium** significance. With interventions by CNOOC, the project could contribute positively to the control of non-communicable diseases in the LSA.

Water-Borne Diseases

The main reason for project impact on water-borne disease would be uncontrolled defecation by project personnel in the project area, particularly in or near water courses. This issue is discussed under the construction phase and proposals are made to manage it. Once the construction phase is over and the project settles into a routine, the likelihood of this continuing is small, subject to the training of personnel and contractors and the provision of adequate, clean, toilet facilities at locations which are convenient to access. These impacts will be local, long term and of **low medium** magnitude and significance, reduced to **low** significance with appropriate management.

8.3.4.2 Impact on Pollution

Treated Sewage Effluent

Treated sewage effluent in excess of approximately 45 m^3/day will be discharged from a sewage treatment plant at the permanent camp, while a similar quantity of around 50 m^3/d will be discharged from the drilling camp while drilling continues. Treated sewage effluent from the drilling camp is used on the lawns and gardens at the camp.

The camp effluent will be required to meet the project standard for domestic effluent, which is based on the Ugandan legal standard. This effluent, meeting the discharge standards, will be discharged to the stormwater system that ultimately discharges to the lake adjacent to Pad 2. Section 8.1.2 describes the potential biological response to increased nitrogen and phosphorous entering the lake just south of well pad 2, and the possibility of creating algal blooms and stimulating growth of water hyacinth in the nearshore environment around the discharge point. From a social perspective, this could decrease access to the water to local fisherman, creating more difficult fishing conditions. It could also impact on fish stocks, although this would probably be very localised. In the absence of mitigation, the social aspects of this impact are considered to of high magnitude but local in scale, long term and of **high medium** significance. It is recommended that the measures described in Section 8.1.2.2.3 in relation to disposal of treated sewage effluent via irrigation be implemented within the areas indicated in Figure 8-4. This should continue through the operational phase.

Domestic Waste Generation

Ugandan legal requirements for the management of domestic waste include avoidance, minimisation, recycling/re-use followed by disposal as the last option. CNOOC will be required to comply with this standard for domestic waste management at the CPF, wells and permanent camp. In the absence of proper management, impacts are potentially of **high medium** significance, particularly if wastes were left in the open in areas of public access, where there could be leaching to groundwater, where dogs or other animals could gain access to it. Section 8.1.2 provides further details.

8.3.4.3 Impact on Community Safety

Traffic and Pedestrian Safety

The risks of traffic accidents and injuries affecting communities will reduce during the operational phase, with vehicle traffic and general project activity outside of the defined working areas being far less than that experienced during construction. Nevertheless, a number of villages on the Buhuka Flats (Nsunzu, Nsonga, Kyabasambu and Kyakapere) are close to ongoing project activity and pedestrians and stock are likely to use the escarpment road and the infield roads. This will pose an ongoing risk to communities, particularly to children and stock. Without appropriate controls in place to manage vehicles and traffic, train and monitor drivers and educate the communities about traffic risks, traffic could result in injuries of high magnitude (disabling injuries or fatalities), with risks extended over the lifetime of the project (long term), being highly probable or definite, long term and of **high** significance.

Release of Hazardous Materials or Waste

Under normal operating conditions, health impacts caused by community exposure to hazardous products or emissions (process waste streams, spilled chemicals) are expected to be negligible, with the exception of possible small spillages of hazardous materials outside of controlled areas if not carefully managed (see Section 8.1.2 on surface and groundwater impact and Section 8.1.1 on air quality impact). No liquid process emissions (with the exception of treated sewage effluent) will be released from the CPF. All produced water will be disposed down reinjection wells and hazardous waste generated at the CPF and on the well pads will be collected and disposed of by hazardous waste contractors at a certified hazardous waste disposal site. Spillages of oil and other hazardous materials within the working areas of the plant and on the well pads will be collected, either in the closed drain system (for processing areas where oil spills are likely) or in the open drain system (where occasional spillage is possible). In both cases, these spillages are managed, in terms of the design, to eliminate the risk of any discharge of oil-contaminated water. Where chemical discharges are expected, such as from the laboratories, these are separately contained, treated and tested prior to release, to ensure that no harmful substances that exceed the project standards are discharged (refer to Volume 4, Specialist Study 5, and Section 8.1.2).

Impact will depend on whether there is sufficient redundancy and management control built into the systems to prevent hazardous products or wastes from escaping from the controlled areas. The risks of major accidents are discussed in Section 10. The probability of small spillages outside of controlled areas is at worst medium, but in the event of their occurring in the sensitive social environment of the Buhuka Flats, they could nevertheless cause health impacts of very high magnitude and long duration, with **high** significance. The most effective form of management would be avoidance, by ensuring that effective management systems are in place to prevent spillages, but where mitigation is necessary, to ensure that there is sufficient redundancy in the pollution control systems to contain any spillages are out of specification wastes within the controlled areas.

Violence and Crime

Violence and crime are already significant problems on the Buhuka Flats. Women, in particular, are subjected to high levels of sexual assault and rape, with female child defilement seen as a particularly severe problem in the villages along Lake Albert.[21] Uganda is ranked 38th in the world on the UNDP's Gender Inequality Index and child marriages are prevalent, particularly in traditionally rural areas such as the Flats.

In the absence of strict policies relating to the interaction of the KFDA production facility personnel with local inhabitants, there are likely to be occasional violent incidents, typically fuelled by drug use or alcohol, or by sexual relationships with local women. A lack of courtesy and discipline will stir up antagonism in relationships between project workers and local people, and arrogant attitudes displayed by workers, who are generally wealthy compared with community members, may also spark confrontations. These issues can generally be managed by a zero tolerance approach to aggression and violence among workers, and by training of staff to be thoughtful and courteous to local inhabitants, but in unmanaged conditions can be an important concern. Incidents are highly probable in the absence of mitigation, causing impacts of medium magnitude and **high medium** significance. With appropriate management, this impact can be minimised and will be of **low** significance.

Fires

Project teams doing hot work create a risk of fire which could escape into the surrounding environment. Similarly, careless disposal of cigarettes by personnel working outside of controlled areas may also increase fire hazard in the local environment. Bush and grass fires on the Buhuka Flats would be a major risk to anyone unable to escape. Housing is clustered close together and most homes have rooves that are thatched. The probability of this impact is medium, but in windy conditions the magnitude of impact could be very high, with long term consequences. Impacts will be of **low medium** significance reducing to **low** significance with appropriate management.

8.3.4.4 Impact of Nuisance

Noise Nuisance

Noise nuisance will remain a major impact for the remaining period of drilling in the operational phase (5 years), at the locations where the drilling is taking place. There will be one drilling rig on site that moves between the well pads over the 5-year period. The villages closest to the rig will experience elevated noise levels over an extended period. Impacts will be most severe at night, since drilling is a 24-hour operation. The traditional housing along the lake shore (clay bricks, thatched roof, no ceiling) provides little protection against noise (for details, refer to Section 8.1.3). Mitigation will reduce the impact but it will still exceed the Ugandan and IFC standards at many households and significant residual impacts will still result. Once drilling is complete, noise impact in the surrounding community caused by the production facility will be

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[21] *Kyabasambu Women's Group (2017) Public Consultation Process*

minor**.** This impact is not rated in this section - refer to Section 8.1.3 and Volume 4, Specialist Study 6 for details.

Dust Nuisance

Impacts of combustion (mainly NO_2) at the production facility are not expected to cause nuisance nor are nuisance - odours expected to be significant. These impacts are not rated here - refer to Section 8.1.1 and Volume 4, Specialist Study 1 for details.

8.3.4.5 Major Accidents

Major accidents could cause highly significant impacts in surrounding communities, resulting in injuries, impact on livelihoods (spillage affecting the Lake Albert), or other major effects. These impacts are considered under 'Unplanned Events' in Section 10.

8.3.4.6 Impacts of In-Migration

Population increases in the LSA are expected to have a wide range of consequences affecting community health, safety and security, most of which will be negative. They will include:

- Vector-related diseases: Malarial risks in communities may increase as a result of increases in areas where seasonal ponding can occur. Increased solid waste generation, in particular during the rainy season, may create additional mosquito breeding grounds for the malaria vector due to reduced predation;
- Sexually transmitted diseases: Foreign migrants, particularly single males, often cause an increase in STDs in the areas in which they reside;
- Haemorrhagic fever: The ongoing civil conflict in DRC, where there has been documented outbreak of haemorrhagic fever in 2018, continues to drive refugee movement across Lake Albert into Western Uganda, with concomitant risk of transfer of disease
- Water borne diseases: Water on the Flats is presently sourced either from the lake or from the gravity flow scheme. Above the escarpment most potable water comes from boreholes. Cholera and typhoid are already constant problems due to poor sanitary practices. Where outdoor toilets exist they are generally unhygienic and do not prevent the leaching of organic pollutants into local groundwater and surface water. Households dispose of solid waste and waste water beyond the homestead, including into the lake, which is also used for bathing and drinking water. Increasing population pressures and even poorer sanitation typically associated with migrants' habitation will aggravate the existing problems on the Flats and above the escarpment.
- Health Services: Migrants will increase pressures on health services, causing a further decrease in the already limited capability
- Crime: There is already an increase in crime which is attributed by local people to 'foreigners' migrating into the LSA. The opening of the escarpment road has allowed easy access to and from the Flats which facilitates opportunities for crime such as stock theft. Gender crime has become a major issue.
- Fire risks: The proximity of thatched housing to each other, coupled with the frequent use of wood fuel fires, creates the danger of localised household fires spreading rapidly through villages, which will be exacerbated by in-migration and further densification of the villages. The settlements along Lake Albert are characterized by dense mixed housing combinations of traditional round thatched huts, rectangular mud and wattle structures with tin roofs and 'flat roofs' or 'long houses' (brick buildings with flat corrugated iron roofing). Wattle and mud structures and flat roofs are frequently rented out, with single room accommodation for up to four families per structure. In some instances, a single (long house) structure may provide rental accommodation for up to 40 people. In an environment such as this, the risks of mortality due to a fire are extremely high.

- Food and Nutrition-related Diseases: Migrants will increase sanitation risks on the Flats, increasing the risk of contamination of food products. Increasing pressure on grazing resources, medicinal plants and other natural resources will further reduce their availability to the existing local population.
- Zoonotic diseases: The increasing incidence of livestock grazing on the Flats brought in by migrants may pose an additional burden of zoonotic diseases, such as increased exposure to ticks. Historically, the livestock on the Flats has remained generally free of ticks in part through elements of natural resistance as well as through isolation from other herds.

Overall, the magnitude of health safety and security impacts due to in-migration will be very high, long term to permanent, and of **high** significance.

8.3.4.7 Impact Mitigation and Monitoring

The following specific mitigation measures are proposed (impact mitigation for emergencies is included in Section 15):

Impact of Diseases

- Ensure that induction programmes are held for all new employees, as well as ongoing sensitisation for new as well as existing employees about the Employee Code of Conduct. A copy of the Code of Conduct is to be presented to all new workers post induction, and signed by each person. The Code of Conduct must continue to address the following aspects:
  - respect for local residents and customs.
  - zero tolerance of bribery or corruption.
  - zero tolerance of illegal activities by construction personnel including prostitution, illegal sale or purchase of alcohol, sale, purchase or consumption of drugs, illegal gambling or fighting.
  - zero tolerance policy of drunkenness and no alcohol and drugs policy during working time or at times that will affect ability to work or within permanent camp or acquired from outside the camp whilst accommodated in the camp.
  - a programme for drug and alcohol abuse prevention and random testing that is equivalent in scope and objectives to the policies prescribed in the Code of Conduct.
  - description of disciplinary measures for infringement of the Code and company rules. If workers are found to be in contravention of the Code of Conduct, which they signed at the commencement of their contract, they must face proportionate disciplinary procedures.
- Update and publicise the Code of Conduct in the settlements potentially affected by operations as well as the permanent camp as part of the community relations plan. This will help ensure that the local residents are aware of the expected behaviour of operational staff. Posters with the Camp Rules should also be posted in neighbouring settlements or lodged with the LC1 of each village and communication related to such rules monitored;
- Ensure that entertainment facilities for workers at the permanent accommodation camp meet the reasonable needs of operational staff and continue to apply clear rules for conduct during leisure time as well as the need to remain within the camp boundaries during leisure time;
- Provide appropriate sporting facilities, including organised sporting activities for workers at the permanent accommodation camp;
- Implement interventions aimed at reducing the impacts of vector borne diseases through mechanisms such as sanitary improvements and minimising areas where water is impounded as a result of operational related activities;

- Ensure that no waste whatsoever, including operational waste is dumped in watercourses or at any site that impacts on villagers or their land use;
- Ensure that the CNOOC use of water does not disturb public water availability and that sources of water are carefully selected.
- Support the development of a Community Health Information System (CHIS) to monitor specific key health indicators in a longitudinal fashion, including to monitor the BOD from malaria and other mosquito-borne diseases in partnership with the district health authorities;
- Develop community-based anti-mosquito interventions in partnership with the Ugandan National Malaria Control Programme (NMCP) and related national strategies;
- Encourage mosquito source reduction in communities through environmental control mechanisms based on community work groups;
- It is a recommendation of the impact assessment that CNOOC develop health intervention programmes in support of community nutrition education and health programmes, including school deworming and feeding schemes and the promotion of food gardens for roll-out into the settlements impacted by the operations. As part of the process, mobilise NGOs and CBOs that operate in this space;
- It is a recommendation of the impact assessment that CNOOC establish a baseline and surveillance system for a knowledge, attitude, practices (KAP) survey on ways TB is transmitted and prevented, BOD from ARIs, and questionnaires on specific environmental hygiene determinants related to housing and influx;
- Evaluate opportunities for health systems strengthening (HSS) with government and key partners for improved case detection and treatment of TB especially from Buhuka Flats and the immediate escarpment area as well as training on the management of integrated management of childhood illness (IMCI) to support care for ARIs;
- Evaluate opportunities for health systems strengthening (HSS) with government and key partners for the detection of MDR-TB in the district, by supporting the use procurement and use of the GeneXpert diagnosis system in the public health system;
- Support community-based information, education and communication (IEC) campaigns to promote improved knowledge and awareness of TB, other infectious diseases and their associated determinants;
- Re-assess project impacts on community-dependent ecosystem services and develop corresponding mitigation measures. This includes the design and development of appropriate environmental health programmes to reduce the potential risk of airborne pollutants such as dust, which may impact on community health;
- Develop educational materials regarding the prevention of water, sanitation and waste related diseases;
- Monitor changes to footprints of animal husbandry activities adjacent to the CNOOC facilities;
- Develop and maintain epidemic preparedness policies and programmes to reduce the impact of any suspected or confirmed outbreak of a communicable disease at the local level;
- Plan and regularly update outbreak control risk assessments by keeping abreast of pandemic alerts through WHO notifications. Project outbreak management plans should align and be integrated with local government outbreak response systems;
- Develop and maintain strong relationships with local health authorities to receive local disease outbreak reports; and

- Support the improvement of veterinary public health services in study area, including preventive programs such as vaccinating and sterilizing dogs, vaccinating livestock and the control of public slaughter of livestock.

Impact on Water Pollution

- Ensure that no waste whatsoever, including construction waste is dumped in watercourses or at any site that impacts on villagers or their land use; and
- Ensure that the use of water does not disturb public water availability.
- Irrigate treated sewage effluent onto lawns and gardens in the permanent camp. Where excess treated sewage effluent is available, consider irrigating pastures around the CPF (refer to Section 8.1.2.3.).

Impact on Community Safety and Security

- Ensure the ongoing implementation of the Community Health, Safety and Security Plan and an Emergency Response Plan as required to meet IFC performance standard 4;
- Incorporate and integrate the Voluntary Principles on Security and Human Rights into CNOOC operational related security management policies, awareness creation and training materials and procedures and assessment processes;
- Communicate regularly with stakeholders about the CNOOC operations as well as plans in support of community initiatives, as a means of reducing local unease or resistance. It is a critical requirement that CNOOC builds trust with its stakeholders in respect of the continuing safe operation of all facilities;
- Ensure the ongoing functionality and accessibility of the grievance procedure that has been implemented for the local community, and that complaints related to CNOOC contractor or employee behaviour that infringes on the health, safety or security of community members that are lodged are responded to in a satisfactory manner. The grievance procedure must include ongoing efforts in respect of:
    - Circulation of contact details of community liaison officers or, if separate, of ‘grievance officers’ or other key contact.
    - Circulation of details of the Witness NGO as well as the mechanisms to access the NGO.
    - Raising of awareness amongst the local community regarding the grievance procedure and how it will work.
    - Establishment of a grievance register that is continuously updated and maintained by CNOOC.
    - Provision of a mechanism to provide feedback to individuals, groups and village councillors regarding actions that have been taken in response to complaints lodged.
- Prepare an updated Traffic Management Plan. This is to be based on CNOOCs existing driving and traffic management plan [CNOOC, undated, Land Transportation Specification, UL-QHSE-L3 (GE)-023 Rev A], updated to accommodate specific aspects related to the operational phase of the project. The final plan should include provision for speed control along roads, requirements for training of drivers to ensure competence (including those of contractor’s / suppliers), monitoring of driver hours and performance, tracking devices in vehicles to monitor speed limit compliance, monitoring of vehicle roadworthiness, requirements for warning signs along in-field roads, ongoing education of communities in the LSA, particularly children, and procedures to follow in the event of an accident;
- Construct pedestrian walkways along the perimeter of the in-field access roads. Educate local inhabitants to use these walkways and not the roads;
- Mechanisms for ensuring site security and associated access management onto CNOOC property;
- Rights and responsibilities regarding movement within the concession area;

- Specific 'no-go' areas as well as interaction with security guards and risks to those within and outside the project site posed by its security arrangements;
- Manage the risks of fire through specific management requirements for hot works and through education of personnel about careless behavior in respect of cigarette smoking;
- Ensure that transport and storage of hazardous materials and wastes are comprehensively aligned with regulatory and community health and safety compliance requirements;
- Ensure that relevant personnel are trained in safe transport, storage, use and handling of hazardous materials as well as use of spill kits and disposal practices;
- Ensure that any hazardous material storage areas are provided with containment measures as per regulatory and community health and safety compliance requirements;
- Provide support for the establishment of an appropriate crime prevention and policing forum in collaboration with role-players from central, district as well as local levels;
- Consider establishing a corruption and crime "whistle-blower" mechanism that allows for anonymous reporting, as well as issuing rewards for reports that are of critical importance in respect of crime and/or general security;
- Ensure that community forums are created in which landowners can raise issues and discuss with CNOOC staff any ongoing concerns about safety associated with KFDA operations or about crime believed to be related to the CNOOC infrastructure and facilities;
- Provide all stakeholders with contact details of maintenance and emergency staff at the production facility and ensure that this information remains updated. Local inhabitants will be CNOOCs eyes and ears in this regard, and can be of assistance in day to day monitoring of any events that should be noted or acted upon in relation to the safety and maintenance of CNOOC infrastructure and facilities;
- Ensure that maintenance staff wear CNOOC-branded safety vests and use CNOOC branded vehicles to provide land owners with an immediate means of distinguishing them from intruders;
- Establish reliable systems to monitor violence and crime at the community level; and
- Establish appropriate policies and management mechanisms for countering the use of CNOOC jetties or areas adjacent to them for illegal activities, including related to smuggling of goods out of or into Uganda via Lake Albert. Establish protocols with the appropriate authorities regarding the management of incidents.

Nuisance Impacts

- Implement all mitigation measures recommended by specialist studies related to, e.g. noise and air quality.

In-Migration

- Continue to implement the strategy for minimising in-migration defined in the Influx Management Strategy and Framework Plan (Volume 4, Specialist Study 11). This will need a combined effort by Government and all oil industry partners;
- Provide ongoing assistance to Government to engage in a partnership for local development as part of the programme to implement the Community Development Plan. This process should include practical mechanisms and mitigation strategies for the loss of grazing land caused by the project and the general loss of resources caused by increasing populations;
- Undertake a regular census in the area and, in collaboration with all relevant central, district and local authorities and develop strategic plans to ensure adequate provision of basic services such as housing, water and sanitation, power, education and health care.

8.3.4.8 Impact Significance Rating

Table 8-27: Operational phase impacts on community health, safety and security

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on diseases										
-Sexually transmitted diseases	9	4	3	5	High 80	4	4	3	4	Low Medium 44
-Vector related diseases	8	4	3	3	Low Medium 45	5	4	2	4	Low Medium +44
-Non-communicable diseases	5	4	3	4	Low Medium 48	5	5	2	5	High +60
- Waterborne diseases	6	4	2	4	Low Medium 48	4	4	2	2	Low 20
- Housing and respiratory diseases	8	4	3	4	High Medium 60	6	4	3	4	High Medium +60
Impact of Pollution										
- Treated sewage effluent	6	4	2	4	Low Medium 48	1	4	2	4	Low 28
- Domestic waste generation	8	4	3	4	High Medium 60	4	4	3	2	Low 22
Impact on Community Safety										
- Traffic and pedestrian safety	10	4	2	5	High 80	4	4	2	3	Low 30
- Release of hazardous materials or wastes	10	4	2	5	High 80	10	4	2	2	Low Medium 32
- Violence and crime	7	4	2	5	High Medium 65	3	4	2	2	Low 18
- Fires	10	4	3	3	Low Medium 51	4	4	2	2	Low 20
Impact of In-Migration	10	5	2	5	High 85	6	5	2	3	Low Medium 33
KEY										

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

Magnitude	Duration	Scale	Probability
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

8.3.5 Housing, Land and Resource Impacts

The project will have no direct requirement for land once construction is complete and no further land take is expected that would impact on households or grazing. This impact is not rated below. Impacts will be related to increases in rental prices and restrictions on land use.

8.3.5.1 Increased rental prices

The industrial development on the Buhuka Flats will result in an increase in rentals for accommodation. The price of rented accommodation is likely to rise sharply. During the project's operational phase, migrants in search of work may look for rental accommodation rather than purchase new housing. As additional demand for housing emerges, there will be a sustained increase in rental prices. While this will benefit the owners of accommodation, it will make rental costs for existing tenants (particularly poor tenants) unaffordable. Impacts for poor inhabitants on the Buhuka Flats and above the escarpment who are obliged to rent will be of high magnitude and long term duration, with **high medium** significance.

8.3.5.2 Restrictions on Land Use

The CNOOC project is a hazardous installation, and this study has recommended that a buffer is established around the CPF and other infrastructure, which prohibits further settlement or other built infrastructure (Figure 8-17).

Other uses of land, including grazing could continue as they are at present. Based on the current settlement patterns these additional restrictions on use rights will have little impact on present land use and the impact will be long term, of low magnitude and **low medium** significance. This will be of particular importance if the proposed physical development plan for the Buhuka Flats comes to fruition, with associated densification and urban planning of the area.

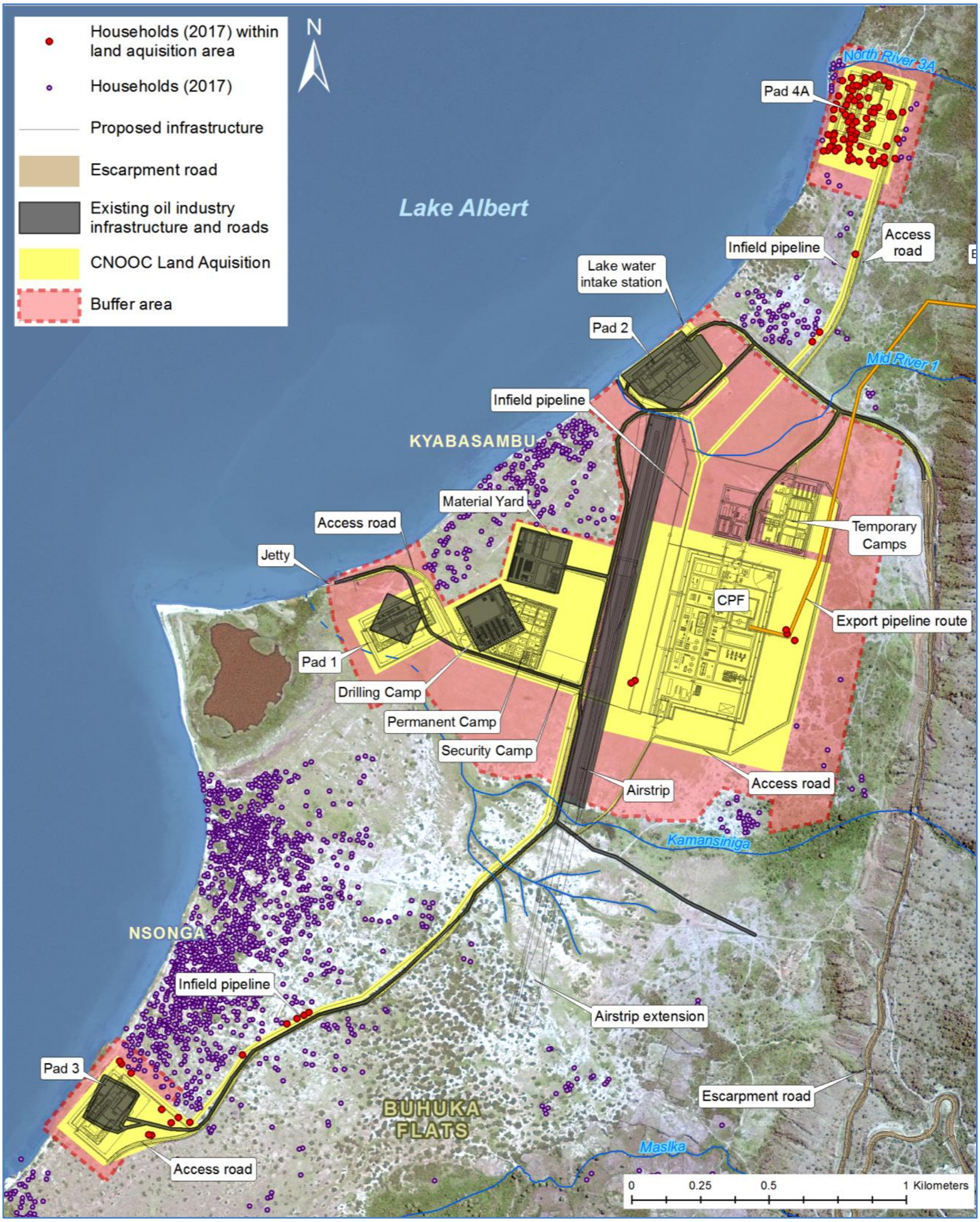


Figure 8-17: Proposed land use restrictions around the CNOOC Production Facility on the Buhuka Flats

8.3.5.3 Impact of In-Migration

The Buhuka Flats are likely to become a hub of small scale informal commercial activity, induced largely by the KFDA and the good access to the lake fishery. This will encourage further settlement among migrants seeking work and opportunities, both on the Flats and above the escarpment. The following land and resource impacts are expected, caused by migrants:

- Opportunistic and uncontrolled fishing will increase significantly. Fish trade appears to be conducted across the lake into the DRC (e.g. at Panyimur, Bwera and Ntoroko), while vast quantities of silver fish of fingerling size are harvested and sold (primarily as poultry feed) within Uganda as well as in Kenya. With continuing settlement and uncontrolled access to the lake, the existing communities on the Flats are likely to face an increasing threat to their livelihoods, with a strong likelihood that local fish catches will become further depleted, forcing local fisherman to venture further and further afield to maintain the food security of their families;
- Grazing and soil capability will deteriorate, with increasing numbers of cattle and other stock on the Flats and a further reduction in available grazing area due to settlement. There is already unsustainable grazing pressure on the Flats leading to land degradation such as loss of soil fertility or erosion, causing declines in productivity and negatively impacting local waterways. Land use patterns are already changing, due to the increasing populations, including goat keeping and extensive planting of cotton and watermelon in the areas between Kiina and Kacunde, Kacunde and Senjonjo and west of Senjonjo. This reflects migrants' priorities for different crops and livestock, which is leading to changing demand and allocation of scarce water resources, introduction of potentially invasive alien species, and use of fertilizers and pesticides that can damage the local environment. Over time, with further population increases, changes in species composition may be expected to favour less palatable grasses and invasion by invasive species will increase. Erosion is also likely to become an increasingly significant problem in the highly erodible soils of the Flats, exacerbating the reduction in grazing capacity;
- Wetlands, which provide vital ecosystem services such as reeds for house roofing and other materials, will be increasingly abused by unsustainable harvesting and the physical damage and eutrophication caused by overstocking. These resources will become scarce, directly affecting the livelihoods of the pre-existing lake communities;
- Clean water will become scarce, with most surface water resources being impacted by stock and poor sanitary conditions associated with the enlarging settlements;
- The existing resource depletion along the escarpment will worsen, with accelerating rates of charcoal manufacturing combined with the impacts of wood harvesting practiced by villagers from the Buhuka Flats for cooking purposes; and
- 'Bushmeat', which helps supplement the diets of people with scarce resources, and which is already scarce, will become virtually unavailable, as migrants increase pressure on remaining wild animal populations on the Flats and on and above the escarpment.

While all of these impacts are already emerging as a result of the escarpment road, independently of oil industry activity (and were subject to a separate environmental authorization), the Buhuka Flats communities are unlikely to make distinctions in this regard. Without careful and systematic planning of settlement and commercial development in these areas there is a high risk of conflict both within the communities and between communities and CNOOC and the government, who are already being blamed by some communities on the Flats for the influx of migrants and over-exploitation of their natural resource base. The housing and land use impacts caused by in-migration, as a whole, are expected to be permanent, of high magnitude and **high** significance.

8.3.5.4 Impact Mitigation and Monitoring

The following impact mitigation and monitoring is proposed:

Increased Rental Prices

- Ensure that CNOOC staff who reside outside the LSA are required to return to their place of residence during periods of leave to avoid potential use of rental property in the area; and
- Provide accommodation for all personnel who do not reside in the LSA and are not brought in on a BIBO or FIFO basis.

Restrictions on Land Use

- Ensure that local communities are fully aware of the reasons for the buffer. Install painted markers to demonstrate where the restrictions are; and
- Consider the use legal instruments to enforce the buffer zone as a long term means of protecting the interests of both communities and the KFDA. CNOOC would be required to motivate this proposal to Government for action.

In-Migration

- Implement the strategy for minimising in-migration defined in the Influx Management Strategy and Framework Plan (Volume 4, Specialist Study 11). This will need a combined effort by Government and all oil industry partners; and
- Assist Government to implement a Community Development Plan with practical mechanisms and mitigation strategies for the loss of grazing land caused by the project and the general loss of resources caused by increasing populations.

8.3.5.5 Impact Significance Rating

Table 8-28: Operational phase impact on Housing, Land and Resources

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of increased Property Rentals	8	4	2	4	High Medium 56	6	4	2	4	Low Medium 48
Impact of Restrictions on Land Use (Land Use Buffer)	2	4	2	4	Low Medium 32	2	4	2	4	Low Medium 32
Impact of In-Migration	10	5	2	5	High 85	6	5	2	3	Low Medium 33

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

8.3.6 Infrastructure and Community Services

8.3.6.1 Impact of Project Use of Community Infrastructure and Services

The project is not expected to use the District health services and there are no other local or district services that are provided that the project will use. The production facility will be provided with a fully equipped clinic and trained staff, including a medical doctor. Local communities will not have access to this facility, but all permanent and contract staff personnel will, so the impact on existing community infrastructure and services should have negligible magnitude and **low** significance**.**

8.3.6.2 Impact of Access Provided by the Regional Road Upgrades

The upgrading of the Kabwoya-Buhuka road and the extension of this road down the escarpment onto the Buhuka Flats has brought significant benefits to the Buhuka Flats villages in respect of access to community services. Where previously access to Parish and District services involved a long journey on foot, the communities can now gain access by vehicle. This is expected to facilitate a general improvement in the health and education in the local population. The upgrading of other regional roads (the PI from Hoima, the R7 and R4) will further improve access above the escarpment. This beneficial impact will persist through the operational phase of the project, being permanent, with high magnitude (given the excellent access provided to the vulnerable local communities in the District since the road was built) and **high** significance. While these roads have been separately considered and authorized, they are included here for completeness, since they have been built in support of the coming oil industry developments.

8.3.6.3 Impact of In-Migration

Operational phase impacts of the KFDA project on infrastructure and community services will be largely as a result of the indirect effects of in-migration. While the project will make use of the road infrastructure, most of the road improvements, which will benefit the broader community, have been in support of the oil industry.

In-migration impacts in the operational phase will be an extension of those occurring during the construction phase. It is expected that migration into the area will continue through the operational phase in the absence of actions to prevent or minimise it. While there may be a decline in the rate of influx described under the construction phase impacts, there is still expected to be ongoing long term population growth around the production facility on the Buhuka Flats, and in the LSA in general, by people migrating into the area in pursuit of CNOOC-related employment and business opportunities. Overcrowding may result in some people leaving the Flats and settling above the escarpment. Over the longer duration of the operations phase, the population demographics may change as the child population enters adulthood and enters the labour market.

Currently, it is projected that there will be an approximate 3.1% annual growth in the District, leading to a 168% cumulative growth in population in Kikuube and Hoima District for the period from 2014 to 2050[22] However, there is already experience on the Buhuka Flats of the effects of in-migration (refer to Figure 8-18),

[22] *UBOS (2014) Projected Population Growth rate per District*

where rapid expansion in the project area over the past 4 years has seen an average growth rate of 12% and more per annum for some of the settlements. This includes Nsunzu which has grown by 76% over the 2014 - 2017 period, Nsonga which has grown by 17%, Kyabasambu which has grown by 32%, and Kyakapere which has grown by 36%. The recent upgrade of a section of the Kabwoya-Buhuka road and the construction of the road down the escarpment onto the Buhuka Flats has improved accessibility to the lake, encouraging settlers who have capitalised on fishing and other activities made possible by improved access. Based on the data in Figure 8-18, the District projections described above may be a significant underestimate. While some people are benefitting financially, this is contributing to pressures on community infrastructure and services, including the following:

- Schooling: The government schools in the parish are currently facing significant challenges, with increasing demand being placed on existing limited services. Private schools have exploited the gap that demand has created, but are of varying quality. The private schools here, and elsewhere, are currently under scrutiny by the Department of Education which has indicated increased vigilance in respect of quality control and standards. At the same time, in the absence of adequate government-supplied educational infrastructure, demand will continue to exceed supply. Recruitment and retention of teachers is challenging due to lack of decent accommodation in the area, as well as the relatively low salaries being offered; and
- Health and welfare services: Local health services are experiencing impacts from the additional non-resident and resident population associated with the project, including health care services (specifically related to children and maternity health), emergency housing support; and family support services.

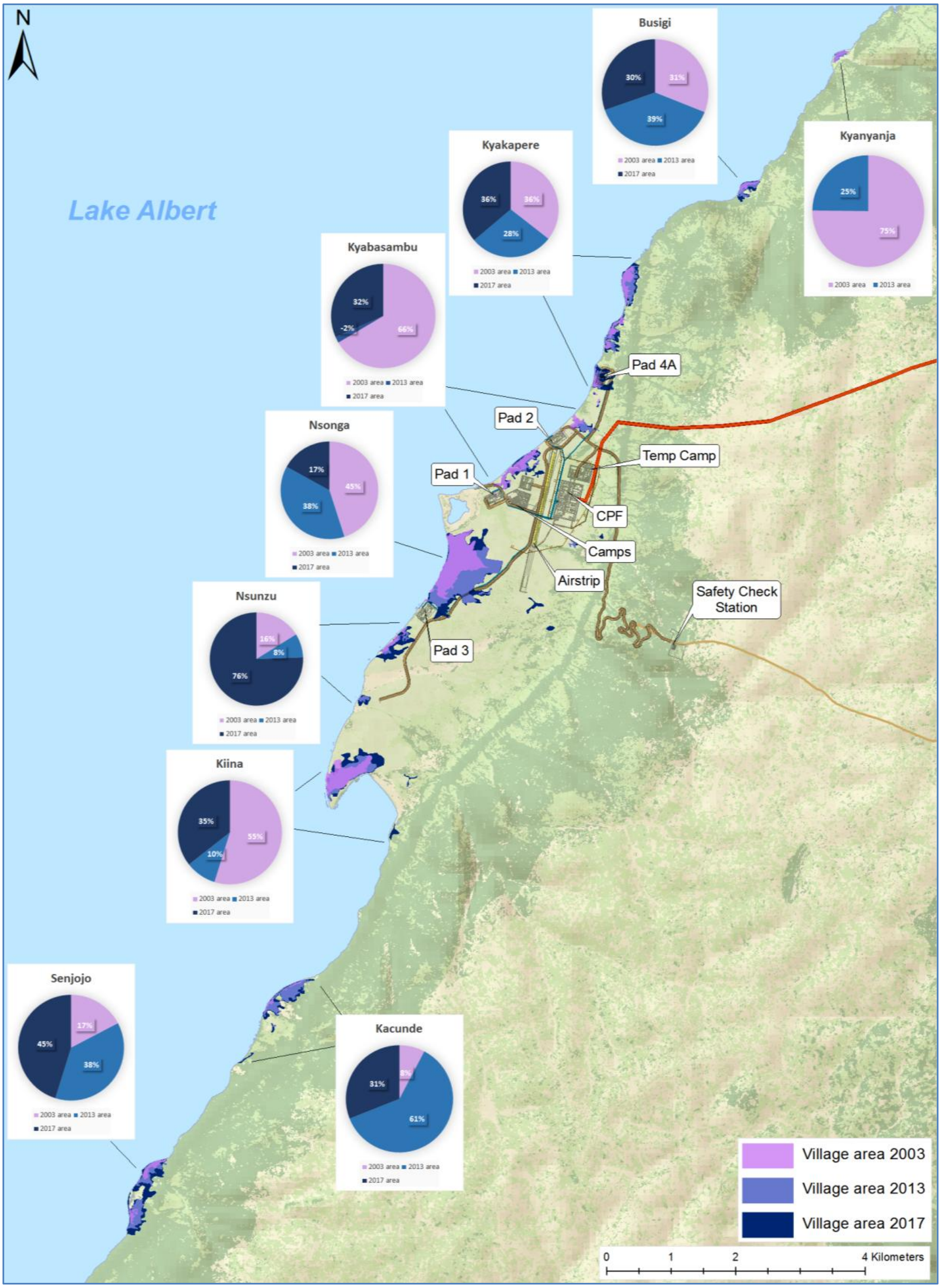


Figure 8-18: Village growth on the Buhuka Flats in the period 2003 - 2017, showing the impact of in-migration

Overall, in the absence of Government interventions, with assistance from CNOOC, the impact of in-migration will overwhelm the capability of the infrastructure and community services available to Buhuka Parish communities. Negative impacts are also likely to be experienced by the poorest members of the communities, who will be unable to take advantage of economic opportunities but will experience the negative effects of burgeoning growth. With regard to community infrastructure and services, the following outcomes are likely (as in the case for construction phase impacts):

- A dilution of local Government influence, as newcomers into the area are typically unfamiliar (or indifferent about) local Government rules and leadership structure. This has already started causing tension within and between communities on the Buhuka Flats and this trend will be aggravated by further migrants; and
- The price of rented accommodation is likely to rise sharply. During the project's construction phase, migrants in search of work may look for rental accommodation rather than purchase new housing. As additional demand for housing emerges, there will be a sustained increase in rental prices. While this will benefit the owners of accommodation, it will make rental costs for existing tenants (particularly poor tenants) unaffordable.

Impacts are likely to be of sub-regional geographic extent, long term and potentially high magnitude and **high** significance.

8.3.6.4 Impact Mitigation and Monitoring

The following impact mitigation and monitoring is proposed:

Access Provided by Regional Road Upgrades

- Ensure that project staff avoid making use of social infrastructure, including during periods of leave, unless they are resident in the project area.

Access Provided by Regional Road Upgrades

- Contribute to training and skills development initiatives that will promote the capacity of local communities to capitalise on the economic opportunities presented by the regional road upgrade, including collaborating with appropriate CSO partners, NGOs as well as donor organisations;
- Contribute to economic development and infrastructure improvement in the project area through a community development plan (CDP); and
- Promote opportunities for use of the road infrastructure to support the implementation of sustainable reduction, re-use and recycling options in respect of Solid Waste Management. In particular, the urgent need to avoid further impacts on the environment and Lake Albert from plastic waste (and in support of existing legislation).

In-Migration Impacts on Infrastructure and Social Services

- Support capacity building for town planning in anticipation of influx and growth in key settlements.
- Establish collaborative initiatives with central, district and local authorities to support the development and establishment of current and projected essential infrastructure related to water supply, health and education services as well as sanitation and solid waste management;
- Support the development of local capacity to offer effective crime prevention, safety, security and policing services;
- Ensure that the Livelihoods Restoration Plan, as well as the Community Development Plan actively take on board practical mechanisms and mitigation strategies for minimising pressure on infrastructure and social services posed by ongoing in-migration. This process should take cognizance of the extent to which households are reliant on subsistence food sources;

- Provide support in alleviating the cumulative pressures on social infrastructure through the timely provision of information to service providers relating to the size and demographic make-up of the projected operations workforce who may need to utilise social services, including any potential additional requirements to adequately respond to potential emergencies;
- Establish a baseline and surveillance system for the state of housing in the area using techniques such as mapping and review of satellite images. Review this regularly to show change from baseline and to support future interventions with the local or district authorities;
- Develop an adequate baseline to describe the water and sanitation conditions in the community prior to the Project development, including the resettlement areas and areas where influx is likely to occur; and
- Support the development of sustainable alternatives to the use of wood fuel and charcoal.

8.3.6.5 Impact Significance Rating

Table 8-29: Operational phase impact on Infrastructure and Community Services

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Infrastructure and Community Services										
- Impact of Project Use of Community Infrastructure and Services	1	4	2	4	Low 28	1	4	2	4	Low 28
- Impact of Access Provided by the Regional Road Upgrades	8	5	2	5	High +75	8	5	2	5	High +75
Impact of In-Migration	8	4	3	5	High 75	3	4	2	5	Low Medium 45

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low $\leq$30; Low Medium 31– 52; High Medium 53 – 74; High $\geq$75. Positive: +							

8.3.7 Individual, Family and Community Life

8.3.7.1 Impact of Social Fragmentation

Without appropriate planning interventions, social fragmentation is expected to escalate over time, continuing through the construction phase of the project into the operational phase. Social fragmentation is discussed in Section 7. The reader is referred to this section for details. The breakdown of the social fabric and traditional values (cultural and spiritual capital) in communities on the Flats and above the escarpment, due largely to the effect of in-migration encouraged by the CNOOC production facility and its improved road access, will pose an increasing threat to the company's social license to operate. Among settlers, there will be winners and losers, but the original fishing communities, resident before the start of oil exploration activity on the Flats, are likely to fall predominantly within the latter group, carrying most of burden of lost social cohesion without the capacity to take advantage of new opportunities.

For these socially vulnerable people, the magnitude of impact of these changes will be high, and the impact significance will be **high,** caused both directly by the operation of the KFDA production facility and indirectly by in-migration.

8.3.7.2 Impact Mitigation and Monitoring

The following impact mitigation and monitoring is proposed:

- Ensure that consideration of conflict issues - latent, existing and potential – is built into all phases and aspects of operations;
- Monitor and track responses to risks and impacts, involving workers and communities;
- Continue to implement the Community Relations Strategy (CRS) and extend the existing parish-based Oil and Gas Activities Monitoring Committee approach, and which meets on a quarterly basis. Ensure adaptation of this approach to promote a process of formalised communication forum that is open to representatives from villages (including but beyond the formalised governance system provided by LC1s), CSOs, NGOs, FBOs as well as traditional clan chiefs (or representatives) and other stakeholders as identified. Ensure regular meetings at local level, hosted by CNOOC, aimed at:
  - communicating with stakeholders to build understanding and demonstrate transparency and accountability.
  - strengthening channels for the provision of further information that may be needed.
  - promoting mechanisms for understanding real issues and concerns related to the project and impacts being experienced from direct (unmitigated), indirect and cumulative impacts.
  - publicly and transparently debating options for sharing out benefits at local level that will take account of the negative impacts experienced locally, including the costs and benefits of different options, their management implications and their role in supporting wider economic development.
- Develop - in consultation with all relevant stakeholders - a Community Development Action Plan (aligned with Kikuube, Hoima District and Kyangwali Sub-county Development Plans) for implementation of activities aimed at:
  - promoting strategic Corporate Social Responsibility (CSR) projects which will not require CNOOC to usurp the government's role or act as substitute government agent in fulfilling human rights related delivery.
  - planning and implementing projects, in partnership with government, that will serve to alleviate existing challenges to the survival, livelihood and dignity of the people of the Buhuka Flats in a sustainable manner. This could include engaging NEMA as well as relevant authorities in implementation of effective solid waste management and associated recycling programmes.
  - planning and establishing adequate sports facilities for schools as well as for youth, in partnership with government and the Bunyoro Kitara Kingdom.
  - planning and achieving critical objectives set out in the project Livelihoods Restoration Plans.
  - planning and implementing immediate measures that will assist in earning and maintaining CNOOC's social license to operate.
  - taking collective action where appropriate to address environmental, social and human rights issues.

- Facilitate and financially support the establishment of a district/area-wide Development Organisation, with a formalised legal structure (such as a Foundation or a Community Development Agency). Such an organisation or agency would:
  - address issues related to human security, as an approach that brings together development, human rights, and peace and security (as defined by the United Nations General Assembly, 2012).
  - allow the identification and redress of widespread challenges to the survival, livelihood and dignity of villagers on the Buhuka Flats and beyond in a sustainable manner.
  - draw together the financial and human resources of the private and public sectors, the traditional leadership and other stakeholder bodies as well as donor and aid organisations.
  - develop issue-based action plans, including business plans for donor funding in respect of various focus areas of need that will address identified human security issues and concerns.
  - allow CNOOC to use its own budget to leverage significant additional budget from other role-players (including international 'GoFundMe' initiatives) and aid organisations with a specific mandate (e.g. the distribution of mosquito nets) to address specific problems encountered at village level.
  - Ensure that at the point of CNOOC closure, such a development organisation could reasonably be expected to be self-sustaining. As well, to have made a lasting contribution to the well-being of the region, particularly within the villages on the Buhuka Flats.

8.3.7.3 Impact Significance Rating

Table 8-30: Operational phase Impact on Individual, family and community life

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of Social Fragmentation										
*- Impact of CNOOC activities***	9	4	2	5	High 75	2	4	2	3	Low 24
Impact of In-Migration	9	4	2	5	High 75	3	4	2	4	Low Medium 36

KEY			
Magnitude	**Duration**	**Scale**	**Probability**
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

*** Depending on the extent of Government commitment to foster development in the LSA, these impacts could become positive*

8.4 The Socio-Cultural Environment

8.4.1 Impact on Intangible Cultural Heritage

'Cultural heritage' refers to realities that communities, groups and individuals recognize and cherish as part of their lifestyle. Heritage items can be tangible such as artefacts, traditional dress or intangible such as language, oral traditions, customs, music, dance and rituals. Specialist Study 12 divides cultural heritage sites into two broad categories and twelve sub-categories. These are **archaeological / historic** (made up of bone sites, lithic archaeological sites, metal sites, quarry sites and historic sites); and **cultural** (made up of religious sites, cemeteries, ritual sites, ritual objects, sacred rivers, sacred trees, cultural trees, cultural landscapes and medicinal plants).

The direct impact of the project on archaeological / historic and cultural sites has been described under Construction Phase impacts (Section 7). Further impact on archaeological / historic sites during the operational phase is not expected. Indirect impacts on cultural sites are likely to continue through the construction phase into the operational phase. The spiritual life of local communities on the Flats will be affected by nuisance associated with the CPF, drilling and traffic (mainly noise and air quality impacts). The drilling of wells will continue for the first five years of operation of the plant, with noise effects considered the greatest impact to cultural sites in the wider vicinity. The major residual impact of noise is described in Section 8.1.3 and in Specialist Study 6. Although these effects would be short term, and localized around the well pad where drilling is taking place at the time, CPF operations will continue for 25 years, with noise generated by the plant, together with all of the traffic and other day to day activity associated with a large industrial facility.

A total of 38 cultural sites could be indirectly affected. The sensitivity of the sites and the expected impact significance of project operational activities on them is briefly described below:

- The 'CE' sites are cemeteries that are all highly sensitive. They are associated with ancestors, present families and/or settlement founders and are frequented by the communities for longstanding cultural purposes. Four sites are potentially lost due to construction phase activities, but assuming they are protected, they will be very close to project infrastructure and will face a risk of damage or nuisance during the operational phase. There is also a risk of damage to or nuisance affecting seven sites around well pad 3 and the airfield. In these cases, impact on these sites is highly probable. Impact magnitude will be high and the significance of impact will be **high medium**;

- The 'CH' sites are churches. Twenty three are within the 250 m buffer zone of well pads 3 and 4A, the materials yard and the flowlines / new road segments. The sensitivity of churches is considered to be low since they are used by the local community (individual villages) and can be rebuilt in another location (relocated) if required. Impact magnitude is medium and impact significance **low medium;**

- The 'CL' sites are cultural landscapes. Three areas of cultural landscape (CL-01, CL-02, CL-03) were identified which have been recognised with reference to the UNESCO definition of an 'associative cultural landscape': "…*justifiable by virtue of the powerful religious, artistic or cultural associations of the natural element*". Lake Albert (CL-01), the Escarpment (CL-02) and the viewpoint (CL-03), on the escarpment road, are iconic features of the natural landscape, defining the local (communal) sense of place and apparent (traditional) cultural associations with the natural environment (rivers, lakes, trees). These sites have high sensitivity. Sites CL-01 and CL-02 could be affected by increased noise, dust and visual disturbance over the long term, resulting in permanent impacts of high magnitude and **high medium** significance;

- The 'RS' sites are ritual sites with high sensitivity, one of which is within 15 m of proposed project infrastructure and is therefore vulnerable to damage or nuisance. This is the Afrocreed Swamp site (**RS-08**) (for the extraction of holy water). Other sites that could be impacted by dust, noise and other operational nuisance, are the Eye of the Lake (Luzira) (**RS-02**), which is associated with the Bugoma lagoon, RS-01 and RS-03 (Kasonga beach sites between the jetty and Nsonga), and RS-09 and RS-10 (known as the Coet/Kuwait site). Sites RS-02 and RS-03 have been particularly noted by all communities on the Buhuka Flats as being important. These sites are considered to be 'non-replicable' (and potentially immovable) cultural heritage sites as defined by IFC (PS 8, 2012). If they are affected by nuisance, the impacts would be long term and of high magnitude. The probability of the impact is uncertain, resulting in an overall significance rating of **high**; and

- The ‘SR’ sites are sacred rivers. The Kamansinig River (SR-02), south of the airstrip and in proximity to Well Pad 1 and the Jetty upgrade site is of high value and sensitivity, mainly in the area of the Bugoma lagoon. This site may be indirectly affected during operation, particularly due to noise, visual and dust impacts. Impacts are long term and of potentially high magnitude, if the sites are impacted, and with an uncertain probability of occurrence, impact significance will be **high**.

It is difficult to predict how and when changes to intangible heritage will occur during project operation. Some cultural change is inevitable. The influx of people seeking work or other indirect socio-economic benefits, together with any loss of access or changes in environmental setting of sites used for traditional activities, is likely to have an impact. Determining the severity of this impact is subjective with deviation from the local cultural norm perceived as either positive or negative by different people. An influx of migrants may either strengthen or weaken local cultural practices over the project lifetime. If impacts were to occur they would be of unknown/long term and potentially of high magnitude and high significance.

Particularly sensitive sites that are outside of the 250 m buffer zone but could still be indirectly affected are the sacred River Masika (SR-01) and the site of the Nsunzu Sacred Tree (ST-01), with its many associated myths and taboos.

Highly sensitive cultural sites that are most likely to be impacted by ongoing operational activities are sites RS-01, RS-02, RS-03, RS-08 and RS-09, and causing impact of medium magnitude and high significance.

8.4.1.1 Management and Mitigation

The following impact mitigation and monitoring is recommended:

- There is potential for the disturbance of previously unidentified archaeological material (i.e. accidental damage or chance finds). Prepare a project-specific, ‘site ready’, Chance Find Procedure. This is a priority since preparation works and environmental studies are ongoing at the project site where highly sensitive artefacts have now been recorded. The Chance Find Procedure must be updated during the course of construction to make provision for a course of action in the event that any cultural heritage artefacts are recovered. It must be presented to the relevant local authority and the National Museum for approval. It must also be provided to all contractors and consultants on the project site during all pre-construction and construction activity and incorporated within the project’s ‘site induction’ process. It must remain in place throughout construction. The Chance Find Procedure is to be a component of a detailed Cultural Heritage Management Plan (CHMP) (as required by IFC PS 8);
- Hold an urgent discussion with CNOOC to determine strategies for avoidance of those potentially highly sensitive archaeological sites identified within, or in close proximity to, the project footprint, which include sites within the Central Processing Facility; Pads 3 and 4A; the materials yard / the camps; and the jetty area;
- Undertake a further stage of cultural heritage study, as a priority, to verify the association (if any) of those surface artefacts recovered and potential sub-surface archaeological features indicative of settlement/industry. This would comprise shallow, targeted, hand-dug test pits (e.g., 1 m x 1 m in size) through which the archaeological potential could be firmly established and any further material analysis undertaken. This excavation programme will seek to eliminate the risk of archaeologically-induced delays during the construction phase;
- Implement a programme of pre-construction mitigation in the event that these targeted sites yield archaeological material. Avoidance (preservation *in situ)* is preferred but where this is not possible, “preservation by record” through systematic recording (e.g., archaeological excavation) is the only recourse. Such work, where required, must be described in appropriate detailed work programmes and specifications to be prepared by the cultural heritage specialist. To meet the requirements of Ugandan

law this work should be carried out by a suitably qualified person under a licence for archaeological survey as issued by the Minister. In the event of artefact recovery, all materials should be surrendered to the National Museum; and

- Monitor the impact of construction on archaeology in the form of a 'watching brief', if necessary, once the test pitting exercise has better established or dismissed the extent of any below-ground archaeological potential. The watching brief will occur during all ground intrusive activity which form part of the construction phase and include an archaeologist in attendance. The watching brief will involve monitoring soil removal / land take for the presence of cultural heritage material. The archaeologist must have the authority to stop construction work in the event that significant materials (e.g., burial sites, iron furnaces) are exposed. These sites will be recorded in full employing 'preservation by record'. The results of the watching brief must be presented to the relevant local authority. Provisions should be made to exhibit materials to interested stakeholders, including the local community.

8.4.1.2 Impact Rating

Table 8-31: Operational phase impacts on intangible heritage

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Church (CH): CH-01, CH-02, CH-03, CH-07, CH-08, CH-16, CH-17, CH-30, CH-31, CH-33, CH-34, CH-35, CH-39, CH-32, CH-33, CH-34, CH-35, CH-39, CH-40, CH-42, CH-43, CH-44, CH-50	6	2	2	5	Low Medium 50	5	1	2	3	Low 24
Cemetery (CE): CE-32*, CE-34*, CE-35*, CE-36*	8	5	2	5	High 75	2	1	2	5	Low 25
Cemetery (CE): CE-04, CE-05, CE-06, CE-31, CE-22, CE-23, CE-37	8	5	2	5	High 75	2	1	2	5	Low 25
Cultural Landscapes (CL): CL-01, CL-02	10	5	2	5	High 85	5	2	2	5	Low Medium 45
Ritual Sites (RS): RS-01, RS-02, RS-03, RS-08*, RS-09, RS-10	10	5	2	5	High 85	5	2	2	5	Low Medium 45
Sacred River (RS): SR-01	10	5	2	5	High 85	5	2	2	5	Low Medium 45
Sacred Tree (ST): ST-01	8	5	2	5	High 75	4	4	2	5	Low Medium 50

KEY			
Magnitude	**Duration**	**Scale**	**Probability**
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
1 None/Negligible						0 No chance of occurrence				
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +										

** these sites are within the 15 m buffer zone. It is assumed that the construction phase impact mitigation protects them and they are not destroyed by construction phase activities*

8.4.1.3 Management and Mitigation

A number of highly sensitive, unique, cultural and sacred sites exist in the KFDA. The following mitigation is recommended:

- Prepare a ‘site ready’ Cultural Heritage Management Plan (CHMP) for the Project area. The CHMP is to highlight the presence of culturally significant places to contractors at an early stage and specify further management necessary (e.g., demarcation/ signage) as required for individual sites;
- Seek to manage and mitigate the identified impacts on cultural resources throughout the construction phase in participation with local communities and identified site guardians. Regular platforms for community liaison are recommended in this regard. This will help to prevent any further (accidental) loss of sensitive cultural assets throughout the pre-construction and construction phases;
- Facilitate respect for local intangible cultural heritage, tradition and taboo through induction and ongoing education of construction personnel - regular platforms for community liaison are recommended in this regard (and detailed within the CHMP);
- Set out a strategy for maintaining community access to sacred sites and facilitating respect for local intangible cultural heritage, tradition and taboo, to ensure that the negative socio-cultural effects are effectively mitigated;
- Avoid all affected cemetery sites as the preferred mitigation. Where avoidance is not possible, a full mitigation strategy should be developed in conjunction with affected communities and the guardians of those sites. If the cemetery sites are found to be adjacent (rather than within) the areas of proposed activity appropriate signage and demarcation is recommended to protect these sites. It will remain important, as the project progresses, to consult with local communities about potential further impacts to other cultural sites in the vicinity;
- Demarcate other sacred sites that have been identified within the project area and make provision for site-specific monitoring as the Project is finalised. These sites may be affected by (as yet undefined) project access routes. Where a change in a site’s setting is anticipated, planting (e.g., screening) may be considered to minimise adverse visual impacts. Any mitigation measures must be agreed with the affected community;
- This next stage of work should also seek to incorporate the views of stakeholders beyond the Study Area including the National Museum; the cultural advisors for the Bunyoro Kitara Kingdom; and the regional cultural leaders (as identified during the community interview phase). A complete baseline can therefore be established and further necessary mitigation prepared (if necessary) and in participation with all parties. The details of such mitigation will be prepared for inclusion within the Cultural Heritage Management Plan (CHMP);
- Enhance or protect the environmental setting of selected cultural heritage sites in consultation with the local community e.g. through planting/screening; and

9.0 DECOMMISSIONING PHASE IMPACTS OF THE PRODUCTION FACILITY AND ASSOCIATED INFRASTRUCTURE

9.1 Key Impacts

Decommissioning of oil and gas production facilities require large teams of contractors and may cause impacts that are similar to, and sometimes greater than, those experienced during the construction phase. In the following sub-section, a summary of probable impacts is presented. These impacts will need to be considered in more detail in a Decommissioning Impact Assessment as the time for closure of the project approaches. At this time, a detailed inventory of decommissioning tasks and expected materials and wastes / waste handling must be prepared by CNOOC as a point of departure for the revised assessment of impacts.

Table 9-1: Summary of impacts expected as a result of decommissioning of the CNOOC Kingfisher Production Facility

Environmental Component	Environmental Impact
Air Quality	Emissions will be generated by heavy vehicles, large diesel generators and other decommissioning equipment. Demolition activities and land grading, backfilling and levelling, removal and clearing of excess fill, ripping of compacted areas for rehabilitation will be a major fugitive dust source at the CPF, well pads and associated infrastructure (camps, materials yard, safety check station). Fugitive emissions from ripping up of in-field roads will also occur unless there is agreement to leave them in-situ for use by communities.
Surface and Groundwater Quality (decommissioning of the CPF and associated infrastructure)	Large quantities of potentially hazardous and non-hazardous waste will be produced during decommissioning and dismantling of the CPF and associated infrastructure. Much of the bulk waste will be recyclable although large quantities of waste concrete are expected which will need to be broken up and disposed of. Hazardous wastes will include potentially oil-contaminated containers and materials, as well as quantities of waste oils, sludges, coolants, waste solvents, cleaning agents, hydraulic fluids, acids etc. It is not clear at present how much cleaning of oil-contaminated equipment and materials will be done in situ on site before it is removed either for recycling or for disposal. If significant cleaning is done, then oil contaminated wastewater and sludges will be generated which will require safe handling, temporary storage and disposal. Release of this wastewater directly into the environment would be likely to cause impacts of major significance.
Surface and Groundwater Quality (decommissioning of wells)	This impact is potentially of major significance in the absence of skilled procedures for well closure. Well closure is a highly technical process, typically involving the permanent sealing off of the well bore to prevent it becoming a conduit for well fluids and contaminating aquifers. Taking into consideration the number of wells that must be plugged and their location in relation to Lake Albert, well decommissioning will need to be of the highest standard in order to minimize long term risks of aquifer or lake contamination.
Surface and Groundwater Quality (in-field flowlines)	In the event that flowlines are left in situ, they will need to be pigged (cleaned) to prevent long term contamination of soils and groundwater. This will generate oil-contaminated sludges at the pig receivers which will need safe handling, temporary storage and disposal. Impacts associated with escape of these wastes into the natural environment would be potentially severe.
Soil Contamination	Spills that have not been fully cleaned up during the operational phase or which occur during decommissioning may result in contamination of soils and may need to

Environmental Component	Environmental Impact
	be bio-remediated or removed for disposal. This impact should be relatively minor since decommissioning of potentially contaminated plant and equipment will take place mainly within the controlled areas of the CPF and
Impact on Ecological Resources	Impacts on valued ecological components would be similar to those expected during the construction phase. Pollution risks will be the single largest issue, with a particular risk to wetlands and Lake Albert in the event that hazardous wastes are not appropriately managed and contaminated liquids or solids escape into the natural environment. Sedimentation during the re-contouring and restoration of the CPF platform and the well pads may be expected
Noise Impacts	These impacts are likely to be significant, although less disruptive than the construction and drilling phase of the wells which would have affected local inhabitants over a period of around 8 years. Decommissioning noise will probably also be limited to daytime hours.
Visual Resource Impacts	Temporary visual impacts will result from demolition, where the visual order of the production facility is lost, being replaced with a large demolition site. This will gradually be replaced by a return to the original pre-construction appearance of the project area, as demolished infrastructure is removed, and the site is finally graded, contoured and rehabilitated. Much of the natural aesthetic landscape should be restorable following removal of all infrastructure on the site. The access road into the Buhuka Flats is likely to remain.
Public Health and Safety (traffic)	Decommissioning will involve large numbers of vehicles and equipment, contractors and contracted personnel, which would result in similar potential safety impacts as those experienced during the construction phase. There will be a significant risk of conflict between decommissioning traffic and other traffic into and out of the Flats, and an increase in risk to pedestrians.
Public Health and Safety (social pathologies associated with large / decommissioning teams)	The range of issues associated with large numbers of contract workers on site (typically single males) that are associated with the construction phase would be experienced during decommissioning as well. Without a high level of management, contract workers may create tensions within local communities, increase the spread of HIV/AIDs and other STDs due to casual sexual interactions with local women and sex workers. Where alcohol and drug abuse is not controlled, this may increase the risk of accidents and also result in aggressive and violent behavior.
Collapse of Socio-Economic Benefits	This critically important impact will occur as a result of the loss of the economic anchor that CNOOC has provided in support of development within the local and regional study area over the 25-year period of its operation. Many of CNOOCs local employees will be laid off. Businesses around the CPF and in the sub-region that developed in support of the oil industry, will lose much of their market. The ongoing injection of capital into the local and regional economy, due to CNOOC maintenance and development expenditure and due to expenditure by employees with disposable income, will also be lost. These impacts can cause great hardships in the communities affected by the loss, with multipliers knocking on through the economy in a reverse (negative outcomes).

9.2 Framework Decommissioning Requirements

Based on the preliminary description of impacts in Section 9.1, this section provides an initial account of decommissioning requirements. This has formed the basis of a Framework Decommissioning Plan, included in Volume 2.

9.2.1 Decommissioning Objectives

Decommissioning planning and implementation must achieve the following objectives:

- Comply with Ugandan legislative and regulatory requirements for decommissioning and rehabilitation;
- Ensure that as much as possible of the work necessary for decommissioning is done before final closure of the project;
- Ensure that measures are in place to maximise, to the greatest reasonable extent, the recycling and re-use of decommissioned plant, materials, equipment and infrastructure to the benefit of people in Uganda and local project-affected people in particular;
- Ensure that measures are in place to safely dispose of all wastes and to clean up any contaminated areas on site;
- Provide initial guidelines for reinstatement of land and rehabilitation requirements;
- Provide initial guidelines concerning the requirements to decommission wells and flowlines and to rehabilitate well pads and flowline/pipeline rights of way;
- Ensure that as much as reasonably possible is done to minimize the impact of job losses that will result from the closure of the project; and
- Provide guidelines for the process to be followed to update the DRP, including requirements for public participation.

9.2.2 Decommissioning Principles and Procedures

In accordance with the objectives, the following general principles and procedures must serve as a basis for decommissioning:

- Carefully consider long term social and environmental liability of all proposed development actions during the lifespan of the project and, where feasible, implement alternatives that minimise long term risks;
- Follow an incremental approach to decommissioning by minimizing the project footprint during the project lifespan and by decommissioning and rehabilitating all areas which are no longer required for the project at the time. Quarries are examples of such areas, which can be fully decommissioned and rehabilitated prior to project closure. This provides the benefit that decommissioned facilities can be monitored over an extended period while the company still has operational capacity on site to manage any deficiencies in the closure process;
- Review current legislation that may influence decision - making at the time of decommissioning, together with best international practices of the oil and gas sector;
- Plan the decommissioning of facilities in consultation with statutory authorities, local communities and other interested parties. Prepare a Decommissioning Environmental Impact Assessment at least 2 years in advance of decommissioning;
- Maximise efforts to assist local communities to build capacity throughout the life of the project so as to reduce the impact of job losses on decommissioning and the termination of CNOOC’s contribution to development in the area. Efforts should include, wherever possible, the re-deployment of local CNOOC personnel to other operations;

- Update the project Waste Management Plan, prepared in accordance with The Ugandan Draft Petroleum Waste Regulations, to include all relevant aspects of waste management during decommissioning; and
- Systematically shut down the operating processes in a manner which minimises risks to project personnel, the environment and the surrounding community, both during and post-decommissioning.

9.2.3 The Main Tasks

The main tasks to consider in the clean-up and restoration of the Kingfisher site will be the following:

- Downhole abandonment of wells;
- Cleaning and purging of process equipment and piping of fluids and sludge;
- Treatment and/or disposal of process fluids and sludge;
- Removal of wastes and/or chemicals for disposal or re-use;
- Dismantling of wellheads, piping and plant facilities with re-usable items placed in laydown areas;
- Removal and cutting (if necessary for size reduction) of equipment and materials tagged for sale as scrap;
- Removal and cutting or sealing of contaminated equipment, tagged for disposal;
- Removal of transformers, instrumentation and electrical systems for re-use or disposal;
- Removal of structures, pads and foundations not destined for re-use;
- Isolation of underground piping, tanks and structures that are left in place;
- Removal of bridges, drainage culverts, roads and other civil works not needed for future access or erosion control;
- Installation of access controls and/or signposting (notification) for remaining structures; and
- Clean up and restoration of sites.

9.2.4 Requirements for Leaving Equipment and Infrastructure in Place

The following general requirements should apply to decisions about equipment and infrastructure that should remain:

- Before ripping and rehabilitating in-field roads, consult with local communities, district and regional Government to determine whether they could be useful if left in place. In this instance, the transfer of the responsibility of maintaining the roads shall be considered;
- Consider the feasibility of transferring other fixed assets with beneficial re-use to third parties. Where practical, safe and useful options exist, which are agreed to by the parties, formally transfer responsibility (for maintenance and legal compliance) of specifically defined remaining infrastructure and equipment to identified third parties. Verify that the recipient of any infrastructure is properly instructed in the safe operating methods and appropriate maintenance of the equipment or infrastructure;
- Obtain the approval of the relevant regulatory authorities and potentially affected landowners before a decision is made to leave any equipment on site for third party use. Make provision to ensure that this infrastructure or equipment does not create a safety hazard; and
- Document appropriate options for flowline/pipeline decommissioning including leaving them in place, or removing them for re-use, recycling or disposal. All relevant factors should be taken into account in this decision, including environmental risks of re-excavating the trenches if they are to be removed, pollution

and ground settlement risks of leaving them in situ, financial cost, reuse and recycling value and any other considerations raised by Government and other stakeholders.

9.2.5 Requirements for Decommissioning of Wells

The following general requirements apply to the decommissioning of wells:

- Remove and dispose of all surface infrastructure associated with the wells. Follow the requirements of the waste hierarchy and re-use and recycle as much of the material as possible. All hazardous or contaminated waste is to be disposed by a waste contractor at a certified hazardous waste disposal site;
- Abandon wells in a safe and stable condition. The method of plugging and abandonment of each well should be determined using an internationally recognised guideline such as the British Oil and Gas OP071 *"Guidelines for Suspension and Abandonment of Wells, Issue 4, July 2012",* as updated. Whatever method is chosen, it must be designed to ensure that aquifers are isolated and the long term risk of aquifer or surface water pollution is minimised; and
- Prepare a surface and groundwater monitoring programme to be implemented post-closure for a specified period of time.

9.2.6 Recycling and Reuse of Plant, Equipment and Materials

Recycling and reuse is a central component of a decommissioning plan. The plan should be developed around the following general recommendations:

- Dismantle infrastructure that has no beneficial re-use and which is not to be left in situ;
- Identify suitable recycling and disposal options for the equipment and materials that are dismantled, in line with best management principles of the waste hierarchy. Recycling and reuse of materials is to be maximised to the greatest extent possible, subject to safety and pollution considerations;
- Maintain a detailed log of all recycled materials, including auditable chain of custody information; and
- As far as reasonably practical, and subject to considerations about safety and pollution, provide local people with first choice concerning acquisition of recyclable or reusable infrastructure, non - polluting waste (such as wood), parts and equipment.

9.2.7 Contaminated Land Management and Waste Disposal

The following recommendations set out the procedures to be followed as a basis for a plan to rehabilitate contaminated land and to dispose of waste generated by decommissioning:

- Prepare a contaminated land assessment which identifies all areas of contaminated land, the nature of the contamination and the necessary measures to contain and rehabilitate these sites. Specifications are to include in situ bioremediation, where feasible, or other measures to remediate the area in accordance with Ugandan legislation and good industry practice, including the removal of the contamination to a registered hazardous waste disposal site, if no other options are available, using third party contractors as required by the Ugandan Draft Petroleum Waste Regulations (2016, or as updated);
- Contain liquid and solid wastes for treatment and safe disposal, in accordance with Ugandan legal standards and other appropriate standards and guidelines applicable at the time. This includes any wastewater generated by flushing and cleaning of pipelines and tanks to remove hydrocarbons;
- Prepare an inventory of all hazardous materials and wastes to be disposed of and specify the method of disposal in accordance with the MSDS, current Ugandan legislation at the time and best practice industry standards; and
- Remove and dispose of demolition waste at an appropriate authorised waste disposal facility.
- Remove and dispose of all litter, parts and equipment at an approved disposal site.
- Disassemble and remove all machinery from the site.

9.2.8 Re-contouring, Reinstatement and Rehabilitation

The general recommendations below provide a basis on which to prepare detailed, site specific specifications in a Decommissioning Plan prior to closure:

- Shape, level and de-compact the final landscape after removal of all project infrastructure, dress with topsoil and, where necessary, vegetate with indigenous species. Commission specialists to assist in planning re-vegetation and the management of environmental impact, as required;
- Remove access roads with no beneficial re-use potential by deep ripping, shaping and levelling after the removal and disposal of any culverts, drains, ditches and/or other infrastructure. Natural drainage patterns are to be reinstated as closely as possible;
- Shape all other channels and drains to smooth slopes and integrate into the natural drainage pattern;
- Construct contour banks and energy dissipating structures as necessary to protect disturbed areas from erosion prior to stabilisation;
- Promote re-vegetation through the encouragement of the natural process of secondary succession. Natural re-vegetation is dependent on de-compaction of subsoils and adequate replacement of the accumulated reserves of topsoil (for example, over the well sites), so as to encourage the establishment of pioneer vegetation;
- Remove alien and/or exotic vegetation; and
- Undertake a seeding programme only where necessary, and as agreed with the re-vegetation specialist. Natural re-seeding is generally regarded as being the most effective means of rehabilitation, subject to proper reinstatement of topsoil. Acceptable cover from which typically occurs over two or three rainy seasons.

9.2.9 Socio-Economic Considerations

The Final Decommissioning Plan must consider the negative socio-economic effects resulting from the project decommissioning and identify measures to minimise these as far as practically and economically possible. Much of the work necessary to manage these impacts must be done during the operational life of the project in which CNOOC should contribute to sustainable development in project-affected areas by building capacity in various fields. As closure approaches, CNOOC will need to work closely with the local communities to reduce the negative impacts associated with employment termination at the end of the operational phase by:-

- Ensuring that employees are fully informed about decommissioning and how it will affect them well before the project finally closes;
- Building community capacity to manage opportunities and impacts arising from the decommissioning and post-decommissioning phase of the project;
- Providing training to build local skills tailored to project decommissioning and post-decommissioning activities (equipment dismantling, rehabilitation activities, monitoring etc.). This will promote local communities (local labour) benefits from some employment opportunities created during decommissioning and post decommissioning phases; and
- Providing training to transfer project-learned skills to alternative and secondary industries tailored to respond to market economy.

9.2.10 Post closure monitoring, auditing and reporting

9.2.10.1 Closure and post-closure monitoring

Prior to decommissioning and rehabilitation activities, a monitoring programme must be developed and submitted to the relevant Ministry for approval, as a part of the Final DRP. The programme is to cover proposed monitoring during **and after** the closure of the facility and must include the following:

- Verification that any waste, wastewater or other pollutants generated as a result of decommissioning are appropriately managed, in accordance with the detailed requirements set out in the Final DRP;
- Verification that all de-contaminated sites are free of residual pollution after decommissioning;
- Verification that acceptable cover has been achieved in areas where natural vegetation is being re-established. ‘Acceptable cover’ means re-establishment of pioneer grass communities over the disturbed areas at a density similar to surrounding undisturbed areas, non-eroding and free of invasive alien plants; and
- Verification that abandoned wells are safe and are not resulting in a pollution hazard. Post-closure monitoring of abandoned wells must include continued inspection and testing of water quality from monitoring boreholes situated to provide an early warning of any contamination risks, and from Lake Albert in the vicinity of the well pads.

9.2.10.2 Reporting and Auditing

A reporting schedule must be developed. The period of time over which reporting is required must be agreed with NEMA. Reporting for the rehabilitated CPF site could be annually in the order of 3 years. For the monitoring of water pollution from the abandoned wells, the frequency of this reporting period may be extended to include longer term water quality monitoring, at intervals to be agreed with NEMA.

Monitoring reports must include a list of any remedial action necessary to ensure that infrastructure that has not been removed remains safe and pollution-free and that rehabilitated project sites are in a stable, weed-free condition.

Aside from any audits conducted by NEMA, it is recommended that independent auditors with specialist expertise in the management of oil industry impacts are appointed to conduct decommissioning audits, extending into the post-closure period.

10.0 UNPLANNED EVENTS

Unplanned events are reasonably foreseeable incidents that are not anticipated as part of the normal operation of a project, but which may conceivably occur as a result of project activities, albeit with a low probability of occurrence. Unplanned events may occur during the construction, operational or decommissioning phases of a project.

Risk management for unplanned events typically follows the series of steps shown in Figure 10-1. Hazards are identified, and their likelihood is determined. The consequences of the credible worst case are then assessed, taking into consideration local valued environmental components. The overall assessment of risk combines the probability and consequence of each particular event as a means of determining its acceptability. Finally, measures are proposed to reduce the risk of specific events, where necessary, and to manage the consequences if they were to occur.

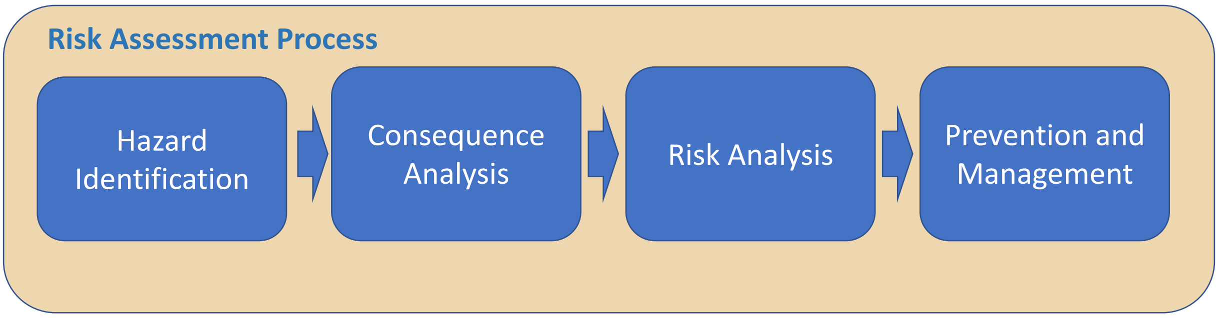


Figure 10-1: Risk assessment and management process

In the context of oil industry developments (oil wells, flowlines, processing facilities such as the CNOOC CPF), unplanned events are principally about oil spills (where the oil does not ignite) and fires and explosions. CNOOC has commissioned a number of studies outside of the framework of the ESIA as a basis for managing these risks. This chapter divides the studies into groups.

Two studies have been undertaken to develop a better understanding of particular natural hazards. These concern geotechnical instability and flooding. In this chapter, these investigations are summarized as follows:

- Geotechnical Hazards: Sub-section 10.1 describes the hazards resulting from seismic events and other natural hazards related to soils and geology, based on a CNOOC (2017) geohazard report. Since the rift valley is an area of geotechnical instability, a knowledge of the hazards caused by seismic events is important. Geotechnical instability may lead to equipment failure and consequently to oil spills or fire and explosion hazards; and
- Flood Hazards: Sub-section 10.2 considers the risk of flooding of the well pads or the CPF, which is reviewed in Sunshine Projects and Geoengineering Technologies (2010), based on various contributing factors, including rainfall, strong winds, earthquakes and tsunamis.

CNOOC (2018)[1] describes the process of evaluation of risk associated with well blowout. While this document is not a structured risk assessment in the conventional sense it does describe the technical considerations that the company has gone through in positioning of well pads to avoid contact with known faults, specification of well design (casing specifications, cementation, mud weighting et cetera) and drilling controls taking into account the characteristics of the reservoir.

The conclusions of this report, in summary, are that the formation pressure and temperature system in the Kingfisher Field Development Area is normal. There is no H_2S detected and CO_2 content is very low. All well locations have been properly selected to avoid known faulting based on available geological information. The

[1] CNOOC (2018) Kingfisher Oilfield Well Blowout Risk Analysis

well drilling design (casing, drill fluids, cementation and well controls) can meet the requirements of primary well controlled. Furthermore, in the event that there is need for secondary well control during well drilling this can be accommodated within the current design, leading to an overall conclusion within the report that well blowout risk is very low.

Two further studies are broad-based risk assessments, dealing separately with oil spills and fires and explosions:

- Oil Spills: Sub-section 10.3 summarises a risk assessment of defined oil spill scenarios, prepared by Worley Parsons (2017). On the basis of a preliminary risk analysis of the most likely oil spill events, taking into account their size, WP modelled the consequent dispersion of the spills above and below ground in more detail. Where necessary, recommendations were made to minimise the risks and recommendations for Emergency Response;
- Fires and Explosions: Sub-section 10.3.10 describes accidents involving oil and gas, which lead to ignition and fires or explosions. CNOOC (2017) has investigated a range of scenarios in which these events occur as a result of the failure of specific equipment. Hazards are identified and the consequences of the events are modelled and evaluated against recognized standards for acceptable personnel (worker) and societal risks.

  The final study provides a recognized international approach to the details of risk management, which links specific actions and requirements to identified hazards; and
- Safety Case: Sub-section 10.5 summarises the Safety Case, prepared for CNOOC by Bureau Veritas (2017), which sets out a roadmap for company systems and processes required to manage the hazards arising from the construction and operation of the production facility. This investigation provides a thorough understanding of the hazards associated with the project, the Safety Critical Elements (SCEs) (barriers to accidents which may be structures, plant or equipment) and the management of these SCEs to ensure that they are maintained to comply with appropriate performance standards.

10.1 Geotechnical Hazard

The geohazard assessment is based on studies undertaken over a number of years, including Fugro (2008, 2013), CPECC (2014; Volumes 1-6) and ZYGIC (2014). The rift valley is known for the occurrence of seismic events. Historic data show that the KFDA study area is seismically active and susceptible to geological hazards. Three earthquakes of magnitude greater than Mw 7.0 have occurred in the region. The largest event was the 1990 Mw 7.6 earthquake in the northern part of the model region (Fugro, 2008). Figure 10-3 shows the distribution and scale of seismic events recorded in the region.

A number of faults are present in the region. The main fault in the KFDA LSA is known as the Toro-Bunyoro fault. This fault is linear with a general trend of about N50°E, the eastern trace along the coastline and the western trace about 10 km offshore. Geophysical studies undertaken for CNOOC have identified two local faults, referred to as F1 and F2, both trending east-west with a dip angle of around 60-80 degrees. The upper depth of the faults is around 150 m below surface.

Regional earthquake frequency suggested by data analysed by Fugro (2008) suggests data suggest the potential for a threshold Magnitude (M) 5.0 or larger earthquake every 1.5 years, and a M6.5 or larger event every 50 years. Very large events (M7.0 to 7.5+) may also occur along the rift bounding faults, but are likely associated with long recurrence intervals of thousands of years. ZYGIC (2014) concludes that the surface geology is unstable and that design peak ground acceleration should be considered to be around 0.8 – 1.6g. The study also indicates that the soils of the LSA, beneath the well pads and CPF, have high swell-shrink ratios and relatively high liquefaction potential.

ZYGIC (2014) consider the geohazards described in the following subsections.

10.1.1 Landslides

A landslide may occur when a slope changes from a stable to an unstable condition. A change in the stability of a slope can be caused by a number of factors, both natural and human-induced. Natural causes include groundwater pressure acting to destabilise the slope, change in soil structure due to fires and loss of vegetative cover, erosion from the toe of a slope, earthquakes and volcanos. Landslides may be caused or aggravated by human activities such as deforestation, vibration caused by machinery, blasting, earthworks, and any activities that change the amount of water entering the soil.

The terrain of the LSA consists mainly of shallow gradients on the Buhuka Flats, which are too shallow to trigger landslides and granites along the steeper slopes of the escarpment, covered by weathered material no more than a metre deep. It is highly unlikely that rainfall or any other aggravating condition could trigger landslides on the slopes of the escarpment and this is not considered to be a material risk to the production facility.

10.1.2 Rockfalls

Rockfalls are typically more severe in environments where there are slopes steeper than 45 degrees and where there are interbedded hard and soft rocks, resulting in differential weathering. Heavy rainfall and/or vibration may be triggers for rockfall. With the close proximity of the escarpment to the production facility on the Buhuka Flats, the potential for rock fall damage is material. Based on an assessment of slope and distances to the well pads and CPF, ZYGIC (2014) concluded that well pad 4-2 falls within a high-risk zone, being close to the escarpment, with a 980 m level difference. It was recommended that the well should be relocated, resulting in it being moved to the current position at pad 4A, which is 278 m from the base of the escarpment, and together with the other well pads and the CPF, which is 407 m from the base of the escarpment, has a low risk of damage by rockfall.

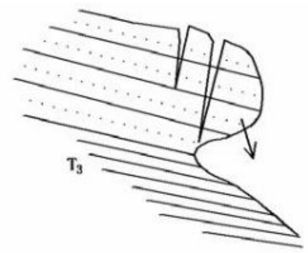


Figure 10-2: Typical cross section of an area prone to rockfall

Photograph 10-1. An example of rockfall from the escarpment above the Buhuka Plain

10.1.3 Mudslides

Mudslides typically occur during floods and are the result of the displacement of large amounts of sediment or soil by water, generally on steep slopes. The conditions that induce mudslides may include large amounts of natural or artificial accumulation of sediment, loose and unstable soils, or soils that were stable under natural conditions have become unstable due to human interference, heavy rains or earthquakes.

As a whole, the terrain on the Buhuka Flats is flat, the weathering layer thickness of the eastern escarpment is less than 1m and vegetation is abundant. The likelihood of mudslides under these conditions is low, even in circumstances of heavy rainfall.

10.1.4 Ground subsidence

Ground subsidence is typically caused by one of two factors - collapse at the surface due to underlying karst[2] topography or collapse due to previous underground mining. There is no karst topography in the LSA and no past history of mining. Ground subsidence is therefore not an issue that requires detailed consideration.

10.1.5 Ground fissures

Ground fissure is a geological phenomenon, referring to the surface cracking of rocks and soils dues to natural or man-made events. Causes may include excessive groundwater abstraction, particularly in karst environments, and strong earthquakes.

The Buhuka Flats are mainly lacustrine deposits, without extensive pumping of groundwater and no obvious active faults. The geological environment is not typical of areas where ground fissures are expected. Site investigations show no evidence of fissures and the risk to the production facility is considered to be low.

10.1.6 Seismic Activity

The seismic assessment is based on studies undertaken over a number of years, including Fuguro (200x, 2013), CPECC (2014; Volumes 1-6) and ZYGIC (2014). The rift valley is known for the occurrence of seismic events. Historic data show that the KFDA study area is seismically active and susceptible to geological hazards. Three earthquakes of magnitude greater than Mw 7.0 have occurred in the region. The largest event was the 1990 Mw 7.6 earthquake in the northern part of the model region (Fugro, 2008). Figure 10-3 shows the distribution and scale of seismic events recorded in the region.

A number of faults are present in the region. The main fault in the KFDA LSA is known as the Toro-Bunyoro fault. This fault is linear with a general trend of about N50°E, the eastern trace following the shoreline and the western trace about 10 km offshore. Geophysical studies undertaken for CNOOC have identified two local faults, referred to as F1 and F2, both trending east-west with a dip angle of around 60-80 degrees. The upper depth of the faults is around 150 m below surface.

Analysis of regional earthquake frequency data by Fugro (2008) suggests the potential for a threshold magnitude (M) 5.0 or larger earthquake every 1.5 years, and an M6.5 or larger event every 50 years. Very large events (M7.0 to 7.5+) may also occur along the rift bounding faults but are likely to be associated with long recurrence intervals of thousands of years. ZYGIC (2014) concludes that the surface geology is unstable, and that design peak ground acceleration should be considered to be around 0.8 - 1.6g. This study also indicates that the soils of the LSA have high swell-shrink ratios. The Design Basis (CNOOC, 2017) draws the following conclusions:

- The geological environment of the production facility is complex and the hazard class is category 1;

[2] *Karst topography is formed from the dissolution of soluble rocks such as limestone, dolomite, and gypsum*

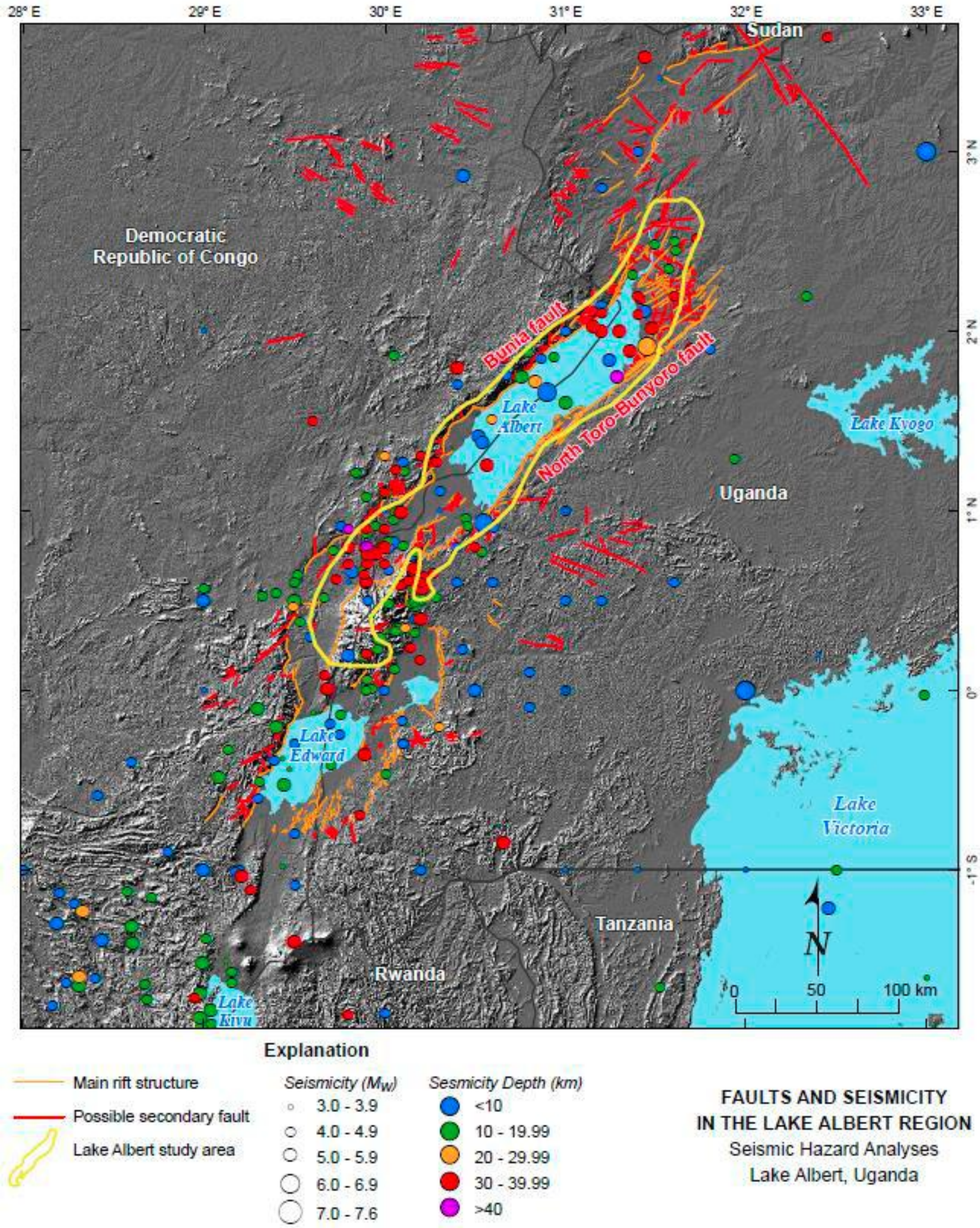


Figure 10-3: Record of Seismicity in the Lake Albert Region

10.1.7 Management of geotechnical events

- Review location of CPF and other infrastructure to be away from cliff location to avoid landslide risk of land or rock slide
- The design basis for the KFDA has taken into account seismic data (section 3.2.6 of the DBM)
- The liquefaction[3] risk of soils during an earthquake is low for all production facility infrastructure sites with the exception of well pad 1 and portion of the CPF. Specific provision for this is to be considered in the detailed design; and
- Further investigation of faults F1 and F2 are required in order to inform the final designs.

Offshore seismic risk could not be established with certainty due to a lack of data and recommendations are made to acquire additional data to inform final decisions about well engineering.

■

10.2 Flood Hazard

Sunshine Projects and Geoengineering Technologies (2010) identify two mechanisms that could lead to flooding of the CNOOC KFDA production facility. These are:

- High rainfall over an extended period, possibly exceeding 170 mm per month for several months. This could lead to ground saturation, a rise in the water table, which coupled with poor channelling and insufficient drainage and floodways, would render the area vulnerable to flooding. Recommendations to protect project infrastructure include properly designed drains to channel water around the CPF and well pads; and
- Larger than normal inflows to the lake, causing a rise in lake level. Lake water level data recorded over 62 years between 1948 and 2010 shows a fluctuation of 4.6 m. It is not known whether high lake levels have been due to purely seasonal climate variations or due to non-natural factors such as river damming. In its Design Basis, CNOOC (2017) presents the extreme maximum lake level for the purposes of design, based on a 100-year recurrence interval and 1m wave surge, as 625.6 masl; while the extreme minimum is 619.1- a difference of 5.5 m. It is possible that high water levels could be aggravated by a seismic event, resulting in a tsunami-like surge.

10.2.1 Management of flood hazard

Flooding occurs in flat areas and is caused by over flow of waters from streams and rivers. Flooding was identified and assessed as one of the geohazards for KF project during the geotechnical/geophysical surveys and geohazard assessment for the Kingfisher Development Area.

The key factors that cause flooding and might bring about flooding at Buhaka flat include the following:

a) Amount of rainfall: there are two rain seasons in Western Uganda: March to May and September to December. The average measurement of rain in the project area is 80mm. The main river / seasonal streams drainage pattern within the area is that they all drain to Lake Albert Basin.

b) Permeability of rock formations where waters pass;

c) Proximity to rivers;

d) Flat terrain.

[3] Liquefaction is the mixing of sand or soil and groundwater (water underground) during the shaking of a moderate or strong earthquake. Liquefaction is a hazard in areas that have groundwater near the surface and sandy soil. Buildings can also be damaged by strong surface waves making the ground heave and lurch.

e) Poor construction methods.

Risk factors, indices and risk levels for flooding for mapped for the KFDA is summarized in the table below.

Table 10-1: Risk factors, and risk levels for flooding for the KFDA

Geohazard	Factors	Risk index	Risk level
Flooding	Rainfall	80-100	Low
		100-120	Moderate
		>120	High
	Topology	Steep slope	Low
		Flat plane	High

The Buhuka plain is prone to flooding. With heavy rainfall and impermeable rocks, water can collect in low gradient areas causing flooding. The escarpment is also deeply incised by streams and gullies.

Consequences

a) economic losses

b) environmental damage

c) loss of lives and property

d) Acceleration of erosion and siltation

Prevention and control measures

a) Controlled by effective engineering designs thorough design and construction of drainage systems including digging channels

b) Maintenance and desilting drainage channels.

c) Sensitize and create awareness in the community on human activities that can increase risk levels of flooding.

4) Planting trees and vegetation along slopes and river banks.

10.3 Oil Spills

10.3.1 Introduction

This sub-section summarises the key aspects of the Worley Parsons (2017) study under the following headings:

- Methods and assessment criteria;
- Spill components and toxicity;
- Fate and behaviour;
- Potential spill sources;
- Causes of containment loss;
- Potential receptors;
- Risk screening; and
- Risk modelling
- Risk of spill during blowout event

Because emergency response is common to several of the studies, it is described separately in Section 10.6.

10.3.2 Methods and assessment criteria

An unplanned event is always associated with a probability. Some accidents are more likely to happen than others. Recognised methods of assessing the impact of unplanned events differ from those used in standard impact assessment, which are described in Section 4. Risk assessment for unplanned events is based on a combination of the likelihood (or probability) of an incident occurring and the consequence should the incident occur. Probability can be determined in a number of ways, ranging from a simple ranking based on professional experience to sophisticated methods which analyse the causes and frequency of accidents using long term records available in international databases. Consequences are typically established by modelling the pathways and dispersion characteristics of a defined spill, either on or below the ground surface.

In the Worley Parsons (2017) assessment, the professional team undertook a preliminary analysis of the risk associated with identified spill scenarios, which screened those to carry forward in detailed modelling. The risk associated with each scenario was determined using a rating scale developed by CNOOC, which ranked risk according to a matrix based on probability versus consequence[4] (Table 10-2). The scenarios included spills from the well pads, spills from the feeder lines and spills from the CPF. The risks coloured green in Table 10-2 are considered to have low significance, those rated as yellow, moderate significance, and those rated as red, high significance. All risks that exceeded a score of 6 (i.e.: from 8 – 25) in Table 10-2 were carried forward for detailed modelling.

[4] *This rating scale was developed by CNOOC and was used by Worled Parsons to rank the risks associated with specific identified inciendent scenarios.*

Table 10-2: CNOOC Corporate Risk Matrix

	1	2	3	4	5	Severity (Consequence) Description			
						Personnel	Property	Environment	Reputation
1	1	2	3	4	5	Negligible injury – no absence from work	Less than US$ 1,500	Leakage of hazardous substances does not affect the area outside the field or facility, micro damage which can be quickly removed	
2	2	4	6	8	10	Minor injuries – need first aid treatment	US$ 1,500 - US$ 15,000	Controllable leaks – no long-term damage.	
3	3	6	9	12	15	Injury	US$15000 - US$ 150,000	Reportable lowest quantity of uncontrollable leakage. Long term impact on the field or facility but no long-term impact on the area outside of the field or facility boundaries	Local mainstream media
4	4	8	12	16	20	Serious injury	US$150000 - US$1,5M	0,5 t to 1,0 t spill of hydrocarbons and hazardous substances, long term damage in some areas outside the field or facility boundaries	State mainstream media
5	5	10	15	20	25	Fatality	>US$1,5M	More than 1,0 t spill of hydrocarbons and hazardous substances, long term damage in some areas outside the field or facility boundaries	International mainstream media
Likelihood Description	A freak combination of factors would be necessary for an incident to result	A rare combination of factors would be necessary for an incident to result	Could happen when additional factors are present but otherwise unlikely to occur	Not certain to happen but an additional factor may result in an accident	Almost inevitable that an accident would result	15-25: Immediate action required to reduce exposure. A detailed reduction plan must be developed, implemented and monitored by senior management to reduce the risk to ALARP 8-12: A reduction plan shall be developed and authorized by the functional manager or area supervisor to reduce the risk to ALARP. The effectiveness of risk reduction measures must be reported to management 1-6: Manage by documented routine processes and procedures. Monitor periodically to determine when situation changes which may affect the risk			
	Never heard of in E&P industry	Heard of in E&P industry	Incident has occurred in similar E&P operations	Happens several times a year in similar E&P operations	Happens several times a month in similar E&P operations				

10.3.3 Spill Components and Toxicity

The modelled components included crude oil, consisting of a range of hydrocarbon compounds and between 0.9 and 2.8% weight Sulphur, and diesel, the major components of which are similar to crude oil except that there are a higher proportion of the more aromatic hydrocarbon compounds.

A summary of the health hazards associated with diesel and oil is provided in Table 10-3.

Table 10-3: Potential hazards associated with diesel and crude oil (APL, 2009)

Health Hazard	Diesel	Crude Oil
Oral and ski toxicity	Acute oral toxicity: LD50 > 5000 mg/kg Acute dermal toxicity: LD50 > 5000 mg/kg	Minimal skin toxicity: LD50 > 5000 mg/kg
Irritancy and sensitisation	May cause skin irritation with prolonged or repeated contact. No skin sensitization effects	Moderate skin irrigation for short-term exposure. Degree of irritation may increase with sun exposure
Effects on eyes	May cause mild irritation	May cause slight irritation
Inhalation	Excessive exposure may cause irritations to the nose, throat, lungs, and respiratory tract. LC50 > 5 mg/l	Irritation of nose, throat and lungs. Headaches, dizziness, drowsiness, loss of coordination, fatigue, nausea and labored breathing. Toxicity: LC50 > 5 mg/l
Ingestion	May cause gastrointestinal disturbances, including nausea, vomiting, diarrhea and central nervous system effects similar to alcohol intoxication	Irritation of mouth, throat and gastrointestinal tract leading to nausea, vomiting, diarrhea and restlessness. May cause headaches, dizziness, loss of coordination, fatigue, nausea and laboured breathing. Toxicity: LD50 > 5 mg/kg
Carcinogenicity	Suspected in causing cancer	Prolonged or repeated contact may create cancer risk
Tumour initiating / promoting activity	May produce skin tumours	May produce skin tumours
Fire and explosion	Highly flammable liquid and vapour	Highly flammable liquid and vapour
Ecological	Toxic to aquatic organisms, LL/EL 1-10 mg/l (to aquatic organisms)	Harmful to aquatic organisms

Notes:
LD = Lethal Dose; EL = Effective Loading; LL = Lethal Loading; LC = Lethal Concentration; DNEL = Derived No Effects Level

10.3.4 Fate and Behaviour

Diesel oils are mobile and will typically reduce by 100% on water over a period of 24-hours. They are lighter than fresh water and therefore tend to float on the surface. They have low viscosity and spread rapidly, becoming thin and breaking up quickly. Their movement is strongly affected by wind and in Lake Albert would be expected to form windrows. Wave energy on Lake Albert is unlikely to cause extensive mixing (emulsion), dispersion or sinking of a spill. On land, a diesel spill is likely to be absorbed into the soils and will persist for longer than in water, Persistence of a ground spill, taking degradation and volatilization into account, is considered to be up to ten years.

Crude oils are among the most persistent group of oils, persisting for over a year on water. Their volume may be reduced by around 50% over a 7-day period. These oils are lighter than water and would be expected to float. The KFDA crude is extremely viscous, and its movement is less likely than lighter oils to be affected by wind. Spreading of KFDA crude is likely to be slow, breaking into patches over time and pooling in layers that are centimetres thick. Currents and wave action on Lake Albert are unlikely to result in significant amounts of the crude sinking and sediment, which may in some circumstances increase the likelihood of sinking occurring, are not a material factor in Lake Albert. Evaporation will be the main weathering characteristic of the crude, given the high temperature environment. A ground spill of KFDA crude will be influenced by vegetation, which will restrict overland flow, which will be very slow, given the high pour point. Partitioning of the lighter oil fractions is likely to occur. These will evaporate and be absorbed into the soils more easily than the heavy fractions. Persistence of a ground spill, taking degradation and volatilisation into account, is considered to be up to ten years.

10.3.5 Potential Spill Sources

From the three main source areas (well pads, flowlines and CPF), Worley Parsons (2017) identify the following spill sources:

Table 10-4: Potential Spill Sources

Source Area	Potential Spill Source	Built in Spill Mitigation
Well Pad	Production wells. Maximum production rate is 11,320 bopd. Leak: well casing failure, partial or full bore with release into ground and groundwater.	Well integrity control, pressure control system, wellhead control system (including subsurface and surface safety and choke valves)
	Oily wastewater pit Leak: through cracks in the wastewater pit concrete liner	Volume of pit is 7,500 m^3. Pit is concrete lined with a secondary HDPE liner
	Manifold connecting the wells Leak: Failure of manifold	Process safety control, inclusion within the well pad bund, pressure control system, emergency shutdown control, corrosion protection, thicker pipe walls for overpressure
	Closed drain drum Leak: cracks in the pit concrete liner or overflow	Volume of pit is 5 m^3. Leakage control includes concrete lining, process safety control, an inspection regime
	Christmas tree Leak: Safety and choke valve failure	Process safety control, pressure control, emergency shutdown control, wellhead control system (including subsurface and surface safety and choke valves)
	All Leak: Bund failure	A 0,5 m bund around the entire well platform. All well pads raised above the maximum (100-year) flood level plus wave height.
Flowlines	Flow rates between 8075 bopd and 19,034 bopd Leak: below ground pipeline failure. Failed welds, catastrophic block valve failure, accidental mechanical damage, and river damage.	Burial (1m to top of pipe), corrosion protection (epoxy or other coating), cathodic protection (another form of corrosion protection), automatic pressure loss detectors, scour protection where the flowlines cross drainage lines
CPF	Oil production manifold. Connects the flowlines to the CPF and handles 40,000 bopd. Leak: Failure of manifold	Process safety control, emergency shutdown control, isolation valve, local pressure monitoring, corrosion protection

Source Area	Potential Spill Source	Built in Spill Mitigation
	Piping carrying hydrocarbons within the CPF between processing stages. Carries up to 40,000 bopd. Leak: Above ground pipeline failure	Leak prevention includes insulation jacket (which will contain small leaks), corrosion allowance, isolation valves, gas detection
	Storage tanks (includes on-spec tanks of 55,000 barrels, off spec tanks of 18,100 barrels, diesel storage tank of 3,145 barrels, diesel day tank of 220.15 barrels Leak: Tank and bund failure	Bunded to 110% of total volume, overfill protection (with audible alarms) and emergency shutdown control

10.3.6 Causes of Containment Loss

Four main causes of containment loss are identified in the study[5]:

- Seismic: The site is seismically active and susceptible to geological hazards. Three earthquakes of magnitude greater than Mw 7.0 have occurred in the region. Geo-hazard assessment has shown that the site has potential to incur ground fissuring and rock falls. Release of oils could occur if pipelines or tanks failed during a seismic event. Seismic activity can also increase the potential for liquefaction. The site generally has low liquefaction potential, except at Pad 1, Pad 4-2 (now replaced by Pad 4A) and part of the CPF area. This is a low risk, however could lead to release if pipelines are exposed or damaged as a result of liquefaction;
- Flooding: Flooding of the site may cause erosion and exposure of buried pipelines and tanks. Scouring may cause damage to above ground pipelines, or pipelines exposed from flooding. This could lead to a release of oils;
- Corrosion: Tests show that the soils at the site vary from moderately to highly corrosive. Sulphate and chloride content tests on water sample suggest that both concrete and steel structures are at risk from corrosion. Pipelines have corrosion allowance and protection to minimise the risk of release of oils from corrosion. There could be risk of release of oils from corrosion of concrete lined pits, if anti-corrosion measures are not in place; and
- Collision: Release of oils could occur as a result of damage to pipelines or tank structure caused by collision. However, as the majority of pipelines are buried underground, this risk is low.

10.3.7 Risk Screening and Modelling

The objective of the risk screening was to rank the accident scenarios as a basis for selecting those with the highest risk on which to focus the spill modelling and to determine the volume of spill to be modelled. The assessment of likelihood followed a qualitative approach based on professional judgement, experience from similar projects and interaction with the project engineering team. The assessment of consequence was based on specialists' input and their professional experience gained from similar projects.

Based on the results of the screening presented in the Worley Parsons (2017) study, ten accident scenarios were selected, assessed as medium or high risk, according to CNOOC's risk matrix. These are summarised in Table 10-5. Only one scenario fell into the high-risk category - that of a catastrophic[6] below ground flowline failure with a spill volume exceeding 1 ton. Other risks of moderate significance included incidents at the well

[5] *Fires and explosions are considered in Section 10.3.10 of this chapter*

[6] *'Catastrophic' as defined by Worley Parsons, does not refer to the environmental consequence of the spill, but rather the nature of the release. A catastrophic release from a pipeline would be a full bore release. A catastrophic leak is not necessarily cleassified as a high risk incident.*

pads (from a loss of containment in the well casing, with spillage to groundwater, to major leaks from the drilling waste pits, also spilling to groundwater); and incidents at the CPF, including spills from tanks, oil production manifolds, and piping leaks.

Table 10-5: Selected medium and high risk scenarios for modelling including risk rating

Source	Type of Release	Compound	Scenario	Risk Assessment		
				Likelihood	Consequence	Risk Value
Well pads	a) Casing leak	Crude oil	Loss of containment from the well casing failure and spill into groundwater contamination	2	4	8
	b) Oily wastewater pit	Oily water	Leaks from pits. Bunded pit with impermeable base	3	4	12
In-field pipelines (below ground)	a) Pipeline FBR	Crude oil	Catastrophic below ground pipeline with direction subsurface migration.	3	5	15
	b) Pipeline failure (long term break)	Crude oil	Chronic leak during long period of time	2	4	8
CPF	a) Tank spill / bund failure	Crude oil (on-spec)	Tank failure without a bund with surface spreading and migration through unsaturated zone	2	5	10
		Crude oil (off-spec)	Tank failure without a bund with surface spreading and migration through unsaturated zone	2	5	10
		Diesel (storage tank)	Tank failure without a bund with surface spreading and migration through unsaturated zone	2	4	8
	b) Oil production manifold	Crude oil	Catastrophic manifold leak with surface spreading above ground	2	4	8
	c) Piping leak	Crude oil	Minor leak above ground pipeline with surface spreading above ground	3	4	12

Note: Likelihood and consequence scoring is based on the CNOOC risk matrix presented in Table 10-2

10.3.8 Oil Spill Planning Scenarios

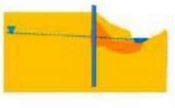
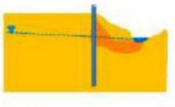
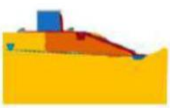
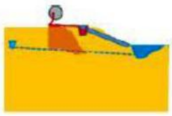
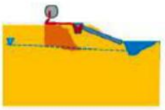
The following parameters were defined for each scenario:

- Flow rate: Used, together with the total leak time, to determine the total spill volume;
- Detection time: Used to determine the delay before measures are taken to shut off flows;

- Total leak time: Used, together with the flow rate, to determine the total spill volume;
- Spilled volume: This volume (the ‘primary loss of containment volume’) is the volume of pollutant that is expected to escape from the source (e.g.: tank or pipeline) and the type of failure (e.g.: catastrophic failure or chronic leak). The volumes were based on estimates of flow rates and leak duration for catastrophic and chronic leaks in-field flowlines, manifolds and casing; emptying of remaining product after catastrophic failure of flowlines; and tank storage capacity in the event of tank failure;
- Existing containment measures and containment capacity: Containment measures include preventative measures such as ditches or storm water trenches which may retain all or part of the spill in an emergency before it reaches a receptor. Containment measures are only applicable to surface spills. Tanks with aboveground bunds were not considered as measures of containment, because the applicable accident scenarios consider bund failure (Scenarios 12, 13 and 14). The CPF ditch discharge to the trench, a rainwater channel, was only considered as a containment measure when associated with emergency procedures;
- Location: all spill scenario locations are shown in Figure 10-4; and
- Potential receptor(s): Identified in an analysis of valued environmental components, undertaken as a part of the study, using field data collected by the Golder (2013) and other studies.

Table 10-6 describes the scenarios. The spill volumes were considered be conservative and subject to revision in more detailed modelling where necessary.

Table 10-6: Oil Spill Scenarios that were Conceptual Modelled (see Figure 10-4)

Scenario No.	Source	Scenario	Pollutant	Release model	Primary Loss of Containment (m^3) (Risk Workshop)	Additional Assumptions or Modifications to Model Screening Stage (Prevention and Containment measures in place)	Final Volume to Model (m^3)
1	Casing (well pads)	Loss of containment from the well casing (failure) and spill into ground and groundwater (FBR for 10 minutes)	Crude oil		0.020 m^3/s	• Defined as a release from the well casing below ground level (no above ground spill). • Reservoir is under low pressure and crude oil will be pumped by Electrical Submersible Pumps (ESP), which will shut down rapidly once the leak detector is activated, reducing pressure and leak. • Credible worst-case: Full bore release (FBR), which would be detected and stopped in 10 minutes and 1.5 flow).	18
2	Casing (well pads)	Loss of containment from the well casing (leak) and spill into ground and groundwater (leak for 6 hours)	Crude oil		6 h	• Defined as a leak from the well casing below ground level (no above ground spill). • The reservoir is under low pressure and crude oil will be pumped by Electrical Submersible Pumps (ESP), which will shut down within rapidly once the leak detector is activated, reducing pressure and leak. • Credible worst-case: Leak assumed from 1 mm diameter hole (casing and cement issues) that is identified within 6 hours and pressure is 20 bar.	0.14
3	Wastewater pit (well pads)	Leaks from wastewater pits. Bunded pit with impermeable base. Bund failure, direct infiltration to soil and groundwater	Oily water		7500	• Pit volume estimate: 7500 m^3 (60m x 30m x 4.1m) • Credible worst-case: Leak assumed from a 1 mm hole during 1 year; • Based on HDPE puncture and a preferential ground infiltration route, i.e., leak volume not reduced by soil permeability) and pressure head of 4.1m (depth of oily water in the pit).	28.02
10	In-field line, below ground	Catastrophic below ground pipeline with direction subsurface migration. Location to be confirmed (closest to lake)	Crude oil		6.6 mbop year flow (0.0333 m^3/s)	• Defined as catastrophic leak during risk workshop with 6 hours to reach and stop the leak. • Automatic detection system in place. • Shut off valves at the well pad and CPF sections of the line. • Worst credible case: 2 minutes until detection and pumps stop (5 to 20 seconds typical for automatic detection and blocking plus activation time) at 0.0333 m^3/s, followed by emptying of the line between the shut-off valves. Complete loss only possible at the lowest point of the ruptured section with emptying of half of the infield line section (worst-case taken as well Pad-3. 12" and 3250 m).	124.54
11	In-field line, below ground	Chronic leak during long period of time (14 days)	Crude oil		14 days until detection, not immediate automatic detection	• Smallest detectable leak: 0.198 m^3 (1% of designed throughput, 0.00033 m^3/s, in 10 minutes). • Worst credible case: Chronic leak from a 1mm diameter hole at 20 bar for 14 days until detection.	7.68
12	On-spec crude oil tank	Tank failure without a bund with surface spreading and migration through unsaturated zone.	Crude oil (on-spec)		8744	• Defined as a catastrophic leak in the risk workshop with bund failure. • API area: 60m x 30m; estimated containment capacity: 7500 m^3 (based on wastewater/drainage pits in well pads). Crude oil assumed to be partially contained in the API separator and in the hazardous area drainage. • Possibility of intervention and crude oil containment and removal in the trench that discharges to the lake: 2.5 m wide and 790 m in length: 592 m^3 minimum containment capacity (0.30 m barrier * 2.5 m * 790 m). • Estimated remaining pool in the CPF: 260 m^3 (5200 m^2 bund, 5 cm remaining product in the bund area (estimate), due to kerbing) • Worst credible case: 392 m^3 exceeds the CPF containment capacity and reaches the lake through the discharge point and trench. A product pool of 260 m^3 should be removed from the CPF assuming some infiltration in unpaved areas.	392 m^3 to lake 260 m^3 ground (pool)
13	off-spec crude oil tank	Tank failure without a bund with surface spreading and migration through unsaturated zone.	Crude oil (off-spec)		2877	• Defined as a catastrophic leak in the risk workshop with bund failure. • API area: 60m x 30m; estimated containment capacity: 7500 m^3 (based on wastewater/drainage pits in well pads). Crude oil assumed to be contained in the API separator and in the hazardous area drainage. • Estimated remaining pool in the CPF: 106 m^3 (2120 m^2 bund, 5 cm remaining product in the bund area (estimate), due to kerbing). • Worst credible case: Crude oil pool of 106 m^3 should be removed from the CPF assuming some infiltration in unpaved areas.	106 to ground (pool)
14	diesel storage tank	Tank failure without a bund with surface spreading and migration through unsaturated zone.	diesel		500	• Defined as a catastrophic leak in the risk workshop with bund failure. • API area: 60m x 30m; estimated containment capacity: 7500 m^3 (based on wastewater/drainage pits in well pads). Product assumed to be contained in the API separator and in the hazardous area drainage. • Estimated remaining pool in the CPF 11.25 m^3 (225 m^2 bund, 5 cm remaining product in the bund area (estimate), due to kerbing). • Worst credible case: Product pool of 11.25 m^3 remains in the CPF assuming some infiltration in unpaved areas.	11.25 to ground (pool)
15	Oil production manifold (CPF)	Catastrophic manifold leak with surface spreading above ground	Crude oil		40,000 bopd, 708 m^3, 6h	• Defined as a catastrophic leak in the risk workshop. • Automatic detection and blocking system in place (Emergency Shutdown Control (ESD), Isolation Valve). • Worst credible case: 10 minute leak until detection and pump stopped at flow rate of 0736 m^3/s. • Crude oil will be drained to hazardous area drainage system and API separator. API area: 60m x 30m; estimated containment capacity: 7500 m^3 (based on wastewater/drainage pits in well pads). • Oil spill assumed to be contained into the API separator and in the hazardous area drainage. • Worst credible case: Some product could reach unpaved areas by projection or process drainage overfilling or blockage: 30-m radius pool (distance between process/storage area and perimeter ditch) with 0.01 m pool depth. • No other route of direct impact considered.	28.27 to ground (pool)
16	CPF piping	Minor leak above ground pipeline with surface spreading above ground	Crude oil		40,000 bopd, 708 m^3, 6h	• Defined as a Minor leak in the risk workshop. • Automatic detection and blocking system in place (Emergency Shutdown Control (ESD), Isolation Valve). Minor leak 10% of the catastrophic rupture of the main manifold. • Oil spill will be drained to hazardous area drainages and conducted to API separator in CPF. API area: 60m x 30m; estimated containment capacity: 7500 m^3 (based on wastewater/drainage pits in well pads). • Oil spill assumed to be contained in the API separator and in the hazardous area drainage. • Worst credible case: Some sections of piping could be above unpaved areas or the spill could reach these areas by projection or process drainage overfilling or blockage. All spilled oil produces a pool with 0.01 depth. • No other route of direct impact considered.	6.62 to ground (14.51 m pool)

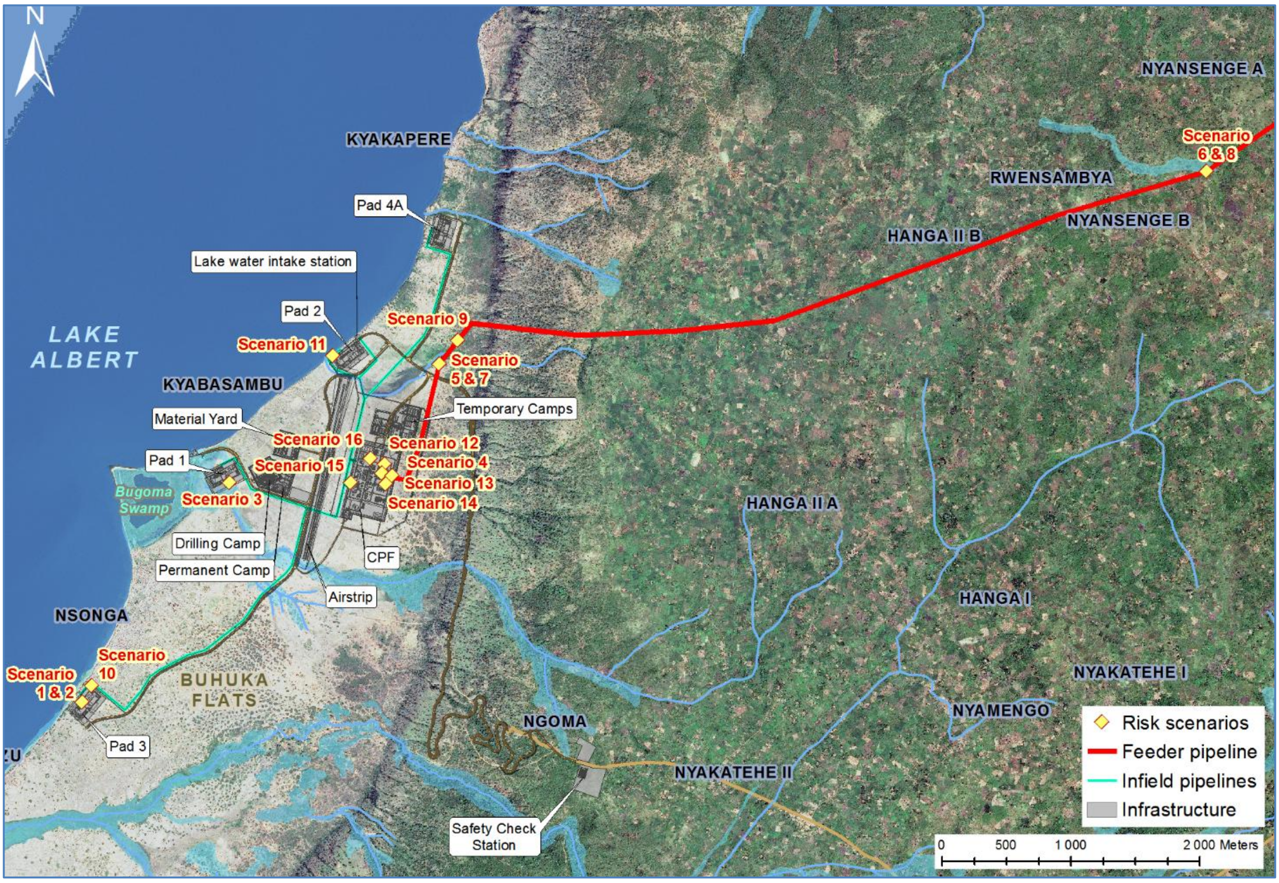


Figure 10-4: Oil spill scenarios locations for conceptual modelling (see Table 10-6)

10.3.9 Conceptual Model

10.3.9.1 Migration Pathways and Environmental Components

Soil, groundwater and surface water were considered both as migration pathways and environmental receptors (Worley Parsons, 2017). Specific assessments of damage to habitats and protected species were not undertaken, but it was assumed that the ecosystems present in an area of impacted soil or surface water would also be severely affected. The potential to cause damage to the following environmental components was assessed:

Soil: Unsaturated Zone (USZ). Standard porosity, bulk density and other properties[7] were assigned to the USZ of the Buhuka Flats, which was categorised as sandy clay

Groundwater: Saturated Zone (ZS): On the Buhuka Flats adjacent to Lake Albert, groundwater is enclosed in sedimentary lithology. The sandy clays are comparatively good aquifers but are often constrained by limited storage and erratic recharge. The depth of the groundwater table varies between 1 and 5 m on the Buhuka Flats. For modelling purposes, an average depth of 2.5 m was assumed.

Surface Water: The Kingfisher Field Development Area lies on the south-eastern flank of the Albert Basin. Lake Albert occupies the majority of the approximately 2 270 km^2 area of the District covered by water bodies. Rivers on the Buhuka Flats are generally seasonal with the exception of the Masika River, at the southern end of the Flats. Standard properties (currents and wind speed) assigned to Lake Albert in the screening calculations were included in the modelling.

[7] *Details provided in Volume 4, Specialist Study 4.*

Ecosystems, Land Use and Protected Species: Both the wetlands of the Buhuka Flats and Lake Albert were considered to be environments with very high sensitivity ratings. Specific modelling of possible species mortality was not undertaken, but the ecological consequences of spillages reaching either the wetlands or the lake were considered to be severe.

10.3.9.2 Modelling Assumptions

Details of the modelling assumptions are described in Worley Parsons (2017). Where choices existed, conservative assumptions were made. An illustrative summary is included below:

- The modelling assessed non-aqueous phase liquid ('NAPL' - which in the present case is oil), largely immiscible when in contact with water; and oily water. Physical and chemical properties of the oil were determined from the CNOOC Basis of Design;
- Natural attenuation (biodegradation) of hydrocarbons in soils was not considered;
- The shortest distance between the source and the lake was assumed for modelling purposes;
- All spills within the boundaries of the CPF included the effect of containment mechanisms built into the design, with the exception of bund walls, which were assumed to be breached;
- With the exception of Scenario 3, the assessment only considered damage due to NAPLs and not by dissolved compounds. Where spillages reached the lake, the dispersion was assumed to be on the surface as an immiscible NAPL, not as a dissolved component. The substance involved in Scenario 3 is oily water which was modelled using a different methodology;
- In the lake, wind was assumed to be in the same direction as the current to provide a worst case plume. No vaporization of dissolution was assumed;
- In the lake, the shoreline morphology determined the maximum spreading distance before shoreline deposition or the placement of a containment barrier. Spills were calculated to move at a rate of 2.75 km per hour across the lake where the current and wind direction combined to create a worst case. The model also considered total deposition of product once the maximum spread distance was reached, without any previous product deposition;
- Fisheries were assumed to be affected by any spill into the lake; and
- For direct discharge to surface water bodies (Lake Albert and the streams and wetlands of the Flats), it was assumed that the area of damaged habitat would be equal to the maximum area covered by the oil spill.

10.3.9.3 Findings of the Risk Assessment

The main results and conclusions of the screening modelling are as follows:

- The accident scenarios were found to result in damage to soil, except under Scenario 3 for which only groundwater impact was anticipated;
- None of the above ground spills (Scenarios 3, 12, 13, 14, 15 and 16) reached the groundwater table;
- The scenarios that affected surface water included:
  - Scenario 10 (in-field line, below ground): The NAPL plume length was limited by the distance to the lake. A sub-surface discharge to the lake would occur under this scenario, but the potential extent of damage to this receptor was not evaluated.
  - Scenario 12 (on-spec crude oil tank): Lake Albert could be affected by a direct discharge due to a spill that exceeds the CPF containment capacity. The lake surface affected would be the maximum area of the spill on the water surface. The length of the affected shoreline would be equivalent to the maximum spill diameter. Assuming full loss of containment and the failure of the perimeter bund, the volume escaping from the boundaries of the CPF was estimated to be a maximum of

392 m^3, while a product pool of 260 m^3 accumulates at the CPF. More detailed modelling in Phase B of the analysis showed that the full volume is likely to be contained within the boundaries of the CPF, even in the event that the retaining bund is fully breached (Figure 10-5).

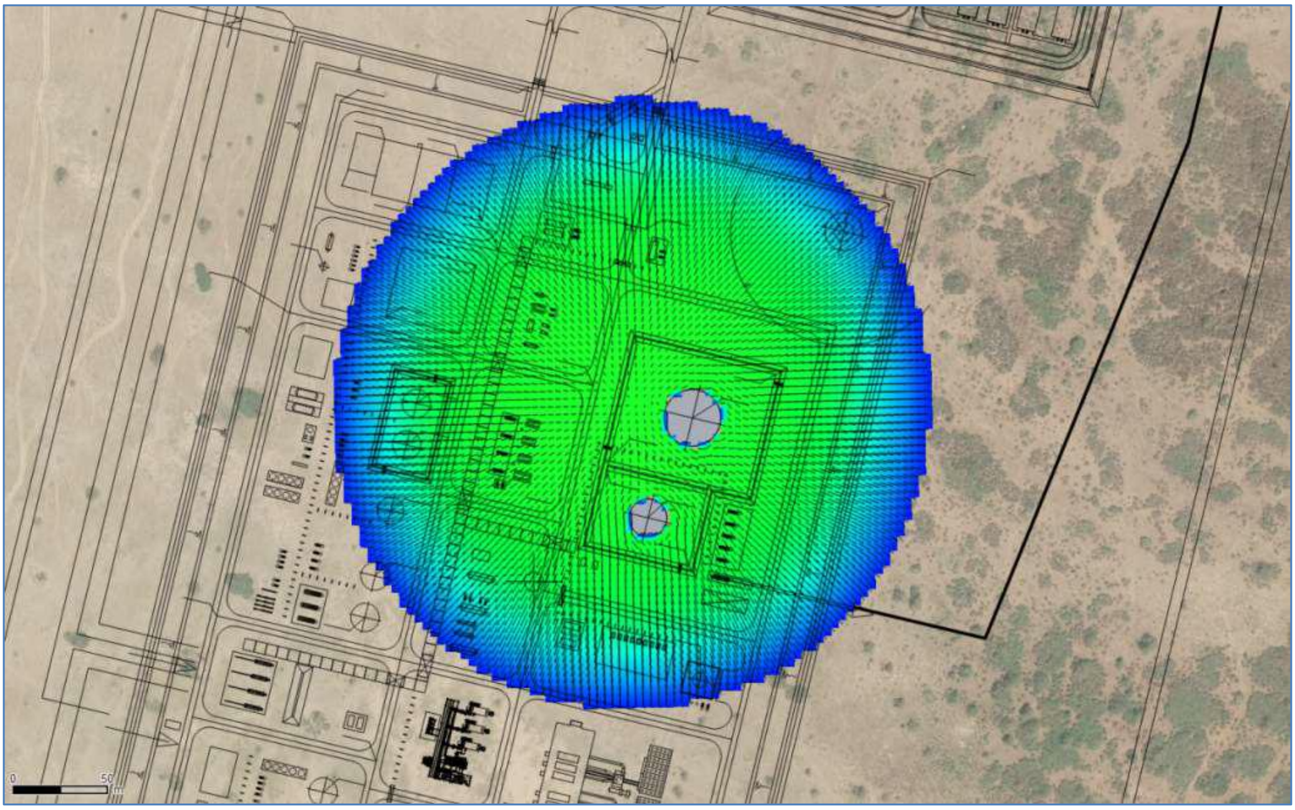


Figure 10-5: Complete tank and bund failure at 8 hours

10.3.10 Oil spill due to blowout

Oil spill modelling has been conducted to estimate the fate of worst case hydrocarbon releases for a number of scenarios within the CUL Kingfisher Development. Table 10-7 summarises the scenarios modelled. Figure 3.7 shows the oil spill sites within the CUL Kingfisher Development area.

The oil spill modelling study has been performed with the BV OILMAP Land software.

Table 10-7: CUL Kingfisher Development modelled oil spill scenarios[8]

Site	Name	Description	Latitude (N)	Longitude (E)	Spill Rate	Duration
1	Pad 1-KF	Blowout Drill Pad 1 (close to Lake)	137,897.0	248,650.0	12,000 bbl/d	2 hours
2	Pad 2-KF	Blowout Drill Pad 2 (close to Lake)	138,789.2	249,562.6	15,000 bbl/d	2 hours
3	Pad 3-KF	Blowout Drill Pad 3 (close to Lake)	136,126.0	247,574.0	20,000 bbl/d	2 hours

[8] Additional information regarding modelling scenarios and parameters is contained in the KF-FD-RPT-GEN-SA-1011 Oil Spill Risk Identification & assessment report

Site	Name	Description	Latitude (N)	Longitude (E)	Spill Rate	Duration
4	Pad 4A-KF	Blowout Drill Pad 4A (close to Lake)	139,764.0	250,316.0	9,000 bbl/d	2 hours
5	CPF	CPF – tanks failure	137,551.3	294,923.0	10,000 bbl	instantaneous

10.3.11 Spill manangement

Spill management will be in accordance with built-in spill mitigations as presented in Table 10-4 elements mitigations for spillages as presented in section 7.2.1.1.3, section 7.2.1.2.3 section 7.2.1.4.3 and section 7.3.4.5. Various plans are to be/have been developed by CNOOC to inform procdures for mitigating spills of a chemical or oil nature. These plans will be aligned with the Uganda National Oil Spill Contingency Plan to ensure all actions to counter/manage spillages are within legal requirements of the country. Further to the information presented in Table 10-4, to the ENVID Report (KF-FD-GEN-SA-1001 HAZID 2017 suggests the following to maange spillages,

- Incident notification procedure specific to the site to be developed prior to the operation stage.
- Develop oil spill response plan specific to the site to be developed prior to the operation stage.
- Provide dedicated storage area for used engine oils in CPF and wellpad that is provided with adequate bunding for spill likely to be generated from machinery.

10.4 Fire and Explosion Hazard

10.4.1 Study Approach

Bureau Veritas Marine China (2017) has undertaken a Fire, Explosion and Risk Assessment (FERA) on behalf of CNOOC. This study included quantification of the risks from well pads 1, 2, 3, 4 and the CPF. The study objectives were to identify the hazards, undertake a failure frequency analysis and consequence analysis, followed by a risk assessment, a consequence assessment and conclusions and recommendations. PHAST software was used to undertaken the consequence calculations.

10.4.2 Accident Types (Failure Mode)

Assuming that the hydrocarbons catch fire, the following consequences are possible, and have been considered in the assessment:

- Jet fire: Jet fire is a burning jet of gas whose shape is dominated by the momentum of the release. Typically, a hydrocarbon jet fire affects a relatively narrow conical volume, emitting radiant heat. Depending on the release orientation, location and density, and the presence of personnel and/or surrounding communities in the area, injuries or fatalities are possible;
- Pool fire: A pool fire can result if a spill of flammable or combustible liquid is ignited. After a pool is formed, the evaporation will take place due to the heat transfer, solar insolation and/or atmosphere. As it evaporates, the vapor may become available for combustion, resulting in a risk of injuries or fatalities to personnel or immediately surrounding communities;
- Flash fire: A flash fire occurs when a flammable cloud of gas burns without generating any significant overpressure or radiant heat. The cloud is typically ignited on its edge, remote from the leak source. The combustion zone moves through the cloud away from the ignition point, and slightly expands a small distance beyond the Lower Flammable Limit (LFL) due to thermal turbulent effect within the burning cloud. Normally the duration of the flash fire is relatively short. For flash fires arising from a hydrocarbon release, it is expected that personnel would only by injured or killed in cases when engulfed within the flash fire; and

- Explosion: An explosion results from the combustion of a flammable cloud of gas which is sufficiently confined within an enclosed space (with poor ventilation), or by obstacles, to generate pressure build-up. The rapid release of energy arising from an explosion causes a significant pressure pulse capable of causing personnel or surrounding community injury or fatality and structural damage. In the QRA study, explosion is distinguished from a flash fire by the fact that the sudden release of energy may result in missile fragments and at the same time the combustion of the gas gives rise to damaging levels of overpressure.

10.4.3 Risk Acceptance Criteria

The study sets out thresholds for acceptable individual risk (worker and community related) and social risk. Individual risks exposures to employees and contractors have been set at a maximum tolerable level (i.e. the upper tier) of one in thousand chances per year (1E-03 per year) of severe injury or death. For individuals with a risk exposure above the maximum tolerable limit their risk exposure is defined as ‘unacceptable’ and risk reduction measures must be investigated and implemented.

At the lower tier, two orders of magnitude less than the upper tier at one in one hundred thousand per annum (1E-05 per year) the risk exposure is considered ‘Broadly Acceptable’ for workers and no further risk reduction measures need to be considered. The region between the upper and lower tiers is referred to as the intermediate tier. Risk exposures that fall within the intermediate tier must be demonstrably reduced to ‘As low as Reasonably Practicable’ (ALARP). When risks fall within this tier, ALARP must be demonstrated by a systematic process of review, identification, analysis and evaluation of potential risk reduction measures. The Three-Tier Framework of Risk Acceptability Criteria is graphically presented in Figure 10-6.

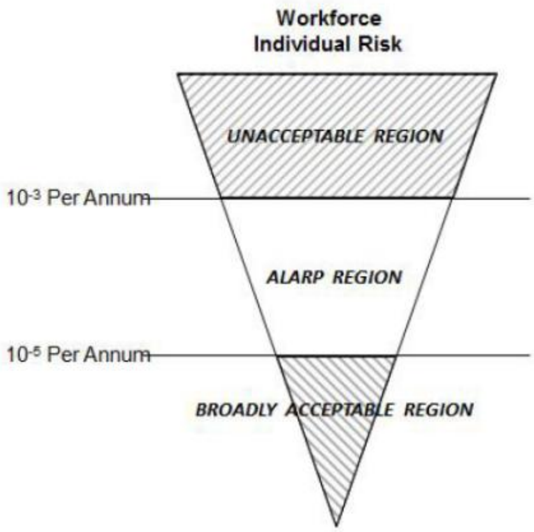
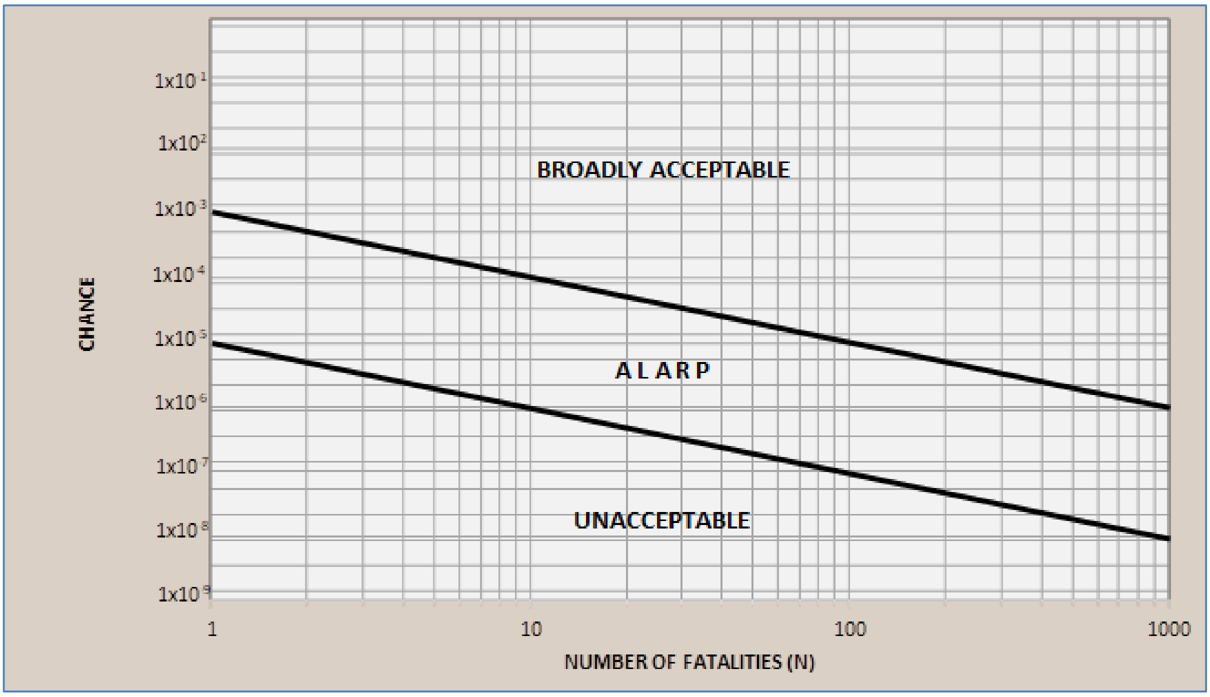


Figure 10-6: On site risk acceptance criteria (Workers)

Acceptability of social risks is based on the thresholds in Figure 10-7. From this figure, the ‘unacceptable’ region for fatalities of more than 10 people would be greater than 1×10^{-4}, the ALARP region would be between 1×10^{-4} and 1×10^{-6} and the broadly acceptable region less than 1×10^{-6} (see explanatory note below the figure).



Explanatory Note*: Exponential numbers are shorthand for large numbers. 10^{-5} means 100,000. Taking an example from the graph, the ALARP range for 10 fatalities per year would be between 1:1 000 000 chances and 1:10 000 chances. Any risks that are determined to be within this range would only be acceptable subject to specific targeted measures to reduce them 'as low as reasonably practical'. Risks of less than 1:1000 000 chances would be broadly acceptable. Risks higher than 1:10 000 would not be acceptable.*

Figure 10-7: Social risk acceptance criteria

10.4.4 Failure Frequency

The study quantified each hazard factor on the well pads and at the plant. There are some 78 hazard factors at the CPF, and between 4 and 8 on each of the well pads. In general, leakages are the main reasons for a fire or explosion. Based on the assessment in the Quantitative Risk Assessment, the high risk equipment was specified, together with its expected failure frequency (quoted as the average number of failures per year, based on published data from international sources). This formed the basis for the assessment of the probability of specified accident events.

10.4.5 Conclusions and Recommendations on the modelling aspects

The effect of jet fires was modelled for radiative flux (heat) intensities of 5 kW/m², 8kW/m² and 30kW/m². For each equipment failure case, the radiation from the fire was modelled, with the above three heat flux contours plotted. Maximum acceptable heat flux at specified buildings and facilities at the CPF and on the well pads was then compared with the modelling results. The following conclusions and recommendations are set out in the study:

- The CPF control room lies within a damage zone affected by an explosion. A blast proof design should be considered;
- The consequences of an explosion or a fire on the well pads would exceed the maximum threshold values at the duty room, living quarters, manager's room, meeting room, security room in all cases for an explosion and in some cases for a fire. The study recommends that prevention measures will need to be considered for the construction phase (i.e.: drilling). Flammable gas detectors must be available on the well pads (location and number to be determined). All staff must be required to leave the well pad as quickly as possible in the event of gas detection; and

- The use of the airstrip for light aircraft flights should be reconsidered in order to minimise the risk caused by an aircraft crashing directly into one of the CPF or well pad installations, with potentially catastrophic circumstances. Note: This recommendation has subsequently been accepted by CNOOC and the airstrip will be decommissioned during construction and converted to a laydown area. A helipad will be used for purposes of emergency medical evacuation.

10.4.6 Fire protection

The overall management of fire hazard requires provision of prevention, detection, control and mitigation measures.

Fire protection measures normally fall under control and mitigation measures to prevent further escalation. Fire protection measures are mainly combination of following systems:

- Isolation and Depressurization
- Passive Fire Protection (PFP)
- Active Fire Protection (AFP)

Depressurization is the main method of preventing catastrophic pressure system failure by intentionally reducing the inventory of system in an emergency.

PFP is used for protection from jet fires where active systems are ineffective, impracticable, have insufficient reliability.

Active fire protection is used to control fires, reduce flame temperatures, reduce radiation for persons escaping, reduce smoke generation, potentially extinguish pool fires, and cool engulfed objects in pool fire.

Note: Philosophy for use of fire extinguishers is described in section 4.4.5 Portable Fire Extinguishers.

10.4.6.1 Fire Zones

The definition of a fire zone is determined from an identified risk area, the size of which is assessed by taking into account the fire volume, safe distances and mitigation effects against fire escalation provided by the fire protection systems.

The plant shall be divided into fire zones. Each fire zone shall be suitably equipped with means for fire and gas detection and firefighting equipment.

10.4.6.2 Passive Fire Protection

Fire/blast barriers between equipment areas are normally not required, as the separation distances shall be sufficient to cater for foreseeable fire and explosion hazards. All ESD valves and vessel relief valves shall be specified as fire safe to appropriate API standard or equivalent. Fire and gas detection instrument cables shall be specified as fire resistant to IEC 60331 and instrument control cables as flame retardant to IEC standard 60332 or equivalent.

Fireproofing of structural steel shall be considered following the principles as listed below:

- Primary and secondary structural members whose collapse would cause great negative consequences.
- The facilities whose failure will impair safe evacuation of personnel, or prevent the operation of the emergency equipment.

Vital equipment which can be exposed to fire and which is required to maintain its functionality during a fire, such as remotely operated shut-off and depressurizing valves and actuators, critical power supply cabling and instrument cables serving safeguarding systems shall be taken on cable trays as well as BLEVE-prone vessels (LPG bullets) shall be provided with passive fire protection.

10.4.6.3 Active Fire Protection

Active fire protection systems and equipment shall be considered for all areas of the plant based on credible fire hazard scenarios.

10.4.6.3.1 General Design Criteria

The control and mitigation measures will aim to be specific to the credible fire scenarios.

The general criteria for control & mitigation measures for the expected fire scenarios can be summarized as follows:

- Gas Jet Fires - The primary control measure for gas jet fires is process isolation and emergency blow down. The mitigation measures proposed may also consist of PFP of vessel supports/skirts and critical structures. Due to the momentum of a jet fire, and the high heat flux, deluge at standard flow rates will not extinguish the fire. However, deluge may be effective in certain conditions reducing smoke levels, and possibly shielding against radiation levels on escape routes and smoke production rates. Specific deluge to protect structure or vessels will be impinged by jet fire will not be effective; therefore, water-cooling is a critical safety system in this context.
- Liquid Spray Fires- Control and mitigation measures for liquid spray are similar to gas jet fires. Process isolation and blow down of the vapour phase along with PFP of vessel supports/skirts, will help to mitigate the fire effect to some extent.
- Pool Fires- The primary control measure for pool fires will be a bund around the vessel with associated drainage facilities. Deluge protection to the equipment and bund area cooling will provide effective mitigation against the residual effects of liquid fires following blow down. (Leaks from the condensate systems will be high pressure and will form large spray fires or jet fires, not forming pools in bunds.) Deluge will be provided to cover areas where large inventories are contained within the process areas.
- Non-Process Hydrocarbon fires- These fire scenarios can occur, particularly at the storage of Chemicals, Diesel, lube oil etc. The severity, in terms of thermal radiation and fire duration, is lower than those for the fires scenarios in process area. These are in considered to be unlikely sources of escalation, and can be adequately covered by F&G detection and manual fire fighting systems.
- Non-hydrocarbon fires- Non-hydrocarbon fires include electrical fires, generation system fires and machinery fires. Fire protection system will include:
  - Fire Suppressions Systems for enclosures containing high value, and critical electrical systems enclosures including control systems and power supplies.
  - Manual fire fighting systems would be acceptable for other minor fires.

10.4.6.3.2 Firewater System

The firewater system will be designed to meet the following objectives:

- To mitigate the effects of hydrocarbon liquid fires
- Provide radiation shielding to reduce the incident radiation to personnel escaping
- Reduce the production of smoke, to aid the escape of personnel
- Cool adjacent vessels to prevent escalation by reducing the incident radiation

Firewater system design considerations will include:

- Vessel specific deluge will be applied to process vessels containing significant hydrocarbon liquid inventory, to prevent escalation to the vessel from an adjacent fire.

- Monitors will be provided in process areas so that the water flow from monitors can cover all equipments.
- Hydrant-hose stations or hose reels will be provided in non-hazardous areas outside the process areas (e.g. building areas, fire water tank/pump area).

The firewater system shall consist of a firewater tank, jockey pumps to pressurize the firewater network, diesel engine driven firewater pumps (2W+1S).

The maximum firewater demand shall be based on the calculation of firewater requirement for single largest credible fire area. Deluge rates will be based upon API 2030 and NFPA 15 with appropriate contingencies applied for wastage and hydraulic imbalance.

The discharge pressure shall be sufficient to achieve 3.5 barg at the most remote nozzle in a deluge system as well as to maintain sufficient pressure (typically 7 barg) for the most remote hydrant. The required pump discharge pressure shall be calculated based upon elevation changes, and the estimated pressure drop through pipe and fittings.

For firewater demand requirements refer to Fire Water Demand Summary Report document no. KF-FD-RPT-CPF-SA-0002.

10.4.6.3.3 Firewater Distribution System

The firewater distribution system shall be designed as ring main system. As far as practicable the ring main routing shall be such that maximum use is made of structural shielding to minimize the risk of damage by impact, blast and resulting projectiles.

Supply from the ring main to each of the fire zones shall be through isolating valves, locked in the open position. Closures of such a valve shall not inhibit the water supply to other fire zones.

The ring main is sectionalized through isolation valves in order to maintain integrity of the firewater supply during maintenance intervention. The valves shall be normally car sealed open.

The lines will be sized on the basis of both pressure drop and flow velocity considerations. Adequate provisions should be made for flushing and draining all sections of the firewater mains.

Off take branches from the ring main supply the following users:

- Deluge nozzles.
- Monitors
- Hydrants

Deluge System

Automatic deluge system design target is to achieve full steady flow of water at the most hydraulically remote nozzle within 30 seconds from detection of fire. The start up of the pump and the time of opening of the deluge valve will be set to cope with this requirement, considering surge pressures at start-up. The deluge system will have a manual start switch at the control room.

Deluge protection shall be provided to following equipment/areas:

- On-spec Oil Storage Tank & Off-spec Oil Tank and Diesel Tank
- LPG Bullets and Pumps
- Oil Feed Pumps, Oil Transmission Pumps and Oil Return Pump
- Truck Loading Area
- Compressor

No deluge protection will be provided for transformers.

Monitors

- Delivery rate: 120 m3/hr.
- Rotation: Horizontal – 360o, Vertical + or – 45o

Hydrants

Hydrants shall be fed directly from the ring main. The quantity and location of hydrants in process and utility areas shall be such that two water streams can be applied to any likely fire area.

The design requirements for hydrants are:

- Delivery rate: 54 m3/hr.
- 30 m long with nominal bore of 1 ½”.
- Hoses approved by recognized authorities.
- Nozzles adjustable for spray and solid jet.

10.4.6.3.4 Foam System

The fire suppression of oil is achieved by foam application. A fixed flow expansion foam system will be provided at CPF comprising a foam station, foam solution distribution piping, foam maker and pourer, foam hose reel and monitors.

Foam station shall consists of foam concentrate storage tank, proportioner, interconnecting piping, etc. 3% AFFF concentrate shall be used for making foam solution.

A foam solution distribution piping system shall be provided for delivering foam solution to on-spec oil storage tank, off-spec oil storage tank and diesel storage tank.

For the purpose of non dike spill fire, fixed foam hose reels shall be located in external process area where potential liquid hydrocarbon hazards exist.

10.4.6.3.5 Portable Fire Extinguishers

Portable and Wheeled fire extinguishers shall be provided at strategic locations around the plant. The following types of portable fire extinguishers shall be used as appropriate to the type of risk:

- For areas where there are ordinary combustibles, such as wood, cloth, paper, plastic, etc. extinguishers shall be suitable for Class A Fires. These shall be dry chemical.
- For areas where there are flammable liquids, oils, greases, paints etc extinguishers shall be suitable for Class B fires. These can be dry chemical or carbon dioxide.
- For areas where this is energized electrical equipment extinguishers shall be suitable for Class C fires. These shall be dry chemical or, preferably, carbon dioxide.

These shall be portable or wheeled dependent on the size of extinguisher required.

10.4.6.3.6 Fixed Fire Suppression Systems

Fixed FM 200 Fire Suppression Systems shall be provided at:

- Control Room
- Switchgear/MCC Room
- Battery Room

Fixed CO2 Fire Suppression System shall be provided at:

- Electrical Generator Enclosure

On confirmed fire detection inside the above mentioned building, the Fire Alarm panel located inside each of these location shall initiate an output signal to activate the Fire Suppression System dedicated to each of these buildings. A pre-discharge alarm shall be provided locally 20 seconds before activation discharge. The alarm shall also be duplicated to the Main Fire & Gas panel in the Control Room. Confirmed Fire and Fault signal shall also be communicated to the Main Fire & Gas panel for operator action. The system status (including the discharge inhibit state) shall be displayed to alert personnel. Manually actuated suppression system is envisaged for the continuously manned Control Room in the plant.

10.4.7 Fire Station

There is no existing externally available fire station in the vicinity of the CPF, so a fire fighting station will be provided and built at CPF, and serviced for firefighting of all Kingfisher oil field such as CPF, Permanent Camp, Supply Base and wellpads etc. The station will provide parking accommodation for the required number of vehicles and fire-fighting equipment. The building will also include facilities for recharging breathing apparatus and fire extinguishers. Firemen's and safety equipment such as fire protection suits, firefighting equipment, breathing apparatus and rescue equipment will also be provided for use by trained operators.

10.5 The CNOOC Safety Case

10.5.1 Introduction

The CNOOC production facility is a major hazard installation (MHI). An MHI is an installation where any substance that is produced, processed, used, handled or stored, has the potential to cause a major accident hazard (MAH). CNOOCs planning for MAHs has followed international best practice in the development of a Safety Case, which sets out a roadmap for company systems and processes required to manage the hazards arising from the operation of the production facility. The Safety Case has been prepared by *Bureau Veritas (2017)*, an international consulting group providing specialist services in this regard.

A Major Accident Hazard (MAH) is defined as an incident which leads to extensive damage to property, major impact to company reputation and / or severe or catastrophic consequences to people. The Safety Case only considers major accidents that have the potential to cause harm from the occurrence of a single, unexpected and unplanned, acute exposure, release or event such as a fire or explosion. While the emphasis is on human health, by planning to minimise the risk of injuries or fatalities to people caused by major accidents, there is a guarantee of a high degree of environmental protection as well.

10.5.2 Study Approach

The scope of the Safety Case has covered the well pad facilities, in-field flowlines, CPF and lake water intake facilities. There are four broad components that form the basis of the study approach, known as 'Hazard Identification and Risk Assessment' or 'HIRA' (Figure 10-8). HIRA is an interactive process designed to identify HSE hazards and assess the associated risks and develop the control and recovery measures to reduce the risks to levels As Low As Reasonably Practicable (ALARP). The four stages may partially overlap or may be carried out more than once. With reference to Figure 10-8, the stages involve:

- Identifying all hazards, threats and top events associated with the facility through a comprehensive and structured process considering people, environment or assets;
- Assessing the likelihood, causes, size of consequences and severity of outcomes with respect to people, environment, asset and reputation, based on a Risk Assessment Matrix (RAM) – in this case, the matrix used by CNOOC for all of its facilities, reproduced in Figure 10-9;
- Determining the controls that must be in place to remove the hazard from the business, or reduce the likelihood of it occurring, or reduce / eliminate the size of the consequence and its severity; and

- Providing recovery measures that allow people to escape from the location of the hazard or re-establish normal operations after the incident to ensure that recovery capabilities are suitable and sufficient.

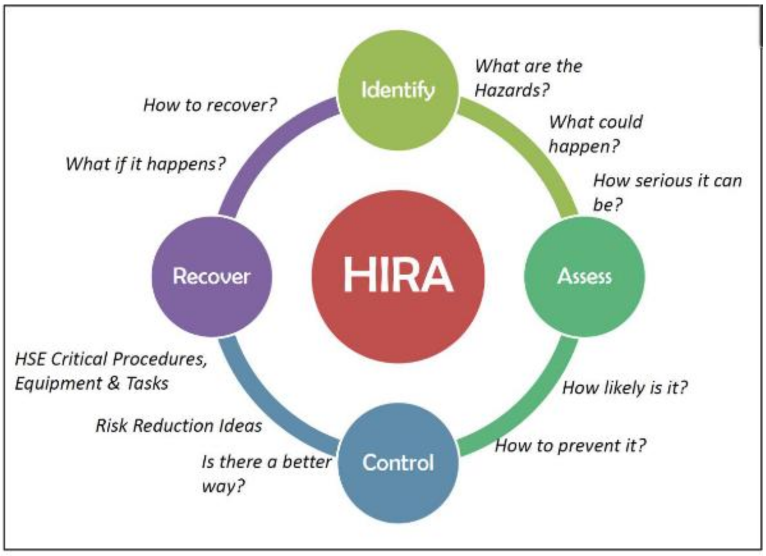


Figure 10-8: Overview of hazard identification and risk assessment (HIRA)

A more detailed breakdown of the approach followed by Bureau Veritas (2017) is provided in Figure 10-9. In the Hazard Identification and Risk Assessment (HIRA) procedure, Bureau Veritas (2017) present all the potential hazards identified and their subsequent assessment, the means by which they are to be controlled, and the recovery mechanisms that would be necessary in the event that the hazard occurred. In the first stage of the assessment, the hazards are identified and evaluated against CNOOC's defined risk assessment criteria. In the following stage, the Technical Safety Assessment, detailed studies are undertaken to define Safety Critical Elements (SCEs). Finally, recommendations are made to improve safety to meet ALARP or better, and to define measures to be taken and responsibilities in the event that an accident occurs.

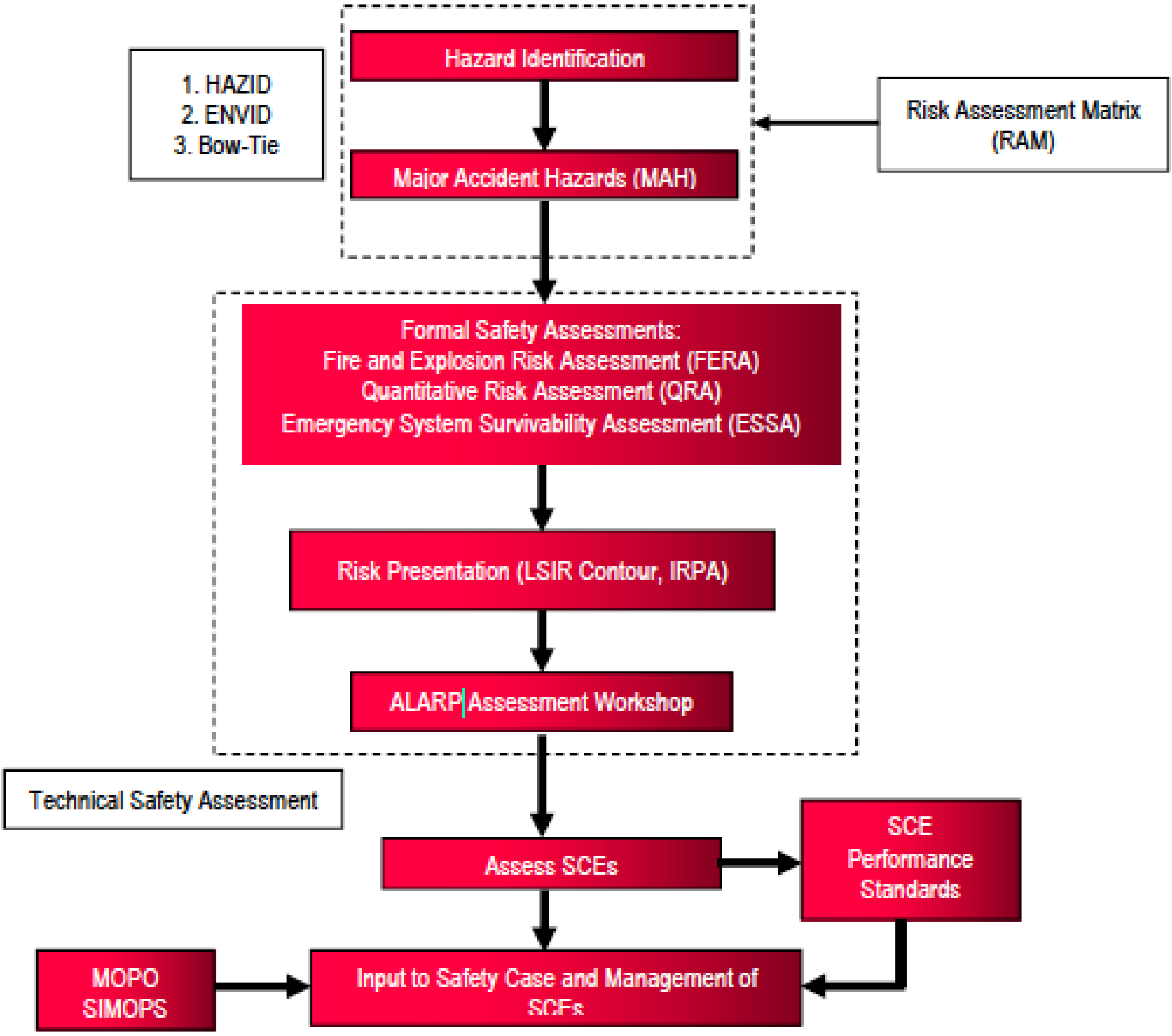


Figure 10-9: Process Flow of all safety case studies (Bureau Veritas, 2017)

The various elements of the HIRA process referred to in Figure 10-9 are defined below:

- Hazard and Effect Register: contains all possible hazards, sources, threats, consequences, the risk level based on the CNOOC risk matrix (Figure 10-1), barriers and suggested remediation for the production facility;
- Bow-Tie Assessment: reviews potential hazards / causes and possible consequences of the Major Accident Hazard (MAH) for the production facility. The analysis assesses the adequacy of the prevention and mitigation barriers (which are essentially Safety Critical Elements) and, for identified gaps, additional risk reduction measures are proposed;
- Fire and Explosion Risk Assessment (FERA): Carried out to assess the fire and explosion risks at the well pads and CPF. Based on the study findings a number of fire and explosion scenarios were found to impair buildings on the well pads and at the CPF;
- Quantitative Risk Assessment (QRA): Carried out to establish the level of risk to which personnel on the well pads and CPF will be exposed to during normal operations and whether this falls within ALARP;

- Emergency Systems Survivability Analysis (ESSA): Carried out to identify systems to ensure continued life support ensuring capability of key personnel to assess and respond to the effects of fire, explosion, vibration or other credible scenarios as intended during emergency conditions;
- Manual of Permitted Operations and Simultaneous Operations (MOPO and SIMOPS): These are tools to guide key personnel to during planning and coordination of response to abnormal conditions by showing what can be done when SCEs are impaired or not present;
- Safety Critical Element (SCE) and Performance Standard ID: Determination of remedial actions to be carried out in areas where SCEs / barriers were found to be only partially effective; and
- Critical Activity Matrix: Maps the position of key personnel at the production facility against identified critical activities. The roles of the personnel are marked as Accountable and Responsible person in the Critical Activity Matrix.

10.5.3 Hazard Identification

The possible Major Hazard Accidents (MHAs) associated with the CNOOC production facilities are described in Table 10-8. Hazard identification was done by a multi-disciplinary team, in a workshop environment, considering the complete lifecycle of the project. Other specific assessments prepared for CNOOC on different hazards were used to inform the hazard ID.

Table 10-8: Summary of Major Hazard Accident Scenarios

Type of Hazard	Hazard Description	Major Accident Event
Crude Oil Liquefied Petroleum Gas Hydrocarbon Gas	Hydrocarbon under pressure in process piping and equipment	Loss of containment
	Hydrocarbon in external floating roof storage tank	
	Hydrocarbon in fixed roof storage tank	
	Fuel in fired heater	
	Hydrocarbon under pressure in infield pipelines	
	Hydrocarbon in formation during drilling activity (well pad)	
Produced Water	Produced water under pressure in process piping and equipment	Loss of containment

10.5.4 Risk Analysis and Evaluation (Bow-Tie)

10.5.4.1 Approach

Figure 10-10 shows the risk analysis and evaluation stages of the HIRA procedure.

The Hazard Identification study (HAZID), described in Section 10.5.3 above, and is used to develop a Hazard and Effect Register (HER). The Hazard and Effect Register documents all hazard, control and mitigation measures that have been identified, based on an assessment of risk. ‘Bow-tie’ is used for this purpose. One bow-tie is developed for each of the major accident hazards identified for the facility, the objective being to identify and ensure the adequacy of controls and recovery barriers for the facility hazards. Bow-tie provides a graphical representation of the top event related to a hazard (i.e. loss of containment), the potential threats and barriers preventing the top event as well as consequences and recovery preparedness measures if the top event occurs (Figure 10-10).

Figure 10-10: The principles of a bow-tie (Source: University of Toronto / Minerva, 2015, Rev. 4)

Figure 10-11: Illustration of barriers to initiating events (threats) and consequences

Barriers comprise proactive barriers and reactive barriers. Proactive barriers are required to prevent a hazard being realized and appear on the left-hand side of the bow-tie diagram. Reactive barriers are designed to prevent unwanted events or consequences being realised and appear on the right-hand side of the bow-tie diagram (Figure 10-10 and Figure 10-11).

Escalation factors are conditions that make a particular barrier fail, by defeating or reducing the effectiveness of a control. Escalation factors may also be termed as defeating factors or barrier decay mechanisms. In a similar way to Threats, there may be controls in place that prevent the escalation factor being realized. Escalation Controls are the barriers in place that prevent the escalation factors from arising.

Figure 10-12 below shows an example of the Bow-tie assessment process. This process is followed for each of the major identified events.

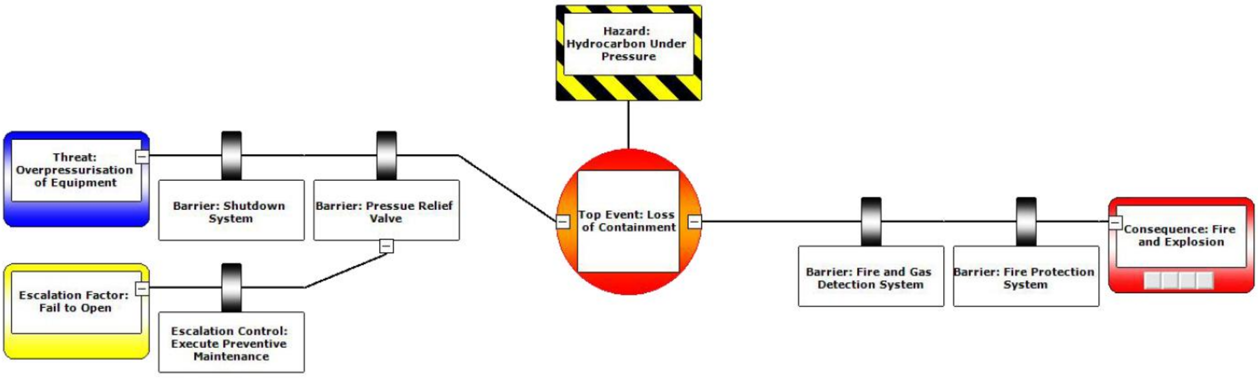
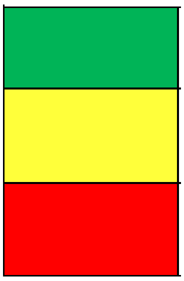


Figure 10-12: Bow tie assessment process

The barriers and controls effectiveness is reflected in the Bow-tie diagram with the following colour coding:

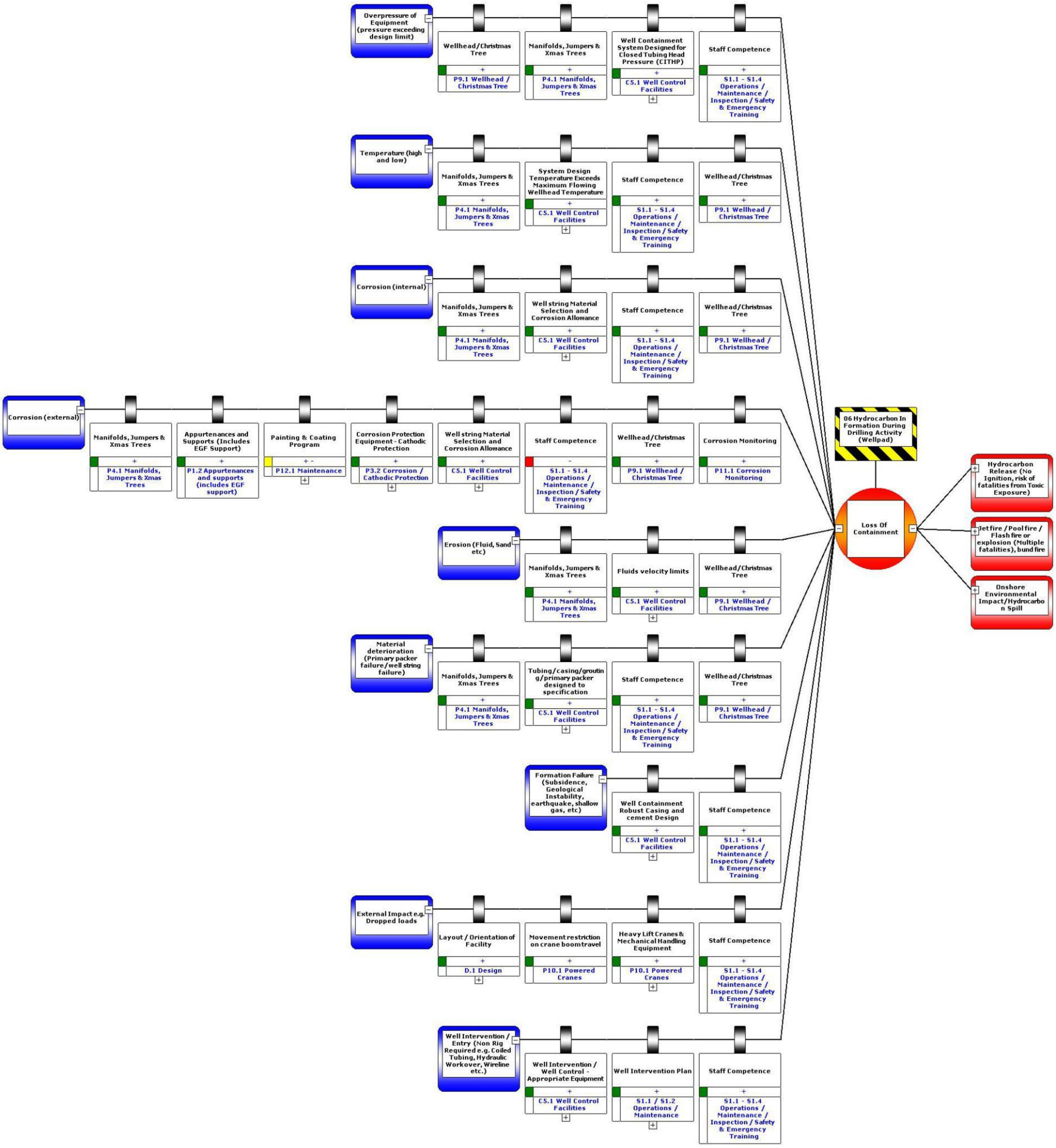


1. *Effective – the control always works as intended*
2. *Partially Effective – the control works most of the time but there are some weakness or performance issues*
3. *Ineffective – the control is not present or if present is not suitable for the required function*

For any control which is ranked as 'Partially Effective' or 'Ineffective', there is a risk that the barrier it supports will fail leading to the potential for a major accident (or the inability to recover from one). To rectify this, 'Remedial Actions' are proposed which identify the steps that need to be taken to reinstate the control to full effectiveness.

Figure 10-13 presents an example of a Bow-tie for one top event – hydrocarbon leakage into the formation during drilling[9]. Specific actions are developed to reduce the risk in areas where controls are only partially effective (shown in yellow) or ineffective (shown in red).

[9] *For other top events, refer to Bureau Veritas (2017)*


Overpressure of Equipment (pressure exceeding design limit)
Wellhead/Christmas Tree
P9.1 Wellhead / Christmas Tree
Manifolds, Jumpers & Xmas Trees
P4.1 Manifolds, Jumpers & Xmas Trees
Well Containment System Designed for Closed Tubing Head Pressure (CITHP)
C5.1 Well Control Facilities
Staff Competence
S1.1 - S1.4 Operations / Maintenance / Inspection / Safety & Emergency Training
Temperature (high and low)
System Design Temperature Exceeds Maximum Flowing Wellhead Temperature
Corrosion (internal)
Well string Material Selection and Corrosion Allowance
Corrosion (external)
Appurtenances and Supports (Includes EGF Support)
P1.2 Appurtenances and supports (includes EGF support)
Painting & Coating Program
P12.1 Maintenance
Corrosion Protection Equipment - Cathodic Protection
P3.2 Corrosion / Cathodic Protection
Corrosion Monitoring
P11.1 Corrosion Monitoring
Erosion (Fluid, Sand etc)
Fluids velocity limits
Material deterioration (Primary packer failure/well string failure)
Tubing/casing/grouting/primary packer designed to specification
Formation Failure (Subsidence, Geological Instability, earthquake, shallow gas, etc)
Well Containment Robust Casing and cement Design
External Impact e.g. Dropped loads
Layout / Orientation of Facility
D.1 Design
Movement restriction on crane boom travel
P10.1 Powered Cranes
Heavy Lift Cranes & Mechanical Handling Equipment
Well Intervention / Entry (Non Rig Required e.g. Coiled Tubing, Hydraulic Workover, Wireline etc.)
Well Intervention / Well Control - Appropriate Equipment
Well Intervention Plan
S1.1 / S1.2 Operations / Maintenance
06 Hydrocarbon In Formation During Drilling Activity (Wellpad)
Loss Of Containment
Hydrocarbon Release (No Ignition, risk of fatalities from Toxic Exposure)
Jet fire / Pool fire / Flash fire or explosion (Multiple fatalities), bund fire
Onshore Environmental Impact/Hydrocarbon Spill

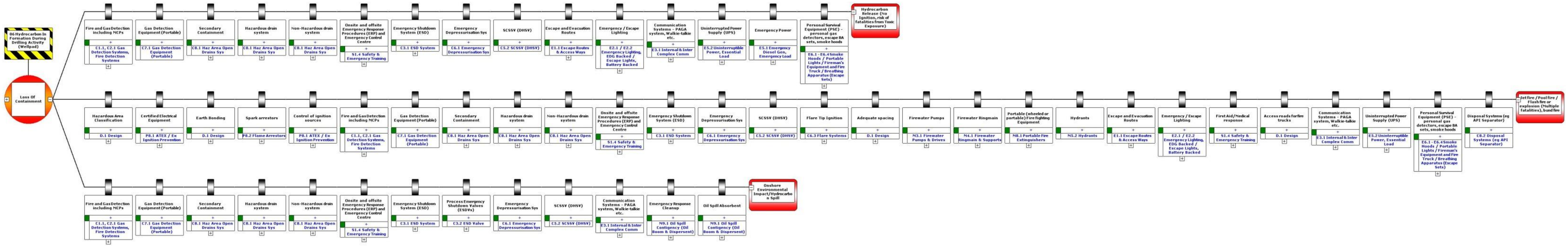


Figure 10-13: Bow tie for hydrocarbon leakage into the formation during drilling

10.5.5 Safety Critical Elements (SCEs) and Barriers

The bow-tie assessment is used to broadly identify the applicable Safety Critical Element (SCE) groups and sub-groups. Barriers in the bow-tie that are structure, plant or equipment (hardware) - related are called Safety Critical Elements (SCEs). Failure of these barriers could cause or contribute substantially to a Major Accident and its consequences. While called "Safety" critical elements, SCEs also help to manage health and environmental hazards as well. Barriers are divided into 'primary barriers' (barriers in which failure could result in a Major Accident Events i.e.: hazard prevention); 'secondary barriers' (elements required to control initial losses of integrity to prevent or minimise escalation i.e.: hazard control); and 'tertiary barriers' (elements required to mitigate the consequences of Major Accident Events i.e.: hazard mitigation). The barriers are assessed in detail in Bureau Veritas (2017), a sample of which is described below:

- Primary barriers (among others) include pressure vessels, venting devices, flame arrestors, wellheads, blanket and inert gas systems, corrosion inhibitor injection systems, high pressure water injections rotating equipment manifolds, jumpers and Xmas trees;
- Secondary barriers (among others) include gas detection systems, fire detection systems, ESD system, Riser and Pipeline ESDVs, well control facilities, blowdown valves, hazardous area open drain systems, flare systems, disposal systems, such as the API separator); and
- Tertiary barriers (among others) include blast walls, passive fire protection, firewater pumps and drives, deluge / sprinkler systems, hydrants, process deluge/ foam systems, oil spill contingency booms and dispersants).

In addition to SCE's there are other Safety-Critical features of a facility that inherently limit risk but may not fit with any of the generally accepted categories of SCE. There are several 'global' Safety-Critical features of KF facilities:

- Equipment layout well-spaced to minimise possible explosion over pressure;
- Adequate separating distance between the mustering area and the process area;
- Multiple safe access routes to the primary muster area that is out of range of the foreseeable major accident events;
- Welded rather than flanged connections, where possible, to minimize leaks; and
- Minimization of hydrocarbon inventory and vessel sizes by introducing multiple process trains.

10.5.6 Performance Standards

Bureau Veritas (2107) set out the requirements for the development of performance standards, based on the specific SCEs identified for the KFDA production facility. The inspection, testing and preventative maintenance plans for the SCEs must test the performance of the SCE against the minimum acceptance criteria established in the performance standard. By ensuring the technical integrity of barriers throughout the operating life of the facility, there can be confidence in maintaining its safety.

The following five stages are to be undertaken in respect of performance standards:

- Identification of performance standards for the identified SCEs;
- Identification of the assurance processes that maintain / ensure the continued suitability of the SCEs and are meeting the performance standards;
- Identification of the minimum acceptance criteria for the SCEs performance;
- Development of an inspection, testing and maintenance regime that confirms compliance of the SCE with the applicable minimum acceptance criteria stated in the performance standard; and

- Verification processes that ensure that all steps have been undertaken to establish the continued and ongoing integrity of the SCEs.

Performance standards must cover at least three major areas of control: **functionality** (what to control to ensure the equipment fulfils its functions); **availability and reliability** (at what frequency should it be controlled and maintained to meet performance integrity minimum standards); and **survivability** (does the equipment need to continue to function during an incident and what to do to maintain this capacity).

10.6 Management and Monitoring of Major Hazards

Management and monitoring recommendations to reduce the risk and consequences of major accidents are included in both the Bureau Veritas (2017) Safety Case and the Worley Parsons (2017) Oil Spill Planning and Response Report. The former report deals with a broad range of requirements to manage prevent and manage accident risks - the latter deals primarily with emergency preparedness and response. Recommendations from these two reports are integrated in this section.

10.6.1 Critical Activities

The identified controls recommended to ensure that hazards are minimized need to be managed. The activities undertaken by the company to create and maintain these controls provide the assurance that MAHs are being managed effectively.

Activities can be classified into four general types (Bureau Veritas, 2017):

- Design – which specifies the necessary hardware (e.g. safety critical equipment). These tasks are usually completed before the facility is operating except where modifications are made;
- Inspection, Test & Maintenance – to ensure that equipment integrity is sustained in line with the performance standards;
- Operational – to ensure that the equipment is used within the defined limits of the controls provided, and that change is managed appropriately; and
- Administrative – covering aspects such as training and auditing.

Bureau Veritas (2017) identify 8 critical activity groups which form the basis of an effective management strategy (Table 10-9):

Table 10-9: Critical activity groups which form the basis of an effective management strategy

Group	Name	Examples of Critical Activities
A	Change Management	A1: Change Management Process
B	Plan and Execute Facilities Maintenance	B1: Monitor / control execution of maintenance, raise corrective actions and record history in Maintenance Management System. B2: Manage SCE deviations
C	Plan and Execute Facilities Maintenance	C1: Planning – Approve Workpack proposal (for well services) C2: Monitor / control execution of maintenance, raise corrective actions and record history in Maintenance Management System. C3: Manage SCE deviations
D	Production / Operation	D1: Prepare the wells, process units and utilities for production processing (including purging operations if required) D2: Safe operation within limits of Safe Operating Limits – examine SCE status to comply with performance standard D3: Perform root cause ID and corrective action following shutdown D5: Perform process intervention operations as required including sampling, chemical injection, venting and isolation

		D6: Undertake corrective actions following defined HSE controls when wells, process units and utility equipment do not perform to the defined operational performance criteria
E	HSE Studies and Reports	E1: Incident management and investigation E2: Remediation tracking and close out of records E4: Review Individual job training requirements on a regular basis E5: Ensure continued training and competence of operational staff
F	Audit and Review	F1: Technical and HSE Assurance audit F2: Ensure SCE status complies with the Performance Standards
G	Emergency Response Planning	G1: Ensure ER preparedness including housekeeping and effectiveness of ER drills G2: Carry out emergency response to health, safety and environmental events G3: Carry out emergency response to oil spills on land and offshore
H	Manage Logistics	H1: Manage and administer ER equipment H2: Review meteorological data and verify integrity of operations against adverse weather policy

Regarding Item D and F, Bureau Veritas (2017) recommends that CNOOC Uganda monitor the status of the technical integrity of SCEs as follows:

- Continuous monitoring through a Facility Status Management (FSM) system – the FSM shall provide a continuous status monitoring of Preventative Maintenance (PM) and Corrective Maintenance (CM) tasks in PMMS; and provide an indication of the state of technical integrity on the facility;
- Operations / Asset management and Technical Authorities shall review FSM at any stage and look into performance issues of a specific piece of equipment on the facility, or gain an overall picture / trend of the integrity of the facility;
- Periodic monitoring through Audits – there are a number of specific audits which will assure the performance of SCEs and validate the daily monitoring / control through FSM:
  - Audits or any program to verify the barrier integrity and effectiveness i.e. regular Barrier Health Checks by Technical Authorities, Maintenance, Operations and Asset team members.
  - Structured technical integrity audits – such as Independent Asset Integrity Review, by technical authorities or external party.
  - Technical Integrity Framework Review – to validate the process underpinning the technical integrity monitoring.

10.6.2 Organizational Structure

The recommended organizational structure for managing critical activities is set out in Figure 10-14.

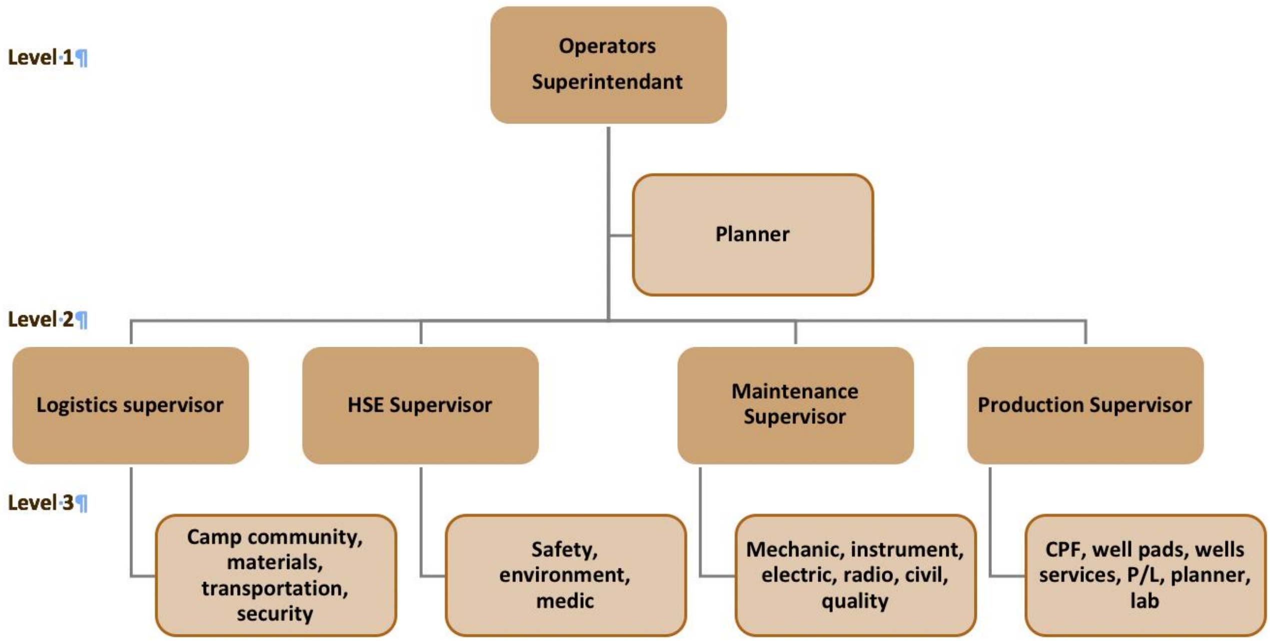


Figure 10-14: Recommended organisational structure for managing critical activities (Bureau Veritas, 2017)

Personnel with the necessary competence are required to manage critical activities, ensuring that the barriers are effective and remain in place. Activities must be matched to a specific person, at two levels:

- The accountable person – usually from management, the person who ensures that the responsible person has the necessary resources to conduct the activity and is the person who is answerable for the task adequacy; and
- The responsible person – the person who is responsible for getting the job done.

10.6.3 Emergency Response Plan

The Emergency Response Plan establishes procedures to manage and coordinate the mitigation and control measures after an emergency. The ERP is designed to provide the principles of emergency management, frameworks and tools to support effective decision-making in any emergency situation. It is not a prescriptive step-by-step process map to resolve specific incidents or to mandate fixed response options. The ERP is updated regularly – CNOOC Uganda's ERP is currently Rev. B.

10.6.3.1 Objectives of Emergency Response

Emergency response has 10 key objectives (Worley Parsons, 2017):

- Protection of human life and health and ensuring safety of people;
- Control of the oil spill source;
- Prevention and minimization of damage to the environment;
- Protection of sensitive areas (e.g. lake and lagoon);
- Activation of appropriate response as close to the source of the spill as possible to avoid oil spread;
- Prevent oil from leaching into soil or groundwater or entering waterways as run-off;
- Minimize potential environmental and socio-economic impact and ensure a fast recovery to affected resources;

- Continuous monitoring and surveillance of the spill and response operations;
- Mechanical and recovery of spilled hydrocarbons at the spill source to prevent their distribution; and
- Clean-up, restoration and rehabilitation of polluted area.

10.6.3.2 Ugandan Spill Response System

The Ugandan Petroleum Authority, established under the Petroleum (Exploration, Development and Production) Act of 2013, is the Competent National Authority responsible for oil spill planning and preparedness. This Authority is required to work with the National Emergency Coordination and Operations Centre (NECOC) established under the National Disaster Preparedness and Management Policy in 2010, and the National Oil Spill Preparedness and Response Committee, to develop a National Oil Spill Contingency Plan (NOSCP). According to the Uganda National Oil Spill Contingency Plan (NOSCP)–Draft, the primary oil spill response tactic is 'mechanical response'. In exceptional circumstances, 'non-mechanical' response tactics may be used with the approval of the National Environment Management Authority, in consultation with the Competent National Authority. Mechanical response tactics may be applied on land, groundwater or surface water and include containment, recovery, diversion and exclusion or deflection. Non mechanical response tactics include igniting the spill on land or on water. The application of dispersants or other chemical formulations as a non-mechanical oil spills management tactic is prohibited.

10.6.3.3 Prevention and Control Measures

All of the controls presented described for oil spills in Table 10-10 are included in the bow tie analysis, a summary of which is provided above in the description of the Safety Case in Section 10.3.

Table 10-10: Examples of prevention and control measures in the KFDA Field Design

Sources	Prevention and Control Measures
Storage tanks	■ Bund 110% ■ Overfilling protection (level protection ESD – HHLL) ■ Local level indication (DCS) – no actions
Oil production manifold	■ Process safety control ■ Well pad bunded and drainage system ■ Pressure control system (HHLL, HLL etc. with automatic link to ESD) ■ Emergency shutdown control (ESD) ■ Thick walls (over pressure not possible) ■ Corrosion prevention and allowance
Christmas tree	■ Process safety control ■ Pressure control system (HHLL, HLL etc. with automatic link to ESD) ■ Emergency shutdown control (ESD) ■ Wellhead control system (subsurface safety valve and surface safety valve and choke valve) ■ Drainage system
Well casing	■ Well integrity control ■ Pressure control system ■ Wellhead control system (subsurface safety valve and surface safety valve and choke valve) ■ Drainage system
Closed drain drum	■ Process safety control ■ Concrete lined ■ Inspection regime
Wastewater pit / underground storages	■ Concrete lined and secondary HDPE
Infield flowlines	■ Corrosion protection (cathodic protection and allowance) ■ Automatic pressure loss detectors

	■ Process safety control ESD system
CPF piping	■ Insulated which will contain small leaks ■ Corrosion allowance ■ Isolation valves ■ Gas detection ■ ESD (pressure control) ■ Drainage system

A three-tiered response procedure is followed, in accordance with standard international practice. Table 10-11 sets out the incident criteria that determine the level of response. It is noted that CNOOC Uganda Limited (CUL) would be responsible for managing Tier 1 and Tier 2 responses – CNOOC International would manage Tier 3 responses. Table 10-12 defines the CUL responsibilities for Tier 1 and Tier 2 incidents in more detail.

10.7 Conclusions and Recommendations

There is a considerable body or risk-related work prepared for the CNOOC KFDA project, a selection of which is presented in this chapter. Much of it is highly technical. For the purposes of due diligence, it is recommended that CNOOC commissions an independent expert review of all previous risk-related work before the completion of the final design. It must be demonstrated (and summarized in simple lay terms) that in the context of the exceptionally high environmental and social sensitivity of the project area, the risk of unplanned hydrocarbon releases into Lake Albert is reduced to an acceptably low level. The work should include a review of the potential triggers of accidents, including seismic events, flooding, fires and explosions, as well as any other reasonably credible causes.

It is also recommended that the Emergency Response Plan is finalized and reviewed by independent experts, taking into consideration the sensitivities in the project area and the need for very rapid response times in the event of an accident.

Finally, it is recommended that CNOOC's safety management systems and risk management performance in respect of accidents is reviewed annually by external auditors with extensive experience of hazard management and best safety practices in oil industry facilities.

Table 10-11: Impact criteria that determine emergency response tiers (Source: CNOOC Safety Case, 2017)

	Tier 1 *ERT level incident*	*Tier 2* *EMT Level incident*	*Tier 3* *CNOOC International Ltd*
People	Minor injury or first aid treatment	Major injury / hospitalisation / fatality	Multiple deaths / hostages / third parties
Environment	Minor environmental or social consequence which can be contained locally	Environmental or social consequences which requires escalation, but does not require government intervention	Catastrophic environmental or social consequences
Assets	Minor damage to local assets, no loss of capability or utilisation	Significant damage and business interruption through loss of use	Significant damage / total destruction of major project sites or loss of HQ building
Reputation A+	Local media attention only. Quickly forgotten. Freedom to operate unaffected. Self-improvement review required	Persistent national concern. Scrutiny required by external agencies. Long term brand impact	International concern, governmental inquiry or sustained adverse national / international media attention. Brand damage significantly affects organisation
Capability & Processes	Minimal impact on non-core business operations. The impact can be dealt with by routine operations	An impact on business resulting in reduced performance such that targets are not met. The project is not threatened, but could be subject to significant review or changed way of operations	Critical business failure, preventing core activities from being performed. The impact threatens not only the survival of the project, but the organisation itself
Financial	1% of project or organisational annual budget	5-10% of project or organisational annual budget	>30% of project or organisational annual budget

Table 10-12: Tier 1 and Tier 2 responsibilities of CNOOC Uganda Limited (CUL) (Source: CNOOC Safety Case, 2017)

Tier	Description
Tier 1	**Site Level Emergency** A site-level emergency is one that can be effectively managed by on-scene personnel responding to the emergency, using the resources that are readily available to them. The Site ERT Leader manages the emergency. It is that person's responsibility to mobilise the Site ERT and determine the escalation of the emergency based on their assessment. All incidents involving the ERT must be conveyed to the EMT duty officer via the 24-hour Emergency Reporting Line (+256772798119) and backed up by an email notification to: EMT@cnooc.com.cn
Tier 2	**CUL Level Emergency** A CUL emergency may stem from one of two different events: 1. A site emergency that escalates beyond the capability of the ERT to effective control it without external support. 2. A non-site–based or corporate-level incident, such as a corruption allegation, extortion attempt or pandemic outbreak.

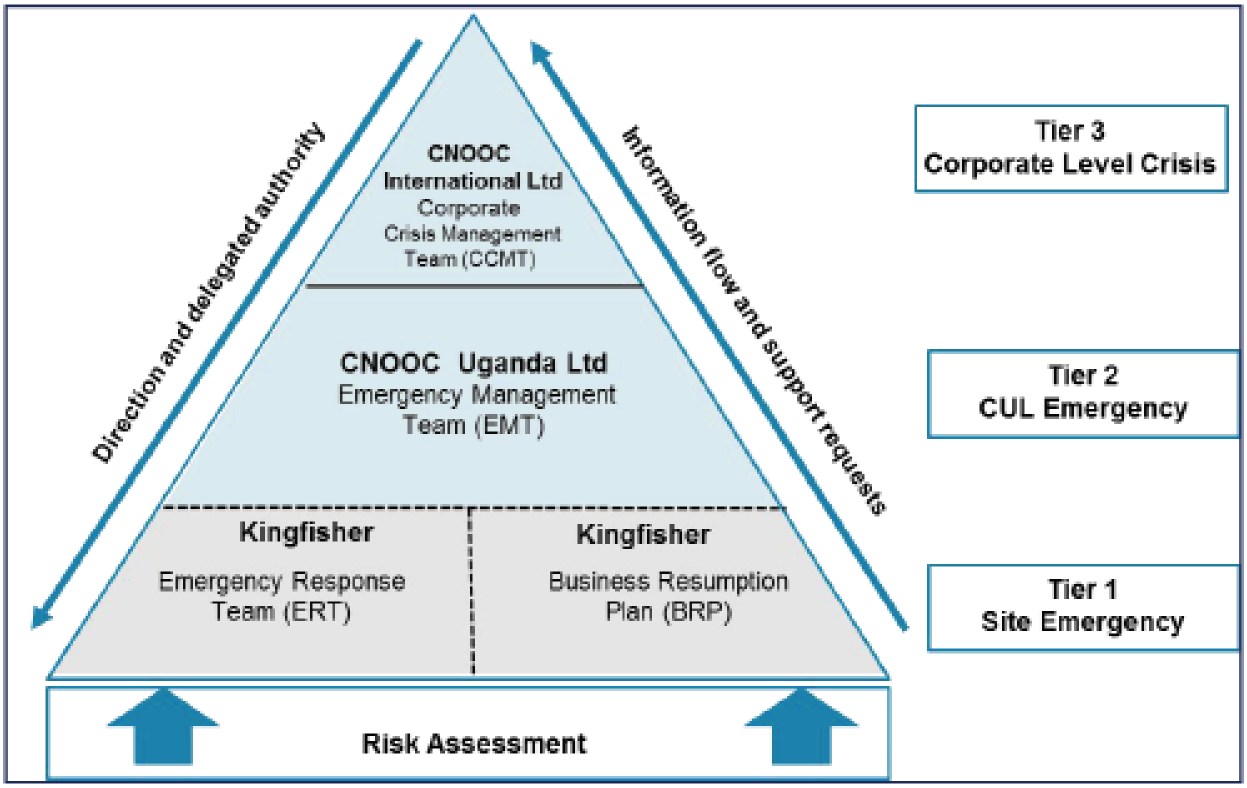


Figure 10-15: CNOOC tiered response structure

CUL emergency management structure distinguishes between Site Emergency Response Teams (Site ERTs) and the CUL Emergency Management Team (EMT). The CUL emergency management structure is based on Site ERTs operationally managing incidents at source. They are supported by the CUL EMT, who will provide direction, additional capacity and capabilities, and coordination of all wider company support. This team consists of a core team (a fixed team consisting of permanent posts), a functional team (functional specialists who join the core team depending on the nature of the emergency) and external specialists, who may include emergency response consultants, legal experts and other external consultants.

The CUL EMT in turn, receives strategic direction and oversight from the CNOOC International Ltd's EMT, the ultimate decision-making authority.

The CUL will use the RACER process (Report, Assess, Convene, Execute, Resolve) for notification and to assess an incident, activating the EMT and managing the incident to its resolution.

10.7.1 Key Conclusions and Recommendations

Taking into account the available information provided in the assessments described in this section, and a knowledge of the receiving environment, the following is concluded:

- Receptor vulnerability is extremely high around the production facility, with multiple VECs immediately beyond the boundaries of the areas of potential hazard at the CPF and on the well pads. These include households, wetlands, valuable grazing land and the Lake Albert fishery. The consequence of a major accident spreading outside of the boundaries of the facility would be grave;
- Given this vulnerability, CNOOC must ensure that the probability of an accident occurring is extremely low – and in the event of it occurring, that the risk of it reaching sensitive receptors is very small. All future design planning must work towards this goal;

- Modelling of the reasonably likely worst-case spill scenarios has shown that the containment provided in the design of the CPF and on the well pads would be sufficient to prevent the escape of oil into the surrounding environment;
- Modelling of the reasonably likely worst-case fires or explosions has resulted in several resulted in several recommendations, including:
  - An explosion-proof control room.
  - De-listing of the airstrip (ongoing aircraft hazard too close to the CPF).
- None of the fire and explosion hazard scenarios modelled in the reported studies show any major effect on surrounding communities or habitats. However, there has been no assessment of potentially cascading events resulting in failures that are cumulatively more significant than single events on their own. The possibility of such knock-on effects must be considered in further risk management planning during the detailed design;
- As recommended in the geohazard studies, the verification of seismic risk at the CPF, and any necessary design response to this risk, must be undertaken before the detailed design is finalised. This should include a final review of the risks associated with the two faults, F1 and F2, and protection of vital infrastructure against an earthquake-induced tsunami or maximum flood;
- All of the recommendations for ongoing management, maintenance, monitoring and emergency response capability made in the reports described in this section must be implemented;
- The staff responsible for the management of major hazards at the production facility must be highly trained and capable. Continuous monitoring must be included in the design as a part of the Facility Status Management System, as recommended by Bureau Veritas (2017);
- To ensure that there are the necessary safeguards to manage critical safety issues continuously and effectively, and to minimise risk to surrounding VECs to levels that are as low as reasonably possible; in addition to the ongoing internal monitoring and auditing of safety performance in respect of major hazards, a six-monthly audit must be undertaken by external major hazard specialists in the oil industry, with findings to be promptly disclosed to NEMA; and
- It is a recommendation of the ESIA that a buffer area around the CPF should be created within which no settlement or other building construction is permitted (Figure 10-16). This will minimise the risk to communities in the event of a catastrophic accident and provide the necessary space for CNOOC to manage the event without direct risk to inhabitants. The buffer does not need to be fenced and normal agricultural activity can continue within it. Legislation which prohibits settlement within the buffer (the responsibility of the Ugandan Government) would help to ensure that the restrictions can be enforced. Compensation will need to be considered for the partial loss of use rights. Communities must be well-briefed and marker beacons would be advisable to provide a visible boundary of the restricted area.

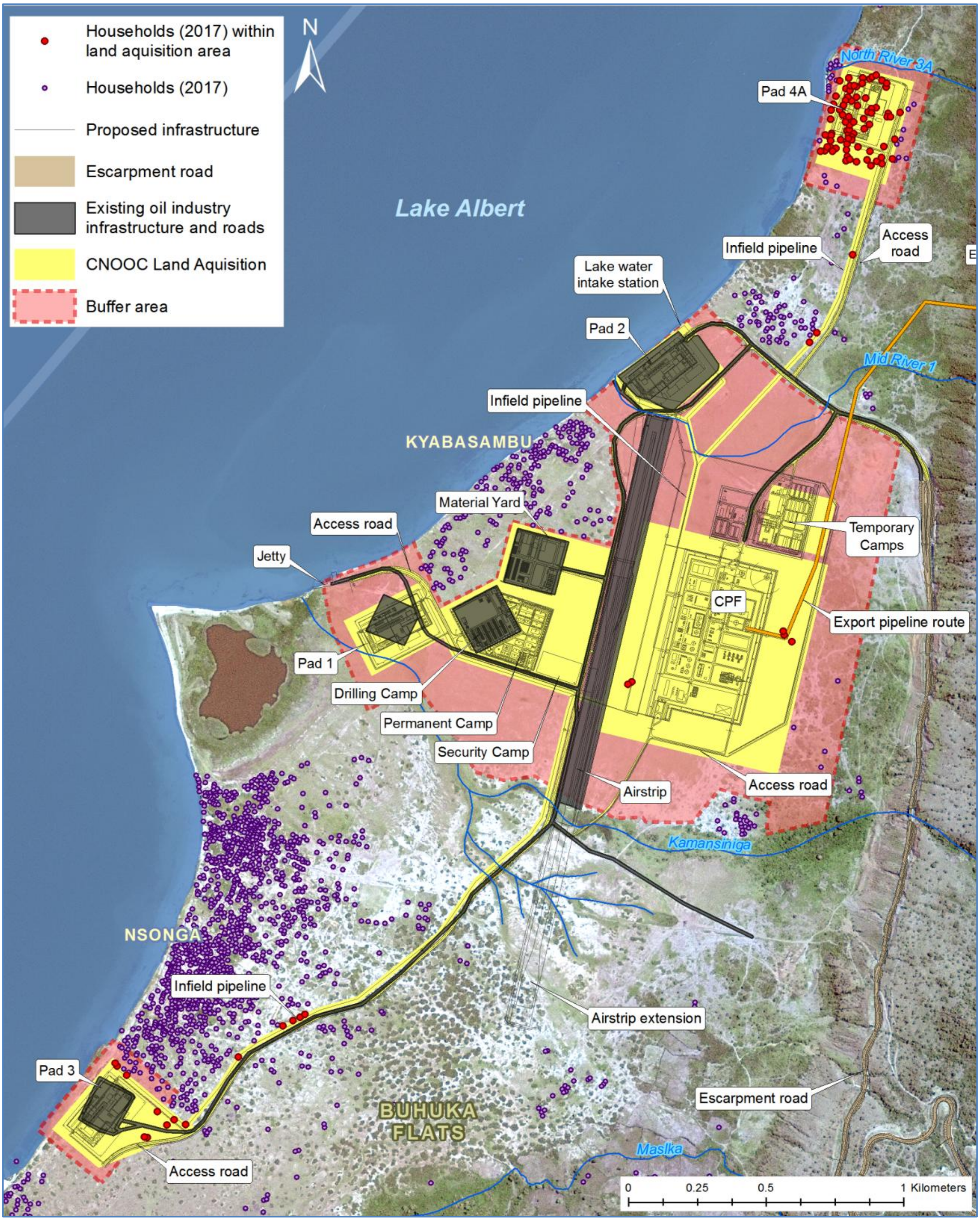


Figure 10-16: Proposed buffer around the CPF within which settlement and building activity should be prohibite

11.0 ALTERNATIVES

Consideration of alternatives is an important part of ESIA process. The search for environmentally better alternatives is the first step in the impact management hierarchy, which involved impact avoidance as a preferred solution ahead of impact minimisation.

This section reviews alternatives that have been considered during the course of the planning of the CNOOC Kingfisher project. Many of these have been investigated before the preparation of the ESIA as a part of ongoing engineering investigations. The source of the information is named in each case. The section is divided into two parts, dealing first with substantive alternatives which could involve major changes to the project, and second with incremental alternatives, which are those that are more limited modifications of an existing proposal.

11.1 Substantive Alternatives

Substantive alternatives are those that fundamentally change the way in which the project would operate. Matters related to water supply, the location of the CPF and the disposal of produced water are included in this group.

11.1.1 Water Supply

Tullow (2017) evaluated water sources for the development and production phases of the upstream oil developments along the eastern shore of Lake Albert. As a point of departure, the report accepts that water supply from Lake Albert is the obvious choice, and sets out to investigate whether there are any reasons why this supply should not be used. Although the water demand for each of the three developments is shown (CNOOC, Buliisa, Uganda EACOP), the evaluation is cumulative, taking all three into consideration. Figure 11-1 includes water for Kaiso-Tonya with the CNOOC Kingfisher development. Averages are shown, since these are more important than maxima for long term planning.

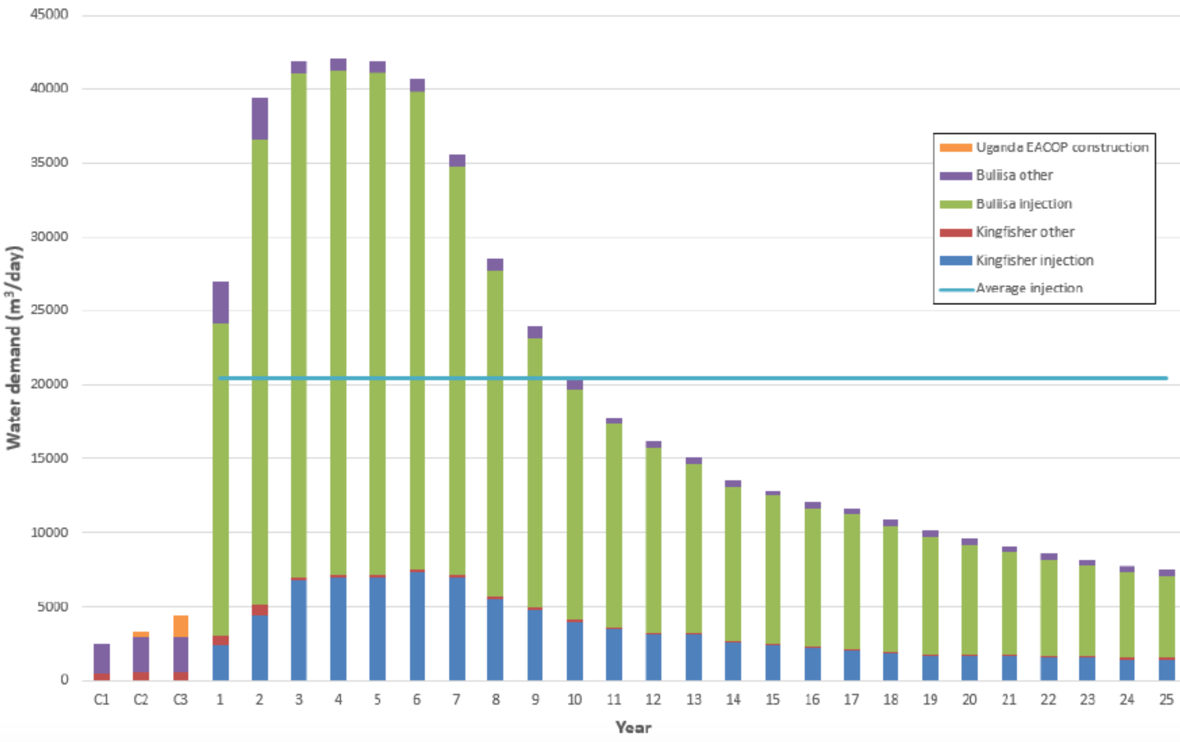


Figure 11-1: Total water demand for all upstream oil developments on the eastern shores of Lake Albert

Tullow (2017) summarises the findings of several other hydrological studies done to determine suitable water supply options for oil development projects along the shores of Lake Albert. These included studies by JDIH (2009) and Atkins (2010a; 2101b).

The JDIH (2009) study was based on an offtake of 32,000 m^3/d, taken from four abstraction points along the shores of Lake Albert. The average outflow from Lake Albert was estimated to be about 159 million m^3/d, based on water balance calculations covering the period 1966 to 1975. On this basis, the abstraction quantity used in the study of 32,000 m^3/d represents about 0.02% of the average daily outflow, which is an impact on water levels of about 2.2 mm in one year over the whole lake surface. Before 1961, the annual average outflow from the lake was about 60 million m^3/d; even judged against that lower baseline, the required abstraction only represents about 0.06% of the average daily outflow from Lake Albert.

The Atkins (2010a) study included a multidimensional analysis of three supply options –directly from Lake Albert, from the Lake Albert Nile (a river intake, distributed to the oil developments along the lake shore by pipeline), and a groundwater supply. Criteria considered in the analysis included construction requirements; capital and recurrent cost; technical feasibility and buildability (including topography, geology, hydrogeology, geomorphology, hydrology, environmental impacts, social impacts, health and safety, regulatory and permitting requirements, and the political context). Based on the detailed options appraisal, the river and groundwater options were excluded, for reasons including much longer pipeline distances, sensitive environmental issues associated with Murchison Falls National Park, and limited groundwater resources. In a more detailed follow-up study, Atkins (2010b) considered the hydrology of Lake Albert in detail. The findings of the JDIH (2009) study were corroborated, with the combined annual water supply for oil developments representing 0,04% of the average flow of the Albert Nile and 0,11% of the minimum flow.

Notwithstanding having ruled out groundwater supply as an option, Atkins (2010c), followed by DWRM (2013), considered groundwater supply for injection water in more detail[1]. Atkins (2010c) found that borehole yields are highly variable, often due to the frequently interbedded clays that break up sand deposits into hydraulically isolated units. Groundwater levels are about 10 m below ground level (mbgl) near the lake shore, with depth to water increasing inland as the topography rises. A hydraulic gradient exists, driving groundwater flow towards the lake, in a similar pattern to surface water. Groundwater as a source of injection water was ruled out for the following reasons:

- There is low groundwater potential in the area - no deep confined aquifers have been identified and the shallow aquifers do not have sufficient reliable yield for use in oil production;
- Groundwater is widely used for domestic water supply in the area and development of large new abstractions would risk derogation of those existing supplies; and
- There are significant easily accessible surface water resources nearby (Lake Albert and the River Nile).

DWRM (2013) found that while borehole water yields in the area of interest were sufficient to supply the required water for oil development purposes, it would require over 100 boreholes pumping at 20 hours per day to meet a total demand of 42,000 m^3/d. Furthermore, Tullow (2017) points out that groundwater and surface water are linked, and while the hydraulic connection between Lake Albert and groundwater in the surrounding area is not well understood, the lake and the groundwater can be considered as part of the same regional hydrological system. Taking groundwater from boreholes along the lakeshore would eventually impact on the lake, albeit after a period of time.

Taking into consideration the findings of the referenced studies, Tullow (2017) concluded there are no reasons that direct abstraction from Lake Albert cannot be supported. The quantity of water abstracted from the lake will be insignificant in relation to the total inflows (Figure 11-2 provides a graphic representation of the relative volumes). Tullow (2017) argues that a small number of intakes would be best to meet the

[1] *While the Atkins (2010) investigation considered areas mainly north of the Kingfisher field, Tullow water supply boreholes were included in the assessment and the broad conclusions are applicable to all groundwater supply development options along the lake shore. The DWRM (2013) study was done on behalf of Tullow and the Ugandan Government.*

demand, with their locations selected in order to minimise the local environmental, social and visual impacts. The proposed sites for central processing facilities for the Northern and Southern Developments (including Kingfisher) are adjacent to or not far away from the lakeshore, which helps to minimize local impacts in terms of pipelines, power supplies and other infrastructure.

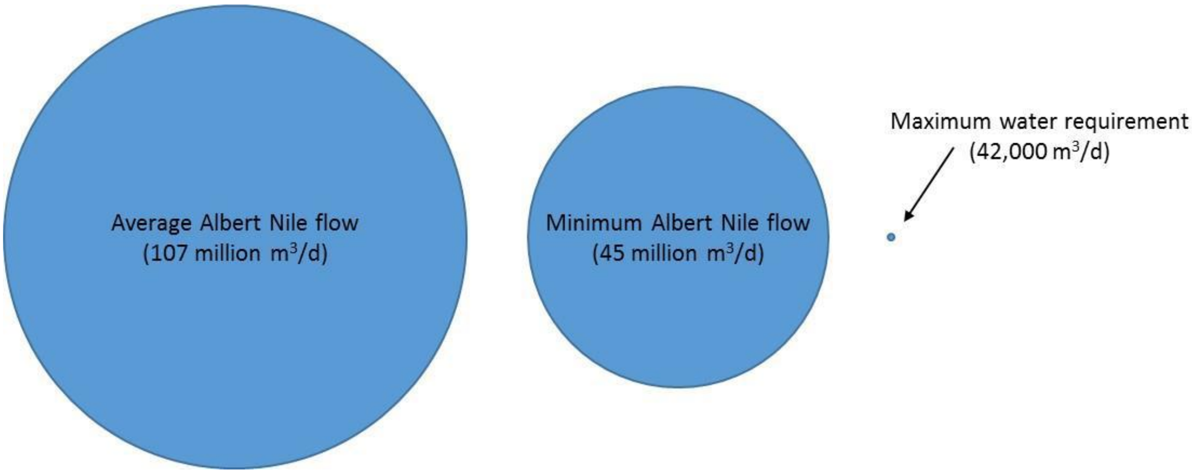


Figure 11-2: Graphic representation of relative water inflow volumes

11.1.2 CPF Location

Petrofac (2012) examined two options for the location of the Kingfisher CPF – a location on the Buhuka Flats and a location on top of the escarpment. The study was prepared on the basis of high level screening, where the details of specific locations were not required. Five parameters were used in determining location suitability and were weighted in the proportions shown in brackets:

- Technical factors, including seismic, flash floods, water level, land slips, foundations and fluid transfer (10%);
- Execution factors, including land acquisition, equipment transportation, CPF construction (20%);
- Operational factors (30%);
- Socio-economic, security and CSR factors (20%); and
- Cost and cost differential factors (20%).

11.1.2.1 Technical Factors

No difference between the alternative sites was found concerning seismic risks. Flood risk was considered to be higher for the Buhuka Flats, although flooding of the pump station would equally affect both options. In a desktop study by Sunshine Projects Ltd. and Geoengineering Technologies (2010), reproduced as Appendix 5 of the Petrofac (2012) report, flooding risk was made up of various contributing factors, including rainfall, strong winds, earthquakes and tsunami. The latter three risks were all considered to be low, while the risk caused by intensive rainfall was moderate. Recommendations included a warning system for seismic events, in collaboration with the Uganda National Seismological Network, construction of channels and floodways, particularly to channel floodwater around the CPF, and the construction of flood protection mechanisms around the CPF to protect it from flooding on the Buhuka flats.

The risk of impact by landslides is slightly greater for the Buhuka Flats option, but the location of the plant is sufficiently far from the escarpment for the risk to be low. Foundations are likely to be more expensive for the Buhuka Flats option but only by a small margin relative to total costs. Regarding the transfer of fluids, there is a significant benefit to the Buhuka Flats option, which avoids pumping of well fluids up the escarpment, although these costs are accounted for in the CAPEX described in Section 1.1.2.4.

Overall, Petrofac (2012) considered the technical differential between the two sites to be small, but slightly in favour of the plateau option.

11.1.2.2 Execution Factors

Execution factors considered land acquisition and equipment transport independently of CAPEX or OPEX, which are assessed in Section 11.1.2.4. Land acquisition was considered to be easier on the plateau, where land rights are better defined and less resettlement would be required. Nevertheless, all of the infrastructure associated with wells, access roads and the drilling camp would still apply. The difference between the options in relation to equipment transportation was slightly in favour of the plateau option, but this was regarded as minor given the good access provided by the escarpment access road. Other than the transport constraint, there are very large benefits to construction on the Flats, compared with the escarpment. Petrofac (2012) lists these as only one construction camp, only one storage site, all personnel together, enhanced security, easier overall management including (QA/HSE), and construction personnel not travelling up and down the escarpment daily. Overall, the option on the Flats is preferred.

11.1.2.3 Operational Factors

Operational factors are all in favour of a location on the Flats. The disadvantages of a plateau location take into account the need to have a multiphase pump station on the Flats, permanently manned in order to manage upsets within the station and at the well pads. The listed advantages of the Flats location include only one operations camp, reduced staffing levels, all personnel in one location, operations staff familiarity with the complete process, ready access to the well pads and other in-field infrastructure, consolidated inspection, maintenance, planning and logistics, consolidated HSE, one spares store and yard with spares readily to hand, and limited trips up and down the escarpment. Petrofac (2012) rank the plateau as a ‘far worse’ option in this regard.

11.1.2.4 Socio-economic, Security and CSR factors

Factors considered in this category were noise, plant safety, oil leakage, air and wastewater emissions, and impacts on local population.

Noise was considered to be a factor in favour of the plateau, although proposals were put forward to expand the buffer zone around the plant to prevent settlement near the CPF, which would reduce the noise impact of the production facility on the Flats.

In terms of impacts of major explosions and fires, Petrofac (2012) referenced a CNOOC quantitative risk assessment which shows that the buffer around the fence line of the CPF is sufficient to minimize the risk of serious injury to tolerable levels in terms of international criteria for involuntary risks affecting the public. There is no material advantage to either alternative in this regard.

Regarding accidental oil spills, the report refers to the high temperatures necessary to ensure that the oil flows under normal operating conditions, which minimizes risk in the event of a spill, since the rapid reduction in temperature of the oil would quickly cause it to solidify, limiting the physical extent of the leakage.

Regarding emissions (planned releases), the report describes a number of issues that would require follow up to ensure they are appropriately managed. These are (i) the measures taken to ensure that metal contamination in Lake Albert does not occur; (ii) how effluent will be handled (so that it is not be discharged directly into the lake); (iii) the quality of water in the lake that needs to be maintained; (iv) the avoidance of any heating of lake water as a result of hot return water; (v) the avoidance of any pollution of underground water or the environment in general; and (vi) the avoidance of significant air pollution that could result in acid rain or from the combustion products of flaring. Petrofac (2012) notes that the above issues are mainly associated with the well pads and would not affect the location of the CPF, or, in the case of item (vi) applies equally to both CPF locations.

Regarding wastes, sludges and solid waste generated by the workforce were considered, as well as the possibility of a water treatment facility to treat liquid or gaseous waste, but these were not identified as factors that would materially influence the decision for either CPF location.

Regarding the CPFs effect on local populations, there was a small preference for the plateau option, due to the lower population densities around the site and the lower likelihood of continual interactions between the plant and surrounding communities.

The main security issues were considered to be the possibility of incursions from the DRC. While the CPF on the Buhuka Flats would be more exposed to such incursions, it will be fully secured and an attempt to disable the plant could as easily be aimed at the pump station that would be necessary in the event of the plateau option being implemented. No preference for either option was expressed on these grounds.

Corporate responsibility (CSR) was seen to be an advantage for the Buhuka Flats option, where there is greater opportunity to develop a lasting relationship with the Flats community and where the project would not be split between two locations.

Overall socio-economic, security and CSR factors were rated slightly in favour of the plateau option.

11.1.2.5 Combined Rating

In the combined assessment, taking the relative weightings of the location factors into account, Petrofac (2012) ranked the Buhuka Flats as <u>significantly better</u> than the plateau option. Operational issues were a major consideration in favour of the location on the Flats, where all facilities associated with the project can be situated in the same place. These outweighed the smaller factors in favour of the plateau.

11.1.3 Produced Water Disposal

From the earliest versions of the design philosophy, CNOOC has accepted that produced water cannot be discharged into the environment due to the risks to Lake Albert. Very large volumes of produced water will be generated, rising from around 3,000 m^3/d in year 3 to nearly 18,000 m^3/d in year 25. Even under the assumption that the water would be treated to a specification that meets Ugandan and international water quality standards, the hydrocarbon loads associated with such large volumes, discharged directly into the lake, would create severe biodiversity and fishery risks, potentially affecting large numbers of fishing families along the lake, and creating a highly volatile social environment.

In line with best industry practice, CNOOC proposes to treat the water to meet a project standard which is higher than the Ugandan effluent standards, and then dispose of it, supplemented by lake water, into the Kingfisher oil reservoir as a means of maintaining reservoir pressure. The sludges generated by produced water treatment will be captured at the CPF and disposed of by a third party hazardous waste contractor, in accordance with Ugandan legal requirements.

11.1.4 Transport of Supplies, Equipment and Materials

The proposed ‘priority oil industry roads’ set out by Government (Figure 11-3) include the R5 (upgraded through the centre of the Bugoma Central Forest Reserve), the P1 (upgraded along the southern margin of the Bugoma Central Forest Reserve) and the R7, a new road which roughly follows the route of existing tracks north-west of the Bugoma Central Forest Reserve.

The ESIA has shown that the upgrading of the R5 is likely to have a significant impact on the integrity of the BCFR, placing endangered populations of Eastern Chimpanzees at greater risk, together with other species such as Nahan’s Francolin. Construction and operational traffic will impact on these populations in various ways, including an effective loss of habitat, barrier effects and increased collision risks. CNOOC has confirmed that it does not require the R5, either for construction or operational access, and has officially confirmed this with the Ugandan Government. The ESIA therefore proposes that this road is de-listed from the group of priority oil roads. All materials, equipment and supplies required by the production facility, both during the construction and operational phases, can be transported via the P2 and R7 roads.

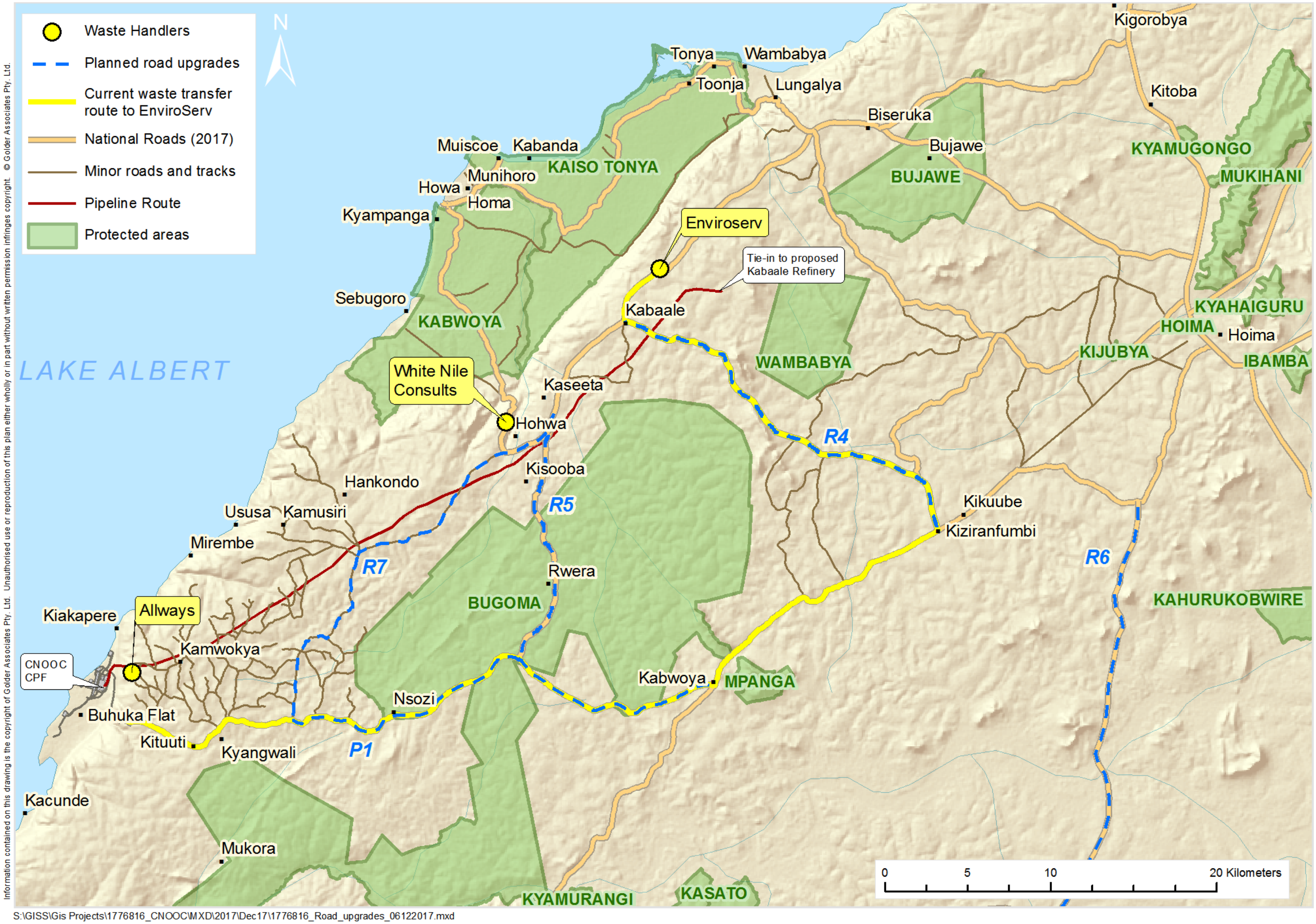


Figure 11-3: Priority Oil Roads proposed by the Government of Uganda

11.2 Incremental Alternatives

Incremental alternatives are those that do not fundamentally change the approach to the location or engineering of the project or associated infrastructure. A range of alternatives that have been considered during the course of the design are included in the section below, some of which have been assessed as a part of ongoing design studies by CNOOCs engineering and environmental team and some of which are recommendations of the independent environmental team. All options recommended by the independent environmental team have been accepted by CNOOC.

11.2.1 Location of the Well Pads

A portion of well pads 1, 2 and 3 has already been developed as a part of the exploration phase of the Project and wells have been drilled on each of them. Well pad 2 is close to its full future extent – well pads 1 and 3 will need to be enlarged to accommodate the full suite of development drilling infrastructure. Well pad 4A is not developed yet but is planned for construction during the operational phase of the project.

The wells are spaced to provide a reasonable spread of drilling coverage from different access points into the oil field. Figure 2-6 shows this schematically. Table 11-1 describes each of the wells, the issues associated with their location, and the advantages and disadvantages of adjusting their locations for environmental or social reasons.

The fact that well pads 1, 2 and 3 already exist and that wells have been drilled on them is an important factor in favour of retaining them for development drilling. Most of the physical disturbance associated with them has already been incurred. Only 17 additional households would need to be resettled as a result of the expansion of the pads to their full development extent (Nomad Consulting, 2018: Table 6). Whatever their original strengths and weaknesses, they are now a known entity and villagers are familiar with them.

With reference to Table 11-1 and Figure 11-4:

- There would be little acoustic benefit to moving the wells within the immediate vicinity of their current locations. Given the escalating population pressure, acoustic impacts of drilling will be significant wherever the wells are located on the Flats
- Resettlement requirements would increase, particularly in the case of the first of the alternatives to well pad 1 (Table 11-1).
- The impact of well pad 3 on the hydrology of the Kamansinig alluvial wetland is uncertain. As a precautionary measure, the impact characterization in Chapter 7 rates this impact as highly significant, mainly because it is discouraged by best practice guidelines. Nevertheless, it is acknowledged that the affected area beneath the proposed extension of well pad 3 is dry for most of the year and that the green habitat, which is clearly evident in the image in Figure 11-4, is not marshland but grassland that is benefiting from additional sub-surface soil moisture. The system entering the lake around the Bugoma swamp is dynamic and the geomorphology is likely to respond to large storms, sediment drift and wave action. There is no evidence that the existing pad's incursion into the wet grassland has materially affected the larger system. For this reason, taking into account that the existing pad has already been permitted, it is recommended that the proposed well pad extension should be permitted subject to offsetting of the residual impacts in accordance with IFC PF6. A monitoring programme for the Kamansinig River and Bugoma Swamp must be implemented.

Table 11-1: Location Alternatives for the four wells

Well Pad	Advantage	Disadvantage
Well Pad 1: Extension of the pad into the Kamansinig seasonally wet grasslands. Possible interference with flood flows and subsurface hydrology in the	■ Eliminates further impacts on seasonally wet grasslands; and ■ Eliminates possible interference with	■ Significant impact on the southern part of the village of Kyabasambu (approx. 26 buildings / structures); ■ Significant cost and delay to relocate the well pad; and

Well Pad	Advantage	Disadvantage
alluvial fan upstream of the Bugoma Swamp. **Alternative:** Move the well pad to the north side of the jetty road, north-west of the drilling camp.	subsurface drainage through the alluvial fan.	■ Loss of the existing well as a future development well.
Well Pad 1: Extension of the pad into the Kamansinig seasonally wet grasslands. **Alternative:** Re-design the well pad to an orientation where the long axis runs parallel to the access road	■ Some reduction in well pad extension into the seasonal wetland.	■ Unlikely to allow orientation of the skid pad as required for the optimal drilling; ■ Poor facility arrangement on the well pad; and ■ Loss of the existing well as a future development well.
Well Pad 2: Drilling noise levels affecting Kyabasambu community **Alternative:** No realistic alternative. Well pad located ideally in relation to the CPF and other infrastructure. No resettlement impact	-	-
Well Pad 3: Drilling noise affecting Nsunzu and Nsonga **Alternative:** Move well pad slightly south equi-distant between the housing clusters	■ Reduces number of people exposed to high levels of drilling noise north of the well.	■ Increases number of people exposed to high levels of drilling noise south of the well; ■ Increasing settlement likely to see infill into the area south of the well before drilling starts. Questionable whether adjusting the pad would serve a useful purpose; and ■ Significant cost and delay of relocating the well pad. ■ Loss the existing well as a future development well.
Well Pad 4A: Drilling noise and resettlement **Alternative:** This pad has already been relocated from initial position further north because of proximity of people and possibility of unstable ground (see Section 11.2.2)	■ At the time that the revised Pad 4A was chosen the area was less populated than it currently is and the current position conferred less social conflict in relation to noise and proximity to village.	■ Influx in the area has contributed to additional settlement within the identified footprint area. This is being handled through resettlement

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Figure 11-4: Location of existing well pads and other infrastructure compared with the current land use status

11.2.2 Well Pad Location

In a geohazard assessment prepared by ZYGIC (2014), the risk of rockfall affecting well pad 4-2 was found to be significant. This well pad is within 50 m of the escarpment. There is evidence of rock fall at the foot of the escarpment and the location of well pad 4-2 was considered to be within the zone of likely rockfall impact. A revised well pad location 4A was selected, which has an increased buffer of 278 m between the pad and the toe of the escarpment. The other locations for well pads have been largely driven by the need for appropriate spacing between each pad and to minimize the direct impact on villages along the lake shore. No alternatives to these pads have been considered.

11.2.3 Produced Water Treatment

The standard for produced water reinjection allows a maximum of 15 mg/l oil, which is the same as the Ugandan legal standard for oil-contaminated water released into the environment. Since the produced water is not to be released into the environment, the reasons for the reinjection standard are technical and not environmental. Nevertheless, failure of the produced water treatment system could have environmental consequences, since out-of-specification water would result in temporary storage requirements before re-processing. Given the volumes involved (3,000 m^3/d in year 3 increasing to nearly 18,000 m^3/d in year 25), storage capacity would quickly become critical.

The treatment options considered are set out in CNOOC (2017) Water Treatment Study Report (Report number KF-FS2-RPT-CPF-PR-0005). One of the most important criteria for selecting water treatment equipment for the removal of oil is the droplet size distribution of the oil phase in the water. The hydrocarbon removal efficiency of gravity-based separation equipment is largely dependent on droplet size, most equipment specifying a minimum droplet size that can be treated effectively. Since this information is not available at present, the basis of the equipment selection has been for a robust design to accommodate a wide range of droplet sizes.

The produced water treatment plant will consist of three treatment stages: primary, secondary and tertiary. Primary treatment options included skim tanks, API separators, plate pack separators and coarse coalescers. Skim Tanks were selected as the preferred treatment mainly because they will provide the required surge capacity for produced water upstream of the Produced Water Treatment Unit (PWTU) for any upsets in the downstream systems. Skim tanks also ensure coarse separation of oil from water, which is sufficient for secondary and polishing stages of separation. Plate-pack Interceptors and Corrugated Plate Interceptors are less suitable because of the possibility of sand fouling issues, which reduce their performance.

The secondary treatment options included induced gas flotation, dissolved oxygen flotation, static hydrocyclones, rotary hydrocyclones, centrifuges or fine coalescers. Secondary treatment encompasses the majority of the de-oiling equipment. Secondary treatment is usually sufficient to reduce the dispersed hydrocarbon content below discharge levels of 30-50 mg/l (provided the droplet size and other water characteristics are within the operating envelope of the equipment). While the other technologies can provide better separation, induced gas flotation (IGF) was selected as the preferred technology due to its reliability under conditions of high throughput.

Tertiary treatment is designed to reduced hydrocarbons in the water to concentrations of around 11mg/l. The options available for this polishing phase include crushed nut-shell filters, dual media filters, cartridge filters, pre-coat filters and membranes. Cartridge and pre-coat filters were ruled out because they require input concentrations not exceeding 10 - 15mg/l which cannot be achieved with DGF. Moreover, pre-coat filters require additional dosage of filter aid, which needs transportation, storage and disposal. Membranes are relatively newer technology and the technology is still not fully developed for produced water treatment. This technology is also expected to be more expensive than conventional walnut shell and dual-media filters. Both walnut shell filters and dual media filters can achieve the desired separation for water injection. However, experimental data of produced water with high solidifying point middle crude oil in this field is not available at this stage of the project, and the design of the produced water treatment system will need to be robust to be able to accommodate a wide range of water quality. Walnut shell filters were selected as the best option to reliably meet a 15mg/l specification.

Overall, technology selection has emphasised reliability under varying quality and load, which is an optimal approach to minimise environmental risk of downtime and consequent storage capacity risks in a remote and sensitive environment.

11.2.4 Oil Storage (floating roof tanks)

Various technologies are available for the storage of oil prior to delivery into the feeder pipeline. Storage tanks that minimise the venting of gasses that accumulate above the stored liquids are designed with a floating roof. The roof rises and falls with the liquid level in the tank. As opposed to a fixed roof tank there is no vapour space in the floating roof tank (except for very low liquid level situations). In principle, this eliminates breathing losses and greatly reduces the evaporative loss of the stored liquid.

Floating-roof tanks provide the most effective and practical means of reducing vapour emissions from stored volatile liquids. Floating-roof tanks may have an open (external) design or may include a fixed roof to aid in the protection of the (internal) floating roof. The basic features and benefits of a floating-roof tank are:

- A welded roof designed to float in contact with the stored product;
- A rim seal system that closes the space between the floating-roof rim and the tank shell; and
- Floating-roof fittings that are functional and provide effective emission control.

A properly designed and maintained floating roof tank can reduce emissions from oil storage facilities by up to 90%. CNOOC has selected these tanks for the main on-specification oil storage tank in the Kingfisher design. The emission reduction that is provided by floating roof tanks, compared with fixed roof tanks, can be up to 90% through the use of a properly designed and maintained floating roof tank.

11.2.5 Air Emissions (NOx burners)

CNOOC proposes to use gas separated from the well fluids to drive gas turbines, which will supply the project with electrical power and heat. Nitrogen dioxide (NOx) is a principle combustion product of gas engines. In the present case, Sulphur dioxide emissions will not be significant due to the low sulphur content of the crude (refer to Specialist Study 1). The project will use low NOx burners in all turbines. These modern burners generate significantly less NOx than traditional burners.

11.2.6 Emergency Pressure Relief on the Well Pads

Overpressure protection is necessary to accommodate fluctuating natural pressures from the wells. This can be provided in a number of ways, and in a recent study (CNOOC, 2016: Overpressure Protection Study Report. Rev 0), five options were investigated:

- Option 1 - Locate relief valves at the well pads and provide local burn pits to collect the relief at each well pad;
- Option 2 - Locate relief valves at the well pads and provide local flare to collect the relief at each well pad;
- Option 3 - High Integrity Pressure Protection System located at the well pads;
- Option 4 - Fully rate the flowlines and inlet facilities until downstream of the last valve on the feed to the 1st Stage Separator; and
- Option 5 – De-rate the flowlines at well pad outlet and provide relief valves at CPF inlet.

A detailed comparison of the options found that fully rating the flowlines and valves to the intake of the first stage production separator at the CPF is the most environmentally and cost-effective solution. This avoids the need for burn pits at the wells pads to accommodate emergency flaring or venting during production. Under this option (Option 4), flaring will only occur during well testing prior to commissioning

11.2.7 Drilling Waste Management

The Petroleum (Refining, Conversion, Transmission and Midstream Storage) Act (2013) specifies that the licensee must contract a separate entity to manage the transportation, storage, treatment or disposal of petroleum waste. The licensee is to remain responsible for the activities of the entity managing the transportation, storage, treatment or disposal of their waste.

To date, a limited number of hazardous waste disposal sites have been licensed in Uganda, which are operated and owned by specialist waste management companies. CNOOC will select one or more of these companies as contractors to manage petroleum wastes generated during drilling and operations. This decision is still to be made, but the company acknowledges its responsibility for good oil industry practice throughout the lifecycle of its activities, including oversight of the handling of its wastes by the third party contractors. CNOOC will follow a guideline such as the OGP (2008) in assessing the capability of the contractor's offering waste transport and disposal services as a basis for a decision about the preferred service provider.

11.2.8 Sewage Effluent Disposal

CNOOC proposes to dispose of treated sewage effluent during the construction and operational phases by releasing it into the drainage line north of the CPF, which discharges into Lake Albert immediately south of well pad 2. During the construction phase, peak discharge will reach approximately 350 m^3/day, including discharges from the EPC camp and the drilling camp. In the initial years of operation of the CPF, when the drilling team is still on site, approximately 90 m^3/day will be discharged, which will reduce to 45 m^3/day once drilling is completed.

The ESIA has flagged the point source discharge of treated sewage effluent as a potentially significant impact. While the sewage works will be designed to meet the Ugandan water quality standards for domestic effluent, the nitrogen loads into the lake could encourage algal blooms, with knock-on effects on fisheries and livelihoods.

Nitrogen in treated sewage effluent is an excellent fertilizer. The ESIA has made the recommendation that CNOOC consider an alternative practice, being to use the effluent to irrigate pastures and woodlots on the Buhuka Flats. This will encourage plant uptake of the nitrogen, minimise the risk of eutrophication in the lake, reduce the pressure on natural habitats for fuel, and provide a benefit to local communities on the Flats.

11.2.9 Stormwater Drainage

CNOOC proposes to dispose of stormwater via cut-off drains that route stormwater around key facilities such as the CPF into local drainage channels. Most of the drainage from the CPF and personnel camps will be delivered northward into the drainage line which discharges due south of well pad 2. A smaller quantity will be discharged southward into the Kamansinig River. Soils on the Buhuka Flats are highly erodible, and modelling has shown that point source discharge of drainage, concentrated by cut off drains, is likely to cause scouring at the point of discharge.

The conceptual drainage design was available for the ESIA, but details of the design were still to be worked out. Alternatives proposed in the ESIA include:

- Construction of an open canal west of the CPF to direct stormwater from the perimeter cut-off drains and clean stormwater from the CPF itself to the lake. The canal should preferably be designed with shallow embankments, as an open swale, with channel reinforcing and grassing, in preference to a concrete structure. Engineering at the point of discharge into the lake should include energy breakers to minimize the risk of channel incision; and
- Construction of energy breakers at all points of discharge where stormwater has been concentrated, as an alternative to direct discharge from a pipe end.

11.2.10 Disposal of Organic Waste

As an alternative to the disposal of organic (kitchen) waste to offsite licensed landfill, or incineration, the ESIA proposes that CNOOC install industrial composting equipment at the production facility. There are various types of suitable digesters which will accommodate all organic kitchen waste, including meat and bones, producing hygienic pathogen-free compost. This can be used on the lawns and gardens at the CPF personnel camp, and if there is an excess could also be made available to communities to improve the fertility of their vegetable gardens. Over a period of time, it may be possible for CNOOC to assist in the establishment of small businesses supplying vegetables to the production facility, and compost would be a useful to improve their production as well.

11.2.11 Airfield Alternatives

The initial proposal for the airfield was to extend the existing strip, immediately west of the CPF, lengthening the runway to the south across the Kamansinig River. Based on the recommendations the Fire and Explosion Risk Assessment (2017), CNOOC has flagged this as a high risk, taking into consideration the potentially catastrophic consequences of an accident involving an aircraft crashing into the production facility. A decision has been taken to decommission the existing airstrip, and to convert it to a laydown yard for use during the construction and production phases. A helicopter pad will be developed (location still to be determined) to facilitate access to the production facility by air.

12.0 CONSTRUCTION PHASE IMPACTS OF THE FEEDER PIPELINE

The impact of the feeder pipeline is discussed in a series of five chapters that address impact and mitigation during construction (Chapter 12), operational (Chapter 13) and decommissioning (Chapter 14) of the feeder pipeline, followed by a discussion on unplanned events (Chapter 15) and the alternatives which were considered in relation to the feeder pipeline (Chapter 16).

The current chapter, Chapter 12, describes the impacts associated with construction of the feeder pipeline.

12.1 The Physical Environment

12.1.1 Air Quality

12.1.1.1 Methodology

Without certainty regarding vehicle numbers and the daily scheduling of vehicle trips, the concentration of suspended particulates (airborne dust) caused by construction of the feeder pipeline cannot be accurately determined. The method used in the air quality assessment is to estimate likely dust loads based on a range of possible construction traffic volumes.

12.1.1.2 Impact of Dust Generation

The main air quality impact caused by construction of the feeder pipeline will be dust generated by heavy vehicles delivering personnel, pipes and other supplies and equipment to the work sites, and activities at the work sites themselves, which will include bulldozers clearing the right of way, backhoes opening and closing the trench, side booms laying the pipe and bulldozers and tractors closing up and reinstating topsoil.

Along most of the pipeline route there are few nearby households, with 19 building structures within 100 m of the pipeline right of way and none between 100 m and 200 m away. Dust impacts caused by the movement of vehicles along the pipeline right of way will therefore be limited to a small number of households. There is presently no certainty about the project use of other access roads, but it may be assumed that there could be considerable additional traffic on them during the period in which the construction teams are working in the area.

Dust generation will depend on the number of vehicles, particularly heavy vehicles, using the road and the nature and moisture content of the roads at the time. Observation during field visits has shown that a high degree of vehicle-generated dust is likely in dry conditions. Figure 12-1 shows typical concentrations of total particulates at 20 m from the road (i.e.: on the side of the road) based on assumptions about different vehicle volumes and axle loads[1]. For households close to access roads with any volume of heavy vehicle construction traffic on them, the Ugandan 24-hour standard of 70 µg/m^3 is likely to be exceeded. Impact magnitude will be high (assuming that there may be more people along some of the access roads used by the pipeline construction teams, in addition to those along the pipeline right of way itself, and that a significant number of local people could therefore be affected during the period of construction). There is potential for dust raising from mobile plants supporting the pipeline construction activities. Impacts will be short term and local along the pipeline route and local access roads and impact significance will be **high medium**. Mitigation using water sprayers is highly effective and subject to sufficient capacity being available can reduce dust loads by 75%, which would reduce impacts to **low** levels of significance.

12.1.1.3 Mitigation and Monitoring

Dust caused by construction activities shall be controlled to ensure no detrimental effect on landowners, occupants, employees or the public. The contractor shall comply with the Ugandan legal requirements and IFC/ World Bank air quality guidelines for suspended particulates. The upper limit values are as follows:

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[1] *Modelling undertaken by Burger (2016). Referenced standards changed to the Ugandan air quality limits for 24-hour total suspended particulates of 70*µg/m^3

- Suspended Particulates (Ugandan daily standard): 200 µg/m³;
- PM_{10} (IFC daily standard): 50 µg /m³;
- PM_{10} (IFC annual standard): 20 µg/m³;
- Respirable particulate matter (<10 µm) (Ugandan daily standard) 100 µg/m³;
- Dust fall 600 mg/m²/day determined in accordance with ASTM D1739 methodology; and

CNOOC and the CLO shall demonstrate compliance with the above standard by monitoring of dust fall and ambient concentrations of respirable particulates at receptor points, using passive air quality monitoring devices

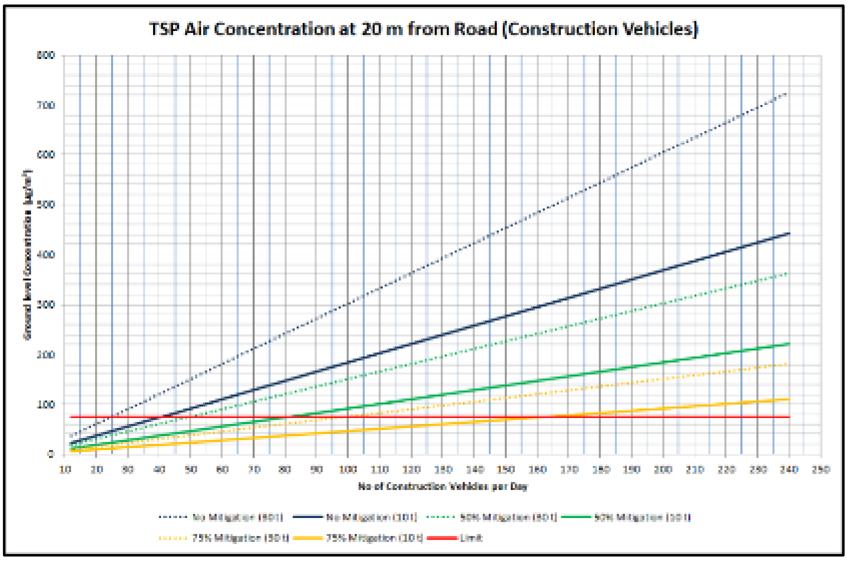

Figure 12-1: Predicted highest daily average TSP ground level concentrations for a range of traffic volumes and emission controls along construction access roads (after Burger, 2016)

Recommendations to manage the impacts of construction on surrounding communities are as follows:

- Implement dust suppression measures using water sprays and 'environmentally friendly' surface binder products;
- Achieve at least 75% dust suppression in areas where people live or where there are other sensitive activities within 50 m of the pipeline right of way or access roads;
- CNOOC will ensure that the Contractor maintains sufficient dust damping capacity to control dust at each work site and along the access roads in dry periods;
- Visually monitor dust generation daily in order direct water trucks to areas where they are needed and;
- Dust generation from mobile plants shall be minimised so as not to create nuisance in surrounding communities. Control measures that may be required include sprays, division panels, and direct feed from silo to mixer or dust screens
- Speed limits must be appropriate (not exceeding 40Km/hr) to minimise dust generation;
- Driving off road or on unauthorised roads must be prohibited without prior approval from the site supervisor; and
- Inform local communities of project activities, including use of vehicles on the road network

12.1.1.4 Gaseous air emissions

Point source emissions are distinct, immobile, and identifiable sources of air pollutants (e.g. exhaust emission from diesel/petrol engines). Emissions from point sources must be minimised and controlled according to CNOOC's Air Quality Management Specification (includes control technologies, as well as stack height and emission guidelines) and Good International Industry Practice (GIIP)[2]. The main sources of air emissions (continuous or no continuous) that would result from the pipeline construction activities include:

[2] IFC Guidelines: Air Emissions and Ambient Air Quality (2007) - http://www.ifc.org/wps/wcm/connect/532ff4804886583ab4d6f66a6515bb18/1-1%2BAir%2BEmissions%2Band%2BAmbient%2BAir%2BQuality.pdf?MOD=AJPERES

- Combustion sources from vehicle and equipment engines, the use of compressors, pumps, and reciprocating engines;
- Fugitive emissions.
- Principal pollutants from these sources typically include nitrogen oxides (NOX), sulphur oxides (SOX), carbon monoxide (CO), and particulates (TSP, PM10, PM2.5 and dust fallout). Additional pollutants can include:
  - Hydrogen sulphide (H2S); volatile organic compounds (VOC's); methane and ethane; benzene, ethylbenzene, toluene, and xylenes (BTEX); glycols; and polycyclic aromatic hydrocarbons (PAHs) (IFC, 2007).

Some of the gaseous emissions released by the project are greenhouse gasses (GHG), which include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

12.1.1.5 Mitigation and Monitoring

The contractor shall comply with the Ugandan legal requirements and the following IFC/ World Bank air quality guidelines:

- Sulphur Dioxide (IFC daily standard): 20 µg/m^3;
- Nitrogen dioxide (IFC annual/hour standard): 40 µg/m^3 and 200 µg/m^3;
- Ozone (IFC 8-hour daily standard): 100 µg/m^3; and
- Particulate Matter $PM_{2.5}$ (IFC annual/ daily standard): 10 µg/m^3 and 25 µg/m^3.
- The height of stacks must be at least 5 m higher than other structures located within a radius of 200 m from the stack.
- Energy efficiency must be maximised to minimize air emissions as outlined in CNOOC's energy management specification. Additional measures that should be applied are outlined by the IFC.[3]

Fugitive source emissions are air emissions distributed over a wide area (i.e. not confined to a specific release point). CNOOC's Air Quality Management Specification must be complied with and the following must be done to minimise and control these emissions:

- Open burning of waste material will be prohibited;
- A procedure must be developed for monitoring of fugitive emissions from infrastructure (e.g. pipes, valves, seals, tanks) and other components with vapour detection equipment, and with subsequent maintenance or replacement of components as needed. The procedure should specify the monitoring frequency and locations, as well as the trigger levels for repairs;
- Collection of vapours and subsequent treatment by removing VOCs with appropriate control should be implemented; and
- Ozone depleting substances will be avoided throughout project lifetime.

Emissions from vehicles include CO, NOx, SO_2, PM and VOCs and general control measures that must be implemented are outlined by CNOOCs Air Quality Management Specification. Measures include:

- Vehicles will be maintained according to manufacturer's recommended maintenance programs;
- Drivers will be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption;
- Where feasible, aging vehicles must be replaced by newer more fuel-efficient alternatives. All vehicles must use clean fuels (i.e. low-sulphur fuels or biofuels); and
- Where feasible, emissions control devices (e.g. catalytic converters) must be installed and maintained in vehicles and mobile machinery.

Greenhouse gas emissions

[3] IFC Guidelines: Energy Conservation (2007) - http://www.ifc.org/wps/wcm/connect/c25b18004886583db4eef66a6515bb18/1-2%2BEnergy%2BConservation.pdf?MOD=AJPERES

GHG include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. CNOOC's Greenhouse gas management specification must be complied with and the following must be undertaken where feasible:

- Enhancement of energy efficiency (see CNOOC's energy management specification);
- Protection and enhancement of sinks and reservoirs of greenhouse gases (i.e. mechanisms to trap or slow the release of GHG);
- Minimisation of methane emissions through recovery and use in waste management, as well as in the production, transport and distribution of energy;
- Promotion of sustainable agriculture and animal husbandry;
- Use and promotion of renewable forms of energy; and
- Use of carbon capture and storage technologies[4].
- Vehicles and equipment must be designed, maintained, and operated in accordance with Good International Industry Practice (GIIP) and the manufacturer's specifications; and
- Vehicles and machinery must use low-sulphur fuels or biofuels to minimise SOx emissions.
- Selected roads will avoid steep gradients and sharp turns which may increase congestion (traffic) and atmospheric emissions; and
- A journey management plan must be developed to minimise vehicle travel (i.e. trips to and from locations). Halving the number of trips undertaken can halve the GHG emissions from the vehicle.

Idling of vehicles must be minimised (i.e. drivers must switch engines off when not in use).

- Diesel-fuelled mobile equipment should be replaced with electrical equipment, utilizing solar-powered back-up; and
- Low-sulphur fuels or bio-fuels should be used where the use of electrical equipment is not feasible.

Vehicles, equipment, and associated infrastructure must be designed, maintained, and operated in accordance with Good International Industry Practice (GIIP) and the manufacturer's specifications.

Vehicles and machinery must use low-sulphur fuels or bio-fuels.

12.1.1.6 Impact Rating Scale

Table 12-1: Construction phase impacts on air quality

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of total suspended particulates	8	2	2	5	**High Medium 60**	1	2	2	5	**Low 25**
Gaseous emissions	6	2	2	5	**Low Medium 50**	1	2	2	5	**Low 25**

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable

[4] Carbon dioxide capture and storage (CCS) comprises separation and isolation of carbon dioxide from industrial and energy-related sources; transport to a storage location; and long-term isolation from the atmosphere (air).

6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

12.1.2 Groundwater

12.1.2.1 Impact on Groundwater Supply and Groundwater Quality

12.1.2.1.1 Risk to Borehole Supply

There is one community borehole located within the pipeline construction right of way, named 'Kyarujumba' in Table 12-2 and Figure 12-2. Kyarujumba borehole will be lost or, as a minimum, will need to be shut down during construction, being within the construction working area. Without mitigation, the community that relies on it will be required to find an alternative water supply, either permanently or at least for the duration of construction. This will cause impacts of varying magnitude (medium to high), which in all cases, taking into consideration community dependence on groundwater, would result in impacts of **high** significance.

Table 12-2: Boreholes and Seeps within 500 m of the feeder pipeline centre line

Sample ID	Distance from pipeline centreline (m)
Kyarujumba	10
Kabaale-1	350
Kabaale-3	160
Kasogo-1	270
Hanga-2A	280
Kyabasambu stream	415

Damage to Groundwater Supply due to Trench Excavation and Blasting

Trench excavation, blasting and other construction activity is not expected to have any material impact on groundwater supply or quality. The shallow excavation dug for the pipeline trench will not intercept groundwater and there is no significant risk to groundwater resources as a result of physical impacts during construction. Blasting is not expected to be necessary except in the short section of the pipeline route across the escarpment. Blasting damage to water supplies or borehole infrastructure is unlikely at distances greater than 200 m from the trench[5]. Table 12-2 shows that there are no boreholes within this area and the seep which feeds the water supply is over 415 m from the pipeline. Impact magnitude is expected to be negligible in most cases and low in the case of the seep. Given the importance of this facility, the magnitude of impact would be high were it to affect the water supply. In the context of medium probability of blasting impact, the impact significance will be **low medium**, which warrants precautions to manage and monitor the impacts of blasting on this stream.

[5] *See, for example, the International Association of Geophysical Contractors (2004)*

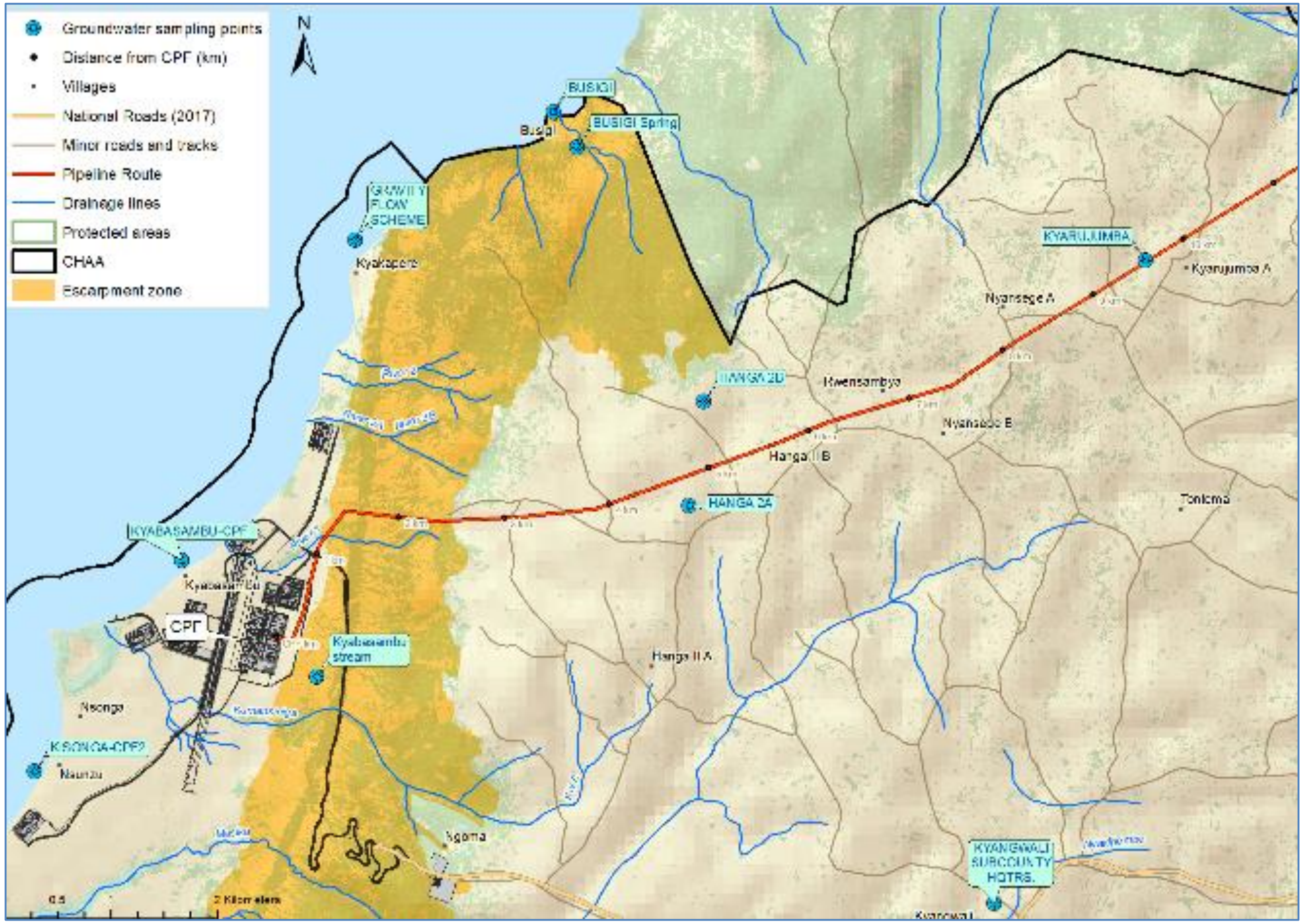

Figure 12-2: Boreholes and other water infrastructure near the pipeline ROW in the escarpment section

12.1.2.1.2 Effect of Treated Sewage Effluent on Groundwater Quality

Sewage at the personnel camp will be treated by a package sewage treatment plant, designed to comply with the Ugandan requirements for effluent disposal and the IFC guidelines for domestic wastewater. Treated effluent will be discharged into a soakaway.

Subject to compliance with the project specifications, it is unlikely that there will be any impact on groundwater quality at the nearest community borehole, which is 2.3 km from the camp site. Soils around the campsite are Ferasols (loamy clays) which are suitable for soakaways. Impact magnitude will therefore be negligible, and impacts will be of short duration, local geographic extent, and **low** significance.

12.1.2.2 Mitigation and Monitoring

The following mitigation and monitoring is proposed:

Lost Borehole Supply

- Drill a new borehole outside of the construction right of way or slightly re-align the pipeline to place the borehole outside of the right of way; and
- Inform communities of the impact and planned mitigation well in advance of construction.

Water Quality and Quantity

- Ensure that blast charges on the escarpment are sufficiently low to minimise risk to the nearby water / borehole supply;
- Monitor water quality in selected boreholes along the route before and after construction as a means of verifying the absence of impact; and
- Ensure that treated sewage effluent consistently meets the project specification.

12.1.2.3 Impact Significance Rating

Table 12-3: Construction phase impacts on groundwater

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impacts on water quality and water supply										
Loss of, or reduction in, borehole supply	10	5	2	5	High 85	1	2	2	5	Low 25
Disruption to groundwater supply due to trench excavation and blasting	8	5	2	3	Low Medium 45	1	2	2	3	Low 15
Effect of treated sewage effluent on groundwater quality (construction camp)	1	2	2	4	Low 20	1	2	2	4	Low 20

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

12.1.3 Surface Water Resources

12.1.3.1 Impact on Water Quality

The feeder pipeline crosses a number of small seasonal drainage lines (refer to Figure 12-4). Depending on the time of year that construction takes place, these may be flowing or dry. The typical method of construction across small drainage lines is to import fill material as bedding to provide a sound footing across the channel, insert flume pipes through the fill to accommodate the drainage, or divert the drainage around the construction area, and excavate the trench for the pipeline through the centre of the bedding fill, in dry conditions. The fill is then removed and the drainage reinstated. Most sediment generation occurs during initial excavation and when the fill is laid and compacted and when the fill and flume pipes are removed.

Figure 12-3: Typical small stream along the feeder pipeline route (upper reach of the Hohwa River near km 28)

The impacts on surface water are considered in relation to human receptors. Biological receptors are considered under Section 12.2.1.3. Sediment generation in a stream channel would probably not be regarded as an effluent by Ugandan legislation, but the requirements for maximum total suspended solids (100 mg/l) and turbidity (NTU) in wastewater discharges are a good guide to minimising the impact of sediment in streams. Downstream sedimentation is likely to exceed these guidelines at the pipeline river crossings for short periods of time in the local area, impacting on the water quality during these times for use by the surrounding communities and their stock, and creating nuisance effects of high magnitude and **high medium** significance.

There is a potential impact of waste water on surface waters. Small quantities of POC wastewater may result from washdown of spillages in the POC work areas at the Base Camp. These include bunded areas for petroleum storage, the bunded generator platform and areas designated for vehicle servicing and repair. There is also potential for contamination of storm water from site activities at the pipeline construction site, base camp. Stream water is consumed by stock and is used for washing and occasionally for drinking. Vulnerability (sensitivity) to fuel and oil spills is high, resulting in high impact magnitude, but volumes are likely to be small and spills limited to a small geographic area. Combined with a medium probability of a fuel or oil spill, under unmanaged conditions, impact significance will be **low medium.**

With appropriate construction management, these impacts can all be reduced to **low** significance.

12.1.3.2 Mitigation and Monitoring

Recommendations to manage the water quality impacts of construction on aquatic fauna are made Section 12.2.2.5. These recommendations apply equally to protecting water quality for human use.

- All wastewater generated from these activities must be managed in accordance with the CNOOC Waste Management Plan and meet produced water and hydrotest water requirements outlined in Table 6-18.
- Domestic wastewater at the construction camp will report to the soak away and must meet local and IFC requirements for discharge as described above.
- Any storm water that has been potentially contaminated by oil, grease or other chemicals from site activity needs to be treated to the discharge standards listed in Table 6-18 before it can be released to the environment. Key principles that must be applied during construction include:
- Plan construction activities to avoid sensitive times of the year, like heavy rain seasons;
- Minimize areas to be cleared, and use hand cutting tools to avoid unnecessary increases in erosion in the area and sedimentation in the surface waters;
- Consider the use of existing roads for access to reduce the impact of erosion, sedimentation and obstruction to the natural surface water flow. Try to construct pipelines along existing infrastructure and roads;
- Install temporary erosion, sediment control measures, and slope stabilization measures at all times, where necessary;
- Peak discharge rate must be reduced in areas of development to reduce the potential erosion of the flow paths and sedimentation of downstream surface waters;
- Storm water must be kept separate from other process and sanitation wastewater streams to reduce the volume of wastewater to be treated;
- Runoff from process areas must be kept separate from less contaminated (or sediment heavy) runoff areas to prevent further water contamination. Storm water from process areas needs to be treated to the discharge standards listed in Table 6-18 before being released to the environment;

- Oil/ water separators and grease traps must be installed and maintained at refuelling areas, workshops, parking areas and fuel storage areas;
- Runoff from areas with potential sources of contamination and sediment loading should be minimized; and
- Reuse of storm water and contaminated runoff should be done. Storm water should be managed as a resource.

12.1.3.3 Impact Rating Scale

Table 12-4: Construction phase impacts on surface water (feeder pipeline)

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on surface water quality (sediment generation)	8	2	2	5	High Medium 60	2	2	2	5	Low 30
Impact on surface water quality (fuel or oil pollution)	8	2	2	3	Low Medium 36	2	2	2	4	Low 24

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

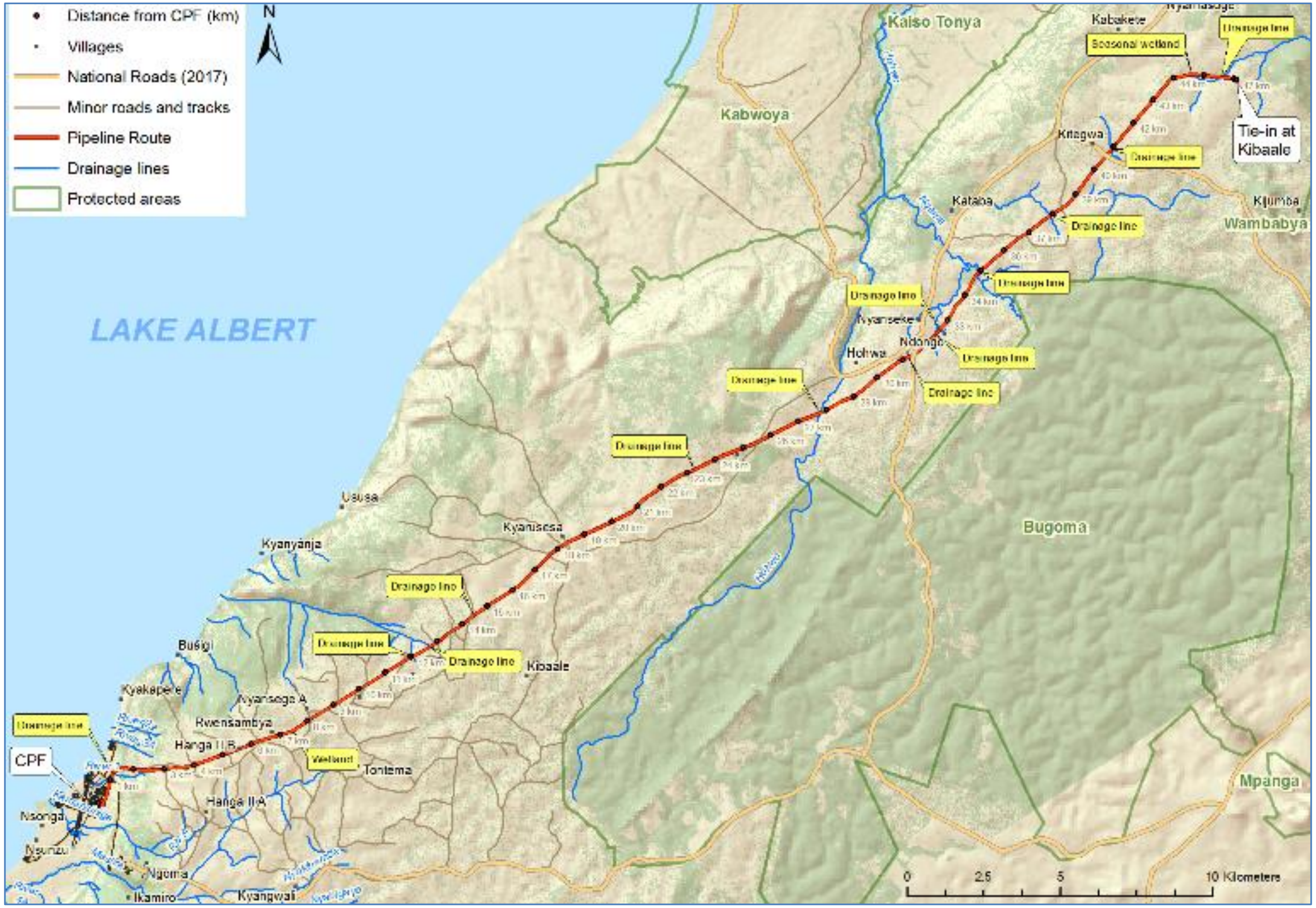

Figure 12-4: Drainage lines and wetlands along the feeder pipeline route

12.1.4 Noise

A variety of activities associated with construction of the feeder pipeline will generate noise that has the potential to impact upon people living in proximity to the pipeline servitude. These noise sources are typical of earthworks and construction activities and will result from a combination of operational noise from vehicles, heavy equipment and mobile power generation together with localised noise associated with rock breaking, where this may prove necessary. The area through which the pipeline will pass is largely a rural environment comprising small-scale agriculture; thus, fields and associated houses. The pipeline bypasses villages per se.

12.1.4.1 Methodology

To determine criteria for the assessment of construction noise impact, the Ugandan noise regulations and internationally accepted standards were reviewed. There are considerable differences in the quoted target values. The existing Ugandan construction noise standard is based on indoor limits (Table 12-5). To convert this to outdoors so as to be comparable with other standards requires an estimate of the expected attenuation between indoors and outdoors. While 15 dBA is often assumed, this as unlikely for the study area where most inhabitants live in thatched roof huts without ceilings. Indoor / outdoor attenuation is estimated to be 5 dBA, which adjusts the Ugandan daytime standard to 65 dBA and nighttime standard to 45 dBA.

For nighttime, at least, this corresponds with the first part of the IFC guideline for outdoor noise levels (Table 12-5). The second part of the IFC guideline, which specifies that sound levels should not be increased by more than 3 dBA above the background ambient, is typically not achievable in the context of construction noise and is often interpreted to apply only in cases where the baseline ambient already exceeds the IFC maxima specified in Table 12-5.

Table 12-5: Ugandan Noise Standards compared with IFC Guidelines

Period	IFC	Ugandan Construction Noise Standard (Indoors)[6]	Draft (Revised) National Ugandan Construction Noise Standard (Outdoors)[7]
Daytime Noise	55 dBA	60 dBA	75
Nighttime Noise	45 dBA	40 dBA	65

Other standards for construction noise impact distinguish between noise levels based on the period of construction. The most cogent of these, and the one used for the purpose of this assessment, is '*Noise and Vibration Criteria Impact Assessment Criteria and Methodology*'[8] produced by Rio Tinto. For medium term construction noise (1- 6 months), the target values are an LAeq (1 hr) of 65 dBA (daytime) and 45 dBA (nighttime). Daytime impact significance ratings for the feeder pipeline based on these threshold values are shown in Table 12-6. No nighttime work will be undertaken.

[6] *National Environment Noise Standards and Control Regulation, 2003*
[7] *Draft National Environment (Noise and Vibrations Standard and Control) Regulations, 2013: Schedule 4 Part A.*
[8] *Rio Tinto (undated)*

Table 12-6: Rio Tinto Impact Rating Scale for Construction Noise for 'medium term' periods of 1- 6 months[9] - feeder pipeline

Time of Day	Noise Level (dB LAeq, I hr)						
	<45	45-55	55-60	60-65	65-70	70-75	>75
Daytime	NS	NS	NS	NS	Minor	Moderate	Major

NS = Not significant

For the personnel camp, which will be located near km 27 along the pipeline right of way, the rating scale in Table 12-7 will apply. In this case, the rating scale is based on a construction period that will exceed 6 months and the standard is therefore more stringent. Nighttime restrictions will also apply.

Table 12-7: Rio Tinto Impact Rating Scale for Construction Noise for 'long term' periods of >6 months[10] - personnel camp

Time of Day	Noise Level (dB LAeq, I hr)						
	<45	45-50	50-55	55-60	60-65	>65	<45
Daytime	NS	NS	NS	Minor	Moderate	Major	NS
Night time	NS	Minor	Moderate	Major	Major	Major	NS

NS = Not significant

To adapt the CNOOC ESIA impact rating scale to conform to the above approach, the normal impact rating criteria are not applied. The ratings of 'minor', 'moderate' and 'major' in Table 12-6 and Table 12-7 are deemed to be equivalent to 'low', 'medium' and 'high' significance in the CNOOC ESIA rating scale.

An average ambient noise level of LAeq 43.8 dBA daytime and 41.7 dBA nighttime[11] (± 5dBA) was used as the existing ambient for the impact assessment, based on the values from measurements taken at Ikamiro village (see Table 12-8) and at the site of the proposed personnel camp. These provide a good representation of typical noise levels in rural communities.

Table 12-8: Baseline noise levels measured at Ikamiro used as a proxy for communities along the whole feeder pipeline

	Ikamiro Village		**Personnel Camp Site**
Period	$L_{Aeq,1hr}$	$L_{A90,1hr}$	$L_{Aeq,1hr}$
Daytime (Max)	57.3	52.9	41.9
Daytime (Min)	44.9	34.7	35.7
Nighttime (Max)	51.9	48.9	-
Nighttime (Min)	40.8	34.6	-

Daytime is 06:00 - 22:00 Nighttime is 22:00 - 06:00

[9] *Ibid*

[10] *Ibid*

[11] *L_{Aeq} and L_{A90} are recognized indices used as a basis for noise impact assessment. L_{Aeq} is an energy average of fluctuating sound, measured in A-weighted decibels, over a representative period of time. L_{A90} is the A-weighted energy average sound level that is exceeded for 90% of the time. A-weighting adjusts sound intensity measurements to match the range of human hearing. Refer to Specialist Study 6 for details*

Noise generation was assumed to be a combination of construction equipment noise from vehicles and other equipment operating at once. This includes bulldozers, dump trucks, pipe trucks, overburden screening plant and excavators. Mobile plant items were assumed to have a utilization factor of 80%. However, it should be noted that the construction of a pipeline is a series of sequential events along a linear corridor, so not all of the equipment that operates is in the same place at the same time. While the pipe supply and other transport vehicles will move up and down the construction corridor for a longer period of time, using the right of way as an access road; the main construction activities will be sequential, and to achieve 45 km in the allocated 8 - 10 month construction period, the construction train will achieve 1 km a week or more.

Figure 12-5: Monitoring location NMP10 at Ikamiro Village

12.1.4.2 Impact of Daytime Noise along the Pipeline Construction Right of Way

No construction will take place at night, except in cases of emergency, and noise impacts along the pipeline right of way will therefore not be subject to the more stringent night time standard described above.

Table 12-9 shows the significance of daytime construction noise impact along the feeder pipeline, based on distance from the construction right of way. A total of 11 buildings (roughly 50 people) will be affected by noise levels that are greater than a LAeq (1 hr) of 65 dBA. These impacts will be of **low** significance. While the noise generated by vehicles bringing materials along the pipeline right of way may extend for periods of up to six months, the noise generated by construction teams working on the welding and laying of the pipeline would, in most cases, be considerably shorter than this, and would progress quickly past any household, extending the distance of the main noise sources from any receiver daily. None compliance with legal requirements may cause activity shut down by Authorities, therefore noise monitoring will be a key issue to implement as a means of evaluating efficiency of proposed mitigations.

Table 12-9: Significance of construction phase noise impact with distance from the pipeline for the daytime period (showing number of affected buildings)

Receptor distance from noise source*	Number of Affected Buildings**		
	Predicted sound levels >65 dBA (dB $L_{Aeq,1hr}$) Significance Low	Predicted sound levels 60-65 dBA (dB $L_{Aeq,1hr}$) Significance Negligible (NSI)	Predicted sound levels 55 -60 dBA (dB $L_{Aeq,1hr}$) Significance Negligible (NSI)
0 - 10m from pipeline RoW	11	0	0
10 m - 50m from pipeline RoW	0	5	0
50 m – 100 m from pipeline RoW	0	-	4
100m - 200m from pipeline RoW	0	0	0

RoW = Right of Way

* *Distances are from the edge of the construction right of way*

*** The relationship between building structures and number of people affected is uncertain but is probably in the order of 1 building = 4.5 people.*

12.1.4.3 Impact of Personnel Camp Noise

Construction noise at the personnel camp is expected to be caused mainly by the camp generator and other incidental sounds associated with camp activities. No inhabitants live closer than 500 m to the camp and predicted daytime and nighttime noise levels at the nearest households are not expected to exceed the maximum thresholds set out in Table 12-7, nor the more stringent IFC general noise management thresholds described in Table 12-5. Impacts will be of **low** significance.

12.1.4.4 Mitigation and Monitoring

By tolerating a higher level of noise in surrounding communities due to the short term nature of the construction activities, the target thresholds permit a large increase above the background ambient sound levels that are typical of rural areas. Noise levels will be potentially disturbing for short periods of time for people living close to the construction right of way and along the main access roads. All reasonable, practical, means of limiting pipeline construction noise effects should be implemented. This is particularly important in any areas where sensitive land uses such as schools, churches or clinics are affected.

The following mitigation and monitoring is recommended:

- Installation of vibration isolation for mechanical equipment,;
- Train drivers and equipment operators to minimise unnecessary generation of noise;
- Train all personnel to be aware of noise nuisance and to minimise their noise footprint in the surrounding community;
- Re-location of noise sources to less, sensitive areas to take advantage of distance and shielding to reduce noise impacts;
- Limiting traffic routing through community areas wherever feasible;
- All vehicles and equipment shall be fitted with noise suppression devices, as appropriate, and operated and maintained as per manufacturer’s specifications, instructions, and manuals;
- Noise producing equipment such as generators, air compressors, etc. should be enclosed in acoustic enclosures. Mufflers, bafflers must also be used where feasible;
- Ensure that silencers on all vehicles and equipment are properly maintained;
- Shield the camp generator with acoustic screening. This should provide the necessary acoustic insulation to minimise night time noise to levels of low significance;

- Noise generating facilities (e.g. well sites, compressors, camps) must be located as far away from noise receptors;
- Noisy activities must be limited to weekdays (06h00 to 18h00), while non-noise related work can take place at any hour;
- The noise emission profile (i.e. anticipated noise output) of heavy fleet vehicles, machines, and equipment must be used as a key reason for its selection. Items with high noise emission profiles must not be selected if practical; and
- Machines and transport equipment must not be allowed to idle, and must be shut- or throttled down to a minimum.
- Comply with the daytime construction restrictions. Daytime should be defined as daylight hours from 06:00 - 18:00;
- Flag any schools, clinics or places of worship within 100m - 200 m of the construction RoW and monitor noise at these locations. If necessary, take measures to minimise the effect of the noisiest activities by timing them to avoid critical periods in the school/worship calendar;
- Ensure that silencers on all vehicles and equipment are properly maintained;
- Communicate with the families in proximity to the right of way to ensure that there is an understanding of the temporary nature of the noise and the expected schedules for construction;
- Use the pipeline construction as an educational opportunity for school children in the communities along the pipeline;
- In areas where blasting is necessary, advise surrounding communities well in advance of the blast schedules. If any blasting is required within 200 m of households, undertake photograph surveys of the buildings before and after blasting and measure blast shock; and
- Shield the camp generator with acoustic screening. This should provide the necessary acoustic insulation to minimise nighttime noise to levels of low significance.

These measures will assist in minimising the more annoying and unnecessary aspects of construction noise along the feeder line RoW.

12.1.4.5 Impact Significance Rating

Table 12-10: Construction phase impacts of noise (feeder pipeline)

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Daytime Impact of Civil Construction Noise	11 buildings (50 people) 65 -70 dBA				**Low**	11 buildings (50 people) <65 dBA				**NSI**
Daytime Impact of Civil Construction Noise (9 buildings)	9 buildings (40 people) 55-60 dBA				**Low**	11 buildings (50 people) <65 dBA				**NSI**
Daytime Impact of Personnel Camp Noise	No household within 200 m				**NSI**	-				**NSI**
Nighttime Impact of Personnel Camp Noise	No household within 200 m				**NSI**	-				**NSI**

KEY (Note: Standard rating scale does not apply to construction noise – refer to the methodology above)

Magnitude	**Duration**	**Scale**	**Probability**
10 Very high/ don't know	Merged into the magnitude ratings for construction-related noise	5 International	5 Definite/don't know
8 High		4 National	4 Highly probable
6 Medium		3 Regional	3 Medium probability
4 Low		2 Local	2 Low probability
1 Minor		1 Site only	1 Improbable
			0 No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +. NSI No Significant Impact

12.2 The Biological Environment

Construction impacts of the feeder pipeline on the biological environment are assessed in two broad categories:

- Impacts on habitats and ecosystem integrity, which include the vegetation corridors along the escarpment and wetlands along the pipeline route. Direct impacts were assessed based on a 30m wide construction right of way, within which vegetation will be cleared or severely disturbed. An additional 50 m buffer on either side of the construction right of way was assumed as the area in which most indirect impacts will occur, including nuisance - related impacts caused by construction equipment and edge effects. In the wetlands, impact assessment takes into consideration the potential downstream effect of pollution, which could extend beyond the right of way;

  No other areas of conservation significance exist along the pipeline route. With the exception of the section of route across the escarpment corridor, the crossings of small wetlands associated with seasonal drainage lines and the section from the CPF to the base of the escarpment, the pipeline passes through highly modified habitats under subsistence cultivation. Very little untransformed habitat remains. Figure 12-5 provides a satellite image of a typical area through which the pipeline is routed. The biological impact of the pipeline in these areas is not considered further in this assessment; and

Figure 12-6: Typical intensive cultivation along the feeder pipeline route

- Impacts on species of concern. Only one species of conservation concern is potentially directly affected by construction of the feeder pipeline - the Grey Crowned Crane. Other species, including the Eastern Chimpanzee and Nahan's Francolin, occur in the Bugoma Central Forest reserve (BCFR) but are not directly affected by pipeline construction, which at its nearest point will be at least 1,8 km from the BCFR boundary. The indirect impacts of population influx, due to expectations of work on the construction contract, are considered since this could impact on the forest reserve.

12.2.1 Habitats and Ecosystem Integrity

12.2.1.1 The Nearshore Environment of Lake Albert

The feeder pipeline will not be constructed in the vicinity of the near-shore aquatic habitats of Lake Albert and construction in the pipeline right of way it is not expected to result in habitat loss. However, changes in water quality as a result of the proposed discharge of mill scale and hydrotest water into Lake Albert could affect the habitat and ecosystem integrity of the near-shore environment of Lake Albert.

Indicators used to assess impacts of the Project on the habitat and ecosystem integrity of the near-shore environment of Lake Albert are changes in ecosystem composition due to water quality impacts. No impacts on representativeness or ecosystem configuration are expected.

12.2.1.1.1 Impact on Ecosystem Composition - Water Quality

The commissioning of the feeder pipeline will involve cleaning of debris and mill scale from the inside of the pipe, typically using a train of pigs driven by water. The pigs include wire brushes that remove the debris on the pipe walls. This is followed by pressure testing with water (hydrotesting), which is a way of checking that all of the pipes and welds can withstand the pressures under which they will be operated. The current proposal is to fill the pipeline with approximately 2,400 m^3 of water, sourced from Lake Albert. The entire line can be tested in one section. Best practice is to minimize the residence time of the water in the pipe in order to avoid the need for corrosion inhibitors and biocides to prevent corrosion, but this is not always possible and may not be specified for the CNOOC project, although the intention to minimize toxicity of the discharges is specified. After cleaning and hydrotesting, the water will be tested to confirm it complies with the Ugandan effluent standard, passed through sand filters in order to remove solids, and disposed back into Lake Albert. The solids, together with the filter sand, will be disposed to a certified waste disposal site.

To ensure that the requirements for managing the hydrotest waste water are captured in the management and monitoring recommendations, it is assumed that the use of corrosion inhibitors and biocides remains a possibility, notwithstanding the intention expressed in the project description. If not correctly treated, the discharge of these fluids directly to Lake Albert during pipeline construction is likely to result in high-intensity, temporary and localised alteration of the ecosystem composition of the aquatic communities; particularly those inhabiting the near-shore habitats in the vicinity of the outfall (causing mortality to a wide range of aquatic organisms, depending on the product and the concentrations). Modelling of impact is not practical without details of source concentrations and product specifications, but the impact magnitude would probably be medium, of local geographic extent and short duration (once - off). Taking into account the high receptor sensitivity of the Lake Albert aquatic environment, but excluding the possible impact on the endangered mud snail (*G. candida*), which is considered separately in Section 12.2.2.4. The impact significance would be **high medium.**

12.2.1.2 Mitigation and Monitoring

12.2.1.2.1 Hydrotesting and Pipeline Cleaning

- Consider all reasonable measures to avoid the use of biocides and corrosion inhibitors as the preferred solution to hydrotest water management. If these substances must be used, select low-toxicity alternatives.
- If the use of corrosion inhibitors and / or biocides prove necessary, then prior to the release of such hydro-test water a Toxicity Identification Evaluation (TIE) must be undertaken as the basis for final decision-making (Table 12-11).

Given the length that it may take to obtain a result from such toxicity testing CNOOC is encouraged to prepare in advance for this scenario through proactive pre-emptive toxicity testing of water samples that include representative ratios of corrosion inhibitors, biocides or corrosion inhibitors and biocides administered together to establish well in advance the toxicity (if any) of such water so that appropriate plans can be put in place for the handling and disposal of this water should it prove unsafe for release to the receiving environment. Alternatively, that CNOOC are well-informed of the potential toxicity of this water and can amend their plans to avoid the use of such additives should this prove necessary well before the requirement for hydro-testing becomes necessary.

Table 12-11: Steps in a Toxicity Identification Evaluation (TIE)

A TIE consists of three phases. In the first phase the physical/chemical nature of the constituents, which case toxicity is characterised using effluent manipulations and accompanying toxicity tests. Each characterisation test is designed to alter or render biologically unavailable a group of toxicants, e.g. cationic metals, volatile substances, non-polar organic substances etc. Typical sample manipulations for this phase include pH adjustment, pH adjustment/filtration, pH adjustment/aeration, pH adjustment/C_{18} solid phase extraction, EDTA (ethylenediaminetetra-acetate), chelation, and sodium thiosulphate oxidant reduction. The manipulations allow the characterisation of the toxicity causing chemical group, but not the identification of individual toxic chemicals. Aquatic toxicity tests are used before and after each manipulation. With the successful completion of the first phase, toxicants can be provisionally categorised in chemical groups. The second phase of testing can involve toxicant treatability or toxicant identification. Toxicant identification involves several steps, all of which rely on tracking the toxicity of the effluent throughout the analytical procedure. Phase three involves the confirmation of the toxicants responsible for the observed toxicity. The combined results of the confirmation tests area used to provide the ‘weight of evidence’ that the toxicant has been identified. Once the toxicant has been identified it can be tracked using chemical analyses.

- Undertake the following definitive biotoxicity tests as a part of the TIE;
  - Fish lethality test
  - Daphnia lethality test
  - Algal growth inhibition test
  - Bacterial growth inhibition test
- If necessary, provide lined storage to temporarily contain the wastewater on site before testing and disposal;
- Filter the wastewater through sand filters prior to its release, so as to remove any solids;
- Comply with the recommendations of the TIE for applicable dilution factors and release rates;
- Consider alternatives to the release of the wastewater directly into the lake. Given the extremely high sensitivity of the Lake Albert fishery, and the likely perceptions that could be created if wastewater is disposed into the lake, even if unfounded, there is a material risk of disputes associated with any mill scale or hydrotest discharges into the lake. Alternatives could include irrigation at specified locations on the Flats and above the escarpment; and
- It is a recommendation of the EIA that CNOOC monitor the effect of disposal of hydrotest water through direct observation by an ecologist who will record specifically whether there is any evidence of biological effect of such disposal practices. The ecologist will maintain a written record documenting the date, time and location of hydro-test water release and whether such water contained corrosion inhibitors and/or the biocides, or was free of these chemicals.

While these measures may appear onerous they will provide protection both to the environment and to the developer as they will establish a clear record of the date, time and location of release of hydro-test waters against which to refer in the event of any reported impacts associated with such release.

12.2.1.3 Impact Significance Rating

Table 12-12: Construction phase impacts on the near-shore environment of Lake Albert - habitats and ecosystem integrity

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Ecosystem Composition - Water Quality (discharge of pipe cleaning and hydrotest water)	7	2	2	5	**High Medium 55**	1	1	2	2	**Low 8**

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	4	Permanent	5	International	5	Definite/don't know
8	High	3	Long-term (>6 months)	4	National	4	Highly probable
6	Medium	2	Medium-term (1-6 months)	3	Regional	3	Medium probability
4	Low	1	Short-term (<1 month)	2	Local	2	Low probability
1	Minor			1	Site only	1	Improbable
						0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +. NSI No Significant Impact

12.2.1.4 The Escarpment Vegetation Corridors

This sub-section presents the assessment of impacts that the construction of the feeder pipeline could have on the habitat and ecosystem integrity within the escarpment vegetation corridors of the CHAA and the LSA.

Indicators used to assess impacts of the pipeline were impacts on:

- representativeness;
- ecosystem composition; and
- ecosystem configuration.

These terms are defined in Table 12-13. Loss of habitat due to direct disturbance and clearing associated with the feeder pipeline was quantified by overlaying the pipeline construction footprint onto the current, baseline extent of the escarpment vegetation communities. Additional, indirect, impacts on habitat were estimated by applying a 0.50 km buffer to the footprint of the feeder pipeline. Specifically, the buffer was selected to account for changes in habitat quantity and/or quality that could be caused by edge impacts, fragmentation, sensory disturbance, changes in water quantity and quality, and air emissions and dust.

Changes in habitat composition and ecosystem configuration were assessed by identifying potential changes in species composition that could occur, and the disruption of known corridors. This was accomplished by examining available literature about the ecology of the vegetation communities on the escarpment, and scientific literature about the impacts of human activities on corridors.

Table 12-13: Definitions of impact assessment criteria related to habitats and ecosystem integrity

Impact Criterion	Impact Characterisation
Representativeness	Impact on the uniqueness of the ecosystem. This rarity factor is related to the concepts of irreplaceability (rarity or uniqueness in the landscape) and vulnerability (the degree of threat).
Ecosystem Composition	Impact on diversity and complexity of the ecosystem - what is there and how abundant it is
Ecosystem Configuration	Impact on the linkages between habitats of the same or different ecosystems. Natural linkages provide an important 'playing field' for ecological processes and enable the goal of their persistence. These linkages are in contrast to a highly-fragmented landscape where patches of natural habitat are effectively isolated.

12.2.1.5 Impact on Representativeness

There is approximately 2233.8 ha of untransformed vegetation in the CHAA section of the escarpment corridor, bounded in the east by agriculturally modified landscapes, and in the west by the Buhuka Flats. These communities form part of the wider Murchison Falls National Park-Budongo-Bugoma-Kagombe-Itwara Forest Reserves-Semliki/Toro Wildlife Reserve corridor (Plumptre et al. 2003).

The total area of escarpment vegetation that will be lost due to the direct impact of construction of the feeder pipeline up the escarpment will be 4.1 ha, in a total area of escarpment vegetation in the CHAA of 2233.8 ha (Table 12-14). This amounts to 0.18% of the vegetation in the escarpment corridor in the CHAA, and a minute fraction of the vegetation within the escarpment corridor at a regional scale. The impact is expected to be medium to long term; while rehabilitation of the affected pipeline corridor will occur immediately after construction is completed, the steep and rocky slopes make it unlikely that habitat recovery by plants other than pioneer species will occur in the short term. Whether there is relatively complete habitat recovery will depend largely on the effectiveness of the rehabilitation strategy. If normal construction management methods are used (without a high degree of specialist rehabilitation intervention), full recovery is unlikely. Nevertheless, the small area affected is not expected to materially impact on the representativeness of the escarpment vegetation corridor, either within the CHAA or at regional scale, and the magnitude of this impact is rated as low. Receptor sensitivity is medium, due to the untransformed status of the vegetation and the importance of the escarpment as a part of a wildlife corridor. Overall impact significance will be **low medium.**

Table 12-14: Area of loss of escarpment vegetation due to construction of the feeder pipeline, compared with the area of escarpment vegetation in the CHAA

Vegetation Type	Baseline in the CHAA (ha)	Area affected by pipeline (ha)	% Lost
Dense bushland	1097.6	1.6	0.14%
Dense Wooded Grassland	613.2	1.7	0.27%
Open Wooded Bushland	523.0	0.8	0.15%
Total	**2233.8**	**4.1**	**0.18%**

12.2.1.6 Impact on Ecosystem Composition

A 30 m-wide linear corridor through the relatively intact vegetation of the escarpment will create edges that could alter the composition of the ecosystem through which the pipeline traverses (Findlay and Bourdages 2000). The edges open up habitat in areas where it was previously continuous, changing the abiotic conditions (for example, temperature, light, and moisture regimes), with consequent changes in plant species composition. Vegetation clearing for the feeder pipeline could facilitate the introduction and spread of invasive plant species in the escarpment vegetation communities and create a nick point for erosion and subsequent degradation of adjacent vegetation. This impact is expected to reduce over time, as recovery over the pipeline servitude occurs.

For fauna species, the impact on habitat quality and quantity along edges can have either a positive or negative impact (Prevedello et al. 2013, Wellicome et al. 2014). To some extent impacts on fauna may already be occurring. For example, very few medium sized mammals were recorded in the CHAA, and those that were recorded tended to be thicket and dense bushland specialists, such as bushbuck and duiker. The low populations and diversity of these species could also be a reflection of increased pressure for bush meat from the local human population, which has increased markedly over the last ten years (AECOM 2012) and particularly since the construction of the escarpment road into the Buhuka Flats. It is expected that the existing trends in this regard will further increase once people become aware that project construction is imminent.

Overall, pipeline construction impacts on ecosystem composition of the escarpment vegetation corridors are likely to be of local geographic extent and long term. Impacts will be partly reversible, assuming rehabilitation after pipeline construction. Recovery to primary levels of succession would be expected in the short term, with further recovery in the medium and long term dependent on the level of specialist intervention. Unmitigated impact magnitude will be medium, which combined with medium receptor sensitivity, and the potential for exacerbation of regional effects on the diversity and complexity of the escarpment vegetation corridor, will result in impacts of **high medium** significance This rating reinforces the study team’s view that for habitat recovery to improve beyond the stage of primary succession, a high degree of management intervention will be necessary during and after construction.

12.2.1.7 Impact on Ecosystem Configuration

The wider Murchison Falls National Park-Budongo-Bugoma-Kagombe-Itwara Forest Reserves-Semliki/Toro Wildlife Reserve corridor is recognised as being important for threatened species in the face of climate change adaptation (Ayebare et al. 2013), and as part of a much broader set of corridors running the length of the Albertine Rift. In the southern portion of the eastern shores of Lake Albert, in the vicinity of the Project, this corridor is very narrow compared to its extent elsewhere, and is recognised as being important for savannah species (Plumptre et al. 2010).

The corridor is recognised as an important refuge for a range of threatened species that could be affected by climate change in the future, and hence it will become increasingly important over time (Ayebare et al. 2013). However, indications are that populations of highly mobile wildlife within the study area, which may depend on the corridor, are not substantial, being severely depleted due to subsistence hunting and surrounding habitat destruction. Apart from birds, the species that could utilise the escarpment corridor, such as large ungulates, predators and primates, are very rare in the area.

The clearing of vegetation and trenching for the pipeline will result in a temporary barrier to the movement of species, due to the nuisance associated with the operation of heavy equipment and the physical restrictions caused by the trench. This will temporarily reduce the value of the escarpment as a wildlife movement corridor. After construction is completed, the trench will be backfilled and there will be no ongoing activity along the corridor, other than post-construction rehabilitation management. Hence, other than in the short term during construction itself, when construction vehicles, personnel and equipment will discourage species from crossing the construction right of way, the completed pipeline is not expected to materially influence the movement of species along the corridor.

Impacts will therefore be short term, reversible and of low magnitude, which combined with medium impact sensitivity, will result in impacts of **low medium** significance.

12.2.1.8 Mitigation and Monitoring

The proposed mitigation and monitoring incudes specific measures related to the escarpment vegetation corridor and more general measures that are applicable to the whole pipeline route.

Specific Measures Related to the Escarpment Vegetation Corridor

- Prepare a detailed method statement for the construction and rehabilitation of the pipeline in the steep section of the escarpment vegetation corridor. Such method statement should be prepared by the appointed contractor and should be signed off as acceptable by CNOOC prior to commencement of work. The method statement is to address the following:
  - Pipeline construction activities, workers, machinery and laydown areas must be restricted to the 30 m right of way to minimize land-take, habitat loss and soil erosion.
  - Access restrictions (to minimise habitat disturbance to the absolute minimum for safe construction).
  - Topsoil stripping and stockpiling (to be stripped to recover as much as possible as a basis for effective rehabilitation and located in safe temporary storage area).
  - Blasting restrictions and management (to minimise blast rock damage).
  - Rock spoil disposal (to be located above the escarpment in an area where there is least additional habitat damage).
  - Trench breakers (to prevent sub-surface channelling of water down the trench).
  - Topsoil reinstatement.
  - Drainage control berms and other erosion control measures.
  - Rehabilitation of the buried pipeline as construction progresses. Grass cover should be re-established as a priority, using suitable indigenous pioneer species that will establish cover quickly. Well-established grass cover will provide erosion protection.
  - Monitoring and maintenance.

General Measures Related to the Pipeline as a Whole;

- Footprint and Infrastructure;
  - Monitor bush clearing to ensure that clearing for the construction right of way does not exceed the specified width of 30 m.
  - Avoid small areas of sensitive habitat (such as large indigenous trees) by micro-adjustments to the pipeline alignment, once the centreline is pegged. Decisions in this regard should be informed by a competent ecologist.
  - Plan construction access roads to minimise their total length. Limit vehicle access to the construction right of way and other existing road networks, wherever feasible.
  - Establish any lay-down areas that are not within the 30-m construction right of way well away from the Bugoma CFR.
  - Enforce measures to ensure that poaching for bushmeat is prevented.

  - Compile a photographic georeferenced pre-construction, construction and post-construction record of the entire alignment.
- Physical Hazards;
  - Restrict vehicle speeds on roads.
  - Use buses to transport workers, where possible, to minimize traffic.
  - Restrict construction traffic to daylight hours, except in cases of emergency, to reduce the risk of animal mortality.
  - Install under road crossing structures (for example, culverts) suitable for amphibians and small reptiles, along any sections of the construction access road that will be in use for the duration of the construction period in order to reduce road mortalities and improve habitat connectivity.
  - Minimise the length of open trench. Monitor open trenches daily (in the early morning) and remove animals trapped in the trench.
- People Management;
  - Preferentially hire from the local communities to minimise regional human population growth and the associated increase in human encroachment into valued component habitat and direct mortality from illegal hunting.
  - Prohibit hunting or collection of flora and fauna by staff and/or contractors.
  - Prohibit project personnel from access to the lake shore, the escarpment area outside of the construction right of way and the Bugoma Central Forest Reserve.
  - Control the spread of diseases and pests by proper cleaning, disinfecting, and/or sterilizing of vehicles and equipment. To this end, for example, CNOOC must implement widely accepted protocols aimed at minimising the risk of transmitting amphibian chytrid fungus disease in/or around the Project site on footwear, vehicles, field equipment.
  - Undertake mandatory environmental induction training for all workers and contractors that highlights conservation issues and species-specific sensitivities. Update this training regularly by means of tool box talks for contract personnel.
- Noise;
  - Mitigate noise in accordance with requirements to minimize human nuisance. This will benefit animals equally (refer to Section 12.1.4).
  - Limit hours of construction to avoid impacts on nocturnal species.
  - Train all personnel, and vehicle and equipment operators in particular, to minimize unnecessary noise.
  - Monitor noise impact on wild animals near the construction right of way. Should the ESO find previously unidentified sites of high sensitivity within 200 m of the construction right of way (e.g.: breeding sites of raptors, bat roosting sites), introduce specific measures to manage noise, vibration and other nuisance.
  - Minimise higher frequency noises, where possible.
- Light;

  - Enforce the prohibition on night time work along the pipeline right of way, except in cases of emergency. Should night time work prove necessary, appropriate approval from the appropriate authorities will need to be secured, and the local population informed of the need for such work.
  - Use the minimum number and brightness of lights required for safety at the construction camp. Use of movement-activated boundary lighting rather than continuous lighting is recommended.
  - Use narrow spectrum bulbs to minimise the range of species affected by lighting (for example, longer wave length red or yellow bulbs rather than "natural" or white light).
  - High-level, high-intensity lighting must be avoided unless there is a strong safety case and motion sensor control should be considered to reduce anthropogenic light to a minimum;
  - Artificial lighting must be positioned so that the extent of light emissions beyond the site boundary is minimised e.g. direct lighting downwards and inwards towards site and avoid up-lighting of structures; and
  - Community awareness of lighting requirements should be carried out.
- Rehabilitation;
  - Strip topsoil to a depth of 300 mm along the construction right of way and at the personnel camp and any laydown areas unless otherwise instructed by the ESO. Train dozer operators to strip topsoil to the specified depth and separately stockpile it from subsoil. Monitor topsoil stripping depth to ensure compliance with the specification.
  - Remove and destroy any invasive alien vegetation encountered along the construction right of way.
  - In the event that rock is excavated from the pipeline trench, which cannot be returned into the trench, identify a suitable rock spoil area that minimizes damage to natural habitats.
  - Ensure slight mounding over the pipeline trench with backfill and topsoil to allow for settlement over time and to avoid channelling of storm water along the pipeline trench.
  - De-compact the construction right of way and reinstate topsoil from the stockpiles after construction is complete. Implement sequential topsoil restoration as quickly as possible after the pipe is laid in order to minimize erosion risk and to encourage rapid rehabilitation from the natural seed beds in the soil.
  - Remove all foundations and other buried and surface infrastructure from the construction camp and laydown areas. Remediate any contaminated soils. De-compact subsoils and replace topsoil.
  - Decontaminate any hydrocarbon-contaminated soils using bioremediation.
  - Prepare a method statement for active rehabilitation measures in any areas where slope or other factors may prevent recovery of a stable vegetation cover from the natural seed beds in the soil. This may include seeding with locally indigenous grasses and various forms of slope protection.
  - Monitor rehabilitation in areas where cultivation is not re-established. Develop a programme for management and removal of any alien invasive weeds.
  - Establish (prior to construction) an environment fund specifically intended for continued restoration of the area after the warranty period of the EPC contractor has expired.
- Dust; and
  - Develop and adhere to airborne pollutant critical load benchmarks (see Golder Associates 2014g) for terrestrial and/or aquatic system impacts for the Project.

- Use dust control methods to minimize impacts on plant and animal species adjacent to the right of way. Measures are to include, as necessary, covers, water suppression, or increased moisture content for open materials stock piles; and water suppression along the construction access roads (refer to Section 12.1.1).

- Waste.
  - All waste is to be managed in keeping with the CNOOC waste management plan, recycled where possible and the balance disposed of by a licensed waste contractor at an appropriately licensed facility in keeping with the hazard class of the waste material.

12.2.1.9 Impact Significance Rating

Table 12-15: Construction phase impacts on the escarpment vegetation corridors

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Representativeness	4	2	2	5	Low Medium 40	2	2	2	2	Low 12
Ecosystem composition	6	2	3	5	High Medium 55	2	2	2	3	Low 18
Ecosystem configuration	4	2	2	5	Low Medium 40	2	2	2	3	Low 18

KEY

Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	4	Permanent	5	International	5	Definite/don't know
8	High	3	Long-term (>6 months)	4	National	4	Highly probable
6	Medium	2	Medium-term (1-6 months)	3	Regional	3	Medium probability
4	Low	1	Short-term (<1 month)	2	Local	2	Low probability
1	Minor			1	Site only	1	Improbable
						0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +. NSI No Significant Impact

12.2.1.10 Wetlands and Drainage Lines

12.2.1.10.1 Impact on Representativeness

The CHAA supports approximately 1157.9 ha of wetlands / seasonal wetlands of which 85.3 ha are classified as seasonal. In addition, 840 ha is associated with drainage lines and riparian areas.

Figure 12-4 shows the location of wetlands and drainage lines affected by the pipeline route. Table 12-16 quantifies the impact of the pipeline on the CHAA wetlands and drainage lines, based on the area of physical disturbance during construction. Approximately 2.6 ha of wetlands, seasonal wetlands and riparian habitat along drainage lines will be directly affected, which is 0.13% of the total area of similar wetland and riparian habitat in the CHAA. Direct impacts on impacts would arise from disturbance to sensitive riparian habitat from construction of access roads, working along stream banks, wetland crossing, buffer areas, there is likely potential contamination from hazardous material storage and impacts on flow connectivity from use of fill material to provide footing for construction erosion impacts on wetlands from construction activities. Further indirect impacts could result from edge effects and channel incision, affecting downstream wetland function. Nevertheless, the geographic extent of impact will be local, impacts will be short term and reversible (subject to reasonable construction management), impact magnitude will be low and overall impact significance in relation to representativeness will be **low medium**. Careful construction management in the seasonal wetlands is likely to reduce the magnitude of the impact to negligible, and the overall impact significance to **low**.

Table 12-16: Area of wetland habitat and riparian impacted along the 30 m wide pipeline construction right of way

Habitat	Area in the CHAA (ha)	Area in the 30m-wide pipeline corridor (ha)
Cultivation and Settlement	31860.9	108.9
Dense Bushland	1097.6	1.6
Dense Wooded Grassland	613.2	1.7
Open Bushland and Shrubland	2896.3	14.9
Open Grassland	568.5	3.1
Wooded Grassland	184,3	3.9
Open Wooded Grassland	1900.9	0.8
Riverine Woodland and Bushland (riparian habitat along drainage lines)	74.8	0.0
Riverine Bushland (riparian habitat along drainage lines)	640.3	1.6
Seasonal Wetland	85.3	0.6
Permanent Wetland	83.8	0.0
Wetland	1072.6	0.4

12.2.1.10.2 Wetland Structure

Buried pipelines crossing rivers and wetlands do not obstruct surface water flow. The risk to wetland function is mainly due to the disruption of wetland vegetation and soils by heavy machinery during construction, particularly when tracked vehicles are used that have greater impact on soil structure and the soil profile is overturned due to careless construction management. Disruption of flows and ecosystem composition may also occur if fill material is imported into the wetland to provide stability for excavators and pipe layers, and is not completely removed and replaced with the natural soils after construction.

Faunal composition in the wetlands could be affected both by changes in wetland function, due to drying out, and due to nuisance. Species such as the Grey Crowned Crane, when foraging in the local area, may be driven away while noisy construction activities take place. Again, impact magnitude is likely to be low given the short period of exposure and the small area of wetland affected. It is also noted that while there is suitable habitat for the Grey Crowned Cranes along the pipeline route, the only area they have been observed by the study team has been on the Buhuka Flats (impacts on the cranes are discussed in more detail in Section 12.2.2.1). Downstream channel incision is a risk where construction management through the wetlands is poor, which may result in a loss of wetland function due to the drying out of areas where seasonal inundation occurs. The vegetation within the seasonally flooded grasslands in the study area is adapted to seasonal inundation and is dependent upon wet and dry cycles for survival. In the absence of seasonal inundation, the species composition will gradually change to species that prefer dry land. These impacts are expected to be long term but of very localized geographic extent, given the small area affected, and the magnitude of impact is considered to be low. Combined with high receptor sensitivity, the overall impact significance will be **high medium**.

12.2.1.10.3 Impact on Ecosystem Composition - Water Quality (Sedimentation and Oil Pollution)

Increased sediment loads are likely to result from construction through the seasonal wetlands and small streams along the feeder pipeline route. Generally, these loads will occur during short periods when initial vegetation clearing takes places and earthworks are established (with associated flume pipes where the wetlands cross a drainage line); and when these are removed after the pipeline has been laid. If there is significant seepage into the trench from the surrounding wetlands during construction, the sediment-laden water may be pumped out, either into the fringing wetlands or into the drainage line. Equipment working in the wetlands may contribute small quantities of oil into the aquatic environment as a result of leakages or spills.

While high concentrations of sediment may be generated during excavation through the wetlands, this will be very localized and occurs over a short period of time, probably not exceeding a few weeks per crossing in the present case. Wetland plant species are generally tolerant of occasional increases in sediment load in storm water flows and can serve as an effective sediment filter. In cases of severe and/or ongoing sediment loading, detrimental impacts on wetland vegetation and macro-invertebrates would be likely, which could detrimentally affect wetland processes and functions and, in turn, wetland composition at a localised scale. Impact magnitude is expected to be medium; in the context of the high sensitivity of wetland environments, will result in impacts of **low medium** significance.

Hydrocarbon spills will only occur if insufficient care is taken during construction to prevent them. Impact magnitude will therefore be low, and in the case of hydrocarbons will have a low probability of occurrence. The vulnerability (sensitivity) of aquatic organisms to fuel and oil spills is high, with many species, including juvenile fish and invertebrates such as aquatic snails and mayflies being vulnerable when exposed to these pollutants. Impact magnitude in this case will be medium, which in the context of high receptor sensitivity, will result in impacts of potentially **high medium** significance.

With appropriate construction management, these impacts can all be reduced to levels of **minor** significance.

12.2.1.10.4 Impact on Ecosystem Configuration

Construction activities through the small wetlands and drainage lines along the pipeline route may act as a barrier to the movement of wetland and aquatic species. This impact will be localized, short term and reversible, subject to the avoidance of permanent structural damage at the crossing points. Specific management measures may be necessary to ensure that permanent damage does not occur, such as changes in hydrology and drying out of downstream sections of the wetland, and edge effects, all of which can result in habitat fragmentation.

Taking into consideration the very localized geographic extent of construction through the wetlands and small drainage lines (see Table 12-16), and the intensive cultivation in all of the surrounding areas, as well as the fact that the pipeline will be buried, the magnitude of impact is considered to be low. However, the effects on ecosystem configuration of wetland habitats may be permanent. Combined with the high sensitivity of wetland and aquatic environments, the overall impact on wetland and drainage line configuration, without mitigation, is expected to be of **high medium** significance. This suggests that project-specific measures will be necessary to minimize the impacts of construction equipment operating in the wetlands and drainage lines.

12.2.1.10.5 Impact of Human In-Migration

Indirect impacts on wetlands could occur as a result of the migration of people into the CHAA in search of work on the construction contract. Existing sanitary conditions in the CHAA are poor, with all of the streams being contaminated with faecal waste from both animals and humans. Increasing population pressures will exacerbate these conditions and further grazing pressure and erosion from denuded areas around expanding settlements will increase erosion and sedimentation in the wetlands.

It is difficult to distinguish between in-migration in response to the construction of the feeder pipeline versus that associated with the project as a whole. The impacts on wetlands and riparian vegetation across the Flats and above the escarpment will be through reductions in sanitary water quality, exacerbation of wetland erosion, increased harvesting of plant species used for traditional home construction, increased fire frequency, increased grazing pressure and pressure on capture fisheries as well as hunting for wild animals. The effects will be irreversible and long term (assuming that migrants are unlikely to leave after construction is completed). Assuming also that the pipeline construction will not generate many migrants, compared to the production facility, the impact magnitude will be medium, which in the context of the high wetland sensitivity, will result in impacts of **high medium** significance, prior to mitigation. This issue is discussed further in Section 7 on the production facility and in the Cumulative Assessment in Volume 5.

12.2.1.11 Mitigation and Monitoring

The following mitigation and monitoring is recommended:

- Follow the principle of avoidance of locally sensitive riparian habitat (such as large indigenous trees) by micro-adjustments to the pipeline alignment, once the centre line is pegged. Decisions in this regard should be informed by a competent ecologist;
- Plan construction access roads to minimise their total length. Limit vehicle access to the construction right of way and other existing road networks, wherever feasible;
- Compile a photographic record of stream bank condition; and measures to prevent creation of temporary waterbodies that could increase water-related diseases;
- Cross rivers and wetlands, wherever possible, in the dry season. Minimise the handling of wetland soils with heavy tracked equipment to the greatest extend possible;
- Locate all stockpiles, laydown areas and temporary construction infrastructure at least 50m from the edge of delineated wetlands and riparian zones;
- Prohibit the storage of oils, fuel or other hazardous materials within 100 m of delineated wetlands and riparian zones;
- Where necessary, maintain flow connectivity in wetlands and watercourses during the construction phase by temporarily diverting flow around the construction area;
- Install erosion prevention measures prior to the commencement of construction activities at wetland/riparian zone crossings. Measures may include low berms on approach and departure slopes to crossings to prevent flow concentration, sediment barriers along the lower edge of bare soil areas, sediment curtains in the stream channels immediately downstream of construction and re-vegetation of disturbed areas as soon as possible;
- Where fill material is introduced into the wetlands and drainage lines to provide footing for construction vehicles, ensure that it is all removed after construction; and
- Prepare a method statement covering all aspects of construction in the wetlands and drainage lines. This is to include:
  - Access requirements and approach.
  - Proposed drainage requirements in the event that stream flow is encountered.
  - An itemised list of equipment that will be used.
  - Provision for sediment barriers in the form of berms and/or indigenous silt fences made from geotextiles and/or indigenous grasses.

  - Measures to reinstate soils, subsurface material and natural ground contours. In the event that impermeable layers are penetrated by excavation of the trench, these must be reinstated.
  - Measures to ensure the continued full reinstatement of the hydrological functioning of the wetland system during after construction.
  - Measures to ensure that vehicles equipment working in the wetlands (such as pumps) are operated on drip trays or plastic liners.
  - Provision to minimise the risk of hydrocarbon spills.
- Supporting local communities in developing sustainable farming, ecotourism or other activities that provide alternative food sources and income.
- Support scientific studies and monitoring programs aimed at assessing the sustainability of using local resources, as part of Corporate Social Responsibility initiatives.
- Enforcement of a complete ban on wildlife harvesting (hunting/ trapping/ fishing) for all project personnel.
- No personnel and/or contractors allowed beyond footprint of Project.
- Worker and community education programme focussing on the impacts and risks of bush meat hunting (e.g. disease) to be incorporated into the Community Development Plan.
  - Inclusion of a construction camp with mess facilities for locally-hired staff to control food provision. The mess-facility must be the primary means of food provision and employees must be discouraged from using other food sources (e.g. bush meat).

To minimise the risk and impact of migration into the area, the mitigation recommended under Section 12.2.2 ‘Species of Concern’ should be implemented, together with the recommendations set out in Volume 5, Cumulative Impact Assessment. How effective this strategy will be is uncertain and it is not assumed that impact significance can be reduced to minor levels of significance.

12.2.1.12 Impact Significance Rating

Table 12-17: Construction phase impacts on wetlands and drainage lines - habitats and ecosystem integrity

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Representativeness	4	2	2	5	**Low Medium 40**	2	2	1	3	**Low 15**
Ecosystem composition										
- *Wetland structure*	4	5	2	5	**High Medium 55**	2	2	2	2	**Low 12**
- *Water quality (erosion and sedimentation)*	6	2	2	5	**Low Medium 50**	2	2	2	2	**Low 12**

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
- *Water quality (hydrocarbon and chemical spills)*	6	2	3	5	**High Medium 55**	2	2	1	2	**Low 10**
Ecosystem configuration	4	5	2	5	**High Medium 55**	2	2	1	2	**Low 10**
Human in-migration	6	2	3	5	**High Medium 55**	4	2	3	5	**Low Medium 45**

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

12.2.1.13 Impact on the Bugoma Central Forest Reserve (BCFR) (Habitat Impacts)

The Bugoma Central Forest Reserve is a valued environmental component for this impact assessment, in terms of biodiversity. It is one of the last stands of tropical semi-deciduous forest in the region, and also supports known populations of the Endangered Eastern Chimpanzee and range-restricted Nahan's Francolin (Plumptre et al. 2011), potential non-breeding habitat for the Endangered Madagascar Pond Heron (see Section 6.3.3.1), as well as elephants and a host of other threatened and irreplaceable species.

The BCFR is under severe pressure from the human population surrounding it. In 2013, more than 1,500 people were evicted after illegally settling within the forest (Mugerwa 2013), and recent (2016) reports from the area suggest that land-grabs have converted an estimated 8,000 ha of forest to sugar cane plantations. The land cover study shows that effectively all of the area surrounding the forest has been transformed for agricultural and subsistence purposes, and the cultivation is now encroaching on the BCFR boundaries.

The BCFR will not be directly affected by the pipeline construction, which at its nearest point will be at least 1,8 km from the forest boundary. The indirect effects of project-induced migration into the CHAA due to expectations of work on the project construction or induced opportunities have the potential to affect the ecological integrity of the habitats within the reserve, as well as the species of conservation concern that occur within it. If the project chooses to access the project site through BCFR, there is a potential for exposure of sensitive habitats to human activities and impacts to animals to traffic hazards in BCFR.

The scale of the influx of people in search of oil industry and other associated work is uncertain and in relation to the feeder pipeline (as opposed to the whole production facility) will be fairly small. Some heightened risk to the BCFR is likely, due to both increased incursions into the forest reserve for wood harvesting and hunting and encroachment by new settlers. The magnitude of the impact is considered to be low, and would be long term and largely irreversible, which together with the high sensitivity of the natural resource, will result in impacts of **high medium** significance.

12.2.1.14 Mitigation and Monitoring of Impact

Recommendations include the following:

- Implement the measures to minimize migration into the area recommended in the Influx Management Strategy and Framework Plan for the project. While the measures may reduce the amount of induced settlement, it is unlikely that in-migration could be fully halted; and
- Increase monitoring of population changes in the RSA and, in particular, any incursions into the BCFR by settlement or people harvesting natural resources. A strategy for this initiative is discussed in further detail in Chapter 17, Cumulative Impacts.
- CNOOC will probe materials sources for products brought to their sites by suppliers. Timber and food products will be rejected if they are obtained from sensitive protected areas, especially in BCFR
- No food grown or product made on degraded forest, wetland, river bank or lake shore land will be consumed by the project. Site visits to sources of these products consumed by the project will be undertaken by the CNOOC environment & procurement team prior to processing orders.
- The Bugoma Central Forest Reserve (Bugoma CFR) is widely recognised as a biodiversity hotspot and constitutes a network and corridor for critical biodiversity sites in Uganda. The R5 must be de-listed from the proposed oil road upgrades and CNOOC must use the P1 as the major haul road during the construction phase and, if upgraded in time, the R7.
- Limit vehicle speeds to 40 km/h along the P1 road in the section from Mpanga to Nsozi.
- Monitor vehicle speeds and fine drivers who do not comply with the speed limit.
- Prohibit transport of construction materials near the forest at night.
- Widen the P1, where necessary, on the non-forest side of the road to minimise forest habitat loss.
- Ensure that all EPC contract transporters are fully aware of the risks to wildlife in the Bugoma Forest.
- Implement the mitigation set out in relation to habitats and ecosystem integrity and for the Bugoma CFR to reduce further loss, fragmentation and degradation of habitat.
- Large, mature buttressed trees that constitute suitable nesting habitat for Nahan's Francolin should be avoided during vegetation clearance works for the P1 road upgrade.
- Implement measures to minimise impacts on Nahan's Francolin abundance and distribution, and reproduction and survival in the CHAA, particularly those arising from sensory disturbance caused by human presence and mechanical noise generated during construction activity associated with the P1 road upgrade activity. These should include restrictions in operating hours for heavy machinery, use of low-pitched reverse alerts, and restriction of access for road construction workers to areas beyond the road upgrade right of way.
- Develop and implement a long-term research and monitoring programme to improve understanding of the behaviour and status of Nahan's Francolin in Bugoma Forest (this recommendation is developed further in Chapter 17 of the ESIA, Cumulative Impacts).
- Support the government in enforcement of existing government forestry policies in Uganda

- Implement measures to minimise impacts on Eastern Chimpanzee abundance and distribution, and reproduction and survival in the CHAA, particularly those arising from sensory disturbance caused by human presence and mechanical noise generated during construction activity associated with the P1 road upgrade activity. These should include restrictions in operating hours for heavy machinery, use of low-pitched reverse alerts, and restriction of access for road construction workers to areas beyond the road upgrade right of way.
- Develop and disseminate community education programmes on Eastern Chimpanzee habitat conservation, and prevention of illegal trade in wild animals for live trade and bushmeat, in liaison with existing Eastern Chimpanzee conservation programmes (e.g. Jane Goodall Institute Uganda's environmental education programme).
- Develop and implement a long-term research and monitoring programme to improve understanding of the behaviour and status of Eastern Chimpanzee in Bugoma Forest (this recommendation is developed further in Chapter 17 of the ESIA, Cumulative Impacts).
- Support the government in enforcement of existing government forestry policies in Uganda..

12.2.1.15 Impact Significance Rating

Table 12-18: Construction phase impacts on the Bugoma Central Forest Reserve (BCFR)

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on habitats and ecosystem Integrity	4	4	4	5	**High Medium 60**	4	4	4	4	**Low Medium 48**

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

12.2.2 Species of Concern

12.2.2.1 Impact on the Grey Crowned Crane

The Grey Crowned Crane is an endangered species and triggers Tier 2 Critical Habitat under Criterion 1. Up to 14 individuals were regularly recorded on the Buhuka flats during baseline surveys, and a pair of Grey Crowned Crane was observed on the Flats during the social baseline survey work conducted in November 2017. The local population of Grey Crowned Crane is thus regarded as highly sensitive, and the wetlands of the CHAA are considered an important conservation unit for the species.

The potential direct and indirect impacts of the construction of the feeder pipeline on the Grey Crowned Crane are presented below. Indicators used to assess construction impacts were habitat quantity and quality, habitat connectivity, abundance and distribution, and survival and reproduction:

- Habitat loss due to direct disturbance and clearing of habitat was assessed by calculating the loss of suitable habitat from the CHAA as a result of the construction of the feeder pipeline, consisting of a 30m construction right of way. Changes to habitat quality due to disturbance were estimated by applying a 200 m buffer to the pipeline footprint. Specifically, the buffer was selected to account for changes in habitat quantity and/or quality caused by disturbance arising from noise, vibration, and edge effects;
- Habitat connectivity impacts were assessed by identifying potential barriers to movement and loss of corridors. This was accomplished by visually examining the spatial distribution of critical habitat for Grey Crowned Crane in relation to the feeder pipeline so as to qualitatively identify areas where habitat becomes fragmented; and
- Abundance and distribution and survival and reproduction impacts were assessed qualitatively by considering changes in disturbances (that is, vehicle traffic, light, noise, vibration) and site clearing activities. Direct interference by construction workers was taken into account. These disturbances were considered in light of known or inferred effects on the survival and reproduction of the Grey Crowned Crane, where data on these types of effects were available. The indirect threat caused by migration of people into the area in search of work was also considered.

12.2.2.1.1 Habitat Quality and Quantity

The Grey Crowned Crane is distributed across eastern and southern Africa. Populations in many areas including Uganda have experienced rapid declines during the past 45 years (BirdLife International, 2018) for reasons including habitat loss to farming, human presence causing disturbance, collection of chicks for domestication, disruption of breeding activity, loss of roosting sites (large trees located remotely from areas frequented by humans) and dry-season fires in wetland habitats (Olupot, 2014). Its habitat preferences are diverse, including wetlands with tall emergent vegetation, open riverine woodland, shallow flooded plains and temporary pools with adjacent grasslands, open savannas, croplands, pastures, fallow fields and irrigated areas (Archibald et al, 2018). It prefers short to medium height open grasslands adjacent to wetlands for foraging, which is consistent with the seasonally flooded grassland wetlands in the Buhuka Flats. For breeding, it prefers marshes with water 1 m deep and emergent vegetation 1 m above the water (Archibald et al, 2018); habitat which corresponds with the permanent wetlands of the Buhuka Flats.

The Grey Crowned Crane can tolerate some human disturbance in areas where it forages (e.g. subsistence and commercial farming practices). In Ugandan wetlands it has been found to be intolerant of human proximity within 100-200 m (Olupot, 2014), flying away on approach; a factor which also affects breeding success as breeding birds flush from nests on approach, causing increased rates of predation, reduced time at the nest (either incubating or feeding), and ultimately nest abandonment. How tolerant foraging/roosting/breeding Grey Crowned Crane may be to indirect disturbances, such as industrial noise, light, vibration and edge effects, is not known, but a 200 m buffer should be assumed as a minimum requirement for impact reduction.

Most of the habitat along the pipeline route is suitable for foraging cranes, including the Buhuka Flats and the extensive cultivated lands above the escarpment. The direct impact of the construction of the pipeline on any cranes foraging in this habitat will be short term, reversible and highly localized, affecting a small fraction of the total available habitat in the CHAA. Small areas of seasonal wetland (approximately 1 ha) will be temporarily affected, but no permanent wetlands suitable as breeding sites will be within the 200 m buffer zone on either side of the construction right of way. The magnitude of direct impact will be low, which in the context of the high receptor sensitivity of the endangered crane, will result in impacts of **low medium** significance. Following the application of appropriate mitigation measures, the magnitude of the impact is expected to remain low, but the likelihood of impact will be reduced; therefore the impact significance will be reduced to **low.**

12.2.2.1.2 Habitat Connectivity

The construction of the feeder pipeline is unlikely to act as a barrier to the movement of Grey Crowned Cranes. The birds are highly mobile and temporary construction nuisance along the pipeline corridor will cause impacts of low magnitude and low significance. With mitigation, the impact magnitude is expected to be negligible.

12.2.2.1.3 Abundance and Distribution

Up to 14 individuals of Grey Crowned Crane were frequently observed on the Flats during the baseline fieldwork conducted in 2014, and a pair were observed in the same area during social baseline fieldwork conducted in November 2017. No cranes have been observed along the pipeline route above the escarpment although the habitat is suitable for the cranes' foraging.

Pipeline construction is unlikely to affect the abundance and distribution of the cranes in the CHAA. Nuisance-related impacts would occur in a narrow buffer zone along the pipeline, probably not exceeding 200 m on either side of the right of way. Impact magnitude is expected to be minor, and the overall impact significance will be **low.**

12.2.2.1.4 Survival and Reproduction

The formation of breeding pairs of Grey Crowned Cranes on the Buhuka Flats was observed during the baseline fieldwork conducted in May 2014. Grey Crowned Crane nests are typically constructed within or on the edges of marshes with water 1m deep and emergent vegetation 1m high (BirdLife International, 2018). Impacts on survival and reproduction of the cranes could be caused by direct loss of wetland habitat and by nuisance during breeding, causing the birds to flush from their nests (refer to Olupot, 2014), with increased rates of predation, reduced time at the nest, and ultimately nest abandonment, affecting reproductive success. Breeding success may also be affected by direct mortality of breeding birds while foraging in surrounding areas or by removal of chicks from the nest for sale (a known practice).

Most of these impacts are unlikely as a direct result of the feeder pipeline construction. The pipeline is remote from the permanent wetlands on the Buhuka Flats and above the escarpment. No areas of suitable breeding habitat will be directly affected by construction activities within the construction right of way or by the 200 m buffer zone, or at the construction camp. Nevertheless, there is a risk that construction workers could harass or hunt cranes foraging in proximity to the construction right of way, particularly if there is insufficient training of construction teams in this regard. It is also possible that chicks could be removed from nesting sites by construction workers, if the locality of any nests becomes known. Overall, the magnitude of the risks is considered to be minor, given the distance of the construction sites from wetland areas suitable for nesting. In the context of the endangered status of the crane (high receptor sensitivity) the impact significance will be **Low Medium** prior to mitigation**.**

Indirect Impact due to In-Migration

Indirect impacts of migration into the area by people in search of work may affect the breeding success of the Grey Crowned Crane. On the Buhuka Flats, separation of the indirect impacts of the pipeline construction and the remainder of the construction of the production facility is difficult. Since the pipeline is only a small component of overall construction on the Flats, this impact has been considered under the production facility (Section 7). Above the escarpment, migration into the area due to expectations about work on the construction projects could result in increased settlement in the CHAA. In the vicinity of the areas of permanent wetland, this could cause greater pressure on natural resources, including harvesting of reeds and an increased threat of discovery and removal of crane chicks for sale. Impacts would be long term (permanent settlement), of local geographic scale and irreversible. The likelihood of impacts is uncertain (it is not known whether there are any breeding pairs of the crane in the permanent wetlands of the CHAA above the escarpment and the extent of migration into the area cannot be determined with certainty). Overall, impact magnitude is considered to be medium, which in the context of the high level of threat to the Grey Crowned Crane (endangered), and the high receptor sensitivity, the impact significance, without mitigation, will be **Low Medium.**

12.2.2.2 Mitigation and Monitoring

The following impact mitigation and monitoring is recommended:

- Implement the mitigation set out for wetlands under Section 12.2.1.3 to reduce further loss, fragmentation and degradation of habitats; and
- Implement measures to minimise impacts on Grey Crowned Crane reproduction and survival in the CHAA. Measures should include the following:
  - Prohibit CNOOC staff and construction subcontractors from entering areas beyond the construction right of way and approved access roads.
  - Develop contractor education programmes regarding the Grey Crowned Crane to prevent the occurrence of incidents involving harassment or hunting of the birds, or capture and sale of chicks if found during construction activities. These programmes should be applicable to all staff at induction and to working teams (as tool box talks) during the course of construction.
  - Develop and disseminate community education programmes on Grey Crowned Crane habitat conservation, prevention of illegal trade in wild birds and chicks, and prevention of incidences of poisoning.
  - Support the development and implement a of a long-term research and monitoring programme to improve understanding of the behaviour and status of Grey Crowned Crane in the CHAA (this recommendation is developed further in Volume 5; Cumulative Impacts).
  - Develop measures to discourage and monitor migration into the area. This recommendation is to involve the Government and CNOOC (and possibly other oil industry players, as a part of an overall cumulative impact management strategy - see Volume 5).

12.2.2.3 Impact Significance Rating

Table 12-19: Construction phase impacts on species of concern – the Grey Crowned Crane

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat quality and quantity	4	2	2	5	Low Medium 40	2	2	2	3	Low 18
Habitat connectivity	2	3	2	4	Low 28	1	3	2	3	Low 18
Abundance and distribution	2	3	2	4	Low 28	1	3	2	3	Low 18
Survival and reproduction	2	3	2	5	Low Medium 35	1	3	2	3	Low 18
Indirect impact due to in-migration	3	4	2	5	Low Medium 45	2	4	2	5	Low Medium 40

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

12.2.2.4 Impact on the Mud Snail

The Mud Snail (*Gabbiella candida*) is a Critically Endangered and range restricted species. Currently, the only known populations occur around Butiaba, which is on the eastern shore of Lake Albert approximately 90 km north of the LSA. Although this species was not confirmed within the CHAA in the baseline studies for the project, there is a likelihood that it will occur in the near-shore habitats of the CHAA, based on its known habitat preferences and those of other Mud Snail species (*Gabbiella* spp.). Hence, a precautionary approach has been adopted, and *G. candida* is assumed to occur in the near-shore habitats of the CHAA.

No habitat loss due to direct disturbance and clearing of habitat is expected during construction of the feeder pipeline, as these habitats lie outside that portion of the LSA. It is unlikely that construction of the feeder pipeline could alter the habitat connectivity of the near-shore habitats in the CHAA. Impacts are limited to the effect of the discharge of pipe cleaning and hydrotest water into Lake Albert and subsequent effects on habitat quality. The assessment of changes to habitat quantity and quality has concentrated on the prediction of changes to water quality due to these activities.

12.2.2.4.1 Pipe Cleaning and Hydrotesting

The concentrations of pollutants in the lake waters of the near-shore habitats of Lake Albert are within the normal range of water quality suitable for aquatic life; and the water supports healthy aquatic communities. Despite the large buffering capacity of Lake Albert, the proposed discharge of cleaning and hydrotest water from the feeder pipeline into Lake Albert could report to the near-shore habitats of the CHAA, with consequent effects on the Mud Snail. Aquatic snails are highly sensitive to chemical pollutants (Araujo et al. 2012) and would probably be severely affected by the toxic compounds associated with biocides and corrosion inhibitors. Depending on plume dispersion, mortality of snails is likely, (an impact of high intensity). Although the discharge will be short term (a once-off discharge), the effects on *G. candida* could be permanent. The effects would need to be considered in an international context, given the globally threatened context. Overall, the potential magnitude of the impact on the mud snail is considered to be high, which in the context of its critically endangered status, will result in an impact significance rating of **high**.

The strict application of the recommended mitigation measures recommended in Section 12.2.1.1 will eliminate the risk of toxicity in the discharged effluent, reducing the magnitude of impact to low and the overall impact significance to **low.**

12.2.2.5 Mitigation and Monitoring

Mitigation of impact is as indicated in Section 12.2.1.1. Monitoring of the mud snails (*Gabbiella spp*. generally and *Gabbiella candida* if found) should be undertaken before during and after construction of the pipeline and disposal of cleaning and hydrotest effluent into the Lake, at locations closest to the discharge point along the shoreline.

12.2.2.6 Impact Significance Rating

The rating of construction impacts on the mud snail, *Gabbiella candida,* is presented in Table 12-20.

Table 12-20: Construction phase impacts on species of concern – the Mud Snail (Gabbiella candida)

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Habitat quality and quantity	8	5	5	5	High 90	2	1	1	2	Low 8

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

12.3 The Socio-Economic Environment

12.3.1 Construction Workforce Related Impacts

This section describes the socio-economic impacts associated with the construction phase of the feeder pipeline.

12.3.1.1 Impact on Employment

12.3.1.1.1 Employment Opportunities

As at April 2018, CNOOC employed 60 Ugandan Nationals, 35 Expatriates and 21 Contractors (as part of the project, engineering and drilling and completion teams). The company's recruitment policy stipulates the procedure according to which professional (i.e. non-casual) and casual appointments are to be made. The casual labour policy reserves at least 60% of casual jobs for local communities in the areas of its operations (there is an undertaking that 100% of casual workers will be sourced from Uganda, with at least 60% from adjacent villages); and this is expected to apply to both the construction and operational phases of the project as well. The CNOOC recruitment policy for casual labour is based on a lottery/raffle system that allows all villagers who apply for work an equal but random chance of being appointed, depending on the number of labour 'slots' or openings available per village. This additional requirement has been introduced to preclude LC1 bias in favour of selected applicants.

Based on its agreements with the Ugandan Government, CNOOC will employ as many local people as possible for semi-skilled and skilled job opportunities. CNOOC has indicated that it will seek to maximise the employment of Ugandans in temporary unskilled and semi-skilled positions during the pipeline construction phase. Twenty skilled positions will be filled by foreign pipeline construction management and technical experts.

Employment will be provided through a selection process that includes all affected villages. In addition, CNOOC's EPC contractor may employ casual workers from the villages around the project for short-term work, like bush clearing. Given the incidental nature of this work, it is not possible to quantify employment numbers at this stage. CNOOC's policy also defines the legal rights of casual labourers in accordance with Ugandan legislation and describes the procedure according to which casual labourers are to be appointed.

Given the population size of villages within the Buhuka Parish as well as villages on top of the escarpment, there appears to be an available workforce. This workforce will be capable of unskilled and some semi-skilled tasks, but a major constraint affecting the local take up of semi-skilled and skilled appointments will relate to a lack of specific education and, to a lesser degree, scarce and critical skills in the oil and gas industry.

Employment creation in the local area and wider region is therefore considered to be an important positive socio-economic impact, but it will be short term and the benefits will quickly work their way out of the economy, limiting the magnitude of impact to low. It will be short term and the benefits will quickly work their way out of the economy, but taking into consideration the need for cash income, the impact significance will be **medium**. With the implementation of the recommended measures to enhance construction employment impacts, the overall significance rating can be increased to **high.**

12.3.1.1.2 Skills Development/Training Opportunities

CNOOC has developed a policy which guides the recruitment and employment process and all contractors and sub-contractors are expected to comply with this policy. CNOOC aims to implement a skills development strategy for their employees to improve the skills of the local labour pool by investing in technical, managerial and administrative skills of the workforce.

Training and skills development will be a positive impact in developing the feeder pipeline construction workforce skills and qualifications and in expanding the human capital available within the local and regional economy. At present, the extent to which the pipeline contractor will be required to implement CNOOC's training policy over the short duration of the construction contract is uncertain and there are practical limitations to what can be achieved within this period. The impact will involve a relatively small number of people, resulting in a rating of medium magnitude, but the benefit will be permanent, and in the context of the great need for skills development in Uganda, the overall impact significance will be **high medium.**

12.3.1.1.3 Layoff of Casual Labour

Layoff of most of the local casual workers hired during construction will accelerate as the construction phase reaches an end. Most of these people will not find employment in the operational phase which has much fewer opportunities for casual workers. This may impact on food security among local families who have become dependent on the income from the lost jobs. This is a well-known problem affecting large construction projects, and has sometimes been accompanied by work stoppages and violent protests, particularly if the terms and conditions of casual employment have not been properly explained to the workers. Without appropriate control, the magnitude of impact could be high, given the vulnerability of the affected workers, and the potential for deteriorating relationships between the company and workers. The residual effects will extend beyond the construction phase into the medium term. The unmitigated impact will be negative and of **high medium** significance.

12.3.1.1.4 Accommodation of the Workforce

In the Basis of Design, CNOOC has made provision for a temporary camp to be built by the EPC Contractor. This camp will provide accommodation for some 200 pipeline - related construction personnel who do not live in the local area. Employees from local villages can continue to live with their families while temporarily employed by the project. Accommodation in the permanent camp will be provided to full time and contract employees who are not locally resident, and visitors.

Appropriate accommodation and catering facilities will be provided for all contract workers living in the contractor's temporary camp and catering will be provided for all workers, including day workers. Accommodation is expected to meet IFC PS1 requirements. The impact will be positive and of **high medium** significance.

12.3.1.2 Employee Health and Safety

Local Ugandan statistics for the causes of injury in the construction industry are not readily available. However, the Labour Force Management Plan for Contractors and Subcontractors (CNOOC, 2015:29) outlines a number of broad categories of oil and gas related workplace hazards. These are:

- Physical hazards that include contact injuries and accidents, UV radiation, falling from height and fire;
- Chemical hazards, in particular related to contact with dangerous chemicals that may lead to various health problems;
- Biological hazards leading to infections and parasitic diseases among workers that are the result of contamination from living organisms or their by-products such as bacteria, moulds, parasites and dust; and
- General hazards, including radiation, noise, vibration and extreme temperature.

These hazards may all be aggravated by specific behaviours, such as working in areas without adequate lighting; carelessness or tiredness affecting attention to the task; inadequate, incorrect, or non-existent use of Personal Protective Equipment (PPE); failure to use rotating machinery with the necessary safeguards, general ignorance of, or failure to follow, recognised and documented safety procedures, dehydration and working on potentially hazardous tasks while alone.

Any of the above hazards and behaviours may lead to occupational accidents, illness or disease that could have chronic consequences, preventing the individual from continuing work. The Rapid Health Impact Assessment (Volume 4, Specialist Study 10, Appendix B) highlights the following issues regarding work - related illness and injuries as important considerations, particularly during the construction phase:

- A significant proportion of the workforce will be sourced from a low skill labour pool and would potentially be unaware of workplace-based health and safety requirements, making them more prone to high risk behaviour and accidents during the construction phase;
- Ugandan labour laws, associated enforcement of health and safety regulations and compensation for occupational injuries and disease lag behind international best practice standards. Disability management and appropriate compensation standards and regulations are limited and are not aligned with IFC and other international standards and requirements; and
- There is a limited emergency response system in the broader study area and indeed district.

12.3.1.2.1 General Construction Safety Impacts

In the context of a pipeline construction project, the safety hazards are more specifically set out in Table 12-21.

Table 12-21: Typical Causes of Health and Safety Impacts by Pipeline Work Category

Site Clearing, Grading and Fencing

- Overhead (large branches) and underground hazards;
- Vehicle-generated dust;
- Poor ground conditions or rough terrain;
- Venomous snakes and insects; and
- Rotating equipment such as chainsaws and angle grinders.

Pipe handling

- Pipe loading and transport, including road use, contractor management, lifting hazards, stockpile pipe falls and pipe falls from height;
- Pipe loadout and stringing, including overhead hazards as a result of lifting, carrying, strapping or rigging, swinging pipes, dropped loads and/or rolling pipes; and
- Pipe bending (and cutting), falls from height, swinging pipes, hot works.

Welding, cutting and tie-ins

- Pipe movement, including falling, swinging or springing pipes;
- Sparks, buffer wires and burns;
- Grinder kickback or broken grinding discs;
- Malfunctioning or poor handling of equipment such as air pressure hoses and oxygen and acetylene torches; and
- Dust, pipe and other particles or weld flash (arc eyes).

Trenching, bedding, padding and backfilling

- Open trenches;
- Trench collapse;
- Overhead and underground hazards;
- Wet, uneven and/or slippery surfaces and associated slips, trips and falls;
- Rotating equipment (crushing of backfill); and
- Snakes, venomous insects and fauna.

Blasting and Field Joint coating

- Abrasive blasting;
- Manual handling of equipment;
- Pressure hazards;
- Equipment failure, malfunction and/or poor handling, including of air pressure hoses;
- Chemicals, fuels, chemical fumes and skin exposure or inhalation; and
- Static electricity, fire / explosions during testing.

In the absence of a highly regulated OH&S environment, with appropriate safety training and a zero tolerance management approach towards unsafe practices, the probability of accidents during the construction phase will be high, resulting in impacts of very high magnitude (disabling or fatal injuries) with potentially permanent consequences and with a **high medium** significance rating. With strict implementation of a high standard of health and safety management, injuries can be reduced to minor non-disabling accidents which are short term and of **low** significance.

Driver and Mobile Equipment Safety

The main causes of accidents involving project - related vehicles and movable equipment on and off site are:

- Failure to drive cautiously and defensively;
- Disregard of speed limits;

- Failure to wear seat belts;
- Use of cell phones while driving;
- Careless driving and/or driving / equipment operation by insufficiently trained personnel;
- Failure to maintain the lights and audible reversing signals on construction vehicles and equipment;
- Night driving; and
- Driver/operator fatigue.

Without appropriate driver training and a zero tolerance management approach towards unsafe practices, the risk of disabling or fatal injuries (very high magnitude) caused by construction vehicles and moving equipment will be high, with a **high medium** significance rating. As in the case of general safety issues, these risks can be minimised by good practice, and injuries can be reduced to minor non-disabling (short term) accidents which are short term and of **low** significance.

Graft & Exploitation

During all phases of the project, CNOOC will need to remain alert to the potential for graft and exploitation that foreign (non-Ugandan) employees and service providers may experience. There have been incidents in which foreigners (particularly Chinese people) have been accosted by the Department of Home Affairs in Hoima, being forced to go to the Hoima Passport Centre to prove that they have work permits in place. People with a relatively poor command of English may feel sufficiently intimidated to offer money to be left alone. Locals keen to find employment have, as well, been subjected to graft and exploitation through unscrupulous role-players who pretend to recruit on behalf of CNOOC. Unsuspecting victims are required to pay a “registration fee” to be included on the recruitment roll. Impacts may affect uninformed locals on the one hand and CNOOC foreign personnel on the other hand and will be of **low medium** significance.

Alcohol and Drug Abuse

Alcohol and drug abuse is often prevalent in construction camps and this spins off into safety in the workplace. As indicated above, the unmitigated risks are highly significant, with a strong correlation between workplace accidents and the use of these substances.

Although there are no specific statistics regarding the impact of substance abuse in the workplace for Uganda, substance abuse has been found to be the third leading cause of workplace violence. Particularly in situations that involve dangerous equipment, locations, or duties, substance abuse can be deadly, and employees that abuse substances are 3.6 times more likely to be involved in workplace accidents than their co-workers (USA Department of Labour).

In the absence of appropriate management and monitoring, the risks of severe (permanent) injury or mortality due to substance abuse will be high, and impact significance will be **high medium**.

Vector-Related Diseases

Malaria in Uganda can have significant negative impacts on worker health and productivity. In the vicinity of the feeder pipeline, there is a paucity of accurate data about vector typology and behaviour, exact prevalence of malaria and indicators related to knowledge, practices and behaviours. This limits the ability to monitor impacts or interventions from a clear point of departure. However, from the data that is available, as set out in the HRIA, the proposed pipeline environment is expected to be a high risk malarial area, supporting numerous breeding sites that are conducive to the promotion of disease transmission. According to the Rapid Health Impact Assessment (RHIA) undertaken for the project, malaria is the most prevalent health concern in the proposed pipeline area, with the disease accounting for 35-54% of all outpatient visits in the study area Health Clinics (Volume 4, Specialist Study 10, Appendix B). Malaria case rates are also described as being on the increase, and that the illness is commonly associated with misconceptions and poor prevention behaviour. There is limited capacity within the proposed pipeline area for the support of malaria and vector control preventive initiatives. The magnitude of malaria impacts on the workforce, without appropriate interventions, will be potentially high, permanent (potentially life threatening), local and of **high medium significance.**

Sexually Transmitted Diseases

The potential spread of sexually transmitted disorders (STDs), including HIV[12]/AIDS, must be regarded as a serious potential impact on the workforce, with the risk of the spread of the diseases due to interaction between construction workers and local communities. Typically, the presence of a large number of well-paid predominantly single males in construction camps encourages sex workers from local communities and further afield, with a resultant risk of the spread of HIV/AIDS and other STDs among construction workers due to unprotected sex. Without a high degree of management, this workforce impact will be long term (depending on the availability of treatment), of very high magnitude, regional scale (spread to other areas when construction worker leave) and **high** significance.

Sanitary and Hygiene-Related Diseases

Maintaining hygienic conditions in a large workforce unaccustomed to requirements in respect of sanitation and hygiene will require ongoing education and management. In addition to the provision of appropriate sanitary facilities for human and food wastes, personal hygiene must be taught and enforced.

Food waste must be disposed of off-site at an appropriately licensed facility by the licensed waste contractor. Importantly, CNOOC must make provision for the collection of food and food packaging waste along the pipeline servitude during the construction period so that indiscriminate littering with such waste does not take place at the dispersed points where construction is taking place at any point in time.

Without proper management in place, outbreaks of diseases caused by poor sanitation and hygiene are highly likely, causing negative health impacts in the workforce and lost man-hours. The magnitude of the impact is potentially high, with local, medium term, effects, resulting in impacts of **low medium** significance.

12.3.1.3 Impact Mitigation and Monitoring

CUL is required to comply with the objectives of the National Oil and Gas policy and legal framework with regard to oil and gas development and benefits to the citizenry. CUL has set out to meet relevant National laws and regulations, policies and action plans, and international best practice to ensure that it complies with a high standard in the management of its labour force. CNOOC Limited is a member of the UN Global Compact, and therefore all its global operations, including CUL, are committed to fully comply with the principles in the Compact related to labour rights.

The following plans will apply to CUL's operations:

- CUL (updated). Labour Force Management; and
- The draft Golder Labour Force Management Plan for Contractors and Subcontractors. Final Plan, prepared on behalf of CUL, (2018).

The Labour Force Management Plan (LFMP) focuses specifically on casual labour which will be characteristic of much of the unskilled labour employment during the construction phase of the pipeline. The LFMP commits CUL to a range of specific actions designed to ensure that its labour practices are fair, transparent and in compliance with Ugandan policy and law and best practice standards, including IFC PS2. The LFMP deals with a wide range of issues, including recruitment and retention of employees, terms and conditions of employment, wage rates, minimum wages, timeliness of payment, entitlements and benefits (work hours, weekly rest, public holidays etc.), repatriation of workers, termination of services, workplace health and safety, HIV Aids policy and prevention, health and welfare arrangements, first aid facilities,

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[12] [12] The acronym HIV refers to the human immunodeficiency virus (HIV) is a virus that causes the HIV infection. Over time, this becomes the acquired immunodeficiency syndrome (AIDS).

measures against biological hazards (insects, pests, virus's, parasites, bacteria), training and development, freedom of association, equal treatment, employment of women, forced labour, grievance management, local content and migrant workers, damage to property and management of contractors and subcontractors.

For the purposes of the EISA, the following recommendations are made (which may overlap in some instances with the recommendations of the LFMP):

12.3.1.3.1 Employment

- Comply with the Occupational Health and Safety standards established by the Government of Uganda and all IFC Performance Standard requirements, including Performance Standard 2, related to labour and working conditions;
- Implement the actions set out in the Golder (2018) Labour Force Management Plan (LFMP). Ensure that all contractors who work on site during the construction phase of the pipeline are aware of, adopt and comply with the Casual Labour recruitment Guidelines and the Labour Force Management Plan. EPC Contractors should be briefed by the lead department before commencement of contract execution to minimise on local employment conflicts;
- Preferentially hire local people, in accordance with CNOOC policies and agreements with Government. Advertise employment opportunities within the local fishing villages (local labour market) so that as many people as possible are employed who can continue to live with their families as they offer their services to the project. The construction contractor is to prepare an employment strategy for unskilled and skilled labour, and to ensure a focus on pipeline-affected communities, demonstrating that similar numbers of people are employed from each village. This must be revised and reviewed at the commencement of pipeline construction. The distribution of jobs will be monitored as a KPI. A project information centre must be established in each sub-Parish crossed by the pipeline and/or community liaison workers appointed who will serve as a source of information on potential job opportunities and probably as a location for recruitment. This strategy must include procedures to identify and verify the areas in which applicants live, as well as information about experience, skills and potential training needs, as per the requirements set out in the applicable CNOOC procedures;
- Develop and implement training and skills development programmes in the construction workforce to expand the human capital available within the local economy; and
- Consider offering bursaries or internships to promising students (refer to discussion on the community development impacts) to build a sustainable and educated future workforce.

12.3.1.3.2 Layoff of Casual Labour

- Ensure that labourers fully understand their conditions of contract with respect to its temporary nature;
- Train the elected office bearers (LC1's) to ensure that they understand and communicate appropriate information to their communities about the temporary nature of construction employment.

12.3.1.3.3 Workplace Health and Safety (General)

- Adopt a zero tolerance approach to employees who transgress health and safety rules;
- Train employees to ensure that they are aware of the requirements of the Occupational Health and Safety standards established by the Government of Uganda and the project health and safety rules;
- Implement health education programmes for employees in order to disseminate information regarding general social pathologies and spread of disease;
- Ensure effective management of camp facilities. Consider a closed camp status;
- Properly design the accommodation and other facilities in the personnel camp to prevent overcrowding and need to use rented accommodation available in communities;

- Ensure that there is sufficient provision for worker recreation in order minimise the lure of substance abuse and use of external sexual services and facilities. While it is understood that it is extremely difficult to ensure prevention, it will be necessary for CNOOC to put very specific measures in place to address such issues. The current CNOOC practice of sequestering workers who reside in the camp to the camp site from 19:00 at night assists in minimising the potential interaction between workers and villagers, including sex workers;
- Incorporate veterinary concerns into the OHS management plan to include appropriate waste management which mitigates against feral dogs and an awareness of the risk of snake bites and other wild animal threats;
- Ensure adequacy of welfare and amenities, including the supply of adequate drinking water as per WHO recommended 5 litres per day, cloak rooms, sanitary facilities separate for men and women, adequately furnished eating places, hand wash rooms/areas and proper meals;
- Develop effective management of emergencies, illness and injuries through adequate medical provision, equipped first aid points at the workplace and as needed in the field and the availability of emergency response facilities; and
- Create awareness of all Occupational Health and Safety requirements from and measures for workers that include adequate orientation as well as ongoing/routine training and sensitisation on OSH.

12.3.1.3.4 Driver and Mobile Equipment Safety

- Implement driver and mobile equipment training programmes in accordance with internationally recognised guidelines for workplace safety.

12.3.1.3.5 Diseases

- Develop communicable disease strategies and site-based plans to include tuberculosis, influenza and meningitis, with the objective of promoting/protecting workplace health;
- Is a recommendation of the EIA that CNOOC consider the development of a vaccine preventable disease programme for all employees and visitors based on risk for travellers and at-risk occupations. All employees and contractors residing in close contact in camps should receive vaccines for communicable diseases where these are appropriate, including for the quadrivalent meningococcal meningitis vaccine. ;
- Screen local employees/contractors for TB at recruitment and provide adequate care and treatment programs from the Project’s workplace medical service while complying with the requirements of the national TB program;
- Develop an integrated workplace malaria and vector control programme to include source reduction and environmental management of breeding sites, that all accommodation units in the permanent camp are proofed against mosquitoes, routine inspections of accommodation units, appropriate IEC programmes for the workforce and contractors prior to secondment and for use in country, policies and programmes related to use of protective clothing and the use of malaria chemoprophylaxis and surveillance programmes between the workplace medical service and vector control team to determine the likely origin of, and root cause of malaria cases;
- Reduce potential human vector contact and control of breeding sites of disease vectors such as mosquitoes. Continually monitor activities on site to ensure adequate drainage and management of storm water to minimise breeding in the area;
- Develop a clear HIV policy and programme in the workplace which includes ensuring that there is adequate accommodation capacity at the temporary personnel camps to eliminate the need for contractors or visitors to seek accommodation in the local villages;

- Develop and implement an HIV and STI prevention programme for suppliers, which is to include awareness and education about STI's. The design and placement of rest stops for drivers transporting goods and materials to and from the production facility should be away from local communities and properly subsidised for cheap food / entertainment to avoid the potential for prostitution and to eliminate the need for drivers to seek accommodation in the local villages;
- Develop a code of conduct that actively discourages sexual relationships between the workforce and the local community;
- Incorporate effective and adequate Health and Safety measures, including the provision of adequate and sufficient PPC/E of nationally or internationally recognised standards to all workers, clear signage about safety and precautionary warnings around and within construction and high risk areas, protection against biological hazards, including insect and snake bites and provide mobile toilets in different work areas (where formal toilets are not available) to prevent uncontrolled defecation/urination and faecal contamination among members of the workforce;
- Work with the village and traditional leaders to manage truck stops, as well as district authorities to report any increase in high-risk sexual behaviour from elements of the workforce, including the collection of baseline data;
- Develop and implement an HIV and STI management programme in the workforce, to include awareness and education, treatment services that link to the public health service, provision of free condoms, access to counselling, proper provisioning of the work camps to dissuade workers travelling into communities for entertainment and support of family friendly accommodation in the camps;
- Prohibit all drivers (permanent employees, contractors and suppliers) from giving lifts to the local community;
- Screen for STIs and hepatitis B/C virus as part of pre-employment fitness to work process. Treatable causes should be managed, and chronic carriers excluded from employment until managed; and
- Support a HBV vaccination campaign/ or antibody testing on any employee who may have not been vaccinated as a child.
- Evaluate opportunities for health systems strengthening (HHS) and support the development and implementation of a clear integrated district health strategy, which can plan for influx and requirements to upgrade health services in alignment with government structures, but ideally focused at the entire district and especially the oil development nodes.
- CNOOC should have a partnership role to play in their study area, but solely in supporting the government to fulfil its mandate of providing public health services and not assuming this role. All HSS should be performed after a formal memorandum of understanding is concluded that defines each party's role and responsibilities and deliver timeframes. These agreements must be based on sound sustainability principles.
- As an element of town planning, support local authorities in the provision of basic services to cater for the anticipated demand, especially environmental health including water, sanitation, and hygiene programmes.
- Ensure adequacy of welfare and amenities, including the supply of adequate drinking water as per WHO recommended 5 litres per day, cloak rooms, sanitary facilities separate for men and women, adequately furnished eating places, hand wash rooms/areas and proper meals.

12.3.1.3.6 Alcohol and Drug Abuse

- Continue the CUL policy of prohibiting the possession and use of drugs and alcohol at all of its camps and worksites and those of its contractors and the associated routine search of vehicles and bags to ensure that unauthorised substances are not taken into the camps facilities; and

- Develop a programme to address education about and management of non-communicable diseases related to use of drugs and alcohol issues.
- Information, Education and Communication (IEC) campaigns to educate the local workforce (and contractors) on financial management.
- Support to Potentially Affected Communities (PACs) and vulnerable groups on gender empowerment, local development programmes, and health issues. Issues must be addressed through contractor management and practices.
- Develop inflation management and monitoring programs. Support vulnerable groups.
- Evaluate opportunities to maintain local cultures and norms and build an equitable society, taking note of especially vulnerable groups.

12.3.1.3.7 Nutrition

- Develop nutritional programmes that promote proper nutritional practices at the workplace to prevent obesity and related health impacts, including education programmes in the workforce on financial management and support of the household units in employees that have traditionally followed a subsistence lifestyle.

12.3.1.3.8 Graft and Exploitation

- Ensure that CNOOC puts in place and meticulously implements all required anti-corruption, business ethics related and internal compliance Policies and Programmes, including the CNOOC Limited Code of Commercial Behaviour and Conduct of Employees, the Procedures for Handling Violation of Rules of CNOOC Limited Employees as well as its Guidelines for Overseas Operation with Compliance of CNOOC;
- Ensure that all employees, contractors and sub-contractors are alert to situations where they may become the victims of crime or targets for corrupt practices, including that perpetrated by civil servants;
- Develop and implement a campaign at national, district and local level to ensure that there is a comprehensive understanding of the manner in which CNOOC appoints staff, as well as associated sensitisation related to graft and exploitation;
- Ensure that all employees, contractors and sub-contractors are alert to situations where they may become the victims of crime or targets for corrupt practices, including that perpetrated by government officials; and
- Ensure that there is a protocol in place for reporting and managing incidences of intimidation and/or corruption. This protocol should include a coherent process for supporting persons who are unable to communicate fluently in English.

12.3.1.4 Impact Significance Rating

Table 12-22: Construction phase impacts on the workforce

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on employment										
- Employment opportunities	6	2	3	5	High Medium	8	2	3	5	High Medium

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
					+55					+65
-Skills development and training	6	5	3	5	High Medium +70	7	5	3	5	High Medium +75
-Layoff of casual labour	8	3	3	4	High Medium 56	4	2	3	4	Low Medium 36
Impact of workforce accommodation	6	2	3	5	High Mediium+ 55	8	2	3	5	High Mediium +65
Impact on Employee Health and Safety										
-general safety	10	5	2	4	High Medium 68	2	2	2	4	Low 24
-driver safety	10	5	2	4	High Medium 68	2	2	2	4	Low 24
-graft and exploitation	7	2	2	3	Low Medium 33	4	2	2	3	Low 24
-alcohol and drug abuse	10	5	2	4	High Medium 68	4	2	2	3	Low 24
-vector related diseases	9	5	2	4	High Medium 64	2	2	3	4	Low 28
- sexually related diseases	10	5	3	5	High 90	4	2	3	5	Low Medium 45
- sanitary and hygiene - related diseases	8	3	2	4	Low Medium 52	2	2	3	3	Low 21

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

12.3.2 Economic Impacts

The project will have impacts in the local, regional and national economy through direct and indirect economic benefits. While it is beyond the scope of this study to conduct a comprehensive macro-economic assessment, general economic impacts are discussed below.

12.3.2.1 National, Regional and Local Economic Development

12.3.2.1.1 National and Regional Economic Growth

The development of the oil and gas resource industry, through the CNOOC project, will have a beneficial impact in the region. This will include revenue for the government, employment opportunities at local, regional and national level and a direct and indirect effect on business development. Increased household income and expenditure will result. On its own and combined with the effect of the other oil industry developments, the CNOOC project is likely to generate significant economic multipliers[13]. Research for other oil development projects has shown that economic multipliers of about 2.33 for value added[14] and between about 2.88[15] and 3.03 for labour income[16] apply. While these studies were undertaken for oil and gas developments in the USA, and the ratios do not necessarily hold true for developing economies, the general positive economic multiplier effect is clear.

The increase in work opportunities provided by the project will result in growth in the proportion of residents with higher incomes. Given the number of oil and gas projects under consideration in the sector, there is likely to be a continued and expanding demand for skilled labour. Wages for skills needed in the oil industry are likely to increase. Employment in the oil industry will generate government revenue, deducted from salaries through Pay As You Earn (PAYE) as well as through Local Service Tax levied on income earners residing in the administrative area.

This economic impact will be positive and of medium magnitude (a significant number of Ugandan people benefitting from economic growth, as a result of the project), and will be permanent and extend to people and businesses at regional and national level, resulting in a **high medium** significance rating. Benefits can be further increased with the implementation of the recommended measures to enhance good governance and investment in local infrastructure and services.

Local Economic Development

The proposed development will stimulate demand for goods and services within Kikuube and Hoima districts, which in turn will have a direct and indirect impact on employment in the local and regional economy. CNOOC has developed a local procurement policy to support further development of the business supply chain locally and regionally through appropriate purchasing and business development strategies. This will also support the district and central government initiatives intended to improve the social capital of the Districts.

It is possible that local economic growth will increase the ability of households to earn a cash-based income. In this regard, CNOOC has indicated that it purchases in the order of 65% of its goods and services from suppliers and contractors in Uganda, which number more than 100 providers to date and that it will maximise the purchase of goods and services from Ugandan suppliers. The Company also trains local suppliers to meet oil and gas quality, safety and other standards and learn the tendering and bidding process.

The overall benefits to local businesses (both direct as a result of local project expenditure and indirect as a result of the growth of the informal business sector) will be of low magnitude, will have short duration

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13 An economic multiplier is the increase in final income that can be derived arising from any new injection of spending, for example $2.33 for every $1 invested or spent. Also termed a 'trickle down' effect of economic growth as those who receive additional income spend that income in shops and businesses, which in turn drives further economic growth.
14 Macroeconomic subgroup, 2011
15 Pennsylvania Economy League of Southwestern Pennsylvania, 2008
16 Macroeconomic subgroup, 2011

(opportunities will dwindle once the cash injection from people employed on the contracts ends), will be local and of **medium** significance.

Human Capital Development

There is a strong relationship between available human capital and the ability to attain social and economic growth and development. It is recognised that the development and promotion of human capacity will be achieved most effectively through a coherent process of investment in the people of Uganda.

Uganda has a low comparative world ranking on the Human Capital Index, being currently ranked 106th out of 122 countries on the overall Human Capital Index (WEF, 2013:13), and 118th out of 122 countries in respect of the Educational Pillar of the Human Capital Index Ibid, p14).

The Business, Technical and Vocational Education and Training (BTVET) Strategic Plan 2011 – 2020 (MoGLSD, 2011) for Uganda, identifies the absence of and the urgent need for a comprehensive process to develop occupationally relevant skills and competencies, including skills for the oil and gas sector. The Oil and Gas Policy (MEMD, 2008:27) emphasises the provision of support for the development and maintenance of national expertise, including planning for the development of formal and industrial training and broadening the national education curricula in preparation for putting the necessary oil and gas workforce in place in the country.

The Industrial Baseline Survey, undertaken by CNOOC in collaboration with Total and Tullow (Hamman, 2014:29) states that it is evident that Uganda is currently unable to meet the manpower demands of the oil and gas sector and recommends, inter alia, that oil and gas operators such as CNOOC (i) in partnership with government work towards strengthening the educational system; (ii) offers direct support to existing training institutions of repute; and (iii) facilitates the establishment of a technical and vocational education and training (TVET) centre, aimed at providing competence development for, inter alia, craftsmen (civil) and mechanical and electrical technicians required by the oil and gas industry. CNOOC is directly involved in this process.

Given the relatively short period envisaged for the construction phase of the project, beneficial human capital development is likely to be limited, unless specific training programmes are put in place, without enhancement will be of **low** significance**.**

12.3.2.1.2 Impacts Retarding Economic Development

Competition for Experienced Labour

The construction phase of the project is likely to exacerbate the current shortage of experienced labour at local and district level. Sourcing experienced workers from the district will drain available skills away from existing businesses, increasing scarcity and cost of labour. While this is a benefit for already-skilled labourers, who will have increased demand for their services and potentially higher earnings, it will create a shortage of labour elsewhere, which will cumulatively impact on the entire Albertine region. Without mitigation, the magnitude of this impact will be medium, and it will be regional in scale, short term (reversible at the end of construction) and highly probable, resulting in impacts of **low medium** significance

Impact on Land and Property Rates

Local knowledge of the proposed Kingfisher development has resulted in speculation for land, where individuals move into the area and claim land for themselves. According to villagers along the pipeline route, these speculators sometimes have title deeds which have been acquired fraudulently. This practice has been successfully challenged at least once, with a prominent government official being jailed for fraudulent transactions. Despite this, it is reported that speculators continue to try to trade up the price of land in the local area.

Without mitigation, this impact is likely to be experienced during the construction phase of the pipeline. Coupled with a struggling land management system, issues about the ownership of land are likely to increase. This impact could reach a point at which hostilities begin to emerge. Impact magnitude is expected to be high at local scale, short term (largely reversible after construction), with a high probability of occurrence and high **medium** significance.

Disruption of Livelihoods

Some people will lose their only sources of livelihood including their access to small sections of land on which subsistence agriculture is practiced. Whilst there will be compensation in respect of crops, individuals who have been in a position to use land by prior permission may find it extremely difficult to source affordable alternatives. This could, potentially, result in a disruption of livelihood-related activities or even their suspension, with associated increased levels of poverty, pending completion of the construction phase.

This magnitude of the impact is potentially very high, with long term consequences for the affected individuals. The impact will be local (restricted to the area along the pipeline) and highly probable, resulting in **high medium** significance.

12.3.2.1.3 Impacts due to in-migration

The influx associated with the escarpment access road is already causing tension within and between communities on the Buhuka Flats and to a lesser extent along the feeder pipeline route. With a steady population influx into the area in response to expectations about work and business opportunities associated with the construction activities, the demand for land and price speculation is expected to continue increasing throughout the construction phase. Tensions are also expected to escalate as migrants settle in the area and compete with local people of natural resources and for jobs on the construction contract. In countries with high levels of unemployment and politically unstable neighbours, economic migration in response to perceived opportunities can be highly significant. While the numbers settling along the pipeline and around the personnel camp cannot be predicted with any certainty, this impact will be felt locally, will be only partly reversible, long term (many migrants may not return to their place of origin), and of high magnitude, taking into account the vulnerability of communities along the pipeline route. It is highly likely that this impact will occur, but since there is some uncertainty about it, the probability is designated as a ‘definite’ rating score (5). The overall impact significance without mitigation will be **high**.

12.3.2.2 Impact Mitigation and Monitoring

The following impact mitigation is recommended:

12.3.2.2.1 National, Regional and Local Economic Development

National and Regional Economic Development:-

- Contribute to economic development and infrastructure improvement in the project area, in partnership with central, district and local government;
- Develop a transparent community development and contribution policy; and
- Support educational and vocational training at schools and technical and vocational education and training centres.

Local Economic Development:-

- Maximise local procurement of goods and services, wherever reasonably possible. CNOOC has committed to this principle, which will apply to the construction contractors responsible for the feeder pipeline as well; and
- Create a detailed and specific local procurement policy (LPP) that will provide benefits to the local community by prioritising sustainable business opportunities with local enterprises, particularly SMMEs. The LPP should set out the steps that will be taken to work with and build the capacity of local suppliers to become more competitive and profitable. This may include the provision of external training and support, aimed at improving their operational, safety, environmental and technical standards to a

standard that allows them to compete effectively for contract opportunities. From an internal perspective, the LPP should integrate real measures to identify local procurement opportunities, to communicate the business case to all relevant stakeholders and to put incentives and opportunities in place that will incentivise a supply chain process committed to ethical local procurement.

Human Capital Development:-

- Identify unskilled construction workers who demonstrate the necessary experience and aptitude for potentially becoming part of a valued workforce, and introduce a directed in-service mentoring and capacity building support programme;
- Support education at school level. In this regard CNOOC is encouraged to consider the support of mathematics, science and literacy programs in local schools, possibly through support for school maths and science programs and libraries;
- Consider offering bursaries or internships to promising students (refer to discussion on the community development impacts) to build a sustainable and educated future workforce;
- Collaborate with the Petroleum Authority of Uganda (PAU), which is tasked with establishing, maintaining and operating a National Talent Register for the petroleum sector to ensure that CNOOC contributions in the form of bursaries and scholarships support the development of an appropriately skilled labour force; and
- Support initiatives that will promote and strengthen the levels of competence of master artisans and crafts persons within the Technical Education and Training (TVET) system, and design mechanisms that will support the entrance of female scholars into TVET institutions.

12.3.2.2.2 Impacts Retarding Economic Development

Competition for Experienced Labour:-

- Develop and implement training and skills development programmes for the construction workforce to expand the human capital available within the local economy; and
- Create opportunities for supporting and up-skilling suitable candidates from the temporary unskilled construction workforce so that their experience and competence is built in a manner that aligns their competencies with workforce skills needs.

Land and Property Rates:-

- Support work to develop comprehensive land policies. This includes support for Government capacity to do strategic, long-term land use planning that protects small holder farmers and helps balance multiple uses of land, including for oil and gas extraction.

Disruption of Livelihoods:-

- Implement the recommendations of the RAP, as well as the Alternative Livelihoods Strategy; and
- Ensure that the Community Development Plan addresses issues related to disruption of livelihoods and the promotion of livelihood-related safety networks.

12.3.2.2.3 Impacts of In-Migration

- Engage closely with government to monitor land ownership and changes thereto surrounding the project development;
- Implement the recommendations of the Influx Management Strategy and Framework Plan (Volume 4, Specialist Study 11); and

- Prepare to accommodate the changes arising from the population influx by sensitising the LC system. This is particularly important, as it is at this level that the stability of a village is decided, including the establishment of checks and balances for maintaining individual rights and responsibilities, and for managing crime.

12.3.2.3 Impact Significance Rating

Table 12-23: Construction phase economic impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
National, regional and Local Economic Development										
- National and Regional Economic Growth	6	2	4	5	**High Medium +60**	8	2	4	5	**High Medium +60**
-Local Economic Development	4	2	2	5	**Low Medium +40**	7	2	2	5	**High Medium +55**
-Human Capital Development	3	5	2	3	**Low +30**	5	5	3	4	**Low Medium +52**
Impacts Retarding Economic Development										
-competition for experienced labour	6	2	3	4	**Low Medium 44**	3	2	2	4	**Low 28**
-land and property rates	10	2	2	4	**High Medium 56**	4	2	2	4	**Low Medium 32**
-disruption of local livelihoods	10	4	2	4	**High Medium 64**	4	2	2	4	**Low Medium 32**
Impacts due to In-Migration	10	4	2	5	**High 80**	6	4	2	4	**Low Medium 48**

KEY

Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

12.3.3 Community Health, Safety and Security Impacts

The Health Impact Assessment for the project (Volume 4, Specialist Study 10, Appendix B) provides a systematic evaluation of the 12 Environmental Health Areas (EHAs) of project-triggered health impacts. The EHA framework is used in the 2007 IFC Guidance Notes for Performance Standard No. 4, Community Health, Safety, and Security. These impacts are related to health and safety of communities in and around the project area, and include housing, diseases, accidents and injuries, crime and nuisance.

12.3.3.1 Impact of Diseases and Health Service Infrastructure

12.3.3.1.1 Sexually Transmitted Diseases

Contractors and workers are commonly perceived as being wealthy by the local population, especially in rural settings such as the escarpment villages along the proposed pipeline route. Previous experience of infrastructure development projects, described by village elders, has shown that these circumstances encourage cash-strapped people to sell sex as a commodity, to generate vital income. Adolescent girls are often the victims of these practices. Members of an external workforce who are allowed to mingle at will with inhabitants from settlements are likely to father children with local women. Given the temporary nature of the work, once the construction activities cease, it is common that both the women and children are abandoned when the workers move on, leaving single female-headed households.

The presence of large construction accommodation camps may also serve to attract sex workers from further afield, with an inevitable associated increased risk of the spread of sexually transmitted diseases.

Without a high degree of management, this type of behaviour will continue and probably increase once contract personnel are on site, resulting in the further spread of STDs, both locally and potentially back to the home villages of workers who do not live in the area (regionally). The unmitigated impact will be long term, being only partly reversible depending on the availability of treatment, of high magnitude and **high** significance.

12.3.3.1.2 Soil and Water Borne Diseases

Water related diseases such as cholera and typhoid remain a constant problem within the Study Area. The project construction teams will be provided with water and sanitation services. The spread of infectious diseases by construction teams could therefore be caused only in the event that personnel defecate or urinate in the field, particularly in water courses. This is likely if appropriate field facilities are not available to personnel working along the pipeline route and also if field teams are not properly trained. Without management control, and in the context of vulnerable rural communities with limited access to health infrastructure, the magnitude of this impact will be medium, duration will be medium term (the impact may persist after construction depending on the availability of treatment), and impact significance will be **low medium.**

12.3.3.1.3 Vector-Based Diseases

Malarial risks in communities near the pipeline may increase as a result of the construction of the project, mainly due to the creation of areas where seasonal ponding can occur. Flooded or open trenches during construction, in particular during the rainy season, will create additional mosquito breeding grounds for the malaria vector, by providing habitats with reduced predation. Nevertheless, this problem is already ubiquitous in the local villages due to many suitable breeding areas for the vectors, including irrigated lands, fresh water points, stagnant water pools in ditches and depressions, as well as marshy areas. The impact will affect local communities along the pipeline route, will be of low magnitude (adding little to the existing malarial risks) and medium term (assuming the effects persist for some time after construction ends), and will result in impacts of **low medium** significance.

12.3.3.1.4 Housing and Respiratory Diseases

The traditional wattle-daub or mud-block constructed houses found in the villages characteristically do not have windows. The associated poor ventilation can cause respiratory health problems that are exacerbated in the presence of damp and mould. An additional factor that negatively impacts air quality is the number of persons sharing the (usually) single room dwelling.

In the case of relocation, new homes provided by CNOOC are well ventilated, multi-roomed and offer general and specific health benefits, including factors that impact respiratory conditions and may be regarded as a positive, permanent, impact of **high** significance for the resettled families.

12.3.3.1.5 Health Service Infrastructure and Capacity

From the baseline socio-economic description, it is clear that health infrastructure and services are lacking in the local study area, and that self-reported disease and illness levels are high and have a significant influence on households' ability to engage in their livelihoods. If communicable and non-communicable diseases increase as a result of the introduction of the project workforce, additional pressure that will be placed on health care systems is likely to result in decreased levels of service.

Teenage pregnancies are already a concern in the region, and according to the Hoima and Kikuube Districts' Police Child and Family Division, there has been a general increase in the numbers of recorded teenage pregnancies. The Division further notes that violence and substance abuse are also increasingly common in the District.

Previous developments in the area, such as that for the road infrastructure project, are reported by village elders to have resulted in sexual engagements between workers and local people. In particular, they expressed concern about young and even under-aged girls having fallen pregnant. Early pregnancies and inadequate health care services contribute to a high maternal death rate, while pneumonia, diarrhoea, malaria and malnutrition produce a very high child mortality rate[17]. Given this, villagers are generally vulnerable to inadequate health care, whilst teenage girls are highly sensitive to this impact. Impact magnitude (decreased level of health service due to pressures caused by the project workforce) will be high, with local, short term effects resulting in an overall impact significance of **high medium**, particularly for teenage girls.

12.3.3.2 Impact of Pollution

12.3.3.2.1 Hydrotesting

Before commissioning of the pipeline, its integrity is tested by filling it with water and pressurising it. On occasions, biocides and corrosion inhibitors are added to the water, depending on the residence time before it is discharged. Details are not presently available but is it is assumed that the water will be discharged into the nearest drainage lines. Without management, its release can present a severe risk in the aquatic environment, resulting in mortality of downstream fauna and flora and risks to communities and stock. Social impacts would potentially have high magnitude, extending into the medium term, with **high medium** significance.

12.3.3.2.2 Treated Sewage Effluent

Treated sewage effluent in excess of approximately 50 m^3/day will be discharged from a package sewage treatment plant at the personnel camp. The effluent will be required to meet the project standard for domestic effluent, which is based on the Ugandan legal standard. Details are not available at present but it is likely that the final effluent, after chlorination, will be delivered into a soakaway. Local soils are loamy clays which are suitable for this purpose. Subject to compliance with the project standard, the magnitude of impact on groundwater and consequent community health risk is negligible and short term and local in extent. Impact significance will be **low.**

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[17] *Population Institute, 2015*

12.3.3.2.3 Domestic Waste Generation

Ugandan legal requirements for the management of domestic waste include avoidance, minimisation, recycling/re-use followed by disposal as the last option. Subject to compliance with these requirements, and management of disposal, domestic camp waste is unlikely to cause community health risks (such as leaching of contaminants to groundwater or infestations of pests). Impact magnitude will be minor, and impacts will be local and short term, with **low** significance.

12.3.3.3 Impact on Community Safety

12.3.3.3.1 Traffic and Pedestrian Safety

Regular travel of construction vehicles, particularly on the dirt roads along the pipeline route, is likely to increase safety risks for pedestrians and other vehicles. Construction traffic to and from the personnel camp and the worksites along the pipeline will be mainly along dirt roads near the pipeline and along the construction right of way itself.

A significant increase in traffic combined with a number of factors including poor current road conditions, uneven surfaces and the limited understanding of road safety among local drivers and pedestrians may increase accident risks in local communities. Vehicles hauling pipeline construction materials and workers may cause traffic hazards in trading centres or near schools and along narrow roads in places where construction traffic is not using the construction right of way. This will be exacerbated by the generation of dust, particularly by the heavy transport vehicles. Children, women and elderly people are often at higher risk of traffic-related accidents. Children are typically curious about large construction sites, and pipeline construction will be something they have not seen before. Many are likely to turn up at the edge of the construction right of way to watch. Pedestrians will also need access across the pipeline right of way in places. Access requirements have not yet been fully assessed, but where they exist, pedestrians will be at risk when crossing the working areas. Where the pipeline trench is open they will be unable to cross safely unless provision is made for crossing points.

Overall, without a high level of management, construction traffic accidents could lead to damages, injuries and even fatalities in local communities. The impact will have very high magnitude (causing severe nuisance or injury), could be long term (in the case of injuries or fatalities), local, and of **high medium** significance.

12.3.3.3.2 Violence and Crime

As with a number of other impacts identified, while there is not necessarily a direct correlation between the levels of violence and crime and construction phase activities of CNOOC, these risks will need to be considered in terms of their direct potential impacts as well as in respect of CNOOCs Social Licence to Operate.

There is a likelihood of some construction workers causing violent incidents in local communities, possibly fuelled by drug use or alcohol. This is more likely to be an issue in Hohwa, which is the village closest to the construction accommodation camp, but cannot be discounted in any other villages where construction activities will be nearby. Arrogant attitudes displayed by construction workers, who are generally wealthy compared with community members, may also spark violent confrontations. These issues can generally be managed by lack of tolerance to aggression and violence among construction workers by management, but in unmanaged conditions can be an important concern. Incidents are probable in the absence of mitigation, and given the vulnerability of local communities, will cause impacts of high magnitude (both in terms of injury to third parties and the effect on CNOOC’s social license to operate), with residual effects possibly extending beyond the short term, and **high medium** significance**.**

12.3.3.3.3 Hazardous Materials and Wastes

Hazardous materials (mainly oils and fuels, acids, paints and cleaning agents) will be contained within the personnel camp and are unlikely to result in risks to surrounding communities. At the work sites, quantities of potentially dangerous wastes are produced such as pipe cuttings, waste welding rods and flux, oil spills from vehicles and equipment and other incidental discarded construction material and waste. There is potential for environmental contamination from chemical and fuel spillage due to offloading of chemicals, servicing and/or refuelling of equipment and vehicles or discharge of effluent. There is also a risk associated with overfilled vessels leading to leakages and spills. If this is not properly cleaned up it may result in a future long term hazard for local communities. Given extensive rural settlement near the pipeline route and the likely use of the pipeline right of way for grazing, after construction teams leave, the sensitivity to potentially hazardous industrial waste along the servitude, not properly cleaned up is high. Without mitigation, the magnitude of this impact will be high, extending beyond the construction phase. Impact significance will be **high medium.**

12.3.3.3.4 Fires

The pipeline team's work with welding equipment to join pipes and other equipment together so there is a risk of accidental fires escaping from the project working areas onto community land. Bush and grass fires on the Buhuka Flats and above the escarpment to Kabaale would be a major risk to people and stock unable to escape. In windy conditions, given the social sensitivity to uncontrolled bush fires, the impact magnitude, should a fire be caused by construction, would be very high, with potentially long term consequences. Without mitigation, the probability of such an incident occurring is medium, resulting in **low medium** impact significance. With appropriate management and emergency preparedness, this impact can be reduced to **low** significance.

12.3.3.3.5 Major Accidents

Major accidents could cause highly significant impacts in surrounding communities, resulting in injuries, impact on livelihoods, or other major effects. Although there are no specific data available in respect of CNOOC transport related accidents, international research and experience over more than a decade, as documented by the National Institute for Occupational Safety and Health (NIOSH[18],[19],[20][21]) provides statistics on work-related vehicle accidents specifically in respect of the oil and gas industry. Based on the research over time, vehicle accidents are the leading cause of oil and gas extraction worker fatalities, with roughly forty percent of on-the-job directly attributable to this. The vast majority of such accidents appear to be directly related to level of specific experience and/or non-compliance with stated safety and health systems and procedures in place within the workplace.

12.3.3.3.6 Impacts of In-Migration

In countries with high levels of unemployment and politically unstable neighbours, economic migration in response to perceived opportunities can be highly significant. The placement of the construction camp close to Hohwa will lead to an influx of migrants into the area, seeking work and business opportunities associated with the construction activities. The demand for land and price speculation is expected to continue increasing throughout the construction phase. Tensions are also expected to escalate as migrants settle in the area and compete with local people for natural resources and for jobs on the construction contract. While the numbers settling along the pipeline and around the personnel camp cannot be predicted with any certainty, this impact will be felt locally, will be only partly reversible, long term (many migrants may not return to their place of origin), and taking into account the vulnerability of receiving communities, with high levels of joblessness and resource poverty, will be of high magnitude, with an overall **high** significance rating.

12.3.3.4 Impact Mitigation and Monitoring

The following mitigation/ enhancement measures are proposed in respect of the community health, safety and security impacts identified:

[18] *National Institute for Occupational Safety and Health (NIOSH) (2012) Fatal Facts, Oil Patch No. 1-2012*
[19] *NIOSH (2004) Report on fatalities attributable to a vehicle hazards*
[20] *NIOSH (2012) Census of Fatal Occupational Injuries*
[21] *NIOSH (2004) Publication No. 2004-136, Statistics on work-related vehicle accidents and prevention options for employers accessed at https://www.osha.gov/ SLTC/oilgaswelldrilling/safetyhazards.html*

12.3.3.4.1 General

- Develop a Community Health, Safety and Security Plan and an Emergency Response Plan as required to meet IFC performance standard 4;
- Develop an induction programme, including a Code of Conduct, for all workers directly related to the project. A copy of the Code of Conduct is to be presented to all workers and signed by each person. The Code of Conduct must address the following aspects:
  - respect for local residents and customs.
  - zero tolerance of bribery or corruption.
  - zero tolerance of illegal activities by construction personnel including prostitution, illegal sale or purchase of alcohol, sale, purchase or consumption of drugs, illegal gambling or fighting.
  - zero tolerance policy of drunkenness on the ROW and no alcohol and drugs policy during working time or at times that will affect ability to work or within accommodation camps or acquired from outside the camp whilst accommodated in the camp.
  - a programme for drug and alcohol abuse prevention and random testing that is equivalent in scope and objectives to the policies prescribed in the Code of Conduct.
  - description of disciplinary measures for infringement of the Code and company rules. If workers are found to be in contravention of the Code of Conduct, which they signed at the commencement of their contract, they must face proportionate disciplinary procedures.
- Publicise the Code of Conduct in settlements potentially affected by the construction camps, as well as those along the RoW, as part of the community relations plan. This will help ensure that the local residents are aware of the expected behaviour of construction staff. Posters with the Camp Rules should also be posted in neighbouring settlements or lodged with the LC1 of each village;
- Provide entertainment facilities for workers at the construction accommodation camp and establish clear rules for conduct during leisure time as well as the need to remain within the camp boundaries during leisure time; and
- Implement a grievance procedure that is easily accessible to the local community, through which complaints related to CNOOC contractor or employee behaviour that infringes on the health, safety or security of community members can be lodged and responded to (see issues in this regard in **Box 12-1**). CNOOC must respond to such complaints in a considered manner, including:
  - Circulation of contact details of community liaison officers or, if separate, of 'grievance officers' or other key contact.
  - Circulation of details of the Witness NGO as well as the mechanisms to access the NGO.
  - Raising of awareness amongst the local community regarding the grievance procedure and how it will work.
  - Establishment of a grievance register that is continuously updated and maintained by CNOOC.
  - Provision of a mechanism to provide feedback to individuals, groups and village councillors regarding actions that **have been taken in response to complaints lodged.**

Box 12-1: Existing Problems with respect to Grievances

According to IFC's Performance Standard 1, if ongoing risks to or adverse impacts on project-affected communities are anticipated, the Project Sponsor is required to "establish a grievance mechanism to receive and facilitate resolution of the affected communities' concerns and grievances about the client's *environmental and social performance" (IFC, 2006, p. 5). To respond to this requirement, CNOOC need to appoint a Witness NGO to provide oversight, to receive grievances and to oversee the process to address these concerns.*

The CNOOC Grievance Mechanism, which is already in use, is not thought to be effective by many villagers. The general perception is that CNOOC has not taken grievances sufficiently seriously and that villagers are powerless to have issues that they believe are important addressed, if CNOOC does not regard them to be important. There is also no evidence that a critical Witness NGO had been appointed to provide oversight of resettlement and compensation discussions between CNOOC and villagers. Grievances are received by CLOs at the Kingfisher Camp, the CNOOC office in Hoima and when they visit communities. As well, there are oil and gas advisory committees within every parish which meets on a quarterly basis. Despite this, it is clear that community members still hold the opinion that they are not being heard. It is necessary to take grievance management closer to the people and to ensure that subsistence stakeholders are able to have their concerns addressed without having to spend any money is realistic and fair. This is a critical issue, and will need to be addressed by CNOOC. Failure to ensure that villagers believe that they are actually being 'heard' will negatively impact on the company's Social Licence to Operate.

12.3.3.4.2 Impact of Diseases

- Develop a Communicable Diseases Action Plan as an essential tool in managing disease related impacts;
- Develop an Employee Health Awareness Policy and ensure its implementation among CNOOC personnel and its contractors or sub-contractors. The policy must provide for:
  - Extend the current short-term HIV/AIDS testing and counselling services being provided and implement related advocacy, factual data provision, awareness creation as well as behaviour change issues around the transmission and infection of HIV/AIDS in a manner that allows linkages with the Government of Uganda HIV/AIDS related initiatives.
  - Health awareness training for workers including communicable diseases at induction and then periodically throughout construction.
  - Awareness raising on communicable diseases for communities close to camps (via posters, leaflets, through health clinics, community meetings).
  - Liaison with local health authorities.
- Implement interventions aimed at reducing the impacts of vector borne diseases through mechanisms such as sanitary improvements and minimising areas where water is impounded as a result of construction activities.

12.3.3.4.3 Impact on Health Services

- Monitor worker compliance with the Code of Conduct;
- Minimise opportunities for fraternising between workers and members of the community, in particular young girls;
- Support community sensitisation and youth counselling initiatives aimed at promoting risk-seeking behaviour amongst youth; and
- Support community-based sensitisation regarding HIV/AIDS, STIs and risks related to early pregnancies.

12.3.3.4.4 Impact of Pollution

- Ensure that no waste whatsoever, including construction waste is dumped in watercourses or at any site that impacts on villagers or their land use; and

- Ensure that the use of water does not disturb public water availability and that sources of water are carefully selected
- CNOOC's hazardous chemical management specification must be complied with and procedures must be in place to ensure compliance with local laws and international requirements applicable to the transport of hazardous materials. Transport of hazardous materials must include:
  - Appropriately trained personnel;
  - Proper labelling on containers (i.e. quantity, identification, and relevant MSDS);
  - Chain of custody documents;
  - Appropriate packaging;
  - Application of special provisions, as appropriate;
  - Vehicle specifications relevant to transported material; and
  - A 24 hour/day emergency response system.
  - Compliance with CNOOC's spill prevention and control specification in conjunction with the latest IFC general EHS guidelines for hazardous materials management and relevant independent risk assessment (i.e. WorleyParsons Oil Spill Planning and Response: Kingfisher Field, 2017).
  - The following must be implemented:
    - Spill kits to be available on sites where handling of chemicals occurs;
    - Regular inspection of all chemical and diesel storage tanks during the project;
    - Report all spills or chemical contact immediately to supervisor;
    - If a spill occurs on an impermeable surface such as cement or concrete, the surface spill must be contained using oil absorbent materials;
    - Any spill clean-up is to be appropriately contained and disposed of by a contractor appropriately licenced with NEMA;
    - If necessary, oil absorbent sheets or pads must be attached to leaky machinery or infrastructure; and
    - Materials used for the remediation of spills must be used according to product specifications and guidance for use.
  - Secondary containment must be installed for equipment that contains hazardous materials (e.g. hazardous material storage areas, vessels, and tanks) to contain accidental releases.
  - In line with IFC hazardous waste materials management, secondary containment must be made of impervious, chemically resistant material and able to safely contain the larger of 110% of the largest tank or 25% of the combined tank volumes in areas with above-ground tanks with a total storage volume equal or greater than 1,000 litres. In the event of a release, contained hazardous materials must not encounter incompatible materials which may cause further hazards (e.g. toxic fumes, fires and explosions).
  - Piping, process equipment and storage tank designs and construction processes must be appropriate to manage corrosion and potential leakage based on the life of infrastructure, and include:
    - Compliance with the current GIIP standards, as applicable (e.g. American Petroleum institute standards, see project codes and standards in APPENDIX A);
    - Corrosion protection (cathodic protection and corrosion allowance);

  - Pressure monitoring system and automatic pressure loss detectors;
  - Inlet/outlet process safety control Emergency Shut Down (ESD) system;
  - Pipeline leak monitoring system (PLMS) which can detect 1% of designed throughput in 10 minutes;
  - Concrete lining of valve stations;
  - Approved (GIIP) or certified integrity testing methods at regular intervals;
  - Scour protection where the pipeline crosses rivers; and
  - An insulation jacket for the pipeline as part of the heat tracing.
- Overfills of vessels and tanks is a common cause of spills and must be addressed through CNOOC's spill prevention and control specification (which is typically aligned with IFC recommendations) as follows:
  - Checklist of measures to follow during filling operations and the use of filling operators trained in these procedures (see CNOOC Spill prevention and control specification);
  - Installation of gauges on tanks to measure internal volumes;
  - Use of dripless hose connections for vehicle tank and fixed connections with storage tanks;
  - Provision of automatic fill shutoff valves on storage tanks to prevent overfilling;
  - Use of a catch basin around the fill pipe to collect spills;
  - Use of piping connections with automatic overfill protection (float valve);
  - Pumped volumes must be less than the available capacity of tanks or vessel; and
  - Use of overflow valves or pressure relief valves so that excess hazardous substances can be released (and safely contained) when necessary.
- A maintenance programs must include regular pigging to clean the pipeline and intelligent (e.g. magnetic flux leakage) and ultrasonic pigging should be considered as required.
- Spill control equipment and materials must be inspected monthly to confirm that all specified equipment is always available and that the equipment has not been utilized for alternative purposes.
- All activities, equipment, and areas associated with hazardous material (e.g. in storage, handling, maintenance) must be identified and managed appropriately.
- Soil contaminated by chemicals, fuel or oil spills, will be collected for treatment at a pre-determined and dedicated location, or will be treated in situ using bioremediation, in accordance with existing procedures;
- Vehicles will be maintained regularly and kept in good working order;
- Chemical storage areas will be adequately bunded to prevent chemicals from entering the storm water system; and
- Vehicle maintenance will not be carried out on the site, but in contractor workshops as appropriate.
- Effluent must be treated to acceptable standards prior to discharge (see Table 6-18 in Water Management plan).
- All chemicals stored indoors must have adequate ventilation that maintains ambient air below the corresponding occupational exposure limits and below the threshold limit values.
- Containers and tanks must be legibly labelled to identify the type of material contained within container/tank and the associated hazards.

- Equipment relevant to chemicals/fuel on site must comply with the relevant MSDS.
- Secondary containment must be provided for any stored contaminated material and must also be regularly inspected to identify signs of deterioration, cracking, or general damage to containment. Any signs of damage must be addressed.
- Provision of emergency shower and eye wash station where handling of hazardous materials occurs.
- Metal drums shall not be stacked more than four (4) high. Containers shall only be stacked four (4) high on on a level, concrete or otherwise stable surface.
- Plastic drums that are 55 gallons and Tote tanks less than 375 gallons will not be stored more than three (3) high. Containers shall only be stacked three (3) high when placed on a level, concrete or otherwise stable surface.
- Acids, flammables, combustibles, and oxidizers must not be stored next to or near battery chargers, electric panels, or equipment with the potential for arch flash, sparks, or electrical discharges.
- Maintain a list of chemicals that are stored or dispensed at the location and identify the hazards associated with the chemicals.
- Maintain a current SDS for all chemicals on site. The MSDS for each chemical must be available in the area where the chemical is stored or dispensed.
- All chemical and diesel tanks to be fitted with impermeable secondary containment with a minimum capacity of 110% of the largest tank volume.
- Spill kits must be available at storage sites.
- Spill kits to be available on sites where handling of chemicals occurs.
- Regular inspection of all chemical and diesel storage tanks during the project construction.
- Report all spills or chemical contact immediately to supervisor.
- If a spill occurs on an impermeable surface such as cement or concrete, the surface spill must be contained using oil absorbent materials.
- Any spill clean-up is to be appropriately contained and disposed of by a contractor appropriately licenced with NEMA.
- If necessary, oil absorbent sheets or pads must be attached to leaky machinery or infrastructure.
- Materials used for the remediation of spills must be used according to product specifications and guidance for use.
-

12.3.3.4.5 Impact on Community Safety

- Ensure that the current CNOOC Land Transportation Specification: Document CUL-QHSE-L3(GE)-023 is further developed in a manner that allows the adoption and implementation of a comprehensive CNOOC driving and vehicle management plan as part of the initial activities which will be adopted for the construction phase. Based on this, CNOOC must adopt the best transport safety practices with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public, as well as creating awareness among the local people and villages about road safety, through the extension of current CNOOC road safety awareness programmes. Other mitigation should include:
  - Adopting appropriate and comprehensive measures to address emerging/new issues as they arise.
  - Implementing practical measures such as the enforcement of slow speeds and water spraying to suppress dust from heavy truck convoys on dirt roads.

  - Ensuring the placement of flag man at trading centres as necessary.
  - Emphasizing the need to conserve the natural environment through aspects such as avoiding the use of the Bugoma Forest Road and the respect for wildlife.
  - Emphasising the need to avoid night driving, except in emergency situations.
  - Labelling all vehicles on the sides with stickers which have recognisable, easy to recall numbers, to assist with ease of identification and subsequent reporting, in case of road safety violations and/or accidents.
  - Emphasising safety aspects among project drivers, specifically ensuring that drivers respect speed limits through busy and built up areas.
  - Ensuring the roster and shifts structure for the project allows employees plenty of opportunity for sleep and rest between shifts and on their days off.
  - Adopting a proactive approach to managing driver fatigue, based on adequate hours of rest to avoid overtiredness.
  - Avoiding dangerous routes and times of day to reduce the risk of accidents.
  - Positioning traffic guides at children crossings to control driver speeds and seeking cooperation with local educational facilities (school teachers) for road safety campaigns.
  - Implementing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions and children crossings.
  - Provision of alternative transport (bus) for the construction workforce.
  - Ensuring contractors regularly maintain vehicles to minimize potentially serious accidents such as those caused by brake failure commonly associated with loaded construction vehicles.
  - Ensuring contractors compile a list of service schedules of all equipment deployed on site.
  - Minimising interaction of pedestrians with construction vehicles through collaboration with local communities and responsible authorities (e.g. police) to improve signage, visibility and overall safety of roads particularly along stretches located near schools or through busy areas.
  - Considering additional warning tape at accident-prone stretches and sensitive locations (schools & hospitals) if identified as required.
  - Developing and implementing road safety awareness campaigns along all transport routes, particularly at centres, school zones and health facilities and collaborating with local communities about education about traffic and pedestrian safety (e.g. one road safety campaign at a nearby location once a month).
- Partner with the Ugandan Police Force Community Liaison Officers to allow sensitisation of communities on issues related to crime;
- Ensure that there is timely public notification of planned construction works and close consultation with local communities to identify optimal solutions for road diversions and pedestrian crossings to maintain community access and social links;
- Provide fencing around the construction and accommodation camp that is sufficiently robust to prevent it from being broken, climbed or breached by employees or local people;
- Manage the risks of fire through specific management requirements for hot works and through education of personnel about careless behaviour in respect of cigarette smoking;
- Ensure that emergency preparedness and response plans include provision for response to fire originating within areas of CNOOC responsibility or active construction areas and which could threaten

local houses. Given the close density of housing and use of traditional natural materials, should fire encroach with in a village context it could spread rapidly and the fire response plan and equipment on site needs to be adequate to cope with this eventuality; and

- Promote awareness amongst members of the settlements about potential fire hazards, and mechanisms for promoting household safety from fires.

12.3.3.4.6 Impact of In-Migration

- Implement the strategy for minimising in-migration defined in the Influx Management Strategy and Framework Plan (Volume 4, Specialist Study 11). This will need a combined effort by Government and all oil industry partners;
- Assist Government to plan, develop and implement community infrastructure and support that improves the living conditions of project-affected people;
- Implement the Community Development Plan and the Alternative Livelihoods Restoration Plan that offers practical mechanisms and mitigation strategies for the loss of grazing land caused by the project and the general loss of resources caused by increasing populations; and
- Plan locations for hiring labour to avoid attracting job seeking migrants to the front gates of the various project work areas and into sensitive communities. Ensure that the EPC and Drilling contractors comply with these requirements.

12.3.3.5 Impact Significance Rating

Table 12-24: Construction phase community health, safety and security impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on Diseases and Health Service Infrastructure										
-Vector related diseases	4	3	2	4	Low Medium 36	3	2	2	4	Low 28
-Sexually transmitted diseases	10	4	3	5	High 85	5	4	3	4	Low Medium 48
-Soil & waterborne diseases	6	3	2	4	Low Medium 44	2	2	2	4	Low 24
- Housing and respiratory diseases	8	5	2	5	High +75	8	5	2	5	High +75
-Health Service Infrastructure and Capacity	8	2	2	5	High Medium 60	2	2	2	5	Low 30
Impact on Pollution										

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
- Hydrotesting	10	3	2	4	High Medium 60	2	2	2	4	Low 24
-Treated sewage effluent	2	2	2	4	Low 24	2	2	2	4	Low 24
- Domestic wastes	2	2	2	5	Low 30	1	2	2	5	Low 25
- Hazardous materials and wastes	9	3	2	4	High Medium 56	2	2	2	4	Low 24
Impact on Community Safety										
- Traffic and pedestrian safety	10	4	2	4	High Medium 64	2	4	2	3	Low 24
- Violence and crime	8	4	2	4	High Medium 56	4	4	2	2	Low 20
- Fires	10	4	2	3	Low Medium 48	4	3	2	2	Low 18
Impact of In-Migration	10	4	2	5	High 80	6	4	2	4	Low Medium 48

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

12.3.4 Housing, Land and Resource Impacts

In a typical project development sequence, the ESIA and ESMP precede the Resettlement Action Plan (RAP), which may only be finalised at the time of the detailed design when there is greater certainty about the project footprint. In the present case, due to project delays over a number of years, the RAP actually precedes the ESIA. All of the asset inventories for project affected people (PAPs) have been completed and discussions have been held with each PAP about the compensation process and, where necessary, physical resettlement. PAP's have been advised not to plant crops in anticipation of compensation for losses being paid. It is noted that disclosures for the feeder pipeline have not been conducted as yet.

The RAP is premised on the commitment to best industry practice, which is widely accepted as being compliance with the IFC's Performance Standard 5, 'Land Acquisition and Involuntary Resettlement'. For this reason, the assessment in this chapter evaluates the significance of physical resettlement and land acquisition impacts in relation to compliance with the guidelines set out in the performance standard

12.3.4.1 Key Principles of the IFC Performance Standard

Under international standards, IFC PS5 (land acquisition and involuntary resettlement) (amongst other international standards) stipulate principles regarding the loss of land and the associated physical and/or economic displacement as follows:

- Involuntary resettlement should be avoided, wherever possible;
- Where involuntary resettlement is unavoidable, all people affected by it should be compensated fully and fairly for lost assets;
- Involuntary resettlement should be conceived as an opportunity for improving the livelihoods of the affected people and undertaken accordingly;
- All people affected by involuntary resettlement should be consulted and involved in resettlement planning to ensure that the mitigation of adverse effects as well as the benefits of resettlement are appropriate and sustainable; and
- Displacement and involuntary resettlement generally are highly sensitive impacts to communities, and without adequate planning and effective mitigation, such displacement and resettlement may result in severe impoverishment of communities.

12.3.4.2 Impact of Involuntary Resettlement

The proposed 46 km pipeline runs along villages and hamlets from the proposed CPF on the Buhuka Flats to the town of Kabaale. The settlement pattern comprises scattered villages with several larger trading posts A total of 38 households[22] will be displaced by the pipeline, being within the 30 m wide construction right of way (refer to Table 12-25). Thirty three other structures (including kitchens, bath shelters, pit latrines and barns) will be lost. The temporary construction camp will not affect any homesteads or other structures.

Table 12-25: Homesteads and Other Structures Impacted by the Feeder Pipeline and Temporary Construction Camp

Facility	Homesteads	Other structures
Feeder pipeline	38	33
Temporary Camp	0	0

Source: Survesis/*Nomad Consulting (2017)*

The project planning has complied with the IFC requirement to minimise resettlement to the greatest extent possible. Three route location studies have been undertaken, with steadily reducing impacts on resettlement in each case. The latest study (GIE, 2017) was intended to optimise the route in relation to impacts on housing and infrastructure (see Section 16 for a full discussion of alternative routes).

While the present route has reduced the number of affected households six-fold, the impact remains of **high** significance in the absence of a structured and fair process of resettlement, compensation and livelihood

[22] Although 38 households will be directly impacted through displacement, there will be a significantly larger number of persons impacted by the development in one way or another.

restoration. Particular issues that arise in the context of the present resettlement process, in relation to physical resettlement are as follows:

- Cash compensation: A particular issue applicable to Uganda is the payment of cash compensation for lost housing and infrastructure. Although international best practice recommends replacement of structures due to the fact that cash compensation can be misused, impoverishing the affected households, Ugandan law requires that CNOOC provide each PAP with the option of cash compensation instead of replacement of assets. This may have an especially adverse effect on women and children where they are excluded from the benefits of cash settlements.

  To mitigate irresponsible squandering of cash payments by the male head of household, Ugandan law requires that men are not able to negotiate cash settlements without their spouses being present in the negotiation and being in voluntary agreement. This is a progressive law but it may have unintended negative consequences. From discussion with households at village level in the project area, including PAPs and other stakeholders such as the Ugandan Human Rights Commission, it is clear that the requirement for both partners to agree to cash compensation is resulting in increased household violence against the women partner. This has been confirmed by the Hoima Community Development and Child and Family Divisions of the Hoima District Police Department.

- Uncertainty about payment: Many PAPs have raised the issue that they have been consulted about asset inventories, but no final offer has been made to them, nor have they been informed about how and where they would be resettled. This is causing anxiety among the affected PAPs.

In the absence of compliance with an appropriate resettlement standard such as IFC PS5 and particular attention to the issues surrounding cash payments in lieu of housing replacement, the pipeline resettlement could result in poverty in the area causing long term impacts of high magnitude and high significance. On the other hand, based on the quality of replacement housing, PAPs who accept the option that sees their housing replaced are likely to experience positive long term impacts of a high magnitude and high significance.

12.3.4.3 Impacts of Land Acquisition

The land that will be cleared for pipeline construction will be within a 30m-wide construction right of way. Within this area, all buildings, other structures, trees and standing crops will be removed for the period of construction. Most of the pipeline route affects cultivated land, which is occupied by smallholders (subsistence farmers) and commercial users. As a rule, smallholders have access to small land parcels (1 acre) which they use for shelter, food and the sale of surplus crops to meet additional basic needs such as school fees, clothing and a variety of non-crop foodstuffs such as sugar. The most common subsistence crops that will be lost are bananas (for food), bananas (for beer), cassava, sweet potatoes, Irish potatoes, cotton, soybeans, groundnuts, pigeon peas, beans, sorghum and maize, whilst perennial crops including coffee, and sugar cane plantations and tree plantations (pine wood, eucalyptus), which are typically commercial crops. Beekeeping for honey production is practised in a number of villages along the pipeline route and these hives will be displaced.

Loss of land and produce as a result of project development has been raised as one of the most significant concerns by communities along the pipeline. Recent displacement caused by other developments near the project area such as the building of roads, the erection of structures for powerlines as well as expansion of subsistence, small and larger scale agricultural initiatives and encroaching practices of land use for cattle grazing, have made local people very aware of displacement-related impacts. The general sense of threat to livelihoods amongst villagers is heightened by the fact that President Museveni, at the opening of the Nile National Agricultural Show, has said that ongoing subsistence agricultural activities, as practiced by villagers, serves as a major constraint to achieving its full agricultural potential (Museveni, 2017). It is clear from discussions with villagers that there is a significant degree of mistrust about land and lack of awareness regarding land rights, displacement and the associated compensation procedures[23]

Land utilisation by the project along the pipeline route will be both temporary and permanent. The construction phase will require a temporary 30 m - wide corridor (called the construction right of way) over which crops and infrastructure will be lost. This will amount to around 106 ha of ploughed agricultural land, in a total land take of 138 ha (based on pipeline length of 46km x 30 m construction right of way), although not all of it will be cultivated at the time of construction, since significant areas of subsistence land lie fallow at any one time. Approximately 510 landowners and 170 land users' landowners will be temporarily affected by clearing for construction (Nomad Consulting, 2018). In addition, approximately 3.6 ha of land will be needed for the construction personnel camp near Hohwa. This land is a part of a 49 ha property owned by a single individual who rents land parcels to tenants.

Two thirds of the agricultural land affected by pipeline construction and all of the land affected by the construction personnel camp will be returned to the owners, for continued cultivation once construction is complete. In the areas that are temporarily affected by construction, owners will be compensated for crop losses, fruit trees and any other lost resources and infrastructure. In the permanent right of way (10 m wide), owners will be compensated for the value of the loss of the land, calculated at market prices as determined by an independent survey. The permanent servitude will be maintained as a grassed corridor where the natural return of forest species will be prevented, and agricultural use will be prohibited.

Considering the number of refugees residing in Uganda as well as the history of conflict in the region, land rights are a sensitive issue that will need to be managed carefully when land and assets are affected. Furthermore, customary law opens the opportunity for widows to be dispossessed of her husband's land. Ugandan law also makes provision for PAPs to be offered cash compensation, which creates considerable additional risks for affected stakeholders, particularly in the present case, where land is heavily utilised and there is limited usable land readily available and in close proximity with which to compensate in kind. Without effective compensation and livelihood restoration, these impacts will be long term, of high magnitude and **high** significance.

However, if compensation is paid in full compliance with IFC PS5 and be combined with mechanisms to ensure effective livelihood restoration, it could improve the personal situations of affected landowners, providing income for landowners temporarily and permanently affected by the project. The mitigated impact could become positive, irreversible and long term, and of **low medium** significance.

12.3.4.4 Damages to Property outside of the Construction RoW

There is a potential for damage to land, property and infrastructure outside of the ROW, involving amongst other things:

- clearing of land beyond the project working areas for which compensation has not been paid;
- vehicles or people straying outside working areas and causing damage to land and crops;
- damage to farming land near the right of way;
- damage to fencing, irrigation and drainage ditches or channels, water sources (communal water points, wells or springs);
- secondary damage to crops where access to irrigation has been blocked by construction;
- vibration damage to houses or other buildings located close to the construction corridor and/or to access roads due to the use of heavy vehicles, etc.; and

[23] *Golder (2018) Stakeholder Engagement report (Minutes of Meetings with Local Communities undertaken in November and December 2017)*

- adverse effects of construction-generated dust on crops.

Without mitigation, these impacts have the potential to sour relationships between CNOOC and local communities and can be long term (in terms of damage to relationships), of high magnitude and **high medium** significance. Careful management, open communications and the transparent implementation of a fair grievance procedure should reduce the impacts to short duration and **low** significance.

12.3.4.5 In-Migration

During the construction phase of the project, there is likely to be a surge in migrants into the area above the escarpment, in response to perceived work and business opportunities associated with the oil industry. Numbers are uncertain, but in an environment where joblessness is rife and there is political instability in surrounding countries, the risks of migration into areas where opportunities exist is high. There may also be migration from the Buhuka Flats due to the rapidly increasing pressures there, with pastoralists seeking additional grazing land for stock, due to poor and overgrazed conditions on the Flats. This problem has already been noted by villagers living at the top of the escarpment. In a number of instances the in-migrants are reported to have allowed their livestock to graze unsupervised, affecting and damaging cultivated crops. This has significant negative impacts on the ability of agriculturalists to generate crops for sale. In the absence of effective mechanisms to resolve disputes, agriculturalists tend to sell land to the pastoralists as a survival strategy.

The risk of increasing tensions between migrants and existing landowners will be high. The project is likely to be blamed for escalating disputes in this regard. Impact magnitude in the absence of management will be high, impacts will be long term (most settlers will not leave when construction ends causing permanent impacts on existing inhabitants and potentially increasing unhappiness in the relationship between CNOOC and local communities), local and of **high** significance.

12.3.4.6 Impact Mitigation and Monitoring

In the context of the above, the following impact mitigation and monitoring is proposed:

- Ensure that there is a process to identify all stakeholders (rights holders) of any land take process. While this will mean engaging the individual who indicates that he/she is the rightful land owner, the identification process should consider information from as broad a consultation group as possible. Secondary PAPs, who may not have been immediately identified, but who have utilised the land in some way for a period of up to two decades and longer. This includes the loss of dwellings of secondary PAPs, loss of crops and assets such as mango trees and resultant loss of income;

- Undertake a full investigation of the allegations that PAPs have been forced to sign documentation and if any allegations are valid, address them comprehensively; and

- Ensure that the RAP comprehensively addresses all aspects of physical and economic displacement experienced by impacted communities, in accordance with the IFC performance standard 5 which addresses the involuntary resettlement and compensation impacts in the project-affected communities (refer to **Box 12-2**).

Box 12-2: Standard Measures to ensure that Resettlement and Economic Displacement are Effectively Managed

- *Quality of life of resettled people and host communities should not be compromised;*
- *The resettlement program has to be adequately financed by the relevant party through the Local Government, to ensure that local commitment and newly occupied resettlement land will have the same production characteristics of the expropriated ones;*
- *Support should be provided to avoid that resettled persons will negatively impact on the life standards of host communities;*
- *Both resettled persons and host communities should actively participate in the resettlement planning process;*
- *The transition period should be as short as possible, and project construction activities should not proceed until the affected persons have been resettled;*
- *The host areas must be as close as possible to the current site;*
- *Resettlement planning must ensure that families, communities and social/cultural groups are kept together to maintain social networks;*
- *Resettled people should be adequately and equitably compensated for the value of their land. In land-based livelihoods, land should ideally be replaced with land of equal or greater value; and*
- *Appropriate livelihood restoration strategies developed to restore livelihoods of affected persons.*

- Provide compensation for lost agricultural productivity during the construction period. Adequate notice of the pipeline construction schedule must be provided to PAPs so that they don't unnecessarily lose crops. Cash compensation must be provided based on the cost of planting, labour and fertiliser inputs required to bring the tree or vine to maturity, plus the cost of the lost production for the period it will take a sapling to reach the production level of the tree/vine at the time it is lost to the project;

- Ensure that the Livelihoods Restoration Plan, as well as the Community Development Plan, provide practical mechanisms and mitigation strategies for the loss of grazing land on the Buhuka Flats as a buffer against out-migration into areas contiguous with the pipeline development area as well as in respect of cultivated land. The extent of household reliance on subsistence food sources should be taken into consideration in this process;

- Set up an accessible and local "one-stop shop" in the community for all issues concerning the pipeline process to handle aspects such as the provision of basic information, a contact point for emergencies and grievances (whether the concern is related to CNOOC, its contractors or sub-contractors) about work on the project. As part of this process, provide a resource person (potentially a community liaison officer) who is able to provide on-site information to communities on the RAP and associated processes, property and land issues during construction, to monitor and assist the construction contractor's pre-entry agreement procedure and final re-instatement sign-off with owners and users and for resolving outstanding issues;

- Provide comprehensive dispute resolution mechanism linked into a coherent two-way communication system (either as part of the 'one-stop shop" or aligned with it, with associated feedback mechanisms that will be readily accessible and available to all villagers and PAPs). This could be community liaison officers who could be the main point of contact for queries, questions and concerns on property and land issues, as well as directly related to the CNOOC process and programme;

- Provide either directly, or in collaboration with an appropriate organisation such as the Uganda Human Rights Commission;

- Ensure that land temporarily used during the construction phase is reinstated to at least the condition it was in prior to construction. This would include all agricultural land, except that needed permanently for the ROW. Agricultural land must be left graded and tilled ready for re-planting. Where land must be re-planted in order to prevent erosion, the regime must be agreed with the landowner; and

- Implement a precautionary approach to offering cash compensation as an alternative to payment in kind for housing, infrastructure and land losses. CNOOC is aware of the vulnerabilities that could be caused by cash compensation and has instituted a number preconditions prior to moving forward with the payment of compensation. These have included (i) the requirement that men are not able to negotiate cash settlements without their spouses being present during the negotiation and being in voluntary agreement (ii) payment of the compensation into a bank account (where the amount is sufficiently large to warrant this) and where the account has been opened in the name of the husband as well as the wife, with withdrawals requiring the permission and signature of both spouses, and (iii) the requirement that PAPs receive training in financial literacy and business entrepreneurship.

While mechanism is a responsive approach to the problems of cash payments, a side effect has been an increase in household violence. In particular, this has led to incidents of assault by husbands where their wives have been reluctant to give approval for intended spending. Based on case reports, the main reason for CNOOC-related incidents of spousal abuse have stemmed from this cause.

CNOOC cannot take sole responsibility for this phenomenon. Additional measures, such as ensuring collaboration between LC1s, the Uganda Human Rights Commission, the Kikuube & Hoima Police Department Family and Child Services Division and traditional leaders must be considered to address general social as well as intra-household violence and disruption, and this is a Government function.

12.3.4.7 Impact Significance Rating

Table 12-26: Construction phase impact on Housing and Land

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of Involuntary Resettlement (Housing loss)	10	4	2	5	High 80	10	4	2	5	High +80
Impact of land acquisition	10	4	2	5	High 80	4	4	2	4	Low Medium +40
Impact of damages outside of the right of way	9	3	2	4	High Medium 56	2	2	2	4	Low 24
Impact of In-Migration	10	4	2	5	High 80	4	3	2	5	Low Medium 45

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance

2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

12.3.5 Infrastructure and Community Services

12.3.5.1 Impact of Project Use of Community Infrastructure and Services

The construction of the pipeline will employ in the order of 200 people, who will be resident in the temporary camps or, apart from cases where employees are from the direct local accommodation camp area (Hohwa), in which case they will be living at home. During this phase of the project, although there may be additional call for social services as a result of in-migration (discussed in greater detail under section 13.2.5.4), CNOOC is unlikely to directly impact on health and welfare, education or emergency services in the local area and district, for the following reasons:

- Construction workers will be served by a fully provisioned clinic, with trained medical staff, to cater for any injuries, emergencies or general health issues experienced by personnel working on the project;
- Families and children will not accompany construction workers and no additional services in respect of education will be needed; and
- The EPC will provide their own emergency services for smaller incidents. Rescue equipment will be available for general rescue and emergency management.

The magnitude of the direct construction - related impacts on existing infrastructure and services will be very low and impact significance will be **low.**

12.3.5.2 Impact of Project Use of Local Roads

The construction teams will make use of the construction right of way (RoW) to provide access to the working areas as much as possible. Nevertheless, it is likely that there will be use of local roads to gain access to the pipeline RoW. Heavy articulated pipe carriers and other multiple axle vehicles will quickly damage the small murram roads that crisscross the local area, causing rutting and erosion. Without mitigation, the impact is likely to be of high magnitude, local, and in the absence or repair long term, resulting in impacts of **high medium** significance.

12.3.5.3 Impact of Access Provided by Regional Road Upgrades

The improved road infrastructure to villages will allow villagers to capitalise and build on the opportunities created by the recent upgrade of a section of the Kabwoya-Buhuka road (the P1), as well as upgrades of the R7 and the R4. Poor road infrastructure has been cited as a key impediment to small-scale farmers in getting their produce to market. It can therefore be expected that increased accessibility to markets will stimulate economic growth in the area as follows:

- Strengthen the local economy by providing good access to offset opportunities;
- Identify and support programmes (including related to micro-financing) in support of vulnerable groups as required (elderly, female headed and child headed households) in settlements most directly impacted by the development as part of the Alternative Sustainable Development Plan;

- Act as buffer against the current rural push factors that create increasing non-sustainable demands on urban infrastructure and services, through the direct and indirect provision of employment opportunities; and
- Act as a catalyst for the development of local business enterprises and strengthen the District's potential appeal to larger retail chains.

In addition to the above, improvements in road conditions could strengthen social capital by allowing opportunities for increased participation in community service and sporting events, as well as offering more ready access to health care facilities and schools.

It is expected that the improvements in district and regional road infrastructure will result in positive long term impacts of high magnitude and **high** significance.

Figure 12-7: Regional road upgrades proposed above the escarpment

12.3.5.4 Impact of In-Migration

Based on information obtained during the consultation process, the District Land Office as well as local councillors (LC1s) and villagers have indicated that there has been a significant influx of migrants into the sub-counties across which the proposed pipeline will run. According to the District Land Board, applications for purchase of land have primarily been for the purpose of large-scale agriculture, although there have also been applications for the establishment of villages ('towns'). The major increase in land speculation in the area is said by villagers to be largely driven by politicians and high level officials directly attributed to knowledge about the suite of developments that have been proposed for the area which includes the oil pipeline construction, a proposed oil refinery, an international airport, petro-chemical industries, waste management facilities an ammonia fertilizer plant as well as housing for refinery workers. (World Bank, 2015:43).

There has been a further influx of people seeking employment and business opportunities that has been facilitated by the improved access to the area brought about by the road network being developed. Experience shows that it is highly likely that additional people will be attracted to the area once pipeline construction activities commence, seeking to sell goods and services ranging from food to prostitution, predominantly around Hohwa where the construction accommodation camp will be situated. This could cause tension with local communities, limit opportunities for local businesses, increase competition for public services and resources, and increase the potential for the spread of diseases and illegal activities including drugs use.

The construction workers and influx of people seeking opportunities might increase demand for infrastructure, goods and services. Infrastructure and facilities that might be impacted include local roads, healthcare and educational facilities and water sources.

- Road Network: There is currently limited traffic on the smaller secondary and tertiary road networks and road conditions, particularly during the rainy season can become quite slippery and treacherous even when relatively well maintained. Additional traffic loads could increase traffic related risks and accidents;
- Schooling: The government schools in the District are currently facing significant challenges, with increasing demand being placed on existing limited services. Private schools have exploited the gap that demand has created, but are of varying quality. The private schools here, and elsewhere, are currently under scrutiny by the Department of Education which has indicated increased vigilance in respect of quality control and standards. At the same time, in the absence of adequate government-supplied educational infrastructure, demand will continue to exceed supply. Recruitment and retention of teachers is challenging due to lack of decent accommodation in the area, as well as relatively low salaries being offered;
- Health and welfare services: From the baseline socio-economic description, it is clear that there is limited health infrastructure in place that can provide adequate services to all villages from Buhuka to Kabaale. Self-reported disease and illness levels are high and have a significant influence on a households' ability to engage in their livelihoods. Unconfirmed reports from villagers state that despite presenting with symptoms of malaria, testing is not carried out as no medicine is available even if a diagnosis is confirmed. Further in-migration will place additional calls on the already overloaded system (specifically related to children and maternity health), emergency housing support; and family support services;
- Emergency services: These services are not readily extended from the Buhuka Parish area to the villages contiguous to the feeder pipeline, despite the improved access. Increased populations will increase pressure on those services that exist; and
- Water supply: Communities have indicated that one of their main development needs is water supply. Population influx has already served to exacerbate this situation and it is expected to worsen with increasing populations.

Overall, in the absence of Government and CNOOC interventions, the impact of in-migration is likely to overwhelm the capability of the infrastructure and community services available to the communities along the pipeline, in particular Hohwa. Negative impacts are also likely to be experienced by the poorest members of the communities, who will be unable to take advantage of economic opportunities but will experience the negative effects of burgeoning growth. With regard to community infrastructure and services, the following points can be made:

- A dilution of local Government influence, as newcomers into the area are typically unfamiliar (or indifferent about) local Government rules and leadership structure. This has already started causing tension within and between communities and this trend will be aggravated by further migrants; and
- The price of rented accommodation is likely to rise sharply. During the project's construction phase, migrants in search of work may look for rental accommodation rather than purchase new housing. As additional demand for housing emerges, there will be a sustained increase in rental prices. While this will benefit the owners of accommodation, it will make rental costs for existing tenants (particularly poor tenants) unaffordable.

In the absence of mitigation, impacts are likely to be of sub-regional geographic extent, long term and potentially high magnitude and **high** significance.

12.3.5.5 Impact Mitigation and Monitoring

It is recognized that, the increases in the population arising from influx and the presence of the construction and operations workforce will place further demands on a range of community services and facilities across the Kyangwali, Kabwoya and Buseruka sub-counties and within each of the five parishes of Buhuka, Kyangwali, Butoole, Kaseeta and Kabaale. However, these impacts are largely cumulative social impacts, and as such, an Influx Management Plan is being developed to manage influx-related impacts. CNOOC is committed to ensuring that the contractor meets the contractual obligation of using local labour wherever feasible, and specifically in terms of local unskilled labour, to avoid infrastructure and community service impacts that would arise from an increase in local population due to non-local workers. This would also improve income opportunities and economic development of the local populations along the line.

CNOOC anticipates continued influx to the area and is committed to investing in sustainable social infrastructure and capacity building at the local and regional level throughout the project's life time.

The following is proposed to further assist support alleviation of cumulative pressures on social infrastructure:

- Provide timely information about the size and demographic make-up of the project construction workforce to service providers including any potential additional requirements to adequately respond to potential emergencies;
- Provide, at all times, paramedical services on site during construction as well as general rescue and emergency management services to minimise pressure on local resources;
- Communicate effectively with stakeholders including information regarding available employment opportunities and the manner in which appointments will be made, to help limit the extent of in-migration;
- Maintain ongoing community communication strategies to keep affected communities informed about changes in the project;
- Finalise the Influx Management Strategy and Framework Plan to identify appropriate measures to mitigate the expected in-migration from the presence of the project; and
- Use the Grievance Redress Mechanism for aggrieved community members affected by project related activities.

12.3.5.6 Impact Significance Rating

Table 12-27: Construction phase impact on community infrastructure and services

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of Project Use of Community Infrastructure and Services	1	2	2	4	Low 20	1	2	2	4	Low 20
Impact of Project Use of Local Roads	8	4	2	5	High Medium 70	2	2	2	5	Low 30
Impact of Access Provided by the Regional Road Upgrades	8	5	3	5	High +80	8	5	3	5	High +80
Impact of In-Migration	8	4	4	5	High 80	4	3	3	5	Low Medium 50

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

12.3.6 Individual, Family and Community Life

A number of individual, family and community level impacts have already started manifesting as part of the pre-construction phase of the pipeline development. Of particular importance are those impacts that relate to aspects of Social Licence to Operate and individual and social disruption emanating from increased incidents of intra-household conflict and abuse, as well as high levels of fear and uncertainty amongst the general population of villagers along the pipeline.

12.3.6.1 Unmet Expectations

The low levels of formal employment in the host Districts, particularly in the directly affected rural settlements makes employment highly desirable. Work seekers who are not successful in their applications for employment opportunities may become frustrated, with resultant resentment and even hostility towards CNOOC as well as those villagers who have succeeded in gaining appointments. Due to the fact that the

LC1 of each village is required to verify that work seekers do reside within the village as stated, a perception that LC1's are involved in "gate-keeping" could easily gain currency.

This issue is likely to be a key concern, affecting CNOOC's social license to operate in the long term, and is considered to be of high magnitude and **high medium** significance. Although experience of large scale construction projects indicates that it will be difficult to eliminate all bias from the recruitment process, there are key measures that can be put in place that could assist in managing this impact, reducing the impact significance to **low medium.**

12.3.6.2 Mistrust and Social Licence to Operate

At the time of the consultation process in 2018 that served to update the SIA, there appeared to be limited knowledge about the project among households. Village level discussions were dominated by questions about the project. Although there has been a process of engagement of villages along the proposed pipeline route as a part of the ESIA, there appears not to have been any further productive discourse about their concerns and fears during the RAP negotiations, which have concentrated on resettlement issues.

PAPs appear to have a reasonable sense of certainty about the resettlement and compensation process, due to a thorough RAP process, but there is still wide-spread uncertainty about some aspects, such as the relocation process, as well as fears related to future safety and security. Assurances by CNOOC that "nothing will go wrong" or that "if something goes wrong we will be the first to know"; are comments which community members have viewed as dismissive of their concerns. There is also suspicion amongst landowners directly adjacent to the proposed pipeline about the need to sign documentation. The relevant documents, required by NEMA and the Government of Uganda[24], will not infringe on their rights, but they do require that landowners provide a signed statement that they understand that the permanent pipeline RoW may not be appropriated or used in any way. Coupled with mistrust emanating from the reported experience of being witness to or victim of previous questionable transactions, this has created a sense of uncertainty and disquiet amongst landowners.

In the absence of mechanisms that will encourage ongoing (as opposed to intermittent) communication with stakeholders, these impacts will be long term (entrenched negative opinions about the project extending beyond the construction phase). Taking into account the vulnerability of the rural people directly and indirectly affected by the pipeline, the impact magnitude will be high, resulting in a **high** significance both for the people concerned, and in respect of CNOOC's social license to operate. With appropriate communication and a strict adherence to promises made to stakeholders, it is expected that these perceptions can be reversed, and impacts can be reduced to **low** significance.

12.3.6.3 Disruption of Social Networks

Based on the routing of the pipeline, a significant number of households across the various villages will require relocation. Even where cash compensation has been accepted, all PAPs consulted have indicated that they intend continuing with their agricultural activities, but at a different location either within the vicinity of the village in which they live or outside of it. Where people relocate from their original villages to new ones, they could suffer the following permanent or long-term disruption:

- troubled, discontinuous or fragmented social ties;
- dismantled production systems;
- individual/household impoverishment resulting from the loss of productive assets or income sources;
- relocation of individuals/households to alternative environments where their productive skills may be less applicable and the competition for resources greater;
- dispersion of kin groups; and

[24] *In accordance with the Petroleum Exploration, Development and production Act 2013, Section 135 that requires consent of landowners and users*

- loss or diminishment of supportive networks, mutual assistance and cultural identity.

These impacts will especially manifest among PAP's that involuntarily move to new or distant locations from their original area of abode. At the same time, PAPs who voluntarily take up a cash compensation option may, inadvertently, place themselves in the same position. Without sensitive handling, the impact will be long term, persisting beyond the construction phase, of high magnitude and **high medium** significance. Even with careful mitigation and monitoring it is likely that these impacts will persist, and will not be eliminated or reduced to negligible levels.

12.3.6.4 Impact Mitigation and Monitoring

The mechanisms to redress community concerns include a change from the approach that regards villagers and PAPs as passive recipients of information to an approach that ensures information exchange and serves to engage PAPs and villagers in discussions and dialogue. This will be particularly important in instances where there will be the need to ensure the cooperation and support from affected settlements. This is not only a critical element for promoting the company's Social Licence to Operate, but is fundamental in addressing the future safety of the pipeline.

The following impact mitigation and monitoring is proposed:

- Establish a sound Community Relations Strategy (CRS) which meets international best practice standards and conventions, all relevant aspects of the Ugandan Constitution and applicable regulations and demonstrates sensitivity and respect for the culture, values and traditions of the affected settlements. The CRS should incorporate real measures that will allow for:
    - timely, open and transparent communication and information sharing, including related to preparatory construction activities) in ways and formats that are fully understandable and accessible to villagers regarding the procedures, schedules as well as potential impacts of construction and operational activities in accordance with international best practice for consultation and disclosure.
    - provide training and ensure the allocation of sufficient and appropriate resources to ensure that all CNOOC employees, contractors and sub-contractors, including dedicated community liaison officers, are aware of and comply with the CRS as well as with CNOOCs commitments to the communities.
    - community liaison officers (or other appropriate resource personnel) to work alongside the construction activities (at the construction camp as well as alongside the pipeline) to assist and advise stakeholders as required.
    - active and timely consideration of community views to allow a clear understanding of concerns, expectations and issues and to design and implement appropriate measures for mitigation or remedy.
    - develop appropriate objectives and targets that will ensure a process of continuing improvement in respect of community relations management and performance.
    - maintain social and community monitoring programmes and provide accurate, clear and transparent project information to community members as well as other stakeholders as required, including CSOs and the UHRC.
- Set up a formal complaints procedure to record and address any complaints received. This is in addition to the grievance mechanism described in Box 12-1, which is intended to accommodate issues where compensation for damages is possible). The complaints procedure should include the provision of nominated individuals (potentially community liaison officers) for community members from settlements along the pipeline to address complaints to directly; as well as commitments in respect of response times required to address complaints. Details of the (toll free) telephone number as well as the procedure to be followed for lodging complaints should be distributed to LC1s, as well as at community meetings and via posters to all communities in the vicinity of the working area, the construction camp

and close to roads that will experience significant increases of traffic. The procedure must make provision for all calls to be answered in person whenever possible during working hours and recorded at all other times. Comprehensive details of the complaint, source, the location as well as date and time of the offending event or issue must be recorded. All complaints will need to be investigated, with feedback provided regarding the outcome of the investigation, as well as the steps taken to address the issue. The location of the community liaison team must be widely publicised so that, where possible, complaints can made in person; and

- Ensure that provision is made for communities to be provided with the contact number of an appropriate person or persons within CNOOC in the event that the initial complaint is not satisfactorily handled. The resolution of any complaint should, in any case, be dealt with as speedily as possible**.**

12.3.6.5 Impact Significance Rating

Table 12-28: Construction phase impact on individual, family and community life

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of Unmet Expectations	8	4	2	5	High Medium 70	3	2	2	5	Low Medium 35
Impacts in respect of Mistrust and SLO	8	4	2	5	High Medium 70	2	2	2	5	Low 30
Disruption of Social Networks	8	4	2	5	High Medium 70	4	3	2	5	Low Medium +45

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

12.4 The Socio-Cultural Environment

The construction of the pipeline will involve clearing of the 30 m wide construction right of way and excavation of the trench for laying the pipeline. All surface or near surface heritage material is likely to be destroyed as a result of bush clearing. In the case of the trenching, more deeply buried materials may be affected.

Only very preliminary work has been done along the pipeline route and the findings below are provisional. Once the pipeline route is pegged, more detailed assessment will be necessary to determine the occurrence of any additional heritage resources.

12.4.1 Potential impact on heritage resources

The following known heritage resources are potentially impacted by the construction of the pipeline. Heritage resources are divided into those that would definitely be destroyed, being within the 30 m construction right of way (RoW) of the pipeline, and those which are potentially damaged, being outside of the 30 m construction RoW but within 100 m of the pipeline centreline:

- The 'LI' sites are lithic archaeological sites from the Stone Age (Figure 12-8). Four sites (Li-47, Li-51, Li-52, Li-53) are directly affected by the pipeline footprint and will be destroyed (refer to Figure 12-8). These sites have high sensitivity and their loss will result in an impact of high magnitude, permanent duration, regional scale and **high** significance. The surface scatter along the escarpment is potentially indicative of increased sub-surface archaeological potential in the vicinity. The probability of damage to the sites outside of the construction right of way and within the 100 m buffer area is medium and the impact significance will therefore be reduced to **medium;**
- The 'CE' sites are cemeteries and are highly sensitive to disturbance. One site (CE-17) is within 250 m of the pipeline right of way. Impact magnitude on this site, if it were to be disturbed, would be high although the probability of impact is only medium. Impact significance is judged to be **high medium;**
- The 'MP' sites are medicinal plants identified within the servitude footprint (Figure 12-9). Five sites are likely destroyed within the pipeline RoW while a further six sites have been identified within the 100 m buffer. These sites are likely to be indicative of others in the immediate vicinity and elsewhere along the pipeline route where searches have not yet been undertaken; and
- It is assumed that any loss of medicinal resources will be local and permanent. Clearance of these resources without mitigation would result in impact of medium magnitude and local extent, with a **low medium** significance.

It is difficult to predict how and when changes to intangible heritage will occur during project construction. Some cultural change is inevitable. The influx of people seeking work or other indirect socio-economic benefits, together with any loss of access or changes in environmental setting of sites used for traditional activities, is likely to have an impact. Determining the severity of this impact is subjective with deviation from the local cultural norm perceived as either positive or negative by different people. An influx of migrants may either strengthen or weaken local cultural practices over the project lifetime. If impacts were to occur they would be of unknown/long term and potentially of medium magnitude and major significance.

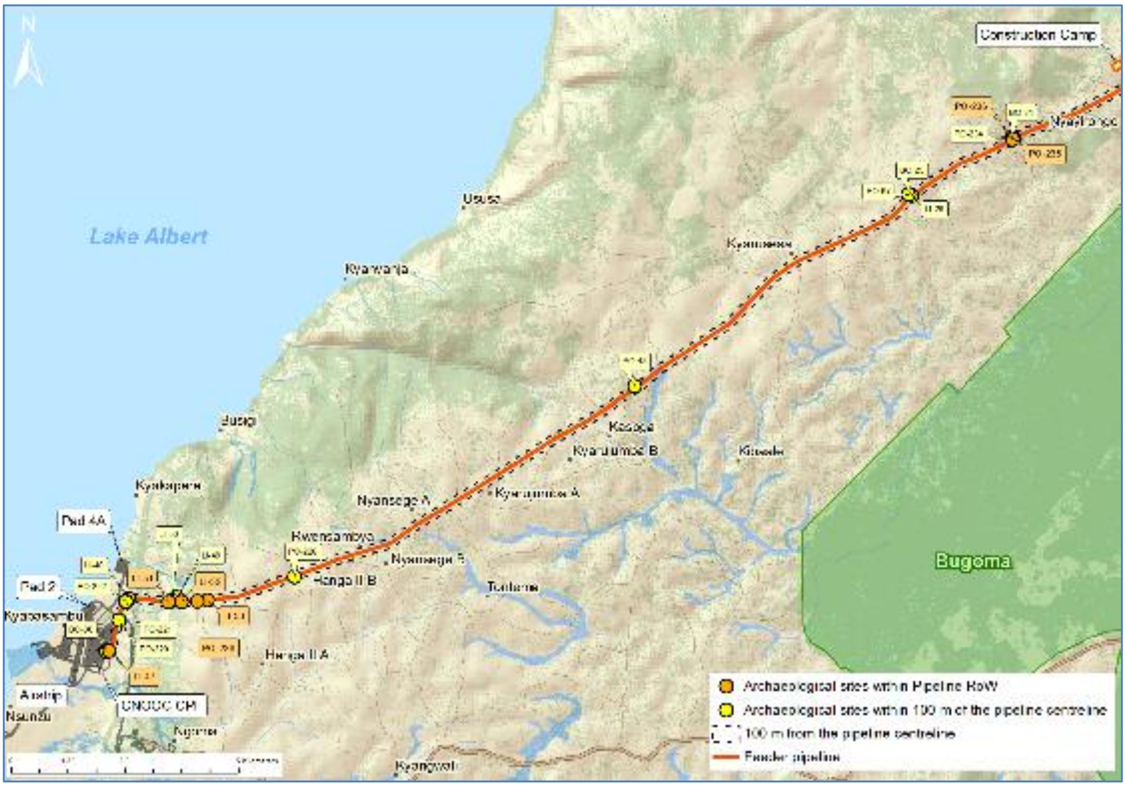

Figure 12-8: Archaeological resource directly or potentially affected by construction of the feeder pipeline

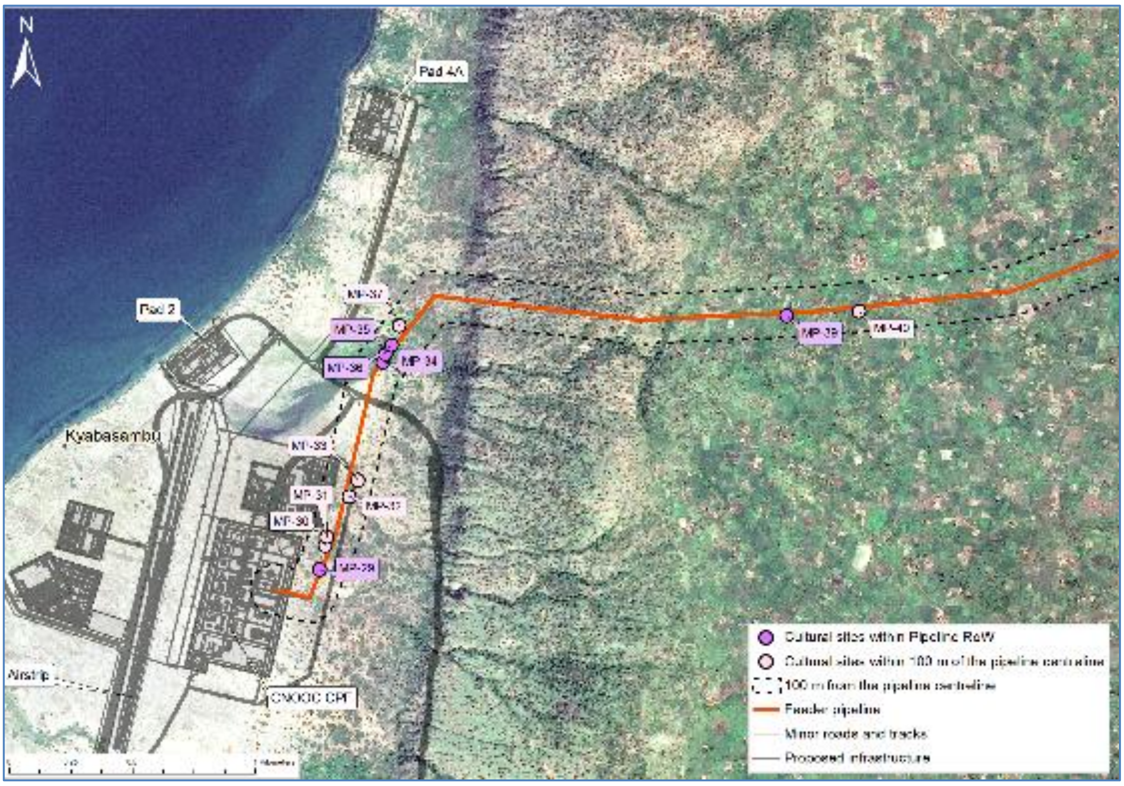

Figure 12-9: Medicinal plant resources directly or potentially affected by construction of the feeder pipeline

12.4.1.1 Impact Mitigation and Monitoring

The following impact mitigation and monitoring is recommended:

- There is potential for the disturbance of previously unidentified archaeological material (i.e. accidental damage or chance finds). Prepare a project-specific, 'site ready', Chance Find Procedure. The Chance Find Procedure must be updated during the course of construction to make provision for a course of action in the event that any cultural heritage artefacts are recovered. It must be presented to the relevant local authority and the National Museum. It must also be provided to all contractors and consultants on the project site during all pre-construction and construction activity and incorporated within the project's 'site induction' process. It must remain in place throughout construction. The Chance Find Procedure is to be a component of a detailed Cultural Heritage Management Plan (CHMP) (as required by IFC PS 8);
- Where there are known gaps in the archaeological field survey, specifically those inaccessible areas along the pipeline route, assess these immediately in order to fully capture a complete archaeological baseline for the project and eliminate the risk of archaeological induced delays during the construction phase;
- Hold an urgent discussion with CNOOC to determine strategies for avoidance of those potentially highly sensitive archaeological sites identified within, or in close proximity to, the project footprint, which include sites within the Central Processing Facility; Pads 3 and 4A; the materials yard / the camps; and the jetty area;
- Undertake a further stage of cultural heritage study, as a priority, to verify the association (if any) of those surface artefacts recovered and potential sub-surface archaeological features indicative of settlement/industry. This would comprise shallow, targeted, hand-dug test pits (e.g., 1 m x 1 m in size) through which the archaeological potential could be firmly established and any further material analysis undertaken. This excavation programme will seek to eliminate the risk of archaeologically-induced delays during the construction phase;
- Implement a programme of pre-construction mitigation in the event that these targeted sites yield archaeological material. Avoidance (preservation *in situ)* is preferred but where this is not possible, "preservation by record" through systematic recording (e.g., archaeological excavation) is the only recourse. Such work, where required, must be described in appropriate detailed work programmes and specifications to be prepared by the cultural heritage specialist. To meet the requirements of Ugandan law this work should be carried out by a suitably qualified person under a licence for archaeological survey as issued by the Minister. In the event of artefact recovery, all materials should be surrendered to the National Museum; and
- Monitor the impact of construction on archaeology in the form of a 'watching brief', if necessary, once the test pitting exercise has better established or dismissed the extent of any below-ground archaeological potential. The watching brief will occur during all ground intrusive activity which form part of the construction phase and include an archaeologist in attendance. The watching brief will involve monitoring soil removal / land take for the presence of cultural heritage material. The archaeologist must have the authority to stop construction work in the event that significant materials (e.g., burial sites, iron furnaces) are exposed. These sites will be recorded in full employing 'preservation by record'. The results of the watching brief must be presented to the relevant local authority. Provisions should be made to exhibit materials to interested stakeholders, including the local community.

12.4.1.2 Impact Significance Rating

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Lithics: LI-47, Li51, Li-52, Li-53	8	5	2	5	High 70	3	1	2	5	Low 30
Lithics: LI-47, LI-48, Li-49, Li-50, Li-26	8	5	2	3	Low Medium	2	1	2	2	Low 10
MP-29, MP-34, MP-35, MP-36, MP-39	6	5	2	5	High Medium 65	2	1	2	5	Low 25
MP-30, MP-31, MP-32, MP-33, MP-37, MP-40	6	5	2	3	Low Medium 39	4	5	2	2	Low 22
Cemetery (CE-17)	10	5	2	3	Low Medium 51	5	1	2	2	Low 18
Heritage Losses due to In-Migration	6	5	2	3	Low Medium 36	4	5	2	2	Low 22

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

13.0 OPERATIONAL PHASE IMPACTS OF THE FEEDER PIPELINE

The impact of the feeder pipeline is discussed in a series of five chapters that address impact and mitigation during construction (Chapter 12), operational (Chapter 13) and decommissioning (Chapter 14) of the feeder pipeline, followed by a discussion on unplanned events (Chapter 15) and the alternatives which were considered in relation to the feeder pipeline (Chapter 16).

The current chapter, Chapter 13, describes the impacts associated with construction of the feeder pipeline.

The operational phase impacts of the feeder pipeline are associated with activities that are related to the phase itself, and not the time at which they occur. Hence, the recovery of vegetation over the construction right of way is a medium-term impact of the construction phase, not an operational phase impact. Impacts caused by new activities, such as pipeline maintenance, which are unrelated to a construction phase activity, are operational phase impacts. All impacts associated with oil flowing in the pipeline and the maintenance of the pipeline are operational phase impacts.

In assessing the impacts of the operation of the pipeline, the specialist team took into consideration the following (further detail is provided in Section 2):

- Woody vegetation will not be permitted over the extent of the pipeline trench and will be actively cleared from time to time. This is to prevent root damage to the pipe;
- Cathodic protection posts will be located at convenient places where existing tracks cross the pipe. A road for maintenance purposes along the pipeline is not required for the operational phase;
- No provision to vent vapour or liquids will be required along the pipeline. There are therefore no air pollution impacts;
- No pump stations are required other than the station at the CPF. Two valve stations are provided for; and
- The pipe will be heat traced using a heating blanket and insulated to maintain the temperature of the oil at around 50°C.

13.1 The Physical Environment

13.1.1 Air Quality

There is possibility for air emissions from Right of Way maintenance activities. Once the contractor has reinstated the works in accordance with the specification and the warranty period has expired, the responsibility for rehabilitation maintenance along the pipeline and flowlines will revert to the operator. The permanent right of way will be unfenced and 10 m wide. Community access across the pipeline will not be affected and natural indigenous grass cover will be encouraged over the pipeline to prevent erosion. Grazing over the right of way will be permitted, while cultivation and settlement will be prohibited in this area. Therefore the impact will be relatively negligible with application of the following mitigations.

Table 13-1: Operational phase impacts on air quality

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Dust raising	2	4	1	2	Low 14	1	4	1	2	**Low 12**
KEY										

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

13.1.1.1 Mitigation and Monitoring

Dust caused by Operation/maintenance activities shall be controlled to ensure no detrimental effect on landowners, occupants, employees or the public. The contractor shall comply with the Ugandan legal requirements and IFC/World Bank air quality guidelines for suspended particulates. These are as follows:

- Suspended Particulates (Ugandan daily standard): 200 µg/m^3;
- PM_{10} (IFC daily standard): 50 µg /m^3; and
- PM_{10} (IFC annual standard): 20 ug/m^3.

Where considered necessary by CNOOC, the Operation/maintenance contractor shall demonstrate compliance with the above standard by monitoring of dust using passive air quality monitoring devices.

- Dust suppression measures to meet the standard shall include dust suppression along roads using water carts and, where necessary, 'environmentally friendly' surface binding products to achieve dust reduction;
- The Operation/maintenance contractor shall ensure that sufficient watering capacity is available on site to dampen dust at all work areas and along access roads used by Operation/maintenance traffic, particularly in areas where there are nearby communities; and

These measures will be applicable where repeated trips are necessary for purposes of maintenance, in particular in proximity to schools and through villages.

13.1.2 Soils

13.1.2.1 Impact of Thermal Expansion of the Pipe on Surface Cracking and Erosion

With the possible exception of the effects of thermal expansion of the pipe on soil cracking at the surface. If this were to occur in places, it would disturb the vegetation cover and create pathways for erosion. The extent to which this impact could manifest is uncertain at present, but it is referenced in the Basis of Design Report and is the subject of more detailed study. The BOD indicates that in places, deeper burial of the pipe may be necessary in order to minimize this risk. For the purposes of the environmental assessment, the impact is regarded as restricted to the local area, of medium magnitude (some exposure at the surface, causing a risk of erosion) but with an unknown probability of occurrence, which will result in **low medium** impact significance. Subject to the necessary design mitigation the residual impact significance should be **low.**

13.1.2.2 Impact of Maintenance Activities

Maintenance activities will cause impacts on soils, particularly if dig ups are necessary and there is some spillage of oil. This would be localized and is unlikely to extend outside of the permanent right of way. Pigging may also result in some spillages, and the generation of Naturally Occurring Radioactive Waste, although this is usually done within a controlled environment to ensure that spills are contained and that any NORM is handled in accordance with appropriate protocols. Without mitigation, impacts should be of low magnitude and **low medium** significance. With appropriate due diligence during maintenance activities, residual impacts should be of **low** significance.

13.1.2.3 Mitigation and Monitoring

- Accelerated erosion during storm events shall be minimised during all stages of Operation/maintenance. Should this be unavoidable, specific erosion control measures shall be implemented for the duration of the storms (e.g. packing of sandbags to control storm drainage, diversion berms, temporary culverts etc.) in order to minimise erosion: Specific measures include;
  - ECO to inspect servitude to ensure no signs of erosion. Particular attention to be paid to steep slopes and pipeline exit up escarpment;
  - Inspection to include visual inspection of all storm water diversion structures taking particular account of where storm water is being discharged to in order to ensure that no inadvertent damage to adjacent community properties is occurring; and
  - Inspection to specifically include walk down of receiving drainage lines in all low points. Drainage line inspection to commence 50 m above pipeline crossing of drainage line and continue for 200 m below crossing point. Specific points of note are signs of enhanced erosion through accelerated water volumes and/or signs of sedimentation and siltation of the watercourse below the point of pipeline interception.
- Should CNOOC, or any of their appointed contractors, require making use of either surface water or groundwater resources during the operational and maintenance period, CNOOC is to ensure that all necessary permits for the use of surface water and groundwater have been obtained by the staff and/or the relevant contractor.

13.1.2.4 Impact Significance Rating

Table 13-2: Operational phase impacts on soils and erosion

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of thermal expansion of the pipe on surface cracking and erosion	6	4	2	4	Low Medium 48	6	4	2	2	Low 24
Impact of pipeline maintenance activities	6	4	2	4	Low Medium 48	2	2	2	5	Low 30

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

13.1.3 Surface Water and Groundwater

13.1.3.1 Impact of Pipeline Maintenance Activities

Under normal operating conditions, there will be no releases from the pipeline to the environment. The pipeline is sealed along its entire length, and its integrity will be monitored continuously at the CPF. Small spillages are possible during maintenance activities at valve stations, during pigging and in the case of pipe dig ups to repair damaged pipe or suspect welds. In the case of pigging, the management of oily wastes will be necessary, but this will be done within a controlled environment at the pig launchers and receivers, where containment of spills is catered for in the design. The greater risks lie in areas along the pipeline route, outside of controlled areas, where there is no provision for managing spills and where any work to repair the pipeline could result in the release of oil into the environment, potentially contaminating surface and groundwater (this excludes accidents where greater volumes of oil could be lost into the environment, which is discussed in Section 15, ‘Unplanned Events’).

Without adequate provision to prevent and clean up spills during maintenance, there is a risk of local pollution, which depending on its location could contaminate surface water or groundwater in the immediate vicinity. Given the viscosity of the oil, it is likely to cool rapidly on release and spread rates would be slow, providing the opportunity for clean-up before the spill has spread away from the work sites. Impact magnitude would be high, but restricted to the immediate area around the work site. Long term or permanent effects are possible, if clean-up is not prompt and effective. In such a case, impact significance could be high **medium**, reducing to **low** if appropriate pollution management protocols are complied with.

13.1.3.2 Mitigation and Monitoring

The following mitigation and monitoring is recommended:

- Undertake a pre-assessment of any possible spillage risks prior to any maintenance work being done and evaluate the potential impacts in the context of the sensitivity of the immediately surrounding environment;
- Where maintenance activities take place near or within drainage lines or seasonal wetlands, or close to community water supplies, ensure that the necessary management measures are identified in the work authorization and are appropriately catered for;
- Ensure that all maintenance is undertaken along the pipeline with appropriate spill management equipment readily available on site;
- Train all maintenance teams about the consequences of oil spillages into the natural environment and the importance of due diligence when undertaking pipeline maintenance; and
- In the event that Naturally Occurring Radioactive Waste (NORM) is encountered during pigging, follow recognised protocols for its management and disposal (such as *OGP, 2008, Guidelines for the Management of Naturally Occurring Radioactive Material in the Oil and Gas Industry*).

13.1.3.3 Impact Significance Rating

Table 13-3: Impact on Surface and Groundwater

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of pipeline maintenance on surface water and groundwater	8	4	2	4	High Medium 56	3	2	2	2	Low 14

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

13.1.4 Noise

13.1.4.1 Impact of Pipeline Maintenance Activities

There will be no significant noise generated by the operation of the pipeline other than noise from the export pumps at the CPF. Since these are a part of the operating infrastructure of the CPF, within the boundaries of the production facility's security fence, the impacts have been combined with those of other sources in the CPF and are assessed in Section 8. The pipeline will not be manned and maintenance checks of CP posts and other infrastructure will be done using an LDV from time to time. Repairs (such as dig-ups of the pipe) are typically very infrequent and are unlikely to occur more than a few times during the life of the project. In such cases, there could be localized nuisance caused by heavy vehicles and equipment, depending on the location of the repair in relation to local populations. These activities would be short term (probably no more than a few days or at most weeks), of local geographic extent, and of low magnitude (affecting few people). Impact significance would be **low medium**. Subject to appropriate communication with local people and, if necessary, the shielding of noise sources, particularly if operating at night, the impact significance will be reduced to **low.**

13.1.4.2 Mitigation and Monitoring

Refer to Section 8 for mitigation of noise generated by pumps and equipment within the CPF battery limits.

The following mitigation is recommended to minimise noise impacts along the pipeline route:

- Undertake a pre-assessment of the location of any maintenance work prior to it being done and evaluate the potential noise impacts in the context of the activity to be undertaken and the proximity to local habitation and other noise-sensitive uses. If there is potential for impact, ensure that the affected people are consulted and are aware of the work schedules, and consider reasonable measures to reduce noise nuisance during the maintenance period;
- Noise levels need to be in compliance with Ugandan Noise standards for operations. In their absence, the World Health Organization guidelines for daytime and night-time noise should be adopted;
- Diesel powered and/or mobile equipment to be used for maintenance purposes, such equipment shall be appropriately muffled, well maintained and, where possible, (on-site generators) positioned so as to cause the least impact on adjacent communities and households;
- Avoid night work at all times during operation;
- Should night-time work be necessary, under emergency circumstances, CNOOC CLO's are to forewarn communities of the need for night-time work and ensure field teams take every precaution to limit the extent of noise generating equipment used at night and position such equipment, where possible, in a manner that it minimises impact on households:
- Where night time work is necessary utilising noisy equipment, CNOOC to make available hearing protection (standard PPE soft disposable earplugs) to community members to minimise sleep disruption.

13.1.4.3 Impact Significance Rating

Table 13-4: Operational phase impacts on noise

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact of pipeline maintenance on noise nuisance	8	2	2	3	Low Medium 36	3	2	2	2	Low 14

KEY			
Magnitude	**Duration**	**Scale**	**Probability**
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

13.2 The Biological Environment

Operational phase impacts on the biological environment concern the effects of the feeder pipeline on habitats and ecosystem integrity of the valued environmental components along the route, which include the escarpment vegetation corridors and the drainage lines and wetlands. It is noted that the direct impacts of construction activities, such as bush clearing and the re-establishment of vegetation, edge effects and alien plant invasion along the cut line are considered to be long term construction impacts (which carry though into the operational period of the project), rather than operational impacts. These are considered in Section 12. Operational impacts are confined to those that result from project or project-related activities occurring during the operational phase of the project. Operational impact assessment considers:

- The effect of heating of the pipeline on soils and habitat above the pipe;
- The effect of the presence of the pipeline on sub-surface flow of water in wetlands; and
- The effect of maintenance activities (also discussed under Section 13.1 in relation to soils and surface water). The assessment is not concerned with major accidents, such as the failure of a pipe weld and loss of large volumes of product into the environment. This is considered under Section 15 'Unplanned Events'.

These impacts are considered in the context of representativeness, ecosystem composition and ecosystem configuration (see Table 13-5 for a definition of these indicators).

Table 13-5: Definitions of impact assessment criteria related to habitats and ecosystem integrity

Impact Criterion	Impact Characterisation
Representativeness	Impact on the uniqueness of the ecosystem. This rarity factor is related to the concepts of irreplaceability (rarity or uniqueness in the landscape) and vulnerability (the degree of threat).

Impact Criterion	Impact Characterisation
Ecosystem Composition	Impact on diversity and complexity of the ecosystem - what is there and how abundant it is
Ecosystem Configuration	Impact on the linkages between habitats of the same or different ecosystems. Natural linkages provide an important ‘playing field’ for ecological processes and enable the goal of their persistence. These linkages are in contrast to a highly-fragmented landscape where patches of natural habitat are effectively isolated.

Outside of the escarpment corridor and small wetlands and riparian areas affected along the route, no other areas of conservation significance exist along the pipeline. Under normal operating conditions, the pipeline will have no impacts on species of conservation concern and these are not considered further in this section. Similarly, the important indirect biodiversity impacts associated with the migration of people into the region in search of work, encouraged by perceptions about opportunities in the oil industry and associated development, is covered in the assessment of the production facility in Sections 7 and 8. The pipeline is unlikely to significantly add to these impacts, since it involves no permanently manned facilities outside of the battery limits of the CPF and will not encourage job seekers, other than in the general sense of being a part of a large industrial project that could create opportunities. The reader is referred to Sections 7 and 8 for an assessment of the significance of migration into the area in relation to the operation of the project as a whole.

13.2.1 Habitats and Ecosystem Integrity

13.2.1.1 Impact on the Escarpment Corridor

13.2.1.1.1 Representativeness

Under normal operating conditions, ongoing project activity is not expected in the escarpment section of the pipeline route and no further direct impacts will occur over and above those expected during the construction phase of the project. Therefore, the probability of impacts occurring was set as improbable, and impacts of low significance are predicted on representativeness of the escarpment vegetation corridor during operation of the pipeline.

13.2.1.1.2 Ecosystem Composition

The pipeline will be buried to approximately 1.0 m depth. The crude oil enters the pipeline at a temperature of 80° C and heating is required to keep the minimum temperature over 50°C. While the pipeline will be insulated, there may still be some radiative heat losses which will warm the soil above it, with the potential to dry out the soils and influence the dominant type of flora species in the grass/herbaceous layer on the surface. Drought-tolerant or xerophytic species may dominate over species that require seasonally-cooler periods for dormancy, or species that require more moisture, affecting the ecosystem composition of vegetation communities and associated fauna (e.g. invertebrates). Taking into consideration the steep slopes and harsher growing conditions, this could result in a deterioration in vegetation cover and increasing levels of erosion over the trench. This impact is expected to be long term, reversible and very localized, affecting only vegetation over the pipeline trench. Impact magnitude will be medium and impact significance **low medium.** In the absence of more specific information about heat losses through the pipeline insulation and heat transfer through the soils, the impacts are uncertain.

13.2.1.1.3 Ecosystem Configuration

Once construction equipment has been removed and the right of way has been rehabilitated, the operation of the pipeline will present no barrier to the movement of faunal species using the escarpment vegetation corridor. The right of way will not be fenced. Although it will be long term, impact magnitude will be negligible and impact significance will be **low.**

13.2.1.2 Mitigation and Monitoring

The following mitigation and monitoring is proposed:

- Verify the likely risk of heat transfer to the surface and ensure that the pipeline is sufficiently well insulated and buried deep enough to minimise heat increases at the surface;
- Include drought-tolerant species in the seed mix of the steep sections of the pipeline trench which are actively seeded after construction;
- Monitor plant recovery over the pipeline trench where growth could be affected by the increased temperature of the soil. If necessary. Make provision for irrigation on the steep slopes on a semi-permanent basis.

13.2.1.3 Impact Significance Rating

Table 13-6: Operational phase impacts on habitats and ecosystem integrity – the escarpment corridor

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Representativeness	1	4	1	1	Low 6	1	4	1	0	NSI
Ecosystem composition	6	4	1	3	Low Medium 33	2	4	1	2	Low 14
Ecosystem configuration	2	4	1	3	Low 21	1	4	1	2	Low 12

KEY

Magnitude	Duration	Scale	Probability
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

13.2.1.4 Impact on Wetlands and Drainage Lines

13.2.1.4.1 Representativeness

During operation, no additional direct effects on the extent and/or condition of wetland, aquatic and riparian habitats are predicted under normal operating conditions.

13.2.1.4.2 Ecosystem Composition

The presence of linear infrastructure, such as pipelines, through wetlands is known to have detrimental impacts on the functioning, processes and species composition of these communities (Roise et al. 2004). Buried pipelines passing through wetlands may result in losses of biodiversity at local and downstream scales largely due to changes in geomorphological properties and interruption of sub-surface hydrology, which could affect the maintenance of flow to wetland areas downstream of the crossing or result in increased erosion potential around the buried pipeline. Given the depth of burial (>1 m through wetland areas and stream crossings) and the small drainage lines and areas of seasonal wetland affected along the route (approximately 333 m in total), this impact is considered to be relatively minimal. Impact duration will be long term, at a local scale and of low magnitude. Combined with high receptor sensitivity the impact significance will be **low medium**. Ensuring that the design makes provision for the pipeline to be buried through rivers and wetlands at a depth that minimises any material interruption of subsurface flow should reduce the impact significance to **low**.

13.2.1.4.3 Ecosystem Configuration

Although the feeder pipeline will cross currently contiguous wetlands and riparian habitats in the LSA, it will be buried and rehabilitated following construction, and rehabilitation measures will eventually return the affected areas to a vegetation cover similar to baseline vegetation communities. During operation, the pipeline is not expected to represent a significant barrier to movement, or break in habitat connectivity, for wetland and riparian faunal species. No significant changes to ecosystem configuration of the wetland and riparian habitats as a result of the long-term operation of the pipeline are predicted. Impact magnitude will be minor and impact significance will be **low.**

13.2.1.5 Mitigation and Monitoring

The following mitigation and monitoring is proposed:

- Verify that the design depth of the pipeline is sufficient to minimise the interruption of sub-surface flows of water in the wetlands and drainage lines that are crossed.

13.2.1.6 Impact Significance Rating

Table 13-7: Construction phase impacts on habitats and ecosystem integrity – wetlands and drainage lines

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Representativeness	2	4	2	2	**Low 16**	1	4	1	2	**Low 12**
Ecosystem composition	4	4	2	4	**Low Medium 40**	2	4	1	4	**Low 28**
Ecosystem configuration	2	4	2	2	**Low 16**	1	4	1	2	**Low 12**

KEY

Magnitude		Duration		Scale		Probability	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

13.3 The Socio-Economic Environment

13.3.1 Operational Phase

13.3.1.1 Overview of Operational Phase Impact Areas

The pipeline route was specifically selected to minimise environmental and social impacts, and the pipeline system designed to require minimal operational and maintenance intervention. The operational phase for the pipeline is estimated to last approximately 25 years. The following social impacts are expected during the operational phase of the pipeline, based on the broad human and socio-economic environment that is valued by people and that forms part of valued environmental components (VECs). These impacts are discussed in the following sub-sections:

- Operational Workforce - Related Impacts;
- Economic Impacts;
- Community Health, Safety and Security Impacts;
- Housing and Land Impacts; and
- Infrastructure and Community Service Impacts.

13.3.1.2 Operational Workforce Related Impacts

13.3.1.2.1 Employment Opportunities

Compared to the construction phase, activities during the operational phase of the pipeline will be of a low magnitude and will involve planned preventive and predictive maintenance (off-site) of the pipeline as well as incident or breakdown maintenance, usually on-site at the point of occurrence, which may be at any specific location along the length of the pipeline. Employment during this phase, specifically in respect of the operation and maintenance of the pipeline itself, will require specialist skills that will be acquired by CNOOC in accordance with its Labour Force Management Plan. It is uncertain what number of skilled personnel will be required to operate and maintain the pipeline, but is probably not more than 10 permanent staff. The maintenance of the right of way will require unskilled labour for cutting of grass and removal of woody vegetation – this task will probably be contracted out to a local firm. Specialist maintenance tasks, such as pigging or dig ups may also be done by contractors.

Where unskilled labour is needed for on-site for maintenance, individuals will be sourced directly by CNOOC or its contractor, in accordance with the CNOOC Casual Contractor Opportunities Standard Operating Procedures.

There will, therefore, be limited employment opportunities during the operational phase. Based on this, the impact magnitude (based on numbers of people employed) is considered to be minor, but long term and regional scale (benefits will extend beyond the local area), resulting in positive impacts of **low medium** significance.

13.3.1.2.2 Impact on Skills Development and Training Opportunities

As described above, the proposed pipeline development process will be characterised by a short term, high demand construction phase followed by a long term low demand operational phase.

CNOOC has a fully developed employment and recruitment policy, and mechanisms for internal succession, apprentice, trainee and graduate programmes and contract labour have been designed as part of the project. CNOOC's aims to implement a development strategy for its employees by investing in technical, managerial and administrative skills of the workforce.

Training and skills development will be a positive impact, helping to develop the capability and qualifications of the local operational workforce and expanding the human capital available within the local economy. A relatively small number of employees will benefit, and the magnitude of impact will be low, but permanent and regional in extent and of **low medium** significance. The magnitude of this impact can be increased if training is prioritised by CNOOC, and the benefits are spread to as many employees as possible, especially if there are efforts to upskill local people to take semi-skilled and skilled positions.

13.3.1.2.3 Impact on Employee Health and Safety

Transport of crude oil by pipeline offers the safest means of transporting crude oil in relation to workplace health and safety. In an assessment of the intermodal safety of oil, Fraser Institute (2013) states that accidents and resultant hospitalisation amongst oil pipeline workers *"was 30 times lower compared to rail workers involved in transporting oil, and 37 times lower than for road transport".*

There are currently no occupational health and safety statistics available for Uganda in respect of the risks of an operating pipeline. However, an extensive international search of risk incidents demonstrates that the vast majority of pipeline - related accidents or incidents during the operational phase result from the specific causes discussed below. A more detailed analysis of risk situations and appropriate response is described in detail in the Environmental Impact Assessment section dealing with Unplanned Events (refer to Section 15).

General Safety

Principle causes of accidents working at elevated heights without harnesses, exposure to the elements and dehydration, the use of hand-held powered tools and the operation of moving plant and equipment without safeguards, failure to wear PPE specified for particular tasks (gloves, goggles, ear muffs, safety shoes), working under the influence of alcohol or drugs (see below), lack of training on HS&E, distractions (use of cell phones while doing other work), general ignorance of, or failure to follow, recognised and documented safety procedures and working on potentially hazardous tasks while alone. Due to the limited number of interventions required to operate an oil pipeline, and the small number of employees necessary for the tasks, these risks are considerably less significant than those that apply to the production facility as a whole.

In the absence of a highly regulated OH&S environment, with a zero tolerance management approach towards unsafe practices, the risk of disabling or fatal injuries on the production sites will be high, with potentially permanent consequences and a **high medium** significance rating. Subject to CNOOC's compliance with the Occupational Health and Safety standards established by Ugandan Government and its own Health and Safety policies and procedures, which are in place to meet the Ugandan legal requirements, as well as guidelines and protocols for sensitisation of employees and monitoring systems to verify compliance, this impact can be reduced to **low** significance.

Driver Safety

Vehicle accidents are the leading cause of worker injuries and fatalities, with the USDoL Census of Fatal Occupational Injuries related to the Oil and Gas sector (BLS, 2016) reporting that 40% of all worker fatalities are directly linked to vehicle incidents. The main causes of work place accidents involving vehicles and movable equipment on industrial sites are typically:

- Failure to drive cautiously and defensively;
- Disregard of speed limits;
- Failure to wear seat belts;
- Use of cell phones while driving;
- Careless driving and/or driving / equipment operation by insufficiently trained personnel;
- Failure to maintain the lights and audible reversing signals on construction vehicles and equipment;
- Night driving;
- Use of alcohol or recreational drugs; and
- Driver/operator fatigue.

Without appropriate driver training and a zero tolerance management approach towards unsafe practices, the risk of disabling or fatal injuries to personnel caused by vehicles and moving equipment will be high, and potentially long term to permanent (disabling or fatal), with a **high medium** significance rating.

13.3.1.3 Impact Mitigation and Monitoring

The following mitigation measures are recommended (which may overlap in some instances with the recommendations of the LFMP):

Employment Opportunities

- Mitigation measures for any potential negative impacts during the operational phase are consistent with those drawn up for the construction phase.

Skills Development

- Collaborate with the Petroleum Authority of Uganda (PAU), which is tasked with establishing, maintaining and operating a national human capacity register for the petroleum sector to ensure that CNOOC contributions in the form of bursaries and scholarships support the development of an appropriately skilled labour force;
- Align the CNOOC Education and Training related support initiatives as well as in-house training and competency development of Ugandan nationals with the critical and scarce skills requirements of the Oil and Gas sector;

- Consider promoting a process of Recognition of Prior Experience (RPE) and Recognition of Prior Learning (RPL) in collaboration with tertiary technical training institutions that will allow the accrual of credit for informal and non-formal skills development into the formal skills development sector;
- Promote STEM at school level by incorporating support to the development of science laboratories at schools, strengthening education in maths and science at schools and the development of well-stocked school libraries as a specific focus of CNOOC Corporate Social Responsibility (CSR); and
- Support initiatives that will promote and strengthen the levels of competence of master artisans and crafts persons within the Technical Education and Training (TVET) system, and design mechanisms that will support the entrance of female scholars into TVET institutions.

Employee Health and Safety

- Continue to implement CNOOC's drug and alcohol policy, which prohibits the use of these substances at all of its camps and those of its contractors. In accordance with this policy, vehicles and bags are routinely searched to ensure that unauthorised substances are not taken into the camps facilities. Employees who transgress these rules are disciplined and face possible dismissal;
- Ensure that the CNOOC Driver Safety Programme is implemented consistently;
- Ensure that the EPC and drilling contractors make sufficient provision for active recreation at the camps. Ugandan Nationals have a great football tradition and a football field could be considered, among other recreational facilities. Sufficient recreation directly combats the lure of substance abuse and should be seen as a necessary component of the camps to maintain a stable and productive workforce;
- Conduct health education programmes for employees designed to disseminate information about social pathologies and the spread of disease; and
- Ensure that the CNOOC Emergency Response and Exposure Control Plans are understood by all workers, including labourers undertaking routine maintenance functions along the length of the pipeline, and not only by first responders, and that adherence is strictly enforced under all circumstances and conditions.

13.3.1.4 Impact Significance Rating

Table 13-8: Operational phase workforce-related impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact on Employment Opportunities	2	4	3	5	Low Medium +45	2	4	3	5	Low Medium +45
Impact on Skills Development	2	5	3	5	Low Medium +50	6	5	3	5	High Medium +70
Impact on Employee Health & Safety										
-General Safety	8	5	2	4	High Medium 60	2	2	2	4	Low 24

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
-Driver Safety	10	5	2	4	**High Medium 68**	2	2	2	4	**Low 24**

KEY			
Magnitude	**Duration**	**Scale**	**Probability**
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

13.3.1.5 Economic Impacts

The project will have impacts in the local, regional and national economy through direct and indirect economic benefits. While it is beyond the scope of this study to conduct a comprehensive macro-economic assessment, general economic impacts are discussed below.

13.3.1.5.1 National, Regional and Local Economic Development

Increase in Government Revenue

Direct oil and gas related government revenue is derived from (i) royalties (resource exploitation related levies based on the value of extracted resources); (ii) surface rentals (annual fees in respect of acreage held by oil companies); (iii) taxation (personal and business taxes as well as specific introduced taxes related to 'windfall gains', resource rent and the environment); (iv) bonuses (paid by the oil companies at defined stages during the exploration and production phases, as per their Profit Share Agreement); (v) what is termed 'Profit Oil" (income from excess oil production over that required to meet all cost recovery and payment requirements); and (vi) 'other fees' (contributions to training of government personnel and/or payments in cash in lieu this). As the sector develops, value chain related operations such as refineries and the sale of petroleum products will provide additional opportunities for income from taxation (see Section 17 on Cumulative Impacts).

The specific terms of agreement between CNOOC and the government have not been made public. Informed projections indicate that government revenues will remain low for a considerable period of time at current crude prices. Henstridge and Page (2012:28) estimate that it will take at least a decade from the start of production for cumulative oil revenues to climb to 5% of GDP, translating to approximately $9 billion. They see this climbing to $7.3 billion (41% of GDP) within the second decade, $14.9 billion (83% of GDP), and $19.8 billion (111% of GDP) by the end of the fourth decade of production (all based on 2012 $ oil prices).

Despite the slow start in income generation, Henstridge and Page (2012:28) state that the deal implied by the terms is assumed to a good one for Uganda: "Between 86 percent and 99 percent of the net present value of the combined investments - depending on assumptions about oil price and the time horizon for production - goes to the government through the various sources of tax revenue and dividends on a 15 percent equity share."

The impact in terms of this indictor is expected to be positive, long term, National in coverage (benefitting all levels of Government) and of **high** significance.

National and Regional Economic Growth

The expansion of the resource industry in Buhuka Flats will have a beneficial cumulative impact in the region, including along the escarpment where the proposed pipeline will be situated. This will include revenue for the government, employment opportunities at local, regional and national level and a direct and indirect effect on business development. Increased household income and expenditure will result. Both on its own and combined with the effect of the other oil industry developments, CNOOC's Kingfisher project is likely to generate significant economic multipliers[1]. Research for other oil development projects has shown that economic multipliers of about 2.33 (Economy League of Southwestern Pennsylvania, 2008) for value added and between about 2.88 (Loren C Scott and Associates, Inc., 2014) and 3.03 for labour income (Macroeconomic Subgroup, 2011) apply. While these studies were undertaken for oil and gas developments in the USA, and the ratios do not necessarily hold true for developing economies, the general effect is clear.

The increase in work opportunities provided by the project will result in growth in the proportion of Ugandan citizens with higher incomes. Given the number of oil and gas projects under consideration in the sector, there is likely to be a continued and expanding demand for skilled labour. Wages for skills needed in the oil industry are likely to increase. Employment in the oil industry will generate government revenue, deducted from salaries through Pay As You Earn (PAYE).

At a regional scale, the magnitude of beneficial impacts will only be medium, but they will be long term. The significance rating is **high medium**. With the implementation of the recommended measures to enhance good governance and investment in local infrastructure and services, the overall significance rating can be increased to that of a **high** positive impact.

Local Economic Development

The Kingfisher development will stimulate demand for goods and services in the area, which in turn will have a direct and indirect impact on employment in the local and regional economy. CNOOC has developed a local procurement policy to support further development of the business supply chain locally and regionally through appropriate purchasing and business development strategies. This will also support the district and central government initiatives intended to improve the social capital within the Districts of Kikuube and Hoima.

The Buhuka area in general is experiencing rapid economic development. Since the opening of the escarpment road into the Flats, two large markets have developed, selling various goods and services, which attract an extensive daily clientele. This has resulted in induced and indirect employment opportunities being created. While most of the current trade is not directly linked to the Kingfisher development, being a consequence of the access provided by the escarpment road, it is an indirect benefit since the primary purpose of the road is to serve the Kingfisher project. Several villagers residing in settlements along the proposed pipeline route report now being able to offer goods to the Buhuka Flats markets. Others, particularly from villages close to the Flats such as Nyasenge B, Hanga II B and Ngoma indicate that they obtain fish from Lake Albert for re-sale to villagers on the escarpment.

The further development of the local economy will be a benefit derived from the presence of the project in the area. It is possible that local economic growth will increase the ability of households to earn a cash-based income. In this regard, CNOOC has indicated that it purchases in the order of 65% of its goods and services from suppliers and contractors in Uganda, which number more than 100 providers to date. The

[1] *An economic multiplier is the increase in final income that can be derived arising from any new injection of spending, for example $2.33 for every $1 invested or spent. Also termed a 'trickle down' effect of economic growth as those who receive additional income, use and spend that income in shops and businesses. This, in turn, drives further economic growth.*

Company also trains local suppliers to meet oil and gas quality, safety and other standards and learn the tendering and bidding process.

In the absence of specific interventions from CNOOC to increase local purchasing and assist local businesses to improve their ability to compete in the market, the benefits will probably by of low magnitude. Nevertheless, they will be long term and are considered to be positive and of **medium** significance. This can be increased to **high** significance if CNOOC implements a full range of interventions to encourage local business development capability, and steadily increases project spend in the local economy (refer to the mitigation measures below).

Human Capital Development

There is a strong relationship between available human capital and the ability to attain social and economic growth and development and that the development and promotion of human capacity will be achieved most effectively through a coherent process of investment in the people of Uganda.

Human Capital represents the knowledge, skills and abilities that enable people to do their jobs, to be innovative and able to learn and adjust to changing economic and social environments. As such, it refers to the adaptive capacity of people to access opportunities. The process of human capital development concerns the creation of an enabling environment in which people can develop their full potential and lead productive, creative, lives in accordance with their needs and interests.

The definition of human capital stresses the concept as primarily, although not exclusively, centred around human capability and productivity engendered through knowledge and skills acquired from education, training and experience, and facilitated by an enabling environment. It development of human capital implies building an appropriate balance and critical mass of human resources and providing an enabling environment for all individuals to be fully engaged and to contribute to national development efforts.

Uganda has a low comparative world ranking on the Human Capital Index. It is currently ranked 106th out of 122 countries on the overall Human Capital Index (WEF, 2013:13), and 118th out of 122 countries in respect of the Educational Pillar of the Human Capital Index Ibid, p14).

The Business, Technical and Vocational Education and Training (BTVET) Strategic Plan 2011 – 2020 (MoGLSD, 2011) for Uganda, identifies the absence of and the urgent need for a comprehensive process to develop occupationally relevant skills and competencies, including skills for the oil and gas sector. The Oil and Gas Policy (MEMD, 2008:27) emphasises the provision of support for the development and maintenance of national expertise, including planning for the development of formal and industrial training and broadening the national education curricula in preparation for putting the necessary oil and gas workforce in place in the country.

The Industrial Baseline Survey, undertaken by CNOOC in collaboration with Total and Tullow (Hamman, 2014:29) states that it is evident that Uganda is currently unable to meet the manpower demands of the oil and gas sector and recommends, among other things, that oil and gas operators such as CNOOC (i) in partnership with government work towards strengthening the educational system; (ii) offer direct support to existing training institutions of repute; and (iii) the establishment of a technical and vocational education and training (TVET) centre, aimed at providing competence development for, inter alia, craftsmen (civil) and mechanical and electrical technicians required by the oil and gas industry. CNOOC is directly involved in this process.

Apart from this, CNOOC invests in Human Capital Development directly through the introduction of training programmes intended to increase the productivity and effectiveness of personnel (as described earlier). It is, as well, investing in the development of essential knowledge and skills required by the modern economy, including the oil and gas industry. This includes the provision of bursaries, engaging in partnerships with local vocational institutions in the host Districts for the expansion of existing skills and vocational training programmes as well as direct support to schools in its area of operation.

Beneficial impacts will be permanent, providing skills that can be used by the beneficiaries throughout their working lives. Job applicants will be sourced regionally, within Uganda, so the benefit will extend beyond the local area. Magnitude (at this geographic scale) will only be low to medium and impact significance will be **medium**. With the implementation of the recommended measures to enhance key aspects such as TVET and STEM education and training, the overall significance rating can be increased to that of a **high** positive impact.

13.3.1.6 Impacts Retarding Economic Development

13.3.1.6.1 Government Revenue Losses due to Corruption

While tax contributions are generally considered to be positive (see above), their impact can have mixed results. Non-transparent payment of taxes, particularly in the extractive industries, has led to corruption and lost benefits when revenues are not paid transparently and monitored. For this reason, since 2007, the IFC has required all of its extractive industry projects to publicly disclose their material payments to host governments (IFC 2006). It is expected that CNOOC will adhere to this requirement.

Raw material exploitation typically generates high "economic rents2" which provides numerous incentives for public and private agents to engage (at times excessively) in "rent-seeking" behaviour. There has already been evidence of a conflict of interest being demonstrated by some politicians and officials who have acquired interests and rights because of privileged knowledge about, for example, the siting of the proposed development and the acquisition of land pre-emptively. Fortunately, the Ugandan governance system, including that related to local and traditional management, has been robust and willing to promote equity. This includes the successful conclusion of legal challenges lodged by community stakeholder groups related to corrupt land acquisitions by government officials (e.g. on the Buhuka Flats).

Uganda has enacted several pieces of new legislation aimed at promoting extractive sector governance. Nevertheless, there are still opportunities for conflicts of interest in the public sector through – for example – politicians and even government officials holding interests in the construction sector at a time when the scale of public contracts is set to accelerate substantially. Although initially mooted as desirable and legislators under the Parliamentary Forum on Oil and Gas have continued to push, Uganda has not yet signed up for the Extractive Industry Transparency Initiative (EITI). This means that Uganda still stands outside a forum that would expect specific actions to be taken to enhance transparency and mitigate the misuse of natural resource revenues.

Proceeds from the extractive sector pose specific challenges to host governments. Kekembo (2017) states that "the sheer magnitude of revenues, the complexities of the fiscal arrangements as well as the high volatility of revenue flows can be a substantial burden for public financial management". He further states that Ugandan membership of the EITI would, as well, provide an essential "feedback loop between the government and citizens. This increased sector transparency through the EITI disclosure, can discourage corruption and bad governance that has ravaged many resource rich countries."

It will be important that CNOOC ensures that it avoids potential situations where it may be accused of complicity in graft or of embroilment in patronage links. The fact that CNOOC is not a supporter company of the EITI and is on record (as partner in Tullow) of declining to publish all its payments to the Ugandan Government has created a sense of unease amongst human rights campaigners. Irrespective of the accuracy of this perception, CNOOC has the opportunity, including through association with initiatives such as the EITI, to exert significant moral persuasion as well as real assistance (to government as well as civil society) in fighting corruption in the oil and gas sector. Its participation in the UN Global Compact and associated commitment to the 10 Principles of the UN Global Compact, in particular Principle 10, which states that "Businesses should work against corruption in all its forms, including extortion and bribery", would reinforce this potential. Without these measures, this impact has the potential to be negative, with long term, regional consequences of **high** significance.

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[2] *The oil and gas industry generates substantial economic rents, in that the commodity value most often exceeds the cost of production by a significant margin. Total economic rents available for sharing among stakeholders is defined as the amount by which the total value of the resource exceeds the total economic cost of producing the natural resource.*

13.3.1.6.2 Lack of Funding to District Government

The District Councils will benefit from the CNOOC development through a number of revenue streams. These include levying local taxes, greater property taxes as well as enhanced economic development and prosperity at district, parish and sub-parish level.

However, Hoima and Kikuube are currently underfunded, and it is unlikely that it will derive enough additional income to service the burgeoning development expected on the Buhuka Flats, particularly if there is a marked increase in population due to in-migration. Currently, for example, Hoima is allocated a mere 10% of its budget requirements for road maintenance[3] which makes it impossible to adequately manage and maintain existing roads.

The need to establish enabling infrastructure and a service-related environment in communities around the Kingfisher development will exacerbate both the Kikuube and Hoima district government's capacity problems in this regard. The host districts will need to fund infrastructure, service delivery and maintenance (including road maintenance) to create a stable environment around the Kingfisher development. This includes the need to provide adequate water and sanitation services, electricity, policing, regulatory enforcement and other essential services. In the absence of this, CNOOC faces the likelihood of community demands to take responsibility for these services itself, becoming, in effect, the government by default. This could create an extremely volatile situation, with service delivery protests on the Flats and above the escarpment and a significant increase in the risk of violence affecting CNOOC personnel.

The impact will be long term and of potentially very high magnitude. The sensitivities are particularly high, given the high probability (perhaps definite) risk of civil unrest if material development benefits do not materialise to offset the cultural and social change that the inhabitants along the pipeline will have to accommodate. Without mitigation, impact significance will be negative and of **high** significance. Alternatively, if Government plans to provide local services are timeously introduced, this impact can be reversed with positive social outcomes in local communities.

13.3.1.7 Impact Mitigation and Monitoring

The following mitigation measures are proposed:

13.3.1.7.1 National and Regional and Local Economic Development

National and Regional and Local Economic Development

National and Regional Economic Development:

- Promote economic development and infrastructure improvement in the project area within Kikuube and Hoima Districts in a partnership with central, regional and local government to develop a comprehensive infrastructure, services and local economic development plan;
- Ensure that the Livelihoods Restoration Plan actively takes on board practical mechanisms and mitigation strategies for the loss of agricultural land; and
- Put in place a Community Development Plan (CDP), including relevant aspects of livelihoods restoration and resource management planning.

Local Business Development:

- Develop comprehensive strategies to build the capacity of local service providers to compete within the local and regional business environment, ideally on a diversified basis that does not only serve the oil industry;
- Develop a local procurement policy and steadily increase project spend in support of local capacity and the further development of the business supply chain through appropriate purchasing and business development strategies; and

[3] *Hoima District Council Officials (2017) Personal Communication*

- Identify and support programmes (including related to micro-financing) in support of vulnerable groups as required (elderly, single women or child headed households).

Human Capital Development:

- Collaborate with the Petroleum Authority of Uganda (PAU), which is tasked with establishing, maintaining and operating a national human capacity register for the petroleum sector to ensure that CNOOC contributions in the form of bursaries and scholarships support the development of an appropriately skilled labour force;
- Align the CNOOC Education and Training related support initiatives as well as in-house training and competency development of Ugandan nationals with the critical and scarce skills requirements of the Oil and Gas sector;
- Consider promoting a process of Recognition of Prior Experience (RPE) and Recognition of Prior Learning (RPL) in collaboration with tertiary technical training institutions that will allow the accrual of credit for informal and non-formal skills development into the formal skills development sector;
- Promote education at school level. CNOOC is encouraged to consider the support of mathematics science and literacy in local schools; and
- Support initiatives that will promote and strengthen the levels of competence of master artisans and crafts persons within the Technical Education and Training (TVET) system, and design mechanisms that will support the entrance of female scholars into TVET institutions.

Impacts Retarding Economic Development

Government Revenue Losses due to Corruption;

- Ensure that CNOOC meticulously implements all anti-corruption, business ethics related and internal compliance Policies and Programmes already in place, including the CNOOC Limited Code of Commercial Behaviour and Conduct of Employees, the Procedures for Handling Violation of Rules of CNOOC Limited Employees as well as its Guidelines for Overseas Operation with Compliance of CNOOC;
- Promote transparency in reporting of all revenue payments to the GoU and, especially, consider becoming a member company of the EITI; and
- Voluntarily collaborate with and support multi-stakeholder forums that engage questions of ethics and corruption in the oil and gas industry, including Civil Society Organisations, NGO coalitions as well as the Uganda Human Rights Commission (UHRC).

Lack of Funding to District Government;

- Contribute to economic development and infrastructure improvement in the project area, in partnership with central, district and local government; and
- Develop a transparent community development and contribution policy.

13.3.1.8 Impact Significance Rating

Table 13-9: Operational phase economic impacts

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Regional and Local Economic Development										
-Increase in Govt. Revenue	9	4	4	5	High +85	9	4	4	5	High +85
-Impact on national and regional economic growth	6	5	3	5	High Medium +70	8	5	3	5	High +80
-Impact on Local economic development	7	5	2	5	High Medium +70	9	5	2	5	High +80
-Human Capital Development	6	4	3	5	High Medium +65	9	4	3	5	High +80
Factors Retarding Economic Development										
- Govt revenue losses due to corruption	8	4	3	4	High Medium 60	4	4	3	2	Low 22
-Lack of funding to District Govt	9	4	2	5	High 75	9	4	2	5	High +75

KEY

Magnitude	**Duration**	**Scale**	**Probability**
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence

Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +

13.3.2 Community Health, Safety and Security Impacts

13.3.2.1 Community Nuisance and Disruption

Once construction is completed and the pipeline is commissioned, there will be a decrease in potential risks and associated community health, safety and security related impacts emanating from traffic on the primary, secondary and tertiary road system. It is possible that a small maintenance track will be maintained along the pipeline (although this is not presently planned). Traffic along the pipeline will be very occasional. The pipeline right of way will not be fenced and there will be no restrictions affecting pedestrian movement across the pipeline corridor.

Notwithstanding the limited activity along the pipeline corridor, necessary for maintenance purposes, there is still the potential for impact on surrounding landowners and users that could result in nuisance or grievances. Typical grievances (events that could result in a need for compensation) could include erosion caused by the project affecting a landowner's fields or mortality of poultry or stock due a collision with maintenance vehicles. In cases where dig ups are necessary, there could be more significant disruption of surrounding landowners within the local area.

There will be a decrease in the potential spread of infectious diseases, including STDs and HIV/AIDS during the operational phase due to the significant decrease in number of workers as compared to that required during the construction phase.

Without mitigation, impacts will have low to medium magnitude, will be short term and local in geographic extent, causing impacts of **low medium** significance.

Potential operational related accidents and disasters, e.g. fire, explosion, spills could have a profoundly negative impact on a long-term basis. "Economically disadvantaged populations are disproportionately affected by disasters. The poor are less likely to have the income or assets needed to prepare for a possible disaster or to recover after a disaster".[4] These impacts are assessed under 'Unplanned Events' in Section 15.

13.3.2.2 Impact Mitigation and Monitoring

The following specific mitigation measures are proposed (impact mitigation for emergencies is included in Section 15):

- Communicate regularly with stakeholders about the pipeline as a means of reducing local unease of risks associated with the transport of oil and, in particular, in relation to the avoidance of cultivation or other activities (other than grazing of stock) on the 10 m wide right of way. It is a critical requirement that CNOOC builds trust with its stakeholders in respect of the continuing safe operation of the pipeline;
- Ensure that communities and adjacent landowners are informed in advance of any major maintenance activities that are required along the pipeline route;
- Ensure that maintenance staff wear CNOOC-branded safety vests and use CNOOC branded vehicles to provide land owners with an immediate means of distinguishing them from intruders;
- Ensure that community forums are created in which landowners can raise issues and discuss with CNOOC staff any ongoing concerns about safety associated with the pipeline in general or about crime related to the use of the pipeline corridor for access;
- Provide all stakeholders with contact details of maintenance and emergency staff at the production facility and ensure that this information remains updated. Local inhabitants will be CNOOCs eyes and ears in this regard, and can be of assistance in day to day monitoring of any events that should be noted or acted upon in relation to pipeline safety and maintenance. Exposure of the pipeline due to erosion or illegal excavation along the pipeline route would be two such events;
- Maintain the grass in the pipeline servitude by slashing or mowing and not by burning to minimise risks to surrounding land owners;
- Ensure ongoing circulation of contact details of community liaison officers or, if separate, of 'grievance officers' or other key contacts; and
- Maintain the grievance procedure developed during the exploration phase in accordance with IFC requirements and including the following:
  - Circulation of details of the Witness NGO as well as the mechanisms to access the NGO.

[4] *Flanagan, B.E. et al. (2011). A Social Vulnerability Index for Disaster Management. Journal of Homeland Security and Emergency Management. Volume 8, Issue 1 2011 Article 3.*

- Maintaining awareness amongst the local community regarding the grievance procedure and how it works.
- Maintenance of a grievance register that is continuously updated by CNOOC.
- Provision of a mechanism to provide feedback to individuals and groups.

Existing problems with respect to the grievance procedure (refer to Box 13-1 below) need to be resolved.

Box 13-1: Existing Problems with respect to Grievances

According to IFC's Performance Standard 1, if ongoing risks to or adverse impacts on project-affected communities are anticipated, the Project Sponsor is required to "establish a grievance mechanism to receive and facilitate resolution of the affected communities' concerns and grievances about the client's environmental and social performance" (IFC, 2006, p. 5). To respond to this requirement, CNOOC need to appoint a Witness NGO to provide oversight, to receive grievances and to oversee the process to address these concerns.

The CNOOC Grievance Mechanism, which is already in use, is not thought to be effective by many villagers. The general perception is that CNOOC has not taken grievances sufficiently seriously and that villagers are powerless to have issues that they believe are important addressed, if CNOOC does not regard them to be important. There is also no evidence that a critical Witness NGO had been appointed to provide oversight of resettlement and compensation discussions between CNOOC and villagers. The expectation that subsistence stakeholders should either wait for a CLO to visit the village, or should present themselves to the CNOOC Hoima/Kikuube office if they have failed to obtain satisfaction related to issues of concern, is neither realistic nor fair given the costs of transport. This is a critical issue, and will need to be addressed by CNOOC. Failure to ensure that villagers believe that they are actually being 'heard' will negatively impact on the company's Social License to Operate.

13.3.2.3 Impact Significance Rating

Table 13-10: Operation Phase Impact on Community Health, Safety and Security

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Nuisance and disruption caused by ongoing maintenance	5	2	2	4	**Low Medium 36**	2	2	2	4	**Low 24**

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

13.3.3 Housing and Land Impacts

13.3.3.1 Impacts due to in-migration

Due to the absence of visible activity along the pipeline route, the operation of the pipeline is expected to have minor impacts in respect of in-migration. While migrants settling above the escarpment is still expected to be a significant long term issue, this is seen in relation to perceptions about opportunities surrounding the production facility as a whole, and its associated economic development, rather than the pipeline. Impact significance of in-migration in relation to the operation of the pipeline alone is expected to have minor magnitude and **low** significance.

13.3.3.2 Land Use Restrictions

Following the construction period, some restrictions will apply to land use, specifically related to the ROW which will be 10 m wide. There will be no permanent access maintained along the ROW (except perhaps for a small maintenance track, although this is not presently planned). No planting of trees, building, excavation for sand or soil, ploughing or any other intrusive activity is permitted in the 10 m servitude and adjacent residents have been required to sign a statement acknowledging their understanding of this. This loss of land use has been assessed under the construction phase impacts dealing with compensation and livelihood restoration. In the temporary servitude, normal agricultural activities after construction of the pipeline can be resumed. Only building infrastructure will be prohibited on this land. Apart from this, the right of way will not be fenced and will have no impact on the continued daily movement of communities. People will be able to cross the pipeline freely without constraint. Impact magnitude will be negligible and impact significance is expected to be **low.**

Further details regarding restrictions in respect of land use along the 10 m-wide servitude, as well as the mechanisms for minimizing the impacts of land users on the pipeline are set out in the Resettlement Action Plan.

13.3.3.3 Loss of Agricultural Productivity

The construction of the pipeline, with the continual movement of heavy vehicles and equipment along the RoW, will compact subsoils. Notwithstanding rehabilitation, reduced agricultural capability on the land affected in the temporary right of way may result as well as infestation by alien plants, affecting the use of the land. Landowners will have only been compensated for the temporary disruption caused by the loss of crops and any losses of fruit trees or other natural resources. Depending on the loss of productivity, the magnitude of this impact could be high, and long term, resulting in local impacts to landowners of **high medium** significance.

13.3.3.4 Impact Mitigation and Monitoring

The following impact mitigation and monitoring is proposed:

- Ensure that there is clarity amongst land users regarding the restricted nature of the ROW, the way it will be maintained as well as the details of the mechanism that will be used to mark the land corridor (e.g. marker posts);
- Remove alien invasive species along the servitude regularly, as a part of normal pipeline servitude maintenance;
- In the event that any major maintenance is required, inform surrounding landowners and communities in good time and notify them of any temporary restrictions affecting access in the area where maintenance is taking place;
- Promote and support good environmental governance from central, district and local level including in respect of the protection of environmentally sensitive and protected areas;
- Engage the Bunyoro Kitara Kingdom traditional leadership in active and ongoing initiatives and efforts to promote environmental conservation and protection;

- Collaborate with central and district government in planning for as well as in the sustainable implementation of infrastructure and services that will ease land and natural resource impacts; and
- Monitor crop production in the temporary right of way to establish whether there is any measurable difference between agricultural productivity on the right of way compared with immediately adjacent areas. If demonstrated to be necessary, re-evaluate compensation payments to affected landowners.

13.3.3.5 Impact Significance Rating

Table 13-11: Construction phase impact on Housing and Land Use

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact due to in-migration	1	4	2	4	Low 28	1	4	2	4	Low 28
Impact of land use restrictions	2	2	2	4	Low 24	2	2	2	4	Low 24
Loss of agricultural productivity	8	4	2	4	High Medium 56	4	2	2	3	Low 24

KEY							
Magnitude		**Duration**		**Scale**		**Probability**	
10	Very high/ don't know	5	Permanent	5	International	5	Definite/don't know
8	High	4	Long-term (impact ceases after closure of activity)	4	National	4	Highly probable
6	Medium	3	Medium-term (5 to 15 years)	3	Regional	3	Medium probability
4	Low	2	Short-term (0 to 5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None/Negligible					0	No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +							

13.3.4 Infrastructure and Community Services

It is expected that the operations phase impacts will show a decline in the opportunistic influx of individuals who are pursuing CNOOC related employment opportunities. Over the longer duration of the operations phase, however, the population demographics may change as the child population enters adulthood and enters the labour market. In this regard, it is projected that there will be a 168% growth in population in the Hoima and Kikuube District in the period that started in 2014 to 2050[5].

However, as infrastructure and social services such as health and education improve, there will be increasing in-ward migration to the various villages by individuals wanting to take advantage of both the improved services as well as the additional economic opportunities that may be created. As discussed in the previous subsection, it is difficult to distinguish pipeline-related impacts in this regard from the impacts of the project as a whole but given the fact that there is no ongoing presence of staff along the pipeline it is not considered to be a major attractant of migrants on its own, and the significant in-migration issues are

[5] *UBOS (2014) Projected Population Growth rate per District*

discussed under the operational phase of the production facility. For the purposes of this assessment, pipeline-related in-migration is considered to be of minor significance.

13.3.4.1 Impact Mitigation and Monitoring

Refer to Section 8 for mitigation measures for in-migration of the project as a whole.

13.3.4.2 Impact Significance Rating

Table 13-12: Construction phase impact on infrastructure and community services

Indicator of potential impact	Pre-mitigation					Post-mitigation				
	Magnitude	Duration	Geographic Extent	Probability	Significance	Magnitude	Duration	Geographic Extent	Probability	Significance
Impact due to in-migration	1	4	2	4	**Low 28**	1	4	2	4	**Low 28**

KEY			
Magnitude	**Duration**	**Scale**	**Probability**
10 Very high/ don't know	5 Permanent	5 International	5 Definite/don't know
8 High	4 Long-term (impact ceases after closure of activity)	4 National	4 Highly probable
6 Medium	3 Medium-term (5 to 15 years)	3 Regional	3 Medium probability
4 Low	2 Short-term (0 to 5 years)	2 Local	2 Low probability
2 Minor	1 Transient	1 Site only	1 Improbable
1 None/Negligible			0 No chance of occurrence
Significance: Low ≤30; Low Medium 31– 52; High Medium 53 – 74; High ≥75. Positive: +			

14.0 DECOMMISSIONING PHASE IMPACTS OF FEEDER PIPELINE

The impact of the feeder pipeline is discussed in a series of five chapters that address impact and mitigation during construction (Chapter 12), operational (Chapter 13) and decommissioning (Chapter 14) of the feeder pipeline, followed by a discussion on unplanned events (Chapter 15) and the alternatives which were considered in relation to the feeder pipeline (Chapter 16).

The current chapter, Chapter 14, describes the impacts associated with construction of the feeder pipeline

14.1 Key Impacts

A Decommissioning Impact Assessment should be prepared as the date for decommissioning of the Feeder Pipeline approaches. This assessment must involve a number of recognized steps (e.g.: Rodriguez, 2009; World Bank), including preliminary discussions with regulators, definition and analysis of decommissioning options, preparation of a draft plan, consultation with stakeholders and submission of a final plan for approval.

Options for the pipeline decommissioning might include leaving it in place or removing it for re-use, recycling or disposal. All relevant factors should be taken into account in the decision, including environmental and social impacts of re-excavating the trench if the pipeline is to removed, pollution and ground settlement risks of leaving it in situ, financial cost, reuse and recycling value and any other considerations raised by Government and other stakeholders. As a general rule, the most commonly applied option for the decommissioning of buried oil or gas pipelines worldwide has been to clean them and leave them in situ, subject to agreement with the regulatory authority and appropriate action to ensure that the pipeline does not result in a long term safety or pollution hazard. The disruption caused to established vegetation and surrounding landowners by excavating a buried pipeline typically militates against its removal.

14.2 Framework Decommissioning Requirements

This section provides an initial account of decommissioning requirements for the Feeder Pipeline, assuming it will be left in situ. This has formed the basis of a Framework Decommissioning Plan, included in Volume 2.

14.2.1 Flushing the Pipeline and Cleaning up the Site

With reference to Section 9.1, the following general principles and procedures must serve as a basis for decommissioning:

- Conduct a field survey to determine any areas where there is evidence of surface pollution that has been caused by past spills or leaks. Register these areas for clean-up, together with any other areas identified from a review of company records over the years;
- Wherever possible, remediate in-situ any soils that have been contaminated by oil spills along the pipeline. Only where remediation is not possible should soils be collected for disposal at a hazardous waste site;
- Inventory and remove all surface infrastructure. This includes CP posts, marker posts and valve stations. Cut the pipeline ends to a depth that can be buried without harm to people or the environment;
- Develop a method statement for the purging of the pipeline to remove residual oil and scale and to capture contaminated waste water for treatment and disposal. If NORM is encountered, this should be separately managed by specialist waste contractors;
- Clean valve chambers and fill in with backfill. Break out concrete to below the depth at which it would interfere with future farming and topsoil and reinstate;
- Collect any hazardous cleaning materials used to decommission the pipeline and dispose to a hazardous waste site; and
- Remove all litter from site.

14.2.2 Re-contouring, Reinstatement and Rehabilitation

The general recommendations below provide a basis on which to prepare detailed, site specific specifications in the Final Decommissioning Plan prior to closure:

- Shape, level and de-compact the pipeline right of way in areas where decommissioning work disturbed existing vegetation and any other areas where rehabilitation was inadequate. Where necessary, vegetate with indigenous species. Commission specialists to assist in planning any necessary re-vegetation and the management of environmental impact, as required;
- Remove access roads with no beneficial re-use potential by deep ripping, shaping and levelling after the removal and disposal of any culverts, drains, ditches and/or other infrastructure. Natural drainage patterns are to be reinstated as closely as possible;
- Shape all other channels and drains to smooth slopes and integrate into the natural drainage pattern.
- Construct contour banks and energy dissipating structures as necessary to protect disturbed areas from erosion prior to stabilisation;
- Promote any necessary re-vegetation through the encouragement of the natural process of secondary succession. Natural re-vegetation is dependent on de-compaction of subsoils and adequate replacement of the accumulated reserves of topsoil (for example, over the well sites), so as to encourage the establishment of pioneer vegetation;
- Remove alien and/or exotic vegetation; and
- Undertake a seeding programme only where necessary, and as agreed with the re-vegetation specialist. Natural re-seeding is generally regarded as being the most effective means of rehabilitation, subject to proper reinstatement of topsoil. Acceptable cover from which typically occurs over two or three rainy seasons.

14.2.3 Socio-Economic Considerations

The Final Feeder Pipeline Decommissioning Plan must consider the negative socio-economic effects resulting from the project decommissioning. Since the operation of the pipeline will require few employees, this requirement will be much less significant than for the other aspects of decommissioning of the Kingfisher project. Nevertheless, as closure approaches, CNOOC will need to work closely with the local communities to reduce the negative impacts associated with employment termination at the end of the operational phase by:-

- Ensuring that employees are fully informed about decommissioning and how it will affect them well before the project finally closes; and
- Providing training to help transfer project-learned skills to alternative and secondary industries tailored to respond to market economy.

14.2.4 Post closure monitoring, auditing and reporting

14.2.4.1 Closure and post-closure monitoring

A monitoring programme must be developed and submitted to the relevant Ministry for approval, as a part of the Final DRP. The programme is to cover proposed monitoring during **and after** the closure of the Feeder Pipeline and must include the following:

- Verification that any waste, wastewater or other pollutants generated as a result of decommissioning are appropriately managed, in accordance with the detailed requirements set out in the Final DRP;
- Verification that all de-contaminated sites are free of residual pollution after decommissioning; and
- Verification that acceptable cover has been achieved along the pipeline right of way and that there are no areas where erosion may cause vegetation failure. ‘Acceptable cover’ means re-establishment of

15.0 UNPLANNED EVENTS (FEEDER PIPELINE)

The impact of the feeder pipeline is discussed in a series of five chapters that address impact and mitigation during construction (Chapter 12), operational (Chapter 13) and decommissioning (Chapter 14) of the feeder pipeline, followed by a discussion on unplanned events (Chapter 15) and the alternatives which were considered in relation to the feeder pipeline (Chapter 16).

The current chapter, Chapter 15, describes the impacts associated with construction of the feeder pipeline.

15.1 Introduction

Unplanned events are reasonably foreseeable incidents that are not anticipated as part of the normal operation of a project, but which may conceivably occur as a result of project activities, albeit with a low probability of occurrence. Unplanned events may occur during the construction, operational or decommissioning phases of a project.

Risk management for unplanned events typically follows the series of steps shown in Figure 15-1. Hazards are identified, and their likelihood is determined. The consequences of the credible worst case are then assessed, taking into consideration local valued environmental components. The overall assessment of risk combines the probability and consequence of each particular event as a means of determining its acceptability. Finally, measures are proposed to reduce the risk of specific events, where necessary, and to manage the consequences if they were to occur.

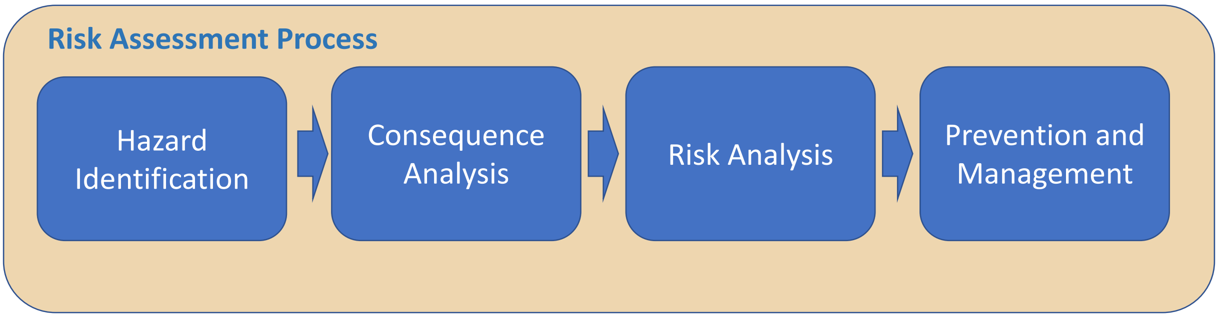

Figure 15-1: Risk assessment and management process

This section summarises a risk assessment of defined oil spill scenarios associated with the Feeder Pipeline, prepared by Worley Parsons (2017). On the basis of a preliminary risk analysis of the most likely oil spill events, taking into account their size, WP modelled the dispersion of the spills above and below ground in more detail. Where necessary, recommendations were made to minimise the risks and recommendations for emergency response were put forward.

The key aspects of the Worley Parsons (2017) study are summarised under the following headings:

- Methods and assessment criteria;
- Spill components and toxicity;
- Fate and behaviour of spills;
- Potential spill sources;
- Causes of containment loss;
- Potential receptors;
- Risk screening and modelling; and
- Emergency response plan.

15.2 Methods and assessment criteria

An unplanned event is always associated with a probability. Some accidents are more likely to happen than others. Recognised methods of assessing the impact of unplanned events differ from those used in standard impact assessment, which are described in Section 4. Risk assessment for unplanned events is based on a combination of the likelihood (or probability) of an incident occurring and the consequence should the incident occur. Probability can be determined in a number of ways, ranging from a simple ranking based on professional experience to sophisticated methods which analyse the causes and frequency of accidents using long term records available in international databases. Consequences are typically established by modelling the pathways and dispersion characteristics of a defined spill, either on or below the ground surface.

In the Worley Parsons (2017) assessment, the professional team undertook a preliminary analysis of the risk associated with identified spill scenarios, which screened those to carry forward in detailed modelling. The risk associated with each scenario was determined using a rating scale developed by CNOOC, which ranked risk according to a matrix based on probability versus consequence[1] (Table 15-1). The scenarios included spills from the well pads, spills from the feeder lines and spills from the CPF. The risks coloured green in Table 15-1 are considered to have low significance, those rated as yellow, moderate significance, and those rated as red, high significance. All risks that exceeded a score of 6 (i.e.: from 8 – 25) in Table 15-1 were carried forward for detailed modelling.

[1] *This rating scale was developed by CNOOC and was used by Worley Parsons to rank the risks associated with specific identified incident scenarios.*

Table 15-1: CNOOC Corporate Risk Matrix

	1	2	3	4	5	Severity (Consequence) Description			
						Personnel	Property	Environment	Reputation
1	1	2	3	4	5	Negligible injury – no absence from work	Less than US$ 1,500	Leakage of hazardous substances does not affect the area outside the field or facility, micro damage which can be quickly removed	
2	2	4	6	8	10	Minor injuries – need first aid treatment	US$ 1,500 - US$ 15,000	Controllable leaks – no long-term damage.	
3	3	6	9	12	15	Injury	US$15000 - US$ 150,000	Reportable lowest quantity of uncontrollable leakage. Long term impact on the field or facility but no long-term impact on the area outside of the field or facility boundaries	Local mainstream media
4	4	8	12	16	20	Serious injury	US$150000 - US$1,5M	0,5 t to 1,0 t spill of hydrocarbons and hazardous substances, long term damage in some areas outside the field or facility boundaries	State mainstream media
5	5	10	15	20	25	Fatality	>US$1,5M	More than 1,0 t spill of hydrocarbons and hazardous substances, long term damage in some areas outside the field or facility boundaries	International mainstream media
Likelihood Description	A freak combination of factors would be necessary for an incident to result	A rare combination of factors would be necessary for an incident to result	Could happen when additional factors are present but otherwise unlikely to occur	Not certain to happen but an additional factor may result in an accident	Almost inevitable that an accident would result	15-25: Immediate action required to reduce exposure. A detailed reduction plan must be developed, implemented and monitored by senior management to reduce the risk to ALARP 8-12: A reduction plan shall be developed and authorized by the functional manager or area supervisor to reduce the risk to ALARP. The effectiveness of risk reduction measures must be reported to management 1-6: Manage by documented routine processes and procedures. Monitor periodically to determine when situation changes which may affect the risk			
	Never heard of in E&P industry	Heard of in E&P industry	Incident has occurred in similar E&P operations	Happens several times a year in similar E&P operations	Happens several times a month in similar E&P operations				

15.3 Spill Components and Toxicity

The modelled components included crude oil, consisting of a range of hydrocarbon compounds and between 0.9 and 2.8% weight Sulphur, and diesel, the major components of which are similar to crude oil except that there are a higher proportion of the more aromatic hydrocarbon compounds.

A summary of the health hazards associated with diesel and oil is provided in Table 15-2.

Table 15-2: Potential hazards associated with diesel and crude oil (APL, 2009)

Health Hazard	Diesel	Crude Oil
Oral and ski toxicity	Acute oral toxicity: LD50 > 5000 mg/kg Acute dermal toxicity: LD50 > 5000 mg/kg	Minimal skin toxicity: LD50 > 5000 mg/kg
Irritancy and sensitisation	May cause skin irritation with prolonged or repeated contact. No skin sensitization effects	Moderate skin irrigation for short-term exposure. Degree of irritation may increase with sun exposure
Effects on eyes	May cause mild irritation	May cause slight irritation
Inhalation	Excessive exposure may cause irritations to the nose, throat, lungs, and respiratory tract. LC50 > 5 mg/l	Irritation of nose, throat and lungs. Headaches, dizziness, drowsiness, loss of coordination, fatigue, nausea and laboured breathing. Toxicity: LC50 > 5000 mg/m^3
Ingestion	May cause gastrointestinal disturbances, including nausea, vomiting, diarrhoea and central nervous system effects similar to alcohol intoxication	Irritation of mouth, throat and gastrointestinal tract leading to nausea, vomiting, diarrhoea and restlessness. May cause headaches, dizziness, loss of coordination, fatigue, nausea and laboured breathing. Toxicity: LD50 > 5000 mg/kg
Carcinogenicity	Suspected in causing cancer	Prolonged or repeated contact may create cancer risk
Tumour initiating / promoting activity	May produce skin tumours	May produce skin tumours
Fire and explosion	Highly flammable liquid and vapour	Highly flammable liquid and vapour
Ecological	Toxic to aquatic organisms, LL/EL 1-10 mg/l (to aquatic organisms)	Harmful to aquatic organisms

Notes:
LD = Lethal Dose; EL = Effective Loading; LL = Lethal Loading; LC = Lethal Concentration; DNEL = Derived No Effects Level

15.4 Fate and Behaviour of Spills

Diesel oils are mobile and will typically reduce by 100% on water over a period of 24-hours. They are lighter than fresh water and therefore tend to float on the surface. They have low viscosity and spread rapidly, becoming thin and breaking up quickly. Their movement is strongly affected by wind and in Lake Albert would be expected to form windrows. Wave energy on Lake Albert is unlikely to cause extensive mixing (emulsion), dispersion or sinking of a spill. On land, a diesel spill is likely to be absorbed into the soils and will persist for longer than in water, Persistence of a ground spill, taking degradation and volatilization into account, is considered to be up to ten years.

Crude oils are among the most persistent group of oils, persisting for over a year on water. Their volume may be reduced by around 50% over a 7-day period. These oils are lighter than water and would be expected to float. The Kingfisher crude is extremely viscous, and its movement is less likely than lighter oils to be affected by wind. Spreading of Kingfisher crude is likely to be slow, breaking into patches over time and pooling in layers that are centimetres thick. Currents and wave action on Lake Albert are unlikely to result in significant amounts of the crude sinking and sediment, which may in some circumstances increase the likelihood of sinking occurring, are not a material factor in Lake Albert. Evaporation will be the main weathering characteristic of the crude, given the high temperature environment. A ground spill of Kingfisher crude will be influenced by vegetation, which will restrict overland flow, which will be very slow, given the high pour point. Partitioning of the lighter oil fractions is likely to occur. These will evaporate and be absorbed into the soils more easily than the heavy fractions. Persistence of a ground spill, taking degradation and volatilization into account, is considered to be up to ten years.

15.5 Potential Spill Sources

The spills on the feeder pipeline could result from pipe failure or failure of a block valve (Table 15-3).

Table 15-3: Potential spill sources from the Feeder Pipeline

Source Area	Potential Spill Source	Built in Spill Mitigation
Feeder Pipeline	46 km long[2]. Flow rates 40,000 bopd Leak: below ground or above ground pipeline failure. Failed welds, catastrophic block valve failure, accidental mechanical damage, river damage.	Burial (1 m to top of pipe), corrosion protection (epoxy or other coating), cathodic protection (another form of corrosion protection), automatic pressure loss detectors, scour protection where the flowlines cross drainage lines

15.6 Causes of Containment Loss

Four main causes of containment loss are identified in the study[3]:

- Seismic: The site is seismically active and susceptible to geological hazards. Three earthquakes of magnitude greater than Mw 7.0 have occurred in the region. Geo-hazard assessment has shown that the site has potential to incur ground fissuring and rock falls. Release of oils could occur if pipelines or tanks failed during a seismic event. Seismic activity can also increase the potential for liquefaction. The site generally has low liquefaction potential, except at Pad 1, Pad 4-2 (now replaced by Pad 4A) and part of the CPF area. This is a low risk, however it could lead to release if the feeder pipeline were exposed or damaged as a result of liquefaction.
- Flooding: Flooding of the site may cause erosion and exposure of the feeder pipeline, leading to a release of oils.
- Corrosion: Tests show that the soils at the site vary from moderately to highly corrosive. Sulphate and chloride content tests on water sample suggest that both concrete and steel structures are at risk from corrosion. Pipelines have corrosion allowance and protection to minimise the risk of release of oils from corrosion. There could be risk of release of oils from corrosion of concrete lined pits, if anti-corrosion measures are not in place.
- Collision: Release of oils could occur as a result of damage to pipelines or tank structure caused by collision. However, as the majority of pipelines are buried underground, this risk is low.

[2] *While the pipeline length considered at the time of the WP Risk study was taken as a rounded 50km length, the actual length is 46 km following optimisation. This does not influence the risk assessment*

[3] *Fires and explosions are not considered in the Worley Parsons (2017) study*

15.7 Risk Screening and Modelling

The objective of the risk screening was to rank the accident scenarios as a basis for selecting those with the highest risk on which to focus the spill modelling and to determine the volume of spill to be modelled. The assessment of likelihood followed a qualitative approach based on professional judgement, experience from similar projects and interaction with the project engineering team. The assessment of consequence was based on specialists' input and their professional experience gained from similar projects.

Based on the results of the screening, four accident scenarios were selected, assessed as medium or high risk, according to CNOOC's risk matrix. These are summarised in Table 15-4. Three scenarios fell into the high-risk category - a full bore catastrophic[4] above and below ground pipeline failure, a slow (chronic) leak released over a long period and an above ground block valve failure, all with spill volumes exceeding 1 ton.

Table 15-4: Selected medium and high risk scenarios for modelling including risk rating

Source	Type of Release	Compound	Scenario	Risk Assessment		
				Likelihood	Consequence	Risk Value
Feeder pipeline (above ground)	a) Pipeline Full Bore Release	Crude oil	Catastrophic above ground pipeline failure within the CPF with surface spreading above ground	3	5	15
Feeder pipeline (below ground)	a) Pipeline Full Bore Release (2 locations)	Crude oil	Catastrophic below ground pipeline with direction subsurface migration.	3	5	15
	b) Pipeline Failure (long term release) – 2 locations	Crude oil	Chronic leak during long period of time with direction subsurface migration	3	5	15
Block Valve Station (BVS)	c) BVS leak	Crude oil	Catastrophic BVS leak with surface spreading above ground	2	5	10

Note: Likelihood and consequence scoring is based on the CNOOC risk matrix presented in Table 15-1

15.7.1 Oil Spill Planning Scenarios

The following parameters were defined for each scenario:

- Flow rate: Used, together with the total leak time, to determine the total spill volume
- Detection time: Used to determine the delay before measures are taken to shut off flows
- Total leak time: Used, together with the flow rate, to determine the total spill volume

[4] *'Catastrophic' as defined by Worley Parsons, does not refer to the environmental consequence of the spill, but rather the nature of the release. A catastrophic release from a pipeline would be a full-bore release. A catastrophic leak is not necessarily classified as a high-risk incident.*

- Spilled volume: This volume (the 'primary loss of containment volume') is the volume of pollutant that is expected to escape from the source and the type of failure (e.g.: catastrophic failure or chronic leak). The volumes were based on estimates of flow rates and leak duration for catastrophic and chronic leaks.
- Existing containment measures and containment capacity: Containment measures include preventative measures such as ditches or storm water trenches which may retain all or part of the spill in an emergency before it reaches a receptor. Containment measures are only applicable to surface spills. The CPF ditch discharge to the trench, a rainwater channel, was only considered as a containment measure when associated with emergency procedures.
- Location: all spill scenario locations are shown in Table 15-5.
- Potential receptor(s): Identified in an analysis of valued environmental components, undertaken as a part of the study, using field data collected by the Golder (2013) and other studies.

Table 15-5 describes the six scenarios. The spill volumes were considered be conservative and subject to revision in more detailed modelling where necessary.

Table 15-5: Spill scenarios along the feeder pipeline

Source	Type of Release	Compound	Scenario	Total Spill Volume (m^3)	Risk Assessment		
					Likelihood	Consequence	Risk Value
Well Pads	a) Casing leak	Crude Oil	Loss of containment from the well casing failure and spill into groundwater contamination	648	2	4	8
	c) Oily wastewater pit	Oily water	Leaks from pits. Bunded pit with impermeable base	7500	3	4	12
Feeder pipeline (above ground)	a) Pipeline FBR	Crude Oil	Catastrophic above ground pipeline failure with surface spreading above ground	2527	3	5	15
Feeder pipeline (below ground)	a) Pipeline FBR	Crude Oil	Catastrophic below ground pipeline with direction subsurface migration.	2527	3	5	15
	b) Pipeline failure (long-term leak)		Chronic leak during long period of time with direction subsurface migration	-	3	5	15
Block Valve Station (BVS) on export pipeline	a) BVS leak	Crude Oil	Catastrophic BVS leak with surface spreading above ground	-	2	5	10
In-field Lines (below ground)	a) Pipeline FBR	Crude Oil	Catastrophic below ground pipeline with direction subsurface migration.	>1 Ton	3	5	15
	b) Pipeline failure (long-term leak)	Crude Oil	Chronic leak during long period of time	> 1 Ton	2	4	8
CPF	a) Tank spill / bund failure	Crude Oil (On-spec)	Tank failure without a bund with surface spreading and migration through unsaturatedzone	8744	2	5	10
		Crude Oil (Off - spec)	Tank failure without a bund with surface spreading and migration through unsaturated zone	2877	2	5	10
		Diesel (Storage Tank)	Tank failure without a bund with surface spreading and migration through unsaturated zone	500	2	4	8
	C) Oil Production manifold	Crude Oil	Catastrophic manifold leak with surface spreading above ground	708	2	4	8
	d) Piping leak	Crude Oil	Minor leak above ground pipeline with surface spreading above ground	708	3	4	12
	e) Booster stations on the export pipeline	Crude Oil	Chronic leak during long period of time	-	3	4	12

*** This table comes from the oil spill response planning study of Worley Parsons 2017, Table 15*

15.7.2 Conceptual Model

15.7.2.1 Migration Pathways and Environmental Components

Soil, groundwater and surface water were considered both as migration pathways and environmental receptors. Specific assessments of damage to habitats and protected species were not undertaken, but it was assumed that the ecosystems present in an area of impacted soil or surface water would also be severely affected. The potential to cause damage to the following environmental components was assessed:

Soil: Unsaturated Zone (USZ). Standard porosity, bulk density and other properties[5] were assigned to the USZ of the Buhuka Flats, which was categorised as sandy clay. Fractured crystalline rocks were assigned to the pipeline route above the escarpment.

Groundwater: Saturated Zone (ZS): On the Buhuka Flats adjacent to Lake Albert, groundwater is enclosed in sedimentary lithology. The sandy clays are comparatively good aquifers but are often constrained by limited storage and erratic recharge. The depth of the groundwater table varies between 1 and 5 m on the Buhuka Flats. For modelling purposes, an average depth of 2.5 m was assumed.

In the plateau areas, the groundwater is drawn from both fractured bedrock and overlying weathered regolith. The aquifer has poor permeability, because it is variably fractured. Aquifer characteristics (permeability and storage) are controlled by fractures and effective porosity in each material respectively. The aquifer can be classified as moderately vulnerable due to the relative depth of the water table (approximately 20 meters below ground level) and is the main sustainable potable water supply for villages in the study area. For the plateau, a theoretical groundwater depth of 20 m was assumed based on available borehole information. The local hydraulic gradient was assumed to be equal to 0.001 (0.1%).

Surface Water: The Kingfisher Field Development Area lies on the south-eastern flank of the Albert Basin. Lake Albert occupies the majority of the approximately 2 270 km^2 area of the District covered by water bodies. Rivers on the Buhuka Flats are generally seasonal with the exception of the Masika River, at the southern end of the Flats. Standard properties (currents and wind speed) assigned to Lake Albert in the screening calculations were included in the modelling.

Ecosystems, Land Use and Protected Species: The wetlands of the Buhuka Flats and in the plateau areas, and Lake Albert, were considered to be environments with very high sensitivity ratings. Specific modelling of possible species mortality was not undertaken, but the ecological consequences of spillages reaching either the wetlands or the lake were considered to be severe.

15.7.2.2 Modelling Assumptions

Details of the modelling assumptions are described in Worley Parsons (2017). Where choices existed, conservative assumptions were made. An illustrative summary is included below:

- The modelling assessed non-aqueous phase liquid ('NAPL' - which in the present case is oil), largely immiscible when in contact with water; and oily water. Physical and chemical properties of the oil were determined from the CNOOC Basis of Design;
- Natural attenuation (biodegradation) of hydrocarbons in soils was not considered;
- The shortest distance between the source and the lake was assumed for modelling purposes;
- The assessment only considered damage due to NAPLs and not by dissolved compounds. Where spillages reached the lake, the dispersion was assumed to be on the surface as an immiscible NAPL, not as a dissolved component;
- In the lake, wind was assumed to be in the same direction as the current to provide a worst case plume. No vaporization of dissolution was assumed;
- In the lake, the shoreline morphology determined the maximum spreading distance before shoreline deposition or the placement of a containment barrier. Spills were calculated to move at a rate of 2.75 km per hour across the lake where the current and wind direction combined to create a worst case. The model also considered total deposition of product once the maximum spread distance was reached, without any previous product deposition;
- Fisheries were assumed to be affected by any spill into the lake;

[5] *Details provided in Volume 4, Specialist Study 4.*

- For direct discharge to surface water bodies (Lake Albert and the streams and wetlands of the Flats of the plateau), it was assumed that the area of damaged habitat would be equal to the maximum area covered by the oil spill;
- Surface water can be affected by a direct spill or a subsurface discharge; and
- Response time for the pipeline **-** the smallest leak detectable, and line rupture detection would take 5 to 20 seconds with worst case scenario up to 40 seconds.

15.7.2.3 Findings of the Screening Modelling

Screening modelling was undertaken for all spills (Table 15-5). The main results and conclusions of the screening modelling were as follows:

- The above ground spills (Scenario 4 above ground pipeline leak within the boundaries of the CPF and Scenario 9 above ground block valve leak on the Buhuka Flats at KP 1.2) did not reach the groundwater table. This is partly due to the very high viscosity of the oil, which would cool rapidly one released from the heated pipe;
- The above ground block valve spill (Scenario 9) at KP1.29 reached Lake Albert (Figure 15-2). This scenario assumed a constant flow rate of 0.078 m^3 /s (42,000 bopd) for 6 hours. The maximum extent of spreading of the plume across the ground surface would be limited to the distance to the lake (613 m). A total volume of 363 m^3 reached Lake Albert in this scenario. The lake surface affected would be the maximum area of the spill on the water surface. The length of the affected shoreline would be equivalent to the maximum spill diameter; and

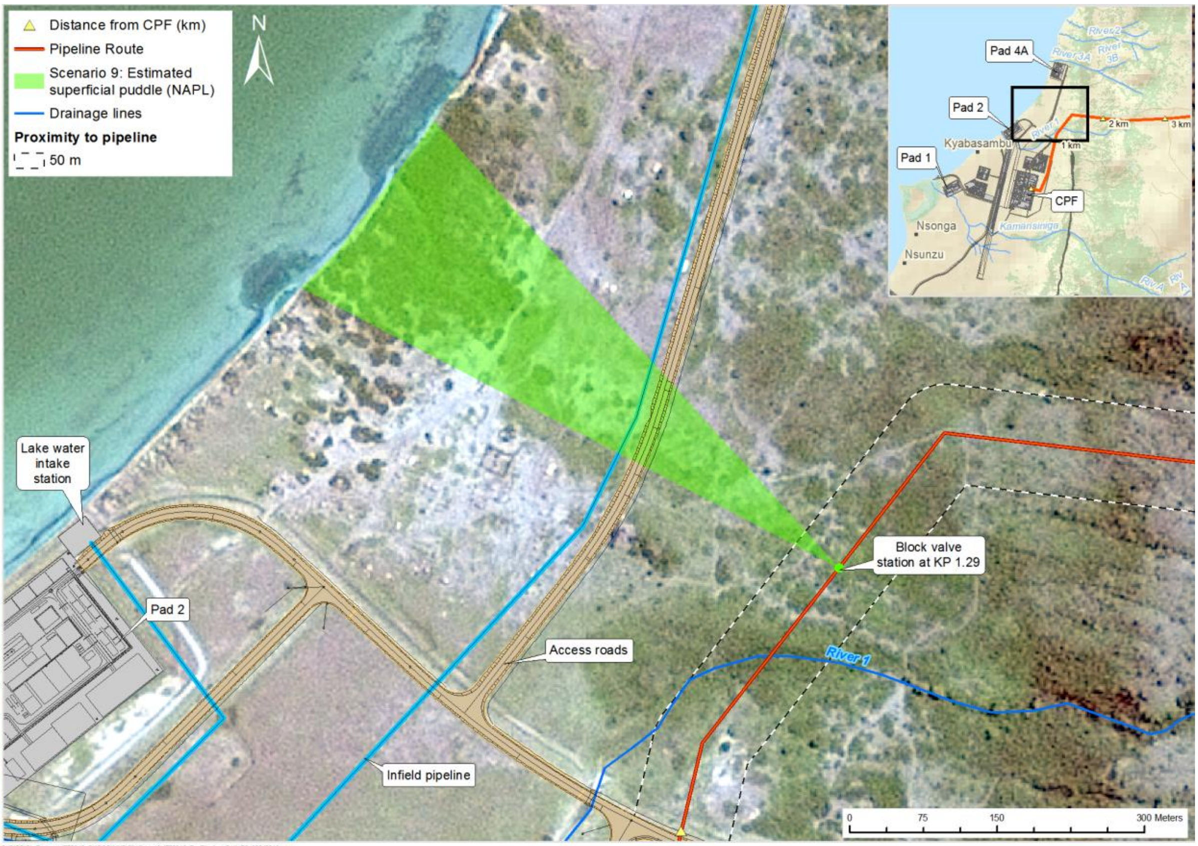

Figure 15-2: Surface spill from the block valve at KP 1.29 (Scenario 9)

- The below ground pipeline spills on the Buhuka Flats at KP1.09 and on the plateau at KP7.42 were modelled under two conditions – a catastrophic spill over a short period of time involving a full pipeline break; and a chronic spill involving a smaller leak over a long period of time. Figure 15-3 and Figure 15-4 show the plume directions and spread distance for the catastrophic spills, which in both cases resulted in the most significant environmental impact than the slow release spills. The modelling results are described in Table 15-6.

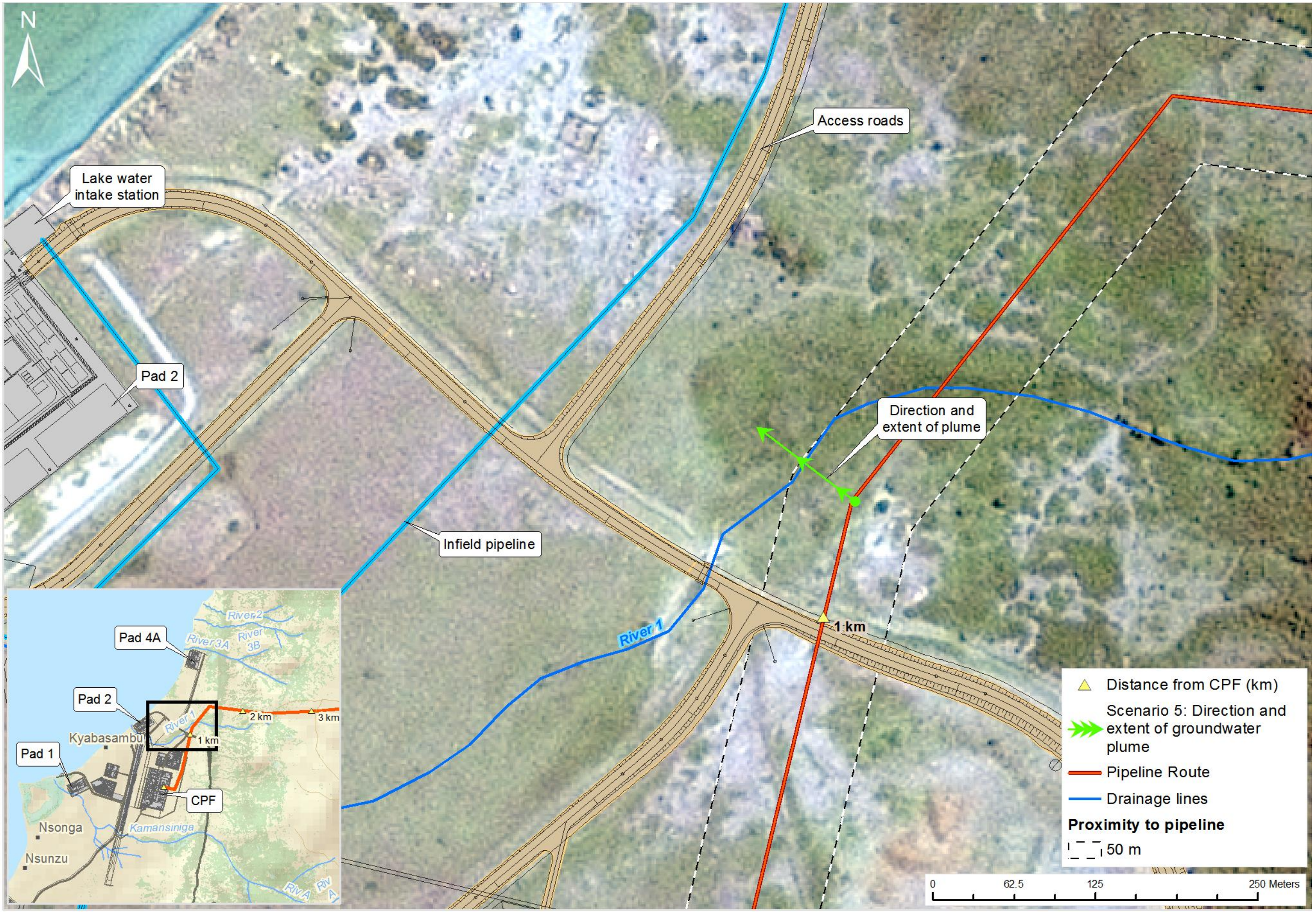

Figure 15-3: Underground spill from a catastrophic pipeline failure at KP1.09

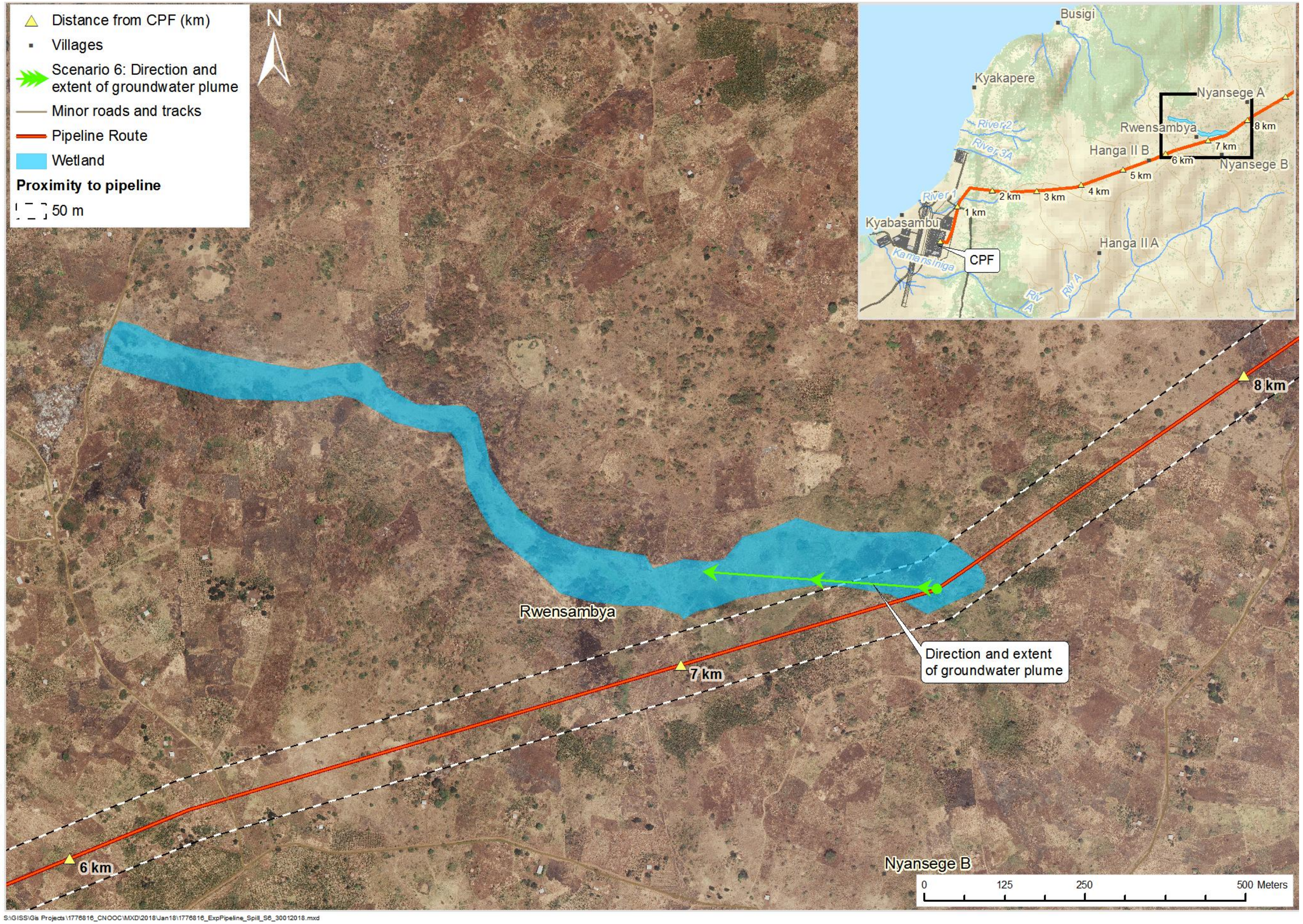

Figure 15-4: Underground spill from a catastrophic pipeline failure at KP7.42

Table 15-6: Results of screening spill modelling for Scenarios 5 and 6 (below-ground spills) along the feeder pipeline

Spill Scenario	Location (KP)	Quantity Spilled (m^3)	Environmental Conditions	Spill Size and Impact
5	1.09	138.5	Buhuka Flats, permeable soils, shallow aquifer	Groundwater plume 70.6 m towards the lake shore. 1387 tons of damaged soil
6	7.42	1213.6	Plateau, fractured aquifer, connection with surface wetland	Spill reaches fractured aquifer at 20 m depth. Groundwater plume is 357 m at full extent but wetland plume may extend over the entire surface (106 712 m^2), affecting habitats and aquatic and wetland species.

15.7.2.4 Findings of the Detailed Modelling

Worley Parsons (2017) remodelled the worst case spill scenarios described in the screening assessment, using a 2D finite difference model (TUFLOW). This included Scenario 4 (surface pipeline leak within the boundaries of the CPF) and Scenario 9 (block valve surface leak on the Buhuka Flats). Both scenarios assumed a leak of 0.078 m^3/s or 42,000 bopd for 6-7 hours which is the maximum credible worst case. This amounts to roughly 1900 bbl (313 m^3) of oil.

Figure 15-5 and Figure 15-6 show the respective plots for the two scenarios. The block valve leak reaches a full extent of 990 m^2. The pipeline leak reaches a full extend of 930 m^2. Neither spill extends far from its source and neither will extend near to the lake edge. In the case of the pipeline spill within the CPF, the entire volume is contained on paved ground and there will be no seepage to groundwater.

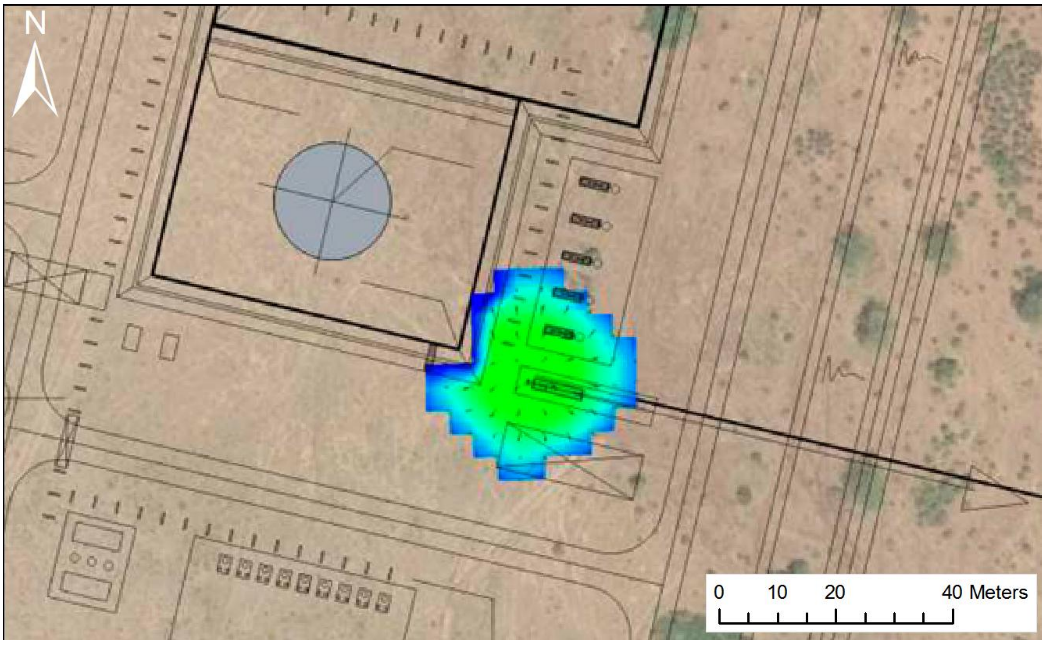

Figure 15-5: Above ground spill due to a pipeline failure within the CPF

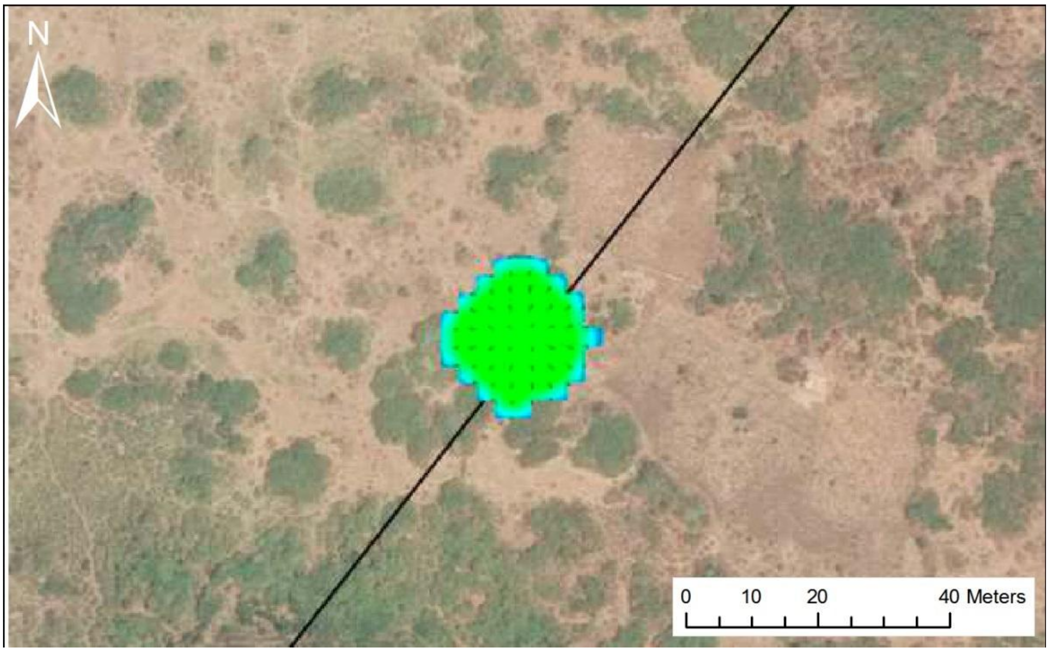

Figure 15-6: Above ground spill due to a block valve failure at KP1.29 on the Buhuka Flats (detailed modelling)
Emergency Response Plan

The Emergency Response Plan establishes procedures to manage and coordinate the mitigation and control measures after an emergency. The ERP is designed to provide the principles of emergency management, frameworks and tools to support effective decision-making in any emergency situation. It is not a prescriptive step-by-step process map to resolve specific incidents or to mandate fixed response options. The ERP is updated regularly – CNOOC Uganda's ERP is currently Rev. B.

15.7.3 Objectives of Emergency Response

Emergency response has 10 key objectives (Worley Parsons, 2017):

- Protection of human life and health and ensuring safety of people;
- Control of the oil spill source;
- Prevention and minimization of damage to the environment;
- Protection of sensitive areas (e.g. lake, lagoon and wetlands);
- Activation of appropriate response as close to the source of the spill as possible to avoid oil spread;
- Prevent oil from leaching into soil or groundwater or entering waterways as run-off;
- Minimize potential environmental and socio-economic impact and ensure a fast recovery to affected resources;
- Continuous monitoring and surveillance of the spill and response operations;
- Mechanical and recovery of spilled hydrocarbons at the spill source to prevent their distribution; and
- Clean-up, restoration and rehabilitation of polluted area.

15.7.4 Ugandan Spill Response System

The Ugandan Petroleum Authority, established under the Petroleum (Exploration, Development and Production) Act of 2013, is the Competent National Authority responsible for oil spill planning and preparedness. This Authority is required to work with the National Emergency Coordination and Operations Centre (NECOC) established under the National Disaster Preparedness and Management Policy in 2010, and the National Oil Spill Preparedness and Response Committee, to develop a National Oil Spill Contingency Plan (NOSCP). According to the Uganda National Oil Spill Contingency Plan (NOSCP) – Draft, the primary oil spill response tactic is 'mechanical response'. In exceptional circumstances, 'non-mechanical' response tactics may be used with the approval of the National Environment Management Authority, in consultation with the Competent National Authority. Mechanical response tactics may be applied on land, groundwater or surface water and include containment, recovery, diversion and exclusion or deflection. Non mechanical response tactics include igniting the spill on land or on water. The application of dispersants or other chemical formulations as a non-mechanical oil spills management tactic is prohibited.

15.7.5 Prevention and Control Measures

A three-tiered response procedure is followed, in accordance with standard international practice. Table 15-7 sets out the incident criteria that determine the level of response. CNOOC Uganda Limited (CUL) would be responsible for managing Tier 1 and Tier 2 responses – CNOOC International would manage Tier 3 responses (Bureau Veritas, 2017). Table 15-7 – Table 15-9 and Figure 15-7 define the CUL responsibilities for Tier 1 and Tier 2 incidents in more detail.

Table 15-7: Risk classification by tiers

		Severity				
		1	2	3	4	5
Likelihood	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Tier 1

Tier 2

Tier 3

Tiered Level	Risk Management
Tier-1 Risk Level (1-6)	Manage by documented routine processes and procedures, monitor periodically to determine when situation changes which may affect the risk.
Tier-2 Risk Level (8-12)	A reduction plan shall be developed and authorized by the functional manager or area supervisor to reduce the risk to ALARP. The effectiveness of risk reduction measure shall be monitored and reported to management.
Tier-3 Risk Level (15-25)	Immediate action required to reduce exposure. A detailed reduction plan must be developed, implemented and monitored by senior management to reduce the risk to ALARP.

Note: Hazard ratings related to Table 15-1 above

Table 15-8: Impact criteria that determine emergency response tiers

	Tier 1 *ERT level incident*	*Tier 2* *EMT Level incident*	*Tier 3* *CNOOC International Ltd*
People	Minor injury or first aid treatment	Major injury / hospitalisation / fatality	Multiple deaths / hostages / third parties
Environment	Minor environmental or social consequence which can be contained locally	Environmental or social consequences which requires escalation, but does not require government intervention	Catastrophic environmental or social consequences
Assets	Minor damage to local assets, no loss of capability or utilisation	Significant damage and business interruption through loss of use	Significant damage / total destruction of major project sites or loss of HQ building
Reputation A+	Local media attention only. Quickly forgotten. Freedom to operate unaffected. Self-improvement review required	Persistent national concern. Scrutiny required by external agencies. Long term brand impact	International concern, governmental inquiry or sustained adverse national / international media attention. Brand damage significantly affects organisation
Capability & Processes	Minimal impact on non-core business operations. The impact can be dealt with by routine operations	An impact on business resulting in reduced performance such that targets are not met. The project is not threatened, but could be subject to significant review or changed way of operations	Critical business failure, preventing core activities from being performed. The impact threatens not only the survival of the project, but the organisation itself
Financial	1% of project or organisational annual budget	5-10% of project or organisational annual budget	>30% of project or organisational annual budget

Table 15-9: Tier 1 and Tier 2 responsibilities of CNOOC Uganda Limited (CUL)

Tier	Description
Tier 1	**Site Level Emergency** A site-level emergency is one that can be effectively managed by on-scene personnel responding to the emergency, using the resources that are readily available to them. The Site ERT Leader manages the emergency. It is that person's responsibility to mobilise the Site ERT and determine the escalation of the emergency based on their assessment. All incidents involving the ERT must be conveyed to the EMT duty officer via the 24-hour Emergency Reporting Line (+256772798119) and backed up by an email notification to: EMT@cnooc.com.cn
Tier 2	**CUL Level Emergency** A CUL emergency may stem from one of two different events: 1. A site emergency that escalates beyond the capability of the ERT to effective control it without external support. 2. A non-site–based or corporate-level incident, such as a corruption allegation, extortion attempt or pandemic outbreak.

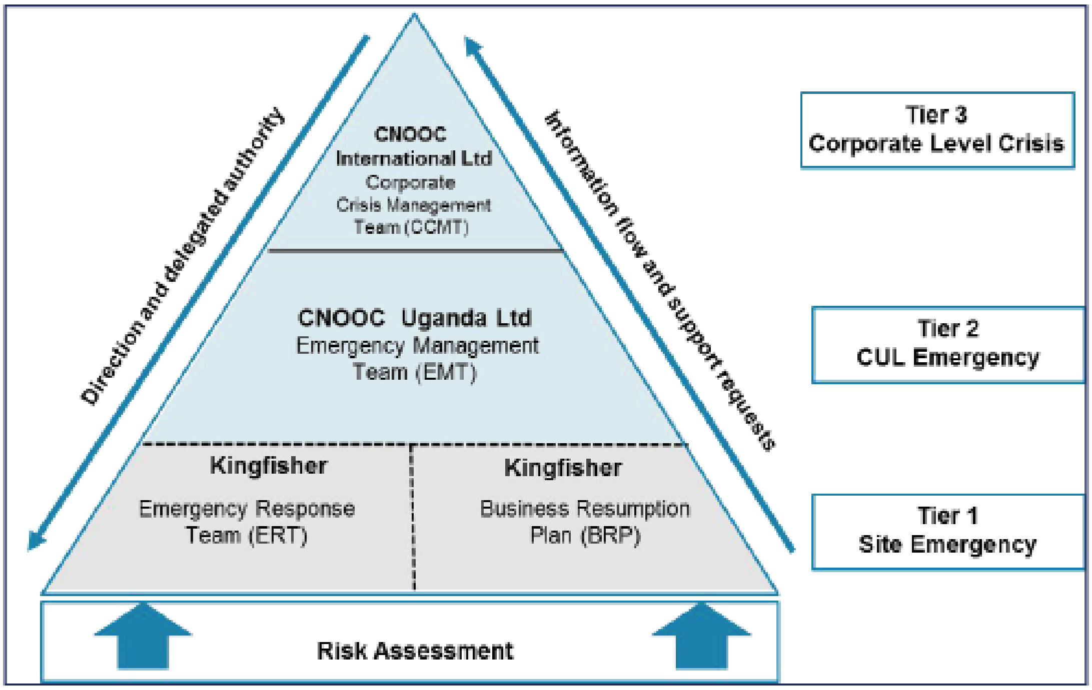

Figure 15-7: CNOOC tiered response structure

CUL emergency management structure distinguishes between Site Emergency Response Teams (Site ERTs) and the CUL Emergency Management Team (EMT). The CUL emergency management structure is based on Site ERTs operationally managing incidents at source. They are supported by the CUL EMT, who will provide direction, additional capacity and capabilities, and coordination of all wider company support. This team consists of a core team (a fixed team consisting of permanent posts), a functional team (functional specialists who join the core team depending on the nature of the emergency) and external specialists, who may include emergency response consultants, legal experts and other external consultants.

The CUL EMT in turn, receives strategic direction and oversight from the CNOOC International Ltd's EMT, the ultimate decision-making authority.

The CUL will use the RACER process (Report, Assess, Convene, Execute, Resolve) for notification and to assess an incident, activating the EMT and managing the incident to its resolution.

15.7.6 Classification of Feeder Pipeline Accidents

Table 15-10 describes the modelled accidents for the feeder pipeline in terms of their tier classification.

Table 15-10: Tier structure of the modelled accidents

Tier	Scenario	Total Spill Volume m^3	Prevention Measures	Response Options
Tier 1	Catastrophic booster station leak with surface spreading above ground	80	Pressure Control Safety Pressure Control ESD for the pumps Corrosion allowance and protection	Containment and Recovery Clean-up and Restoration
Tier 1	"Chronic" leak during long period of time (6h) - into CPF	0	Pressure Control Safety Pressure Control ESD for the pumps Corrosion allowance and protection	Surveillance and monitoring
Tier 3	Catastrophic BVS leak with surface spreading above ground	1,203.62	Corrosion Protection (cathodic protection and allowance) Automatic pressure loss detectors Pipeline Leak Monitoring System (PLMS) Inlet / outlet Process Safety Control ESD system Concrete Lined Pressure Monitoring System	Containment and Recovery Clean-up and Restoration Protection (Diversion / Exclusion or Deflection) - Lake Albert/Shoreline In-Situ Burning (possible)
Tier 3	Catastrophic above ground pipeline failure with surface spreading above ground - location: Buhuka Flats (flat unpaved ground, close to lake Albert), into CPF perimeter	28.27m^3, pool 30 m radius	Corrosion Protection (cathodic protection and allowance) Automatic pressure loss detectors Pipeline Leak Monitoring System (PLMS) Inlet / outlet Process Safety Control ESD system	Containment and Recovery Clean-up and Restoration
Tier 3	Catastrophic below ground pipeline with direction subsurface migration - location 2: plateau	1,213.6	Corrosion Protection (cathodic protection and allowance) Automatic pressure loss detectors Pipeline Leak Monitoring System (PLMS) Inlet / outlet Process Safety Control ESD system	Containment and Recovery Clean-up and Restoration Protection (Diversion / Exclusion or Deflection) In-Situ

Tier	Scenario	Total Spill Volume m^3	Prevention Measures	Response Options
Tier 3	Chronic leak during long period of time (1 month) with direction subsurface migration - location 1 Buhuka flats: permeable soil, shallow aquifer	35.96	Corrosion Protection (cathodic protection and allowance) Automatic pressure loss detectors Pipeline Leak Monitoring System (PLMS) Inlet / outlet Process Safety Control ESD system	Containment and Recovery Clean-up and Restoration
Tier 3	Chronic leak during long period of time (1 month) with direction subsurface migration - location 2: escarpment	35.96	Corrosion Protection (cathodic protection and allowance) Automatic pressure loss detectors Pipeline Leak Monitoring System (PLMS) Inlet / outlet Process Safety Control ESD system	Containment and Recovery Clean-up and Restoration

15.7.7 Equipment for Tier 1 Response (to be kept on site)

Table 15-11 provides a preliminary list of equipment and materials suitable for managing a Tier-1 spill (Worley Parson, 2017).

Table 15-11: Equipment and materials suitable for managing a Tier-1 spill

No	Equipment category	Equipment Type	Description
1	Hand tools	Cotton rugs	Cotton rags could be used to adsorb minor leaks
		Non-sparking shovels	Enforced Plastic shovel to be used to remove contaminated sand/soil.
		Overalls non-permeable	To be used by oil response team to avoid skin contact with hydrocarbon
		Oil chemical resistant gloves	To be used by oil response team to avoid skin contact with hydrocarbon
		Forks	To be used to remove contaminated sand/soil.
		Heavy duty bags	To be used to remove contaminated sand/soil.
2	Sorbent kits	Booms	Booms used to contain spilled fluid and adsorb it.
		Plastic bags for holding recovered waste	Empty big bags to be used for collecting the contaminated soil.
		Oil absorbent pads/pillows/sheets	Adsorbent sheet used to clean minor leaks during repair
	Containment booms	Shoreline sealing boom	To be used to protect Lake Albert and nearby streams. Shore-sealing boom consisting of air and water chambers with ASTM connectors and Monsun valve filling points

No	Equipment category	Equipment Type	Description
		Fast deployment solid boom with necessary ancillaries	To be used to contain spill in Lake Albert and nearby streams.
		Booming Support Kit	Water pump, blowers, suction hose, discharge hoses, perforated lay-flat hose, valve adapters, fuel cans, funnels, etc
		Anchorage	Bruce or sea-claw anchors with 2m anchor chain tripping buoy (1 per anchor)
3	Skimmers and pumps	Vacuum pumps	Non-sparking portable, air pump, with all accessories ready for use. To be used for transfer and recovery
		Shoreline skimmer	Lightweight/man portable variable speed skimmers with portable/wheeled power pack, transfer pump, hydraulic hoses and discharge hose
		Vacuum truck	To be used for transfer and recovery
4	Temporary storage	10 m3 temporary storage tanks (Fast-Tanks)	10 m^3 temporary storage tanks supplied with individual storage box/bag, ground sheet, tank liners, filling points, water decanting and discharge point, repair kit and spares.
5	Heavy Equipment	Loaders and excavators	To construct berms, trenches and Sediment Reworking. It can be hired from a 3rd party.
6	Small Boats	Raft / fishing Boats	To be used in boom deployment as well as assisting in constructing and installation of temporary dams (small streams). I t can be hired from a 3rd party.
7	Air Monitoring Program Devices (site safety)	Ambient and workplace Monitoring Devices (e.g. VOCs)	To be used in determining site safety, warm/hot zones as well as the need for and extent of community evacuation zones. It can be hired from a 3rd party.

*** Source, Table 30 from the WP 2017 report*

15.8 Conclusions and Recommendations

The following conclusions are drawn from the review of the Worley Parsons (2017) study:

- None of the medium and high risk spill scenarios will reach Lake Albert;
- Most of the spills can be contained within a small area and cleaned up by mechanical means;
- In the event of a major spill into one of the wetlands above the escarpment, or into the groundwater feeding these wetlands, the spread of oil would extend for significant distances and would cause mortality among aquatic and wetland species. The probability of such spills,

taking into account the built-in design and operating safety measures, has not been assessed yet; and

- The risk and consequence of fires and explosions has not been assessed, nor the influence that this could have on land use beyond the permanent pipeline servitude.

Recommendations are as follows:

- Prepare a fire and explosion risk assessment for the Feeder Pipeline. Determine the distance from the pipeline at which there is an acceptable level of risk for surrounding populations. This risk should not fall within the ALARP range unless there are specific, fully motivated reasons why this should be the case.

Update the Safety Case prepared for the production facility (see Chapter 10) to include the Feeder Pipeline. Adjust design and operating parameters on the basis of the findings of the Safety Case. Ensure that appropriate management procedures are developed that ensure the ongoing maintenance, monitoring and safe operation of the pipeline.

16.0 ALTERNATIVES (FEEDER PIPELINE)

16.1 Route Selection Criteria

The alignment of the Feeder Pipeline from the Kingfisher CPF to Kabaale was first proposed by Petrofac (2012) and has subsequently been optimized by Worley Parsons (2014) and GIE (2017). Geotechnical analysis (CPECC & TECLAB, 2014) and household and building infrastructure surveys (Survesis, 2015) were conducted in 2014 and 2015 and were used in support of the GIE (2017) study.

The three routes are illustrated in Figure 16-1.

16.2 Proposed Route Variants

16.2.1 Route Selection in 2012 (Petrofac, 2012)

Social and environmental route selection criteria were to minimize impact through the application of the mitigation hierarchy (avoid, minimize, restore and offset). Specifically, the route selection aimed to avoid protected areas and protected species habitat as far as possible, and to minimize impact on resettlement of people, communities, buildings, trees and commercial agriculture and plantations. Engineering criteria have included consideration of topography, geology (faulting), hard rock geology (ditch construction) fluid dynamics, length, wetlands/river crossings and steep slopes.

The Petrofac (2012) route corridor was selected that met most of the route selection criteria. The following points about the route are noteworthy:

- It avoided the Bugoma Central Forest Reserve, being aligned in the approximately 5 km wide corridor between the BCFR and the escarpment. The BCFR is critical habitat for the Eastern Chimpanzee and Nahan’s Francolin;
- It had limited impact on rivers and wetlands, crossing only minor seasonal watercourses where open cut excavation would be feasible;
- It minimised disturbance of untransformed habitat and habitat with high conservation significance. Seventy percent of the route was situated within cultivated lands;
- It minimised the extent of hard rock excavation required. Only the escarpment section of the route would require blasting and removal of waste rock;
- It had a small impact on existing road infrastructure, intersecting only small gravel tracks and district roads, north-east of Hohwa and near Kitegwa; and
- With the exception of the unavoidable crossing of the escarpment, it was located in terrain with gentle gradients.

Given the intensity of cultivation above the escarpment, complete avoidance of agricultural lands and housing and building infrastructure was not possible. Minor refinements of the route to reduce the impact on housing and other building infrastructure was left for later phases of the planning.

16.2.2 Route Optimization in 2014

Worley Parsons (2014) revised the route over the escarpment, taking a more direct line from the CPF and avoiding the planned access road down the escarpment. Other smaller changes to the route were made to find the most suitable river crossings and to minimize impact on settlement, where this information was available. It was confirmed that open cut methods would be suitable for all construction although it was suggested that one of the small river crossings, could be done using trenchless methods of construction.

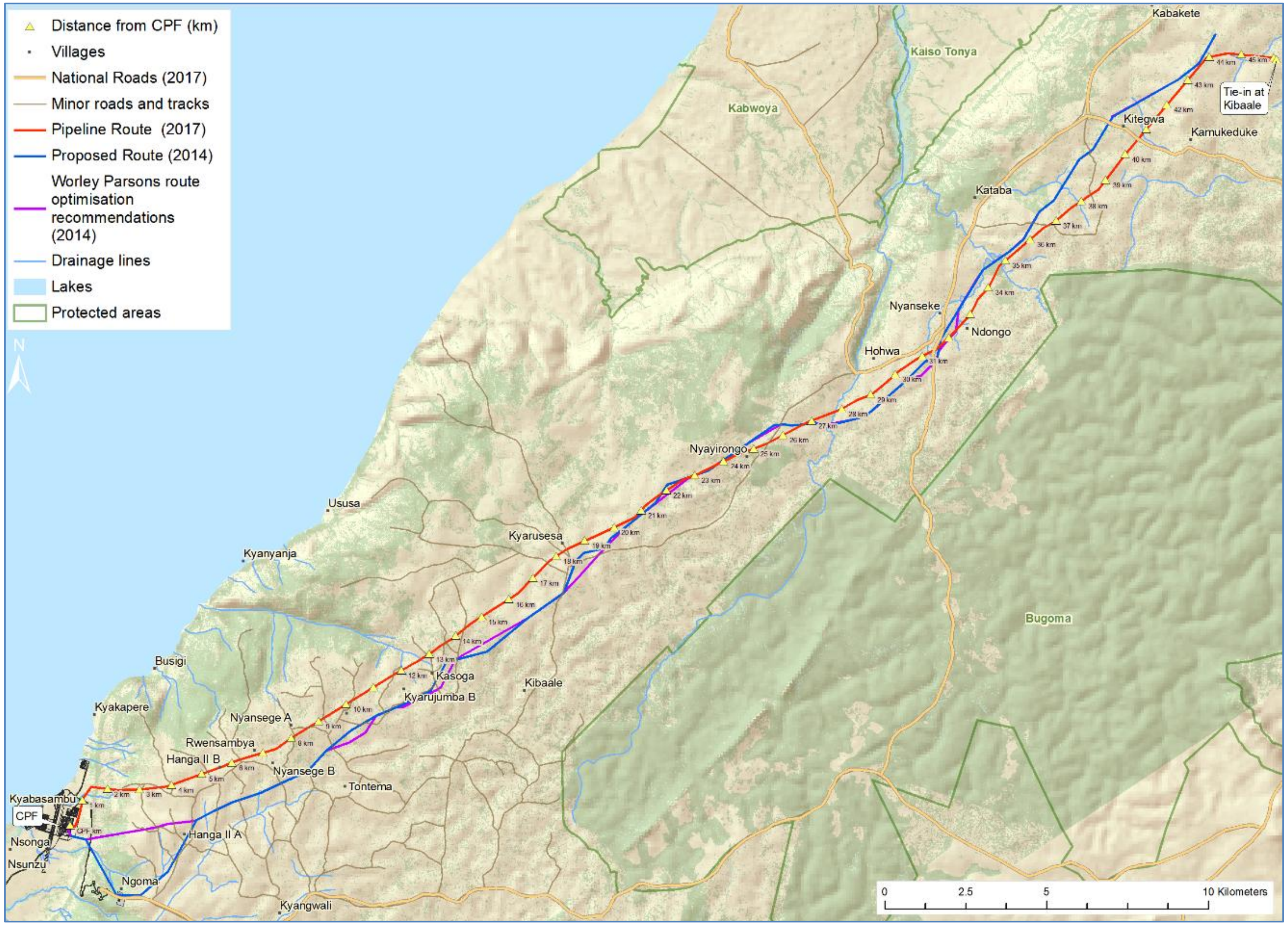

Figure 16-1: Routes for the feeder pipeline developed since 2012

16.2.3 Route Optimization post-2014

The following additional surveys were undertaken between 2014 and 2015 in order to inform further optimization of the route:

- A geotechnical survey: This involved the excavation of test pits and drilling of percussion boreholes along the route. Trial pits were dug to the full 3 m in depth. It was concluded that apart from the escarpment, where shallow granitic soils occur, topsoils are deep, rich and humic overlaying silty clays. Traces of sand were found in many pits. Hard rock was encountered in some pits at 2,7 - 3,0 m, but it was considered unlikely that there would be a need to use blasting to open the trench anywhere along the route;
- A geohazard survey: The survey divided the pipeline route into two, the initial section below the escarpment where soils are mainly an accumulation of lacustrine sediment and the remainder, where soils are stiff silty clays or clayey silts and / or lateritic gravels underlain by weathered rock in places. A consistently loose, dark, layer between 0,4 and 0,7 m exists along most of the route (inferred to be the topsoil layer). Groundwater was generally found in bedrock fissures and was not encountered above 3 m, except at the drainage line crossings. The study defined geohazard risks in terms of ground fissures (medium risk for the first 1,5 km of the route and low for the remainder) and rock fall (risk medium from KP 0,48 to the top of the escarpment and low for the remainder); and
- Rapid asset survey: The survey was undertaken to record basic household / land use data within the 2 km corridor in which the pipeline was routed. A total of 3411 land owners were identified. It was noted that the pipeline centreline was routed through the middle of the trading centres of Kasoga, Kyarushesha and Sayuni.

This information was used to assist GIE (2017) to develop a final route alignment as a part of the Front-End Engineering and Design (FEED). Combined with a field visit and the use of Lidar imagery of the route, the revised alignment shifted the escarpment crossing point 1.3 km further north to avoid the new tarmac road down the escarpment and to provide a better approach to the escarpment crossing (Figure 16-2). A further advantage of the re-route, compared with the 2014 route, was the sparser population at the top of the escarpment.

Figure 16-2: Kingfisher feeder pipeline re-route near the CPF

For the remainder of the route, the alignment was optimized in accordance with similar route selection criteria to those described in Section 16.2.1 above:

- Avoid resettlement or (if not practical) limit the number of resettled households;
- Avoid villages, schools and other built infrastructure;
- Minimise a route which involves construction traffic through villages and past schools; and
- Minimise impact on the following land uses:

    - large trees.
    - standing crops.
    - Bush.
- Avoid protected areas;
- Facilitate access for pipes and materials from main roads / rail;
- Minimise requirements for additional roads;
- Minimise steep sections of route;
- Avoid wet areas; and
- Avoid / minimise crossing of areas with potential geohazard (flooding, faults).

Between KP2 and KP21, the GIA (2017) route runs north of the Worley Parsons (2014) alignment, gradually reducing the separation distance from around 1.3 km at the top of the escarpment to zero at KP21. Emphasis was on refining the alignment to minimise the impact of the pipeline on villages and households.

16.2.3.1 Route Optimization (2017)

Table 16-1 presents a comparison between the three routes, in relation to specified selection criteria. This table updates the analysis of the GIA (2017) route, reported in CNOOC (2017). In relation to land use (houses and other built infrastructure, cultivated lands), the data in this table has also been updated to reflect the current status, and may not correspond to the information reflected in the original reports. Boreholes were not included in the original analysis.

Table 16-1 shows that the GIE (2017) route reduces the length of the escarpment crossing, minimizes impacts on wetlands and drainage lines and significantly reduces the number of buildings (which includes households) within the construction right of way.

Table 16-1: Comparison between the Petrofac, Worley Parsons and GIE routes

Selection Criteria	GIE		Worley Parsons		Petrofac	
	Qty	Distance (m)	Qty	Distance (m)	Qty	Distance (m)
Escarpment Zone Crossing (untransformed habitat)	-	1349	-	1640	-	2314
Protected Areas	0	-	0	-	0	-
Wetlands / Drainage Lines	-	1054		1438	-	1884
Tarmac Roads	1	-	1	-	1	-
Murram Roads	44	-	36	-	38	-
Boreholes	1	-	1	-	0	-
Geohazards (fault)	1	-	1	-	1	-
Cultivated Lands**	-	35397	-	35687	-	38913
Houses (and other built infrastructure)						
- 0 -15 m ***	14	-	66	-	91	-
- 15 - 50 m	162	-	147	-	204	-

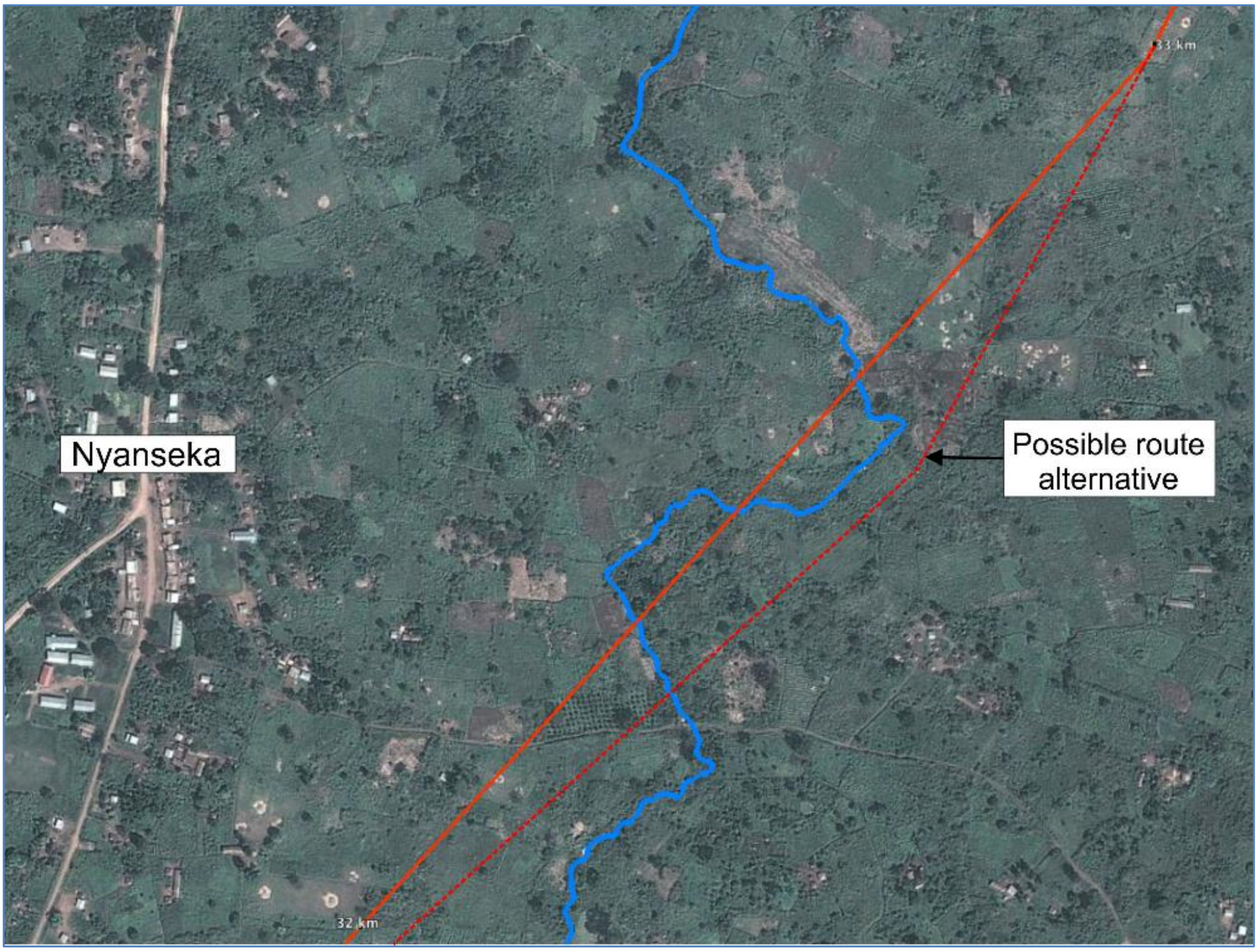

Figure 16-3: Proposed realignment of the Feeder Pipeline route between KP32 and KP33

No other route changes are considered to be necessary by the Consultant study steam.

16.3 Other Alternatives

It is recommended that to the greatest extent practical, the construction of the pipeline through the wetlands and small drainage lines is undertaken in the dry season.

17.0 CUMULATIVE IMPACTS

17.1 Introduction

This chapter addresses potential cumulative impacts that the Kingfisher Project and other existing or planned developments could have on identified valued environmental and social components (VECs) in the regional cumulative impact assessment study area.

> *Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity, when added to other existing, planned, and/or reasonably anticipated future ones.*
>
> IFC (2013)

Multiple and successive environmental and social impacts from existing developments, combined with the potential incremental impacts resulting from proposed and/or anticipated future developments, may result in significant cumulative impacts that would not be expected in the case of a stand-alone development (IFC, 2013). Cumulative impacts may result in either:

- **An additive impact:** where it adds to the impact which is caused by other similar impacts; or
- **An interactive impact:** where a cumulative impact is caused by different impacts that combine to form a new kind of impact. Interactive impacts may be either countervailing (the net adverse cumulative impact is less than the sum of the individual impacts) or synergistic (the net adverse cumulative impact is greater than the sum of the individual impacts).

The Cumulative Impact Assessment (CIA) process involves (a) the analysis of the potential impacts and risks of the Project in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen VECs over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk (IFC, 2013).

This chapter presents a summary of the methodology used to prepare the CIA for the Kingfisher Production Facility and Feeder Pipeline, and the outcomes of the process.

17.2 Methodology

A VEC-centred approach has been used for the regional CIA, conducted in the context of the Kingfisher Field Development and other existing and future planned projects. As recommended by the International Finance Corporation (IFC) advisory team for the various oil development projects ongoing in the Albertine Graben, the *Good Practice Handbook – Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets* (IFC, 2013) is the guideline and direct reference used for the completion of this study. Figure 17-1 defines the steps used in the determination, assessment and management of CIA's. Step 3 is not included here since it is dealt with in detail in Section 6 of this report.

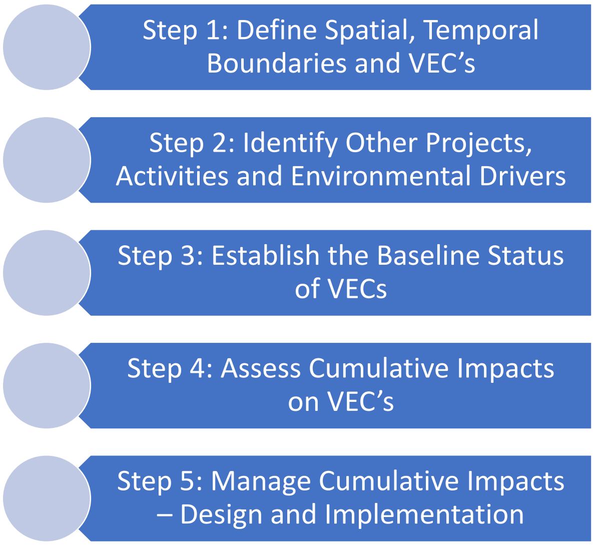

Figure 17-1: Steps in the Cumulative Impact Assessment Process

17.3 Defined Spatial and Temporal Boundaries and Valued Environmental Components (VECs)

17.3.1 Spatial Boundaries

The Study Area for the CIA was broadly defined by a combination of the Regional Study Area used in the main Environmental and Social Impact Assessment, and the Critical Habitat Area of Analysis, i.e. the predicted Project Area of Influence. As required by Performance Standard 1 (IFC, 2012) the Project Area of Influence encompasses the following components:

- the primary project site(s) and related facilities that CNOOC (including its contractors) will develop or control, *i.e.* the Production Facility (CPF and wells), the Feeder Pipeline, and all associated infrastructure including the jetty, water intake structure, access roads, borrow and disposal areas, and permanent and temporary construction camps;
- associated facilities that are not funded as part of the project (funding may be provided separately by the client or by third parties including the government), and whose viability and existence depend exclusively on the project and/or whose goods or services are essential for the successful operation of the project: the proposed upgrade of the P1 and R5 roads by the Ugandan government for the oil industry are included on this basis;
- areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken; and
- areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location:

The spatial boundaries (Study Area) for the CIA are illustrated on Figure 17-2. These incorporate the following areas that interact with the Project components, activities and induced effects:

- In the North: including the refinery, airport and feeder pipeline;
- In the South: extending roughly 10 km south of Buhuka Flats along the lakeshore; and
- In the East extending roughly to Kikuube and including Bugoma Central Forest Reserve.

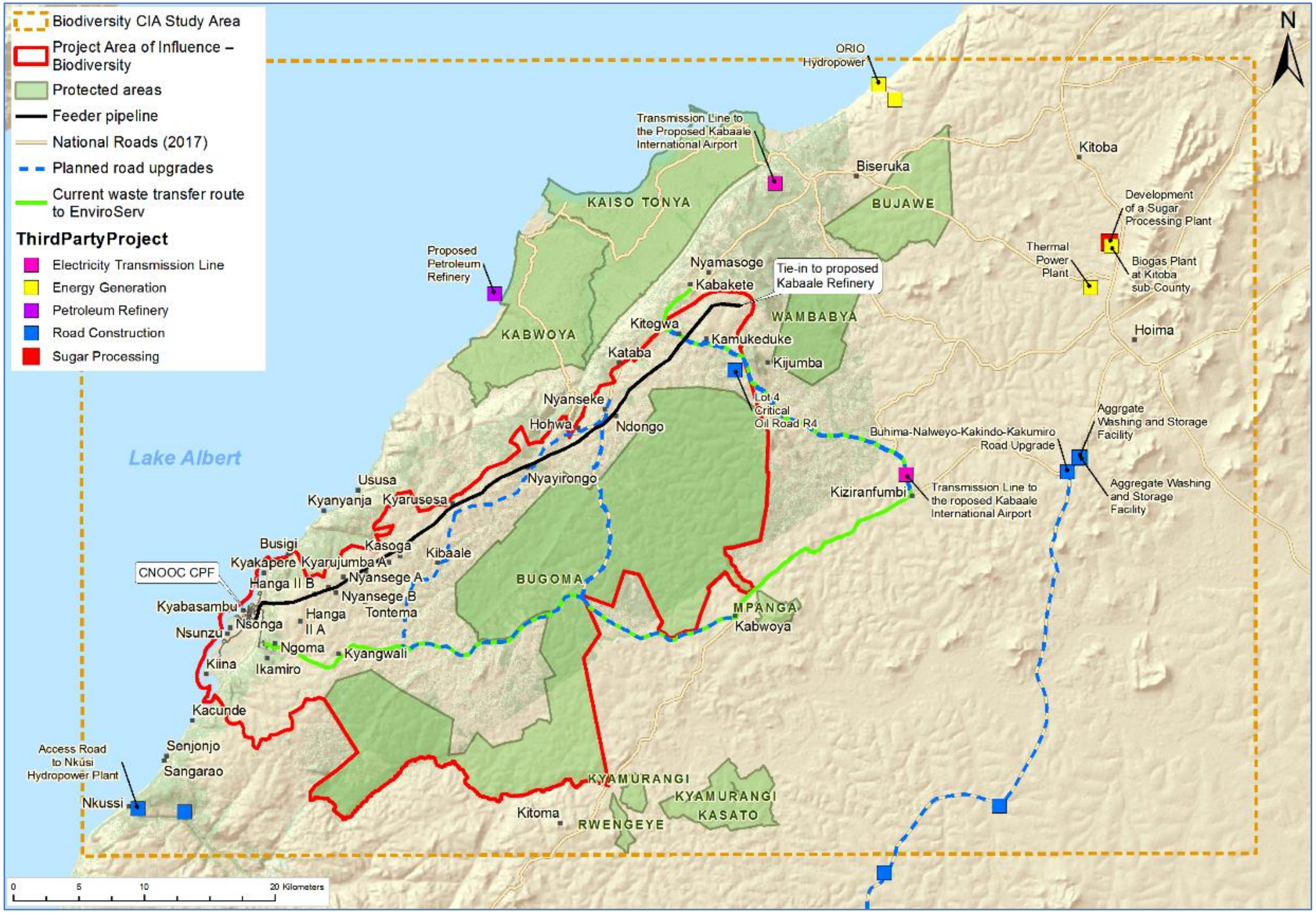

Figure 17-2: Cumulative Impact Assessment study area for CNOOC Production Facility and Feeder Pipeline

17.3.2 Temporal Boundaries

The basic rules of thumb for CIA temporal boundaries are described in Box 17-1. The temporal boundaries for the CIA were aligned with the time periods set for the complete lifecycle of the Project i.e. the construction, operation and decommissioning phases of its two major components (the Production Facility and the Feeder Pipeline), as these are the time periods within which the Project could contribute to cumulative impacts in combination with other projects or activities.

Box 17-1: Basic rules of thumb for temporary boundaries for a CIA

The proposed basic *rules of thumb* to determine the *temporal boundaries* for the assessment are as follows:

I. Use the time frame expected for the complete life cycle of the proposed development.
II. Specify whether the expected time frame of the potential effects of proposed development can extend beyond (I).
III. Use the most conservative time frame between (I) and (III).
IV. Using professional judgment to balance between overestimating and underestimating, and make sure to document the justification or rationale.
V. Exclude future actions if (i) they are outside the geographical boundary, (ii) they do not affect VECs, or (iii) their inclusion cannot be supported by technical or scientific evidence.

The temporal boundaries were defined conservatively as:

- Construction Phase:
  - Production Facility: Commencing 2019, lasting for 3 years.
  - Pipeline: Commencing 2019, lasting 10-12 months.
- Operational Phase: Commencing 2022, lasting for ~30 years; and
- Decommissioning Phase: Commencing 2052, lasting for 2 years.

The temporal extent of impacts from other past, present, and predictable future developments is considered within the same timeframe.

17.3.3 Valued Environmental Components (VECs)

The resources and receptors (VECs) that may be exposed to cumulative impacts as a result of the Project in combination with other existing, planned, and/or reasonably anticipated future projects and activities, include those occurring:

- On the shore of Lake Albert, which could be affected in the event of a large oil spill;
- Along the feeder pipeline route from the Production Facility to the tie-in to the proposed refinery at Kabaale; and
- Within the Bugoma Central Forest Reserve (BCFR).

The VECs and associated indicators identified for the CIA, based on the outcomes of the ESIA, are outlined in Table 17-1.

Table 17-1: Valued Environmental Components (VEC's) for the CIA

VEC Category	VEC	Indicators
Ecosystem integrity	Near-shore habitats of Lake Albert	Regional representativeness Ecosystem composition Ecosystem configuration
	Wetlands	
	Escarpment vegetation corridors	
Priority habitat	Bugoma Central Forest Reserve	
Species of Concern	Mud snail (*Gabbiella candida*)	Habitat quantity and quality Habitat connectivity Abundance and distribution Survival and reproduction
	Grey Crowned Crane (*Balearica regulorum*)	
	Nahan's Partridge (*Ptilopachus nahani*)	
	Eastern Chimpanzee (*Pan troglodytes*)	
Social	Human Environment	Economy
		Worker Health, Safety and Security
		Community Health, Safety and Security
		Environmental Intrusion
		Land and Resource Use
		Population, Infrastructure and Services
		Personal, Family and Community Life
Physical	Physical Environment	Air quality
		Noise levels
		Water quantity
		Water quality

17.4 Other Identified Projects, Activities and Environmental Drivers

17.4.1 Other Projects and Activities

A summary of the existing, planned, and/or reasonably anticipated future projects and activities that have the potential to influence the future environmental baseline within the Study Area, and result in cumulative impacts on identified VECs, are set out in Table 17-2.

Table 17-2: Other projects and activities in the Project Area of Influence

Project	Nature of Project	Brief Description	Location/GPS Coordinates	Nearest Settlement/town	Administrative District	Project Proponent	Proponent Address	Project Timelines	Project documents: EIA, ESIS, ToRs, PBs, etc
Escarpment Road	New road	**Escarpment Road to Buhuka Flats** A road linking Ikamiro Village at the top of the escarpment with the Bugoma Village in Buhuka Parish (which was previously inaccessible to vehicles) was constructed in 2015	Ikamiro Village – Bugoma Village	Ikamiro, Bugoma	Kikuube	CNOOC	CNOOC Uganda Limited, Simba Towers, Plot 22, Acacia Avenue, Kololo, Kampala, Uganda	Complete	ESIA submitted to NEMA in
Powerlines connecting the CNOOC CPF to the grid	Electricity transmission line	**Powerlines to Grid** The CNOOC CPF will be connected to the grid via overhead powerlines following construction of the CNOOC export pipeline. The powerlines will follow the proposed pipeline route.			Hoima and Kikuube	CNOOC	CNOOC Uganda Limited, Simba Towers, Plot 22, Acacia Avenue, Kololo, Kampala, Uganda	Est. start in 2020	n/a
Proposed Kaiso-Tonga oil field development project	Oil & Gas abstraction	The proposed Kaiso-Tonya field development, which comprises TUOP's EA-2 Southern fields will form part of an integrated development of the Lake Albert oil fields, covering four licence areas (EA-1/1A, EA-2 and Kingfisher) to be undertaken in joint venture with TEP, TUOP and CNOOC. A project description for this proposed development is not yet available.	Kaiso and Tonya villages	Toonya Parish, Kabaale, Buseruka and Kabwoya Sub-counties	Hoima and Kikuube	Total Exploration & Production (E&P) Uganda B.V (TEP), Tullow Uganda Operations Pty Limited (hereafter referred to as 'TUOP') and CNOOC	TEP - Course View Towers Plot 21, Yusuf Lule Road, P.O. Box 34867, Kampala, Uganda and TUOP - Plot 15 Yusuf Lule Road PO Box 16644 Kampala, Uganda and CNOOC, Simba Towers, Plot 22, Acacia Avenue, Kololo, Kampala, Uganda		
Tilenga oil field development project	Oil & Gas abstraction	The proposed Tilenga field development, located to the north-east of Lake Albert in the Buliisa and Nwoya districts, comprises the upstream development of six production fields across 34 well pads with a total area of approximately 111,000 hectares (ha). The Project will extract oil and gas from the Miocene reservoirs, which are located between 250m and 900m beneath ground level.	Area adjacent to western border of Murchison Falls Conservation Area	Villages within Ngwedo, Kigwera, Buliisa, Got Apwoyo, Purongo Sub-counties and Buliisa Town Council	Buliisa, Nwoya, Masindi and Pakwach.	TEP and TUOP	TEP - Course View Towers Plot 21, Yusuf Lule Road, P.O. Box 34867, Kampala, Uganda and TUOP - Plot 15 Yusuf Lule Road PO Box 16644 Kampala, Uganda		Scoping report and ToR submitted to NEMA in December 2015. Approved in April 2016.
Proposed Tilenga feeder pipeline project	Oils & Gas abstraction	The proposed Tilenga feeder pipeline will transport crude oil produced by the Tilenga Project to a planned refinery.	From Tilenga CPF to Kabaale in delivery point in Buseruka sub county	Villages within Ngwedo, Kigwera, Buliisa, Got Apwoyo, Purongo Kabaale, Buseruka Sub-counties and Buliisa Town Council	Buliisa, Nwoya, Masindi and Pakwach.	TEP, TUOP and CNOOC	TEP - Course View Towers Plot 21, Yusuf Lule Road, P.O. Box 34867, Kampala, Uganda and TUOP - Plot 15 Yusuf Lule Road		A separate ESIA is currently being developed for this proposed project.

Project	Nature of Project	Brief Description	Location/GPS Coordinates	Nearest Settlement/town	Administrative District	Project Proponent	Proponent Address	Project Timelines	Project documents: EIA, ESIS, ToRs, PBs, etc
							PO Box 16644 Kampala, Uganda and CNOOC, Simba Towers, Plot 22, Acacia Avenue, Kololo, Kampala, Uganda		
Kabaale International Airport Development	Airport Development	**Kabaale International Airport** An airport is to be developed in the Albertine Graben, to be located at Kabaale in Hoima District, so as to facilitate delivery of equipment and transportation of personnel during the exploration and development phases of oil fields	Not available	Kabaale	Hoima	Uganda Civil Aviation Authority (UCAA), International Civil Aviation Organisation (ICAO)	Uganda Civil Aviation Authority (UCAA), International Civil Aviation Organisation (ICAO). Entebbe. aviation@caa.co.ug Telephone: +256 414 352000, 0312 352000	Not yet known	ESIA submitted to NEMA in June 2016
Transmission line to the proposed Kabaale International Airport	Electricity transmission line	**Transmission Line to Airport** Transmission line for two 33kV proposed Kabaale International Airport The Government of Uganda (GoU), through the Ministry of Energy and Mineral Development (MEMD) and the Uganda Civil Aviation Authority (UCAA) as the implementing agency with support from the International Civil Aviation Organization (ICAO), intends to construct an airport (Kabaale International Airport) in Hoima District to facilitate the delivery of heavy, long and sensitive equipment to be utilized in the planned oil refinery and other oil related facilities. Part of the infrastructure development shall be the extension of electricity to the proposed airport as there are currently no electricity supply lines to the area. The airport will be served by two power transmission lines of 33kV constructed within a 10m corridor from the road reserve	36N 289883, 170863 and 299804.5N, and 148707.5E (UTM Arc 1960)	Kiziranfumbi, Buseruka	Hoima and Kikuube	Civil Aviation Authority of Uganda	Uganda Civil Aviation Authority Entebbe Phone: +256 -414-352 000 | +256-352-000 http://www.caa.go.ug	Not yet known	

Project	Nature of Project	Brief Description	Location/GPS Coordinates	Nearest Settlement/town	Administrative District	Project Proponent	Proponent Address	Project Timelines	Project documents: EIA, ESIS, ToRs, PBs, etc
Proposed petroleum Refinery	Petroleum Refinery	**Refinery.** The Uganda refinery project is a proposed 60,000 barrel per stream day (BPSD) Hydrocracker/Coker refinery to be located in Kabaale village (about 49km off Hoima-Buliisa road), Buseruka Sub-county, in Hoima District. Foster Wheeler Energy Limited (a UK based multinational company) was contracted by the government of Uganda to undertake a feasibility study between 2010-2011. The study defined key aspects of the project i.e. size and configuration of the refinery, location, financing, and market for the refined petroleum products, and in addition, it confirmed the economic viability of the refinery project. It is estimated that the proposed refinery area which covers about 29 sq. km will accommodate the initial 30,000 BPSD with possibilities of subsequent expansion to 60,000 BPSD, 120,000 BPS and 180,00 BPSD respectively. Key project components will include; tankage area, process units, utilities, buildings, flare area and expansion area.	0268347E 0162503N	Kabaale, Buseruka sub-County	Hoima	Government of Uganda	Government of Uganda	Not yet known	Environmental Baseline report for the Refinery, and Petroleum Authority of Uganda website: https://www.pau.go.ug/urp
East African Crude Oil Pipeline	Transport of Crude Oil to Tanzanian Port	The pipeline will deliver crude oil from the Kabaale Refinery in Uganda to international markets. The oil pipeline will start in Buseruka sub-county, Hoima District, in Uganda's Western Region. It will travel in a general south-easterly direction to pass through Masaka in Uganda, Bukoba in Tanzania, loop around the southern shores of Lake Victoria, continue through Shinyanga and Siginda, to end in Tanga,a distance of approximately 1,410 kilometres (880 mi).	South along the western boundary of Lake Victoria into Tanzania, then eastward to a port north of Tanga	Southern Uganda, Northern Tanzania	Uganda / Tanzania	Government of Uganda / Government of Tanzania	Government of Uganda / Government of Tanzania	Construction is underway, completion is planned for 2020	Environmental authorizations completed and project under construction
Utility Pipeline (Hoima-Buloba)	Multipurpose Petroleum Pipeline	The Hoima-Buloba pipeline is a proposed 210km pipeline for transporting refined petroleum products from the yet to be constructed refinery in Hoima, to the distribution terminal in Buloba, Wakiso district. A Danish multi-national (Ramboll Group) and New Plan Uganda Ltd were contracted by the Ugandan government to conduct the feasibility study which was completed in 2016. As of now, there are no adequate publicly available project document(s) but some project information can be accessed on the Ramboll Group website, see <http://www.ramboll.com/projects/rog/hoima-kampala-refined-petroleum-pipeline>	Not available	Routing study to be completed	Hoima and Buloba; detailed routing study yet to be completed	Government of Uganda, represented by Ministry of Energy and Mineral Development		Not Available	Ramboll Group website

Project	Nature of Project	Brief Description	Location/GPS Coordinates	Nearest Settlement/town	Administrative District	Project Proponent	Proponent Address	Project Timelines	Project documents: EIA, ESIS, ToRs, PBs, etc
Lot 4 Critical Oil Road R4	Road construction	Lot 4 Critical Oil Road R4 (Kabaale -Kiziranfumbi), R5 (Kaseeta Lwera via Bugoma Forest) and R7 (Hohwa-Kyarushesha-Karokarungi) Road upgrade of Lot 4 Critical Oil Road R4 (Kabaale -Kiziranfumbi), R5 (Kaseeta Lwera via Bugoma Forest) and R7 (Hohwa-Kyarushesha-Karokarungi) from gravel to bituminous standards	01°25'N 31°05'E	Hoima & Kikuube	Hoima and Kikuube	Uganda National Roads Authority (UNRA)	Uganda National Roads Authority (UNRA), Plot 5, Lourdel Road, Kampala, Uganda. P. O. Box 28487, Kampala +256 (0) 414 318 111 info@unra.go.ug	Not Available	ESIS submitted to NEMA October 2017
Development of a sugar processing plant	Sugar Processing	Bwendero Dairy farm proposes to develop a sugar processing plant in Kitoba sub-County to process and package cane sugar	1°30'15.42787" N and 31°20'27.7085" E.	Kitoba sub-County	Hoima	Bwendero Dairy Farm	Bwendero Dairy Farm P.O Box 394 Hoima, Uganda Tel:+256392175763/ 4 info@bdf.co.ug	Not Available	EIA report submitted to NEMA in August 2017
Biogas Plant at Kitoba sub-County	Energy Generation	Construction and operation of a biogas plant that utilises spent wash feedstock for heat/steam and power generation for use at the sugar processing facility (see above)	36N 166062 315577E,	Kitoba sub-County	Hoima	Bwendero Dairy Farm	Bwendero Dairy Farm P.O Box 394 Hoima, Uganda Tel:+256392175763/ 4 info@bdf.co.ug	Not Available	Environmental Impact Statement report prepared by Pinnacle Enviro Consult, February 2017.
Buhimba-Nalweyo-Kakindo-Kakumiro Road Upgrade	Road Construction	Upgrade of 93KM Buhimba-Nalweyo-Kakindo-Kakumiro road to class II, paved with a right of way varying between 50m and 30m for rural and urban areas with a design speed of 70km/hr 50km/hr respectively and estimated design life of 15years	UTM coordinates: 312223 148911 (WGS 84) through Nalweyo (UTM coordinates 306917 123516), Kakindo (298142 118455) and Kakumiro trading centre 313423 86370).	Nalweyo, Kakindo and Kakumiro trading centre	Hoima and Kakumiro	Uganda National Roads Authority (UNRA)	Uganda National Roads Authority (UNRA), Plot 5, Lourdel Road, Kampala, Uganda. P. O. Box 28487, Kampala +256 (0) 414 318 111 info@unra.go.ug	Not Available	ESIA report prepared by UNRA, submitted to NEAM September 2017

Project	Nature of Project	Brief Description	Location/GPS Coordinates	Nearest Settlement/town	Administrative District	Project Proponent	Proponent Address	Project Timelines	Project documents: EIA, ESIS, ToRs, PBs, etc
Upgrade of 66km Bulima-Kabwoya Road paved/bituminous standards.	Road Construction	The government of Uganda represented by UNRA awarded a contract to China Railway Number 5 Engineering Group to upgrade 66km Bulima-Kabwoya Road paved/bituminous standards. The road is located within the administrative boundaries of Hoima and Masindi districts divided into two sections i.e. 22km from Hoima Town (Kinubi Village) to Bulima Village; and 44km from Hoima Town to Kabwoya Village. The project is funded by the government of Uganda, African Development Bank (AfDB) and Department of International Development (DFID).		Hoima town (Kinubi & Bulima villages) and Kabwoya village	Hoima and Masindi	Uganda National Roads Authority (UNRA)	Uganda National Roads Authority (UNRA), Plot 5, Lourdel Road, Kampala, Uganda. P. O. Box 28487, Kampala +256 (0) 414 318 111 info@unra.go.ug	December 2015-May 2018	Uganda National Roads Authority website; Project Brief report (for workers' camp) submitted to NEMA March 2017, prepared by GESCH Consult Ltd. https://www.unra.go.ug/en/projects/development
Aggregate Washing and Storage Facility	Road Construction	Aggregate Washing and Storage Facility Development of aggregate washing and material stock pile area along Hoima-Bulima road	36N 313114mE150043mN, 313180mE 150057mN, 313139mE 149957mN and 313096mE 150014mN	Buhimba sub-County	Kikuube	China Railway Number Five Engineering Group Co., Ltd.	Plot 12A, Faraday Road, Bugolobi, P.O.Box 3874, Kampala, Uganda. E-mail:lipeng854@163.com Mob: +256-785593259	December 2016-May 2018	Project Brief report prepared by Aerial Environ Consults Limited, submitted to NEMA July 2017
Thermal Power Plant	Energy Generation	Uganda Electricity Generation Company Limited (UEGCL) on behalf of the government of Uganda contracted Albatross Energy to construct a 230MW thermal power plant at Itara cell, Kibingo Ward, Busisi division, Hoima municipality. The power plant is expected to utilise both crude oil and natural gas (multi-fuel) largely produced from the Albertine graben.	Itara Cell, Busisi Division, Hoima Municipality, GPS Coordinates: N 01.47329, E 031.32792	Hoima Municipality	Hoima	Albatross Energy		Not Available	EIA report submitted to NEMA in May 2015
Transmission line upgrade	Transmission Line	Uganda Electricity Transmission Company Limited (UETCL) is in the process of constructing 132/33kV Substations in Hoima district. The project will involve the installation of the following lines; 1) 4 x 33kV AAAC 150 25.6km integration lines from Hoima-UETCL substation. 2) 4 x 33kV 185sqmm 1C 2.4km cables to be laid from the feeder bays to the overhead termination points. 3) 1 x 33kV 185sqmm 3C 1.9km cable to be laid where the O/H power line installation is not possible due to way leave issues. 4) 4 x 11kV 185sqmm 3C 1km cables are to be laid where both 33kV and 11kV O/H lines intersect. 5) 4x 33kV bays will be installed at Hoima-UETCL substation i.e. Buseruka line, Hoima-UMEME, Munteme line and Masindi-Hoima line bays.	Not available	Villages of; Bulemwa, Itara, Kibingo Kyitara, Rusembe 2, Bujwahya and Kilyateete West	Hoima	UMEME Ltd and UETCL	UMEME Limited, 2nd Floor, Rwenzori House| Plot 1 Lumumba Avenue. P.O. Box 23841 Kampala, Uganda. Tel: +256-312-360600 Fax: +256 414 346199	Not Available	ESIA report prepared by EnvTech Consult Ltd, submitted to NEMA Nov. 2016

Project	Nature of Project	Brief Description	Location/GPS Coordinates	Nearest Settlement/town	Administrative District	Project Proponent	Proponent Address	Project Timelines	Project documents: EIA, ESIS, ToRs, PBs, etc
ORIO Hydropower Project	Energy Generation	The ORIO Project is a proposed run-off-river 3.312MW mini hydropower plant along River Hoimo (which drains into Lake Albert), in Buseruka sub-County Hoima district. The run-of-river hydropower will be based on creating a level difference between an upper intake point in the river and a lower point for the turbine by diverting water flow from a river using a small diversion weir, through a channel which runs parallel to the slope and then down a penstock to power a turbine and then return to the original river. The main components of the plant will include the access road, transmission lines, and powerhouse and construction yard.	UPSTREAM: 01 60239 E031 19325; DOWNSTREAM : N01 61297 E031 18230	Buseruka sub-County	Hoima	Uganda Energy Credit Capitalisation (UECC)	(UECCC); Plot 29/33 Kampala Road Amber House 3rd Floor Block E; P. O. Box 29725 Kampala, UGANDA Telephone: +256 312 165 650 Fax: +256 312 202 220 Email: info@ueccc.or.ug URL: http://www.ueccc.or.ug/	Not Available	ESIA report prepared by Royal HaskoningDHV and Batur Engineering Services; submitted to NEMA June 2016
Access Road to Nkusi Hydropower Plant	Road Construction	Constructing 4.4km long access road going through Kyangwali Refugee settlement up to Nkusi Hydropower plant project cement mixing area	N. 01.11294; E.30.70477 and N. 01.11530, E. 30.67262	Kyangwali sub-County	Kikuube	PA Technical Services	PA Technical Services Plot 2292, Pepsi Cola Zone, Kansanga, Muyenga, POB10585, Kampala Uganda Tel+47- 92 459697	Not Available	ESIA Project Brief report submitted to NEMA May 2016

17.4.2 Other Environmental and Social Drivers

17.4.2.1 Climate Change

The climate in the Albertine Rift is already changing, with records over the last century indicating an increase in temperature of 2°C in some areas (Seimon & Picton Phillips, 2011). This relatively rapid increase in temperature cannot be attributed to global climate change alone and is driven for the greater part by forest and wetland clearance in the region (Carr et al., 2013). Some climate change models predict that Uganda is likely to experience more extreme periods of intense rainfall, an erratic onset and cessation of the rainy seasons and more frequent episodes of drought (GCCA 2012).

While current records of Lake Albert's water level indicate that it varies by approximately 4 m every year, as influenced by rainfall, a climate change-driven overall increase of approximately 180 mm per annum is predicted, which will result in a mean annual rainfall for the Project Area of Influence of 880 mm to 1580 mm for the period 2020 to 2039.

Both Uganda and China are signatories to the Paris Agreement within the United Nations Framework Convention on Climate Change (UNFCCC). This is a recognition of the long-term and cumulative impacts that the emission of greenhouse gases will have on the world's climate. Such impacts are inherently cumulative and dispersed in nature. As a result, the climate change impacts from this proposed project will not necessarily be noticeable within the immediate surrounds of the project area, or indeed, globally, but the fact that both countries involved are signatories places a responsibility and a monitoring and administrative burden on the project staff. It is likely that local Ugandan officials will have to report greenhouse gas emissions for their local area as a part of a national climate report which must be submitted to the United Nations under the responsibilities of all signatories. This administrative burden is frequently passed on to the staff of the area's largest emitters which, in this case, is likely to be CNOOC.

From a positive point of view, the fact that both parties are signatories to the Paris Agreement provides an opportunity to access climate change funding to help redress the biodiversity impacts that have already occurred in the area as a result of the increased access occasioned by the road construction. At the moment, it appears that the primary biodiversity funding into Uganda related to the Agreement is provided by the European Union to bolster the protection of the Rwenzori National Park to the south of Lake Albert. With the development of the CNOOC project and the subsequent oil and gas projects still in the pipeline for the Lake Albert east coast, there is a good case for international climate change funding to be applied into the project region to offset the biodiversity impacts that have already, and are still expected to occur.

17.4.2.2 Population Influx

The Western Ugandan region in proximity to Lake Albert is under pressure from population influx driven by a variety of factors including refugee influx (predominantly from eastern DRC), the uptake of land in Western Uganda by people resident in other parts of the country (party speculative and partly for purposes of agriculture and access to fisheries) and an influx of people hoping to benefit from employment or commercial opportunities associated with oil development in Western Uganda.

Due to the expected environmental and social pressures that population influx will cause within the CIA area of influence, a separate specialist study has been prepared as a basis for managing these risks (Volume 4, Study 11).

17.5 Estimated Overall Cumulative Impact on VECs

This section focusses on the VEC's which are relevant in the context of cumulative impacts associated with CNOOC's Kingfisher Production Facility and Feeder Pipeline. The IFC stresses that: "Scope creep should be prevented; expansion of the Cumulative Impact Assessment (CIA) scope beyond the impacts and risks related to a project is not good practice; focus on a small number of key Valued Ecosystem Components (VECs)." This is the approach followed in this study.

For a cumulative environmental impact to occur, there must be an environmental effect caused by the project, which combines cumulatively with the environmental effects from other projects or activities, and environmental and/or social drivers (Table 17-3).

Table 17-3: Estimated Cumulative Impacts

	Near-shore habitats L. Albert	Wetlands	Escarpment Vegetation	Bugoma CFR	Mud Snail	Grey Crowned-Crane	Nahan's Francolin	Eastern Chimpanzee	Human Environment	Provisioning ES	Cultural ES	Air Quality	Noise Levels	Water Quantity	Water Quality
CNOOC Production Facility	x	x	x		x	x			x	x	x	x	x	x	x
CNOOC Pipeline				x			x	x	x	x					
CNOOC Escarpment road	x	x	O						O	O					x
CNOOC Powerlines to grid						x									
TOTAL	x	x							x	x	x	x	x	x	x
TULLOW	x	x							x	x	x	x	x	x	x
Kabaale International Airport									x				x		
Transmission line to Kabaale Airport						x		x							
Uganda Petroleum Refinery	x	x	x		x						x	x		x	x
Hoima-Buloba pipeline (EACOP)		x				x									x
Critical oil roads upgrade				x			x	x		x					
Sugar Processing Plant in Kitoba												x		x	x
Biogas Plant in Kitoba												x		x	x
Buhimba-Nalweyo-Kakindo- Kakumiro Road upgrade		x				x									x
Bulima-Kabwoya Road upgrade				x			x	x							
Aggregate washing and storage facility, Hoima-Bulima Rd															
Thermal Power Plant at Itara Cell, Hoima															
Transmission line upgrades, Hoima						x									
Orio Hydropower Project	x		x		x									x	
Access road to Nkusi Hydropower			x							x					
Climate change	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Population Influx	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

The cumulative impacts on VECs that are likely to arise from the CNOOC Production Facility and Feeder Pipeline in combination with the other identified existing/proposed projects in the Study Area are discussed in the following sub-sections.

17.5.1 Biological Effects

17.5.1.1 Near-shore habitats of Lake Albert

Other planned projects and activities that could directly impinge on the future condition of near-shore habitats of Lake Albert within the Study Area include the proposed Uganda Petroleum Refinery at Kabaale Village on the lake shore, and the Orio Hydropower project at Kaiso-Tonya approximately 40km north of the CNOOC Production Facility, as well as the other oil projects further north being developed by the other partners (TOTAL and Tullow). These developments are likely to have direct effects on the integrity of near-shore habitats, including habitat loss caused by the project footprint and habitat degradation arising from activities such as waste disposal, occasional accidental leakages and spills, water abstraction from the lake, and discharge of treated stormwater runoff to Lake Albert.

The human in-migration associated with these future proposed oil and gas developments is likely to be accompanied by increased demand for fish leading to exacerbated fishing pressure, as well as increased trampling of the lake shore by drinking cattle. Furthermore, the oil and gas development projects could lead to future detrimental impacts on fish habitats in the event of environmental contamination caused by a significant spill (MEMD, 2013).

The estimated Project impact of the CNOOC Production Facility is expected to contribute to the cumulative impacts on the future baseline condition of the near-shore habitats of Lake Albert. The relative significance of the direct contribution of the Project in the context of the overall cumulative effects largely driven by uncontrolled in-migration and the potential effects of climate change is difficult to quantify, but will probably be small; and will occur on a localised basis within the Study Area in the absence of accidents, contributing to overall cumulative impacts on this VEC.

17.5.1.2 Wetlands

Cumulative impacts on wetlands are expected as a factor of direct habitat loss and degradation due to the development of various linear infrastructure (pipelines, roads) associated with the oil and gas developments throughout the Study Area, as well as those O&G developments located on the shore of Lake Albert itself. Of potentially greater concern is the degradation of wetland habitat through conversion to market gardens and use as livestock grazing areas as a result of human in-migration associated with the O&G developments. In particular, cumulative impacts on the wetlands of the Buhuka Flats are anticipated as a result of the high rate of population influx to the area that has been sustained since the construction of the escarpment road in 2015 and is likely to continue with the construction and operation of the Kingfisher Production Facility.

However, as is the case for near-shore habitats of Lake Albert, the relative significance of the direct impacts of the Project compared with impacts driven by uncontrolled in-migration and the potential effects of climate change is difficult to quantify, but will probably be minor in the absence of major accidents.

17.5.1.3 Escarpment vegetation corridor

Several other proposed lakeshore developments (Uganda Petroleum Refinery, Nkusi Hydropower Plant, ORIO Hydropower plant) and particularly the roads that connect them to the upper plateau of the escarpment are expected to contribute to cumulative impacts on the future condition of the escarpment vegetation corridor, in combination with the Project impact. The future baseline condition of this VEC is predicted to be to be moderately-largely degraded, with the extent of degradation being a factor of proximity to settlements, and the size of those settlements.

The estimated Project impact of the construction and operation of the Feeder Pipeline, together with the proposed roads and powerlines from the lakeshore developments to the escarpment will affect the representativeness of the escarpment vegetation community, as well as its composition and configuration – further affecting its capacity to continue to function as a recognised ecological corridor for fauna moving between Semiliki and Murchison Falls protected areas.

The significance of the overall cumulative impact on the escarpment vegetation corridor is therefore likely to be major. The relative contribution of the Project in this regard (its effect on the future baseline condition of the vegetation and its role as a wildlife corridor) is considered to be significant, as its development – particularly the escarpment road built for vehicular access to the production facility - has caused fragmentation of the corridor, by both the immediate footprint of the road itself, as well as the human influx-induced habitat degradation advancing from its edges.

17.5.1.4 Bugoma Central Forest Reserve (BCFR)

The footprint of the Kingfisher development (the production facility, oil wells, feeder pipeline and associated infrastructure) will have no direct impact on the BCFR. Impacts are likely to be caused by the construction and operation of the proposed roads built in support of the oil industry (P1, R5, R7, R4). The upgrading of the R5 is likely to have a severe impact on the BCFR, both as a result of the direct habitat loss caused by the upgrade, and the long term effect of significantly increased volumes of traffic, with associated risks of collisions with fauna, nuisance effects, diseases and increased bush meat hunting. This road represents a severe threat to the BCFR and the species of concern in the forest (Eastern Chimpanzee, Nahan’s Francolin). The ESIA recommends against its use for oil industry purposes and proposes that access should restricted, with permission granted only to vehicles authorized for forest management and sustainable harvesting purposes. The proposed R7 will serve the purpose of general public access in a north - south direction between Hohwa, the Kingfisher project and areas further to the south (Figure 17-3).

Supported by the oil industry road upgrades, the Kingfisher project will encourage migration into the area around the BCFR. A significant increase in settlers is already being experienced along the Feeder Pipeline route and this is expected to accelerate once construction of the project starts. Combined with other developments within the CIA area of influence, including the Kabaale Refinery, the Kingfisher Project will be a lure for people seeking new jobs and opportunities in the oil industry, encouraging a wave of migrants into the area. Studies referenced in the ESIA have shown that the perimeter of conservation areas are often favoured by settlers, who find themselves in a new and possibly unfriendly environment, with no guaranteed access to work or support, and whose only means of survival may be through access to natural resources. Overall in-migration encouraged by new developments in the CIA area of influence is expected to be a severe risk affecting the habitats of the BCFR.

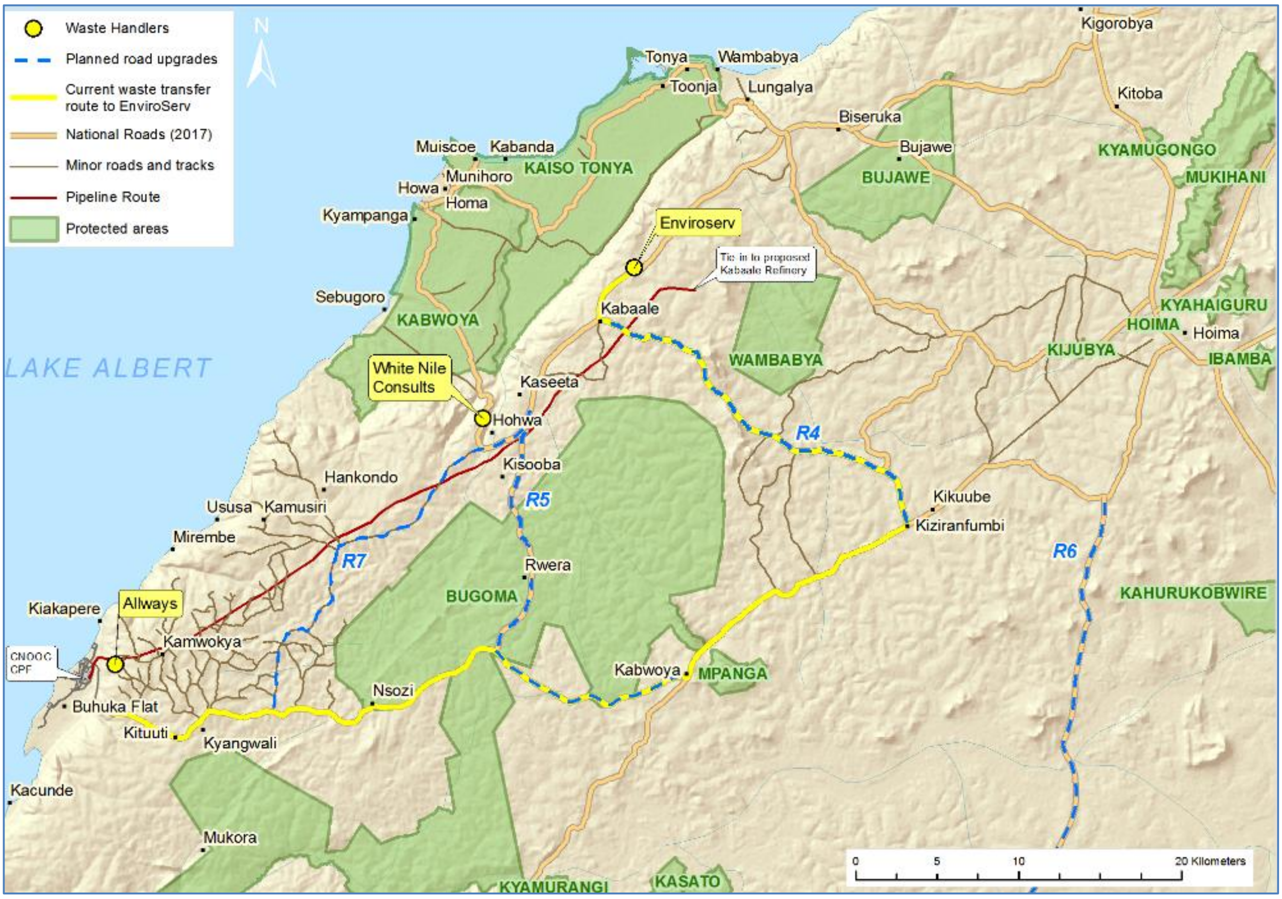

Figure 17-3: Roads and road upgrades proposed in support of the oil industry

17.5.1.5 Mud Snail (Gabbiella candida)

The only known location of the mud snail, *G. candida*, is Butiaba port, which is a busy commercial port which has seen a decline in habitat quality due to erosion and silting from agriculture and water pollution (Kyambadde, 2010). There could be moderate further degradation of this habitat due to oil industry developments along the lake shore.

The addition of the Kingfisher Project impact to this scenario could contribute to impacts on the Mud Snail and its habitat, should the Mud Snail be confirmed to occur parts of the Study Area other than Butiaba, which is 90km north of the project. Otherwise, the project is not expected to contribute to the overall cumulative impact on the future baseline condition of this species.

17.5.1.6 Grey Crowned Crane

The major threats to the Grey Crowned Crane in Eastern Uganda have been identified as habitat loss and conversion of land for farming, collection of chicks in rural areas for rearing and long-distance trade in crane products, intentional and unintentional poisoning, dry season fire outbreaks, loss of tree roosting sites and continuous human presence in wetlands (Olupot, 2014). Cranes are also susceptible to injury and mortality arising from collision with powerlines (Morrison, 2015), a threat that will become more significant in the future as the rollout of electricity supply across eastern Uganda continues and the electrification network expands (AEWA, 2015), particularly for the various planned projects in the study area.

The Kingfisher Project and other proposed projects and supporting infrastructure will all contribute to cumulative impacts on Grey Crowned Crane. The presence of the Project on the Buhuka Flats, and associated traffic of workers, vehicles and project-induced population influx will increase disturbance levels in wetland habitats on the Flats in the future and limit their suitability as breeding and foraging habitat for this species. A transmission line to be constructed by Government from the Kingfisher Development Area to the national grid, which is proposed to run parallel to the feeder pipeline route, will increase collision risks for the cranes. The Project and other associated and independent developments will therefore negatively influence the predicted future baseline condition of Grey Crowned Crane habitat and subsequently the species abundance, distribution, survival and reproduction on a localised basis within the Study Area, contributing to overall cumulative impacts on this VEC.

17.5.1.7 Nahan's Francolin

Oil and gas development-related population influx by opportunity seekers, compounded by the expected influx of refugees, is likely to negatively affect the future baseline population of the species in the Study Area – primarily as a result of deforestation of BCFR, and increased bush meat hunting.

Although no significant direct project impacts on the species are anticipated; the addition of the indirect effects of project-related population influx is expected to contribute to the overall cumulative impact on Nahan's Francolin and its habitat. Depending on the extent of migration into the CIA area of influence, and settlement in the immediate environs of the BCFR, impacts may be severe.

17.5.1.8 Eastern Chimpanzee

As is the case for Nahan's Francolin, oil and gas development-related population influx by opportunity seekers, compounded by an influx of refugees entering the region, is likely to negatively affect the future baseline population of Eastern Chimpanzee in Bugoma CFR and Wambabya FR – primarily as a result of deforestation, increased bush meat hunting, a heightened risk of human-induced disease and increased human-wildlife conflict as the chimpanzees extend their foraging trips to surrounding agricultural areas, while their remnant patches of forest habitat contract.

Although direct Kingfisher project impacts on the Eastern Chimpanzee are not anticipated; the indirect effects of industry and other traffic on the upgraded oil industry roads (particularly the R5 through the BCFR) and population influx, which will be encouraged by perceptions about opportunities in the oil industry as a whole, are expected to contribute to the overall cumulative impact on the abundance, distribution, survival and reproduction of the chimpanzee in the CIA area of influence. How this influx will play out is uncertain - there may be a wave of new migrants when construction of the Kingfisher project starts, but perceptions about better opportunities associated with the oil industry as a whole, including opportunities associated with the Kabaale Refinery, may result in ongoing migration into the area over an extended period of time. Overall, without mitigation, the cumulative effects on in-migration caused by all developments in the CIA area of influence is predicted to result in a significant increase in the threat to the Eastern Chimpanzee populations in the BCFR and Budongo Forest Reserves.

17.5.2 Social Effects

17.5.2.1 Human Environment

It is not possible to accurately predict the cumulative effects of the Lake Albert oil industry developments and other identified activities and drivers within the CIA area of influence on the community's resident in the area. Nevertheless, there is a broad understanding of some of the possible outcomes that will result from these cumulative effects that will extend well beyond the direct impact of the Kingfisher project alone. It is clear that failure to actively manage these outcomes will result in significant risks, which will affect both the communities and the Kingfisher project itself.

The most significant negative effects will be caused by the combined influence of development within the Kingfisher CIA area of influence on migration into the area. This may be both due to economic migration, with people pursuing the prospect of jobs either in the oil industry or in the other developments which are proposed in the CIA area of influence, or political migration, caused by refugees.

Significant social change has already resulted from the developing road network. The CIA area of influence, which was virtually inaccessible until 2015, now has a road network that allows open access to all, including the perceived direct CNOOC - related employment opportunities. At present, there is an exponentially greater influx of people drawn to the Buhuka Flats by factors that are not based on perception about work created directly by the oil industry. These include the fact that Lake Albert serves as an unmonitored open water body with a substantial fish supply, easy access in and out of the DRC (including access for black market goods) as well as the direct and indirect development opportunities that the rapidly expanding settlements provide. This has resulted in massive bush-clearing and overfishing of Lake Albert, which is impacting on the ability of the pre-existing communities along the lake shore to sustain their livelihoods.

As importantly, it has also changed the socio-political structure of the communities around the proposed project. Until the construction of the road, the villages in the project area had stable local governments dating back generations. The Lake Albert area has now become a 'place of refuge and hope' for large numbers of people immigrating from elsewhere in Uganda, and from Sudan, Rwanda and - in particular - the DRC. With the influx of foreign immigrants, particularly Congolese people, most, if not all communities are now dominated by new and possibly temporary residents. Village leaders on the Buhuka Flats, for example, have all indicated that around 70% to 75% of the population in each village is now Congolese, with the local (original) Bunyoro Kitara peoples making up a maximum of 10% to 15% of households in each village. The Congolese migrants and refugees are said to have an attitude towards Ugandan natural and cultural-heritage resources that is more intensively driven by consumption than wise utilisation, although this is a difficult aspect to isolate in respect of contribution to cumulative impacts. Certainly, the water and sanitation-related hygiene practices of the migrant villagers on the edge of Lake Albert tends to be less fastidious than the long-settled Ugandans. Of note is the dearth of sanitation facilities such as latrines found amongst the vast majority of migrants, irrespective of the time that they have stayed there.

Continuing migration into the CIA area of influence is likely. UBOS (2014) projects that there will be approximately 3.1% annual population growth in the Districts of Hoima and Kikuube between 2014 and 2050[1], leading to a 168% cumulative growth in population for the period. However, from the experience on the Buhuka Flats and increasing numbers of people settling above the escarpment, these projections may well be an underestimate. While the burgeoning markets along the lake shore and the increase in settlement are presently mainly unrelated to the oil industry, it is expected that a further rapid escalation in migration into the study area will result from the start of construction of oil industry infrastructure on the Flats and above the escarpment.

On the Buhuka Flats, growth rates have averaged over 12% per annum over the past 4 years for some of the settlements. This includes Nsunzu which has grown by 76% over the 2014 – 2017 period, Nsonga 17%, Kyabasambu 32%, and Kyakapere 36%.

Perceptions about job and business opportunities created by the oil industry will be created not only by the Kingfisher development but by other oil industry growth, including the refinery at Kabaale, the proposed power plant and other unrelated development. While there will be many local benefits from a developing District economy, these will be unequally distributed and will be accompanied by social fragmentation affecting existing communities, as the effects of rapid population changes on the social fabric of communities becomes more apparent. In the enclave of the Buhuka Flats, this will be particularly keenly felt, and will significantly affect the way in which CNOOC is able to engage with local communities, making relationships substantially more difficult. Social tensions will increase, and CNOOC is likely to have to interact with people who have little or no social contract or connection to the local pre-existing communities and cultural environment. A current example of this occurred recently in meetings with the predominantly foreign members of the Kiina community who 'demanded' that CNOOC supply them with fresh water and provided them with preferential access to construction.

CNOOC has already undertaken to provide fresh water into affected settlements which will have the effect or enhancing the attractiveness of these villages for settlement from outside. There is a danger that CNOOC becomes a de facto supplier of state services in the area, without any of the power of the state to enforce

[1] UBOS (2014) Projected Population Growth rate per District

and control the supply of those services. The risks associated with this are two-fold. It exposes CNOOC to the threat of disruption of activities should something happen to cause disaffection in the surrounding communities. In addition, on ultimate closure of the project, CNOOC will have created an expectation and reliance on their presence which could then be disastrous for these communities on ultimate withdrawal of CNOOC from the area.

Overall, the cumulative effects of in-migration into the Kingfisher CIA area of influence has potentially positive and negative social consequences, but in the absence of government intervention to regulate influx and to promote equitable development, particularly on the Buhuka Flats, negative effects will predominate, resulting in a potentially volatile and politically unstable situation that will be to the detriment of most existing inhabitants and may also negatively affect the continued safe operation of the CNOOC production facility.

17.5.2.2 Security

In other African oil fields, such as the Niger Delta, the deliberate sabotage of oil pipelines has become epidemic. This sabotage tends to take three forms as discussed in the following sections. This type of effect not only affects the social VEC under consideration for the CIA, but also presents a risk of significant cumulative effects on the water quality and fisheries VEC in the study area.

17.5.2.2.1 Politically motivated destruction

This may be caused by rebel or terrorist groups who are opposed to the oil company's presence, as in the case of the Niger Delta Greenland Justice Mandate (NDGJM), or are at odds with the Government, as in the case of the Niger Delta Avengers in their battles with the Nigerian government to attract a greater share of oil revenues for the communities of the Niger delta. Internationally, pipelines have been a favourite target of rebel groups, including India's United Liberation Front of Asom (ULFA), Turkey's Kurdistan Workers Party (PKK) and Colombia's Revolutionary Armed Forces of Colombia (FARC) and the National Liberation Army (ELN). While this is not currently seen as a major risk for the Kingfisher Project, the uncontrolled cross border movement in the area, combined with the instability present in some of Uganda's neighbours, poses a future risk of increasing political instability.

17.5.2.2.2 Economic vandalism

There may be an economic incentive to damage pipelines to create local employment opportunities for clean-up crews. Nigeria's National Oil Spill Detection and Response Agency recorded more than 900 such events over 12 700 km of pipeline in 2014. Such vandalism has been successfully combated in places by providing communities with ownership stakes in the oil industry.

17.5.2.2.3 Organised theft

Apart from the opportunistic small-scale theft (and the often horrific consequences that may result from fire), pipelines are uniquely vulnerable to organised criminal syndicates because of the difficulty inherent in policing linear infrastructure. Pipeline oil theft is rampant in almost all developing oil producing nations. In his report into the matter, Ralby (2017) identifies pipeline oil theft as being "…*highest in states where oil is refined, but the most common determinant of oil theft is a significant price discrepancy between one state and its neighbour. Other factors in neighbouring states—instability, currency imbalances and lack of border controls—also impact the extent to which a state experiences downstream illicit activity. Areas where there are few fuel distribution centres are particularly ripe for organized criminal groups to fill the void*."

While the thick waxy Kingfisher crude transported by the in-field flow lines and the feeder pipeline to Kabaale is a less desirable and more difficult product to steal than refined products, the other factors described above fit the circumstances in the CIA study area well. There is a likelihood of criminal impacts affecting the project (and in turn, the possibility that the project will attract criminal activity into the area), and this will need to be addressed in long term planning. Such theft has been combated with some success in markets such as Mozambique through the provision of oil royalties to local communities but the weakening of the social fabric of communities in the Kingfisher CIA area of influence, associated with high levels of foreign in-migration, will make this harder to achieve.

17.5.2.3 Physical Effects

Since the predicted effects of the Project on air quality and noise levels do not overlap spatially with the predicted effects of other projects and activities, no cumulative effects on air quality and noise levels within the study area are predicted. In-migration is, however, expected to increase impacts on these VEC's, particularly in respect of low level air pollution caused by the burning of wood and charcoal.

17.5.2.4 Water Quantity

A surface water resources assessment completed for the Tullow operation (JDIH, 2009) found that the proposed daily water requirement of 50,000 – 200,000 barrels (8,000 – 32,000m^3) represents 0.5 - 2.2 mm of water depth in 1 year over the whole lake surface. The predicted changes in lake level of a few millimetres were considered insignificant when compared to the 0.5m natural annual fluctuation in lake level.

During the operational phase, the CNOOC Project in the Kingfisher Development Area will require between 520 m^3/day and 7 315 m^3/day, and thus will have a similarly negligible impact on the quantity of the water resource provided by Lake Albert. Therefore, no cumulative impacts on water quantity within the CIA Study Area are predicted.

17.5.2.5 Water Quality

Although minor residual project impacts on the water quality of surface and ground water systems are predicted, these impacts are not expected to contribute significantly to declining water quality in Lake Albert. The spatial separation of the major developments and the low level of CNOOC's expected impact (subject to accident-free operation) is not expected to combine to create significantly greater impact. High level of population influx to the region may result in broader changes in the nearshore waters.

17.5.3 Recommendations for Management of Cumulative Impacts

The recommendations for management of cumulative impacts focus on how CNOOC can contribute to the management of residual project impacts, and how this can be integrated with the overall regional or basin-wide management of cumulative effects across the three oil and gas partners (Tullow, TOTAL and CNOOC).

17.5.3.1 General Recommendations

It is recommended that a regional environmental and development forum is established by Government and the oil industry partners. The mandate of the forum should be to:

- monitor and manage cumulative environmental and social impacts of the developing oil industry, that are beyond the responsibilities of the individual oil companies;
- ensure that any actions taken to manage cumulative oil industry impacts are aligned with Government policies and plans and are according to a common vision for the oil industry as a whole;
- serve as an advisory body for the allocation and management of funds committed to the control of cumulative oil industry impacts. Funding would be required from Central Government, the Oil Industry partners and, if necessary, sourced from other donor organizations and financiers as well;
- Communicate widely and effectively with stakeholders, including local project-affected communities and local and international NGO's.

The forum should involve the oil industry partners, relevant Government departments and a core group of other stakeholders such as CSOs, community representatives and the traditional leadership.

17.5.3.2 Specific Biological Recommendations

Through the forum, it is recommended that CNOOC:

- champion the Kingfisher ESIA proposals to de-list the R5 running through BCFR. Ideally, access to the BCFR should be restricted (e.g. a boom at entry, allowing passage only to people with a legitimate interest in the management of the forest reserve for sustainable harvesting). Improved north-south access to Hohwa should be promoted via the proposed R7.

- support initiatives such as the Bugoma Central Forest Reserve conservation and reforestation, and chimpanzee corridor restoration between the BCFR and the Wambabya Forest Reserve.
- look for synergies with existing Government initiatives and outside organizations that are involved in conservation efforts in the BCFR (which is managed by the National Forest Authority on behalf of the state). Various conservation programmes especially that of ECOTRUST, are promoting conservation of the forest by involving the surrounding communities in livelihood improvement projects (BirdLife International 2018). The oil industry environmental committee should work with these programme organisers and possibly assist in jointly funding conservation and monitoring efforts, where appropriate.
- participate in a landscape/basin wide biodiversity offsetting scheme for the impacted VECs - which include the near shore habitats of Lake Albert, wetlands, escarpment vegetation corridors, Bugoma Central Forest Reserve, the Mud Snail, the Grey Crowned Crane, the Eastern Chimpanzee and Nahan's Francolin. Depending on agreements reached within the environmental committee, CNOOC may drive the offsetting components that are more specific to the Kingfisher project residual impact.
- assist in the implementation of an Action Plan for minimising in-migration, based on the Influx Management Strategy & Framework Plan (Volume 4, Specialist Study 11).

17.5.3.3 Specific Social Recommendations

- It will be necessary for CNOOC to collaborate closely with both the Central Government and local governments, and to support authorities in Buhuka parish, Kyangwali sub-county, Kikuube and Hoima Districts to understand their responsibilities and the challenges associated with population influx. The KFDA will change the social, economic and environmental setting of what is currently a largely rural area. The Project must define and develop measures to manage influx by:
  - Actively supporting the activities of Kikuube and Hoima District Local Governments as defined within this Influx Management Plan from their District Development Plan, formed to guide and coordinate regional development, and with specific responsibility for "influx management" in the region;
  - Working closely with the Ministry of Works and Transport (UNRA), Ministry of Lands, Housing and Urban Development for physical panning, Ministry of Internal Affairs for emigration and security, Ministry of Energy and Mineral Development, other central government agencies and Local Governments;
  - Assisting with capacity-building for government organisations to develop and budget for appropriate town planning, infrastructure and service provisions in the mid-western region (Hoima and Kikuube). Specifically, this would include plans to create a stable social environment on the Buhuka Flats and along the Feeder Pipeline route;
  - Maximising local content in employment and procurement practices, and support regional economic development;
  - Assisting Local Government to develop plans that will help Interventions on the Flats could include the provision of essential services for local communities.
  - Helping to monitor Project-related in-migration; and
  - Investing in Kikuube and Hoima District Local Governments' infrastructure and service provision in partnership with government, non-government agencies and private sector partners.

It is further recommended that CNOOC:

- Support and/or fund existing (and not currently successfully operating) Beach Management Units to conduct appropriate fishery monitoring and patrols.
- Support the fisheries administration to control the use of destructive fishing gear (MEMD, 2013).
- Investigate opportunities for sustainable hatcheries/farms in the nearshore environment of Lake Albert off Buhuka Flats. This could be considered a part of CNOOC's Corporate Social Investment programme..

17.5.3.4 Physical Recommendations

It is recommended that CNOOC:

- support the Eastern Lake Albert Catchment Management Initiative
- develop an Integrated Water Resource Management Plan together with the other oil industry partners, which should include plans for addressing potential cumulative impacts on water quality and quantity of Lake Albert, as recommended in the Albertine Rift SEA (MEMD, 2013).
- provide support (technical/financial) for establishment of the implementation structures that the sub-catchment management plans require for delivery (Barker, 2009).

17.6 Transboundary Impacts

This section presents an assessment of the transboundary impacts of the proposed Project. Transboundary impacts are impacts that extend to multiple countries, beyond the host country of the project, but are not global in nature for instance water pollution for countries sharing water resources such as L. Albert between Uganda and the Democratic Republic of the Congo, air pollution extending to multiple countries, and transboundary disease transmission.

The Kingfisher Field Development Area (KFDA) is located on the western boundary of Uganda on the Eastern shores of Lake Albert. The international boundary between Uganda and the Democratic Republic of the Congo runs through Lake Albert with the eastern shore of the lake falling within Uganda and the western shore of the lake within DRC. Lake Albert is a shared water resource between Uganda and the DRC meaning any negative impacts (if they are sufficiently substantial in scale and magnitude) on this lake could theoretically affect DRC. The Nile River also flows from Lake Albert through South Sudan, Sudan, and into Egypt, and as such, these countries could potentially be affected. Consequently, the KFDA is located in a boundary area and any potential transboundary impacts associated with the development must receive consideration in the impact assessment, and are discussed in this section of the ESIA document. For purpose of this discussion it is important to note that the KFDA is located on the south-eastern shore of the lake at a point where the lake itself is approximately35 km in width with the international boundary located 20 km from the Ugandan shoreline and 15 km from the shoreline of DRC. Similarly, the KFDA is located approximately 28 km from the southern end of the lake and roughly 130 km from the point at which the Victoria Nile enters Lake Albert and the Nile exits the lake in the extreme north.

In the consideration of impacts associated with construction, operation and decommissioning of the KFDA project infrastructure comprising CPF and associated infrastructure and the feeder pipeline taking produced oil to the tie-in point at Kabaale, it has been shown that the impacts associated with the project are largely confined to the project area and immediate adjacent areas. That said, for purposes of reflecting the discussion appropriately in this part of the impact assessment, key impacts which ostensibly have the potential to impact upon neighbouring territories are discussed briefly below;

- Pollution of lake water resources: There are a number of risks posed to water resources through the proposed development. These include specifically, the potential for lake water contact with and resultant contamination by hydrocarbons through major infrastructure failure or well blowout. The risk of significant migration of oil to the lake in the event of failure of large storage vessels of the CPF has been assessed by Worley Parsons to be low. This is described in the operational scenarios for the CPF under unplanned events. Similarly, the risk of subsurface well failure or well blowout has been assessed to be low (see Appendix A Vol3). Notwithstanding this, emergency preparedness and response plans at site will need to be able to contain an oil spill to lake surface to prevent dissipation of such contaminants should an unplanned event of this nature occur. The combination of influx induced settlement densification on, potential structured urbanisation of and industrial development on the Buhuka Flats will result in nearshore lake-water deterioration, particularly in relation to levels of nitrate and phosphate which is likely to cause localised eutrophication from time to time. Notwithstanding the need to manage this issue, particularly as it relates to those aspects under the direct control of CNOOC (camp treated sewage discharges et cetera) this is not considered to constitute a material transboundary threat to the water resource.

- Mitigation: Any minor spills are unlikely to cause noticeable change to the surface water conditions. Major accidental spills could affect water quality. However, with appropriate control measures and monitoring in place, the probability of unplanned events, including accidental spillages is reduced.
- Details of the impact as a result of unplanned events and appropriate mitigation measures are addressed in Chapter 10: Unplanned Events. The magnitude of impact on the L. Albert is considered to be negligible, and therefore potential impact is assessed to be Insignificant. The viscosity of the oil should slow its rate of percolation and transport, facilitating the pumping of oil from the water and disposal to an onshore licenced hazardous waste facility, should such measures be required.
- Mitigation and monitoring measures to prevent pollution of Lake Albert by oil, chemicals and waste during construction and operation of the production facility as described Section 7.1.2 in *Chapter 7: Construction Impacts of the Production Facility* and Section 8.1.2 in *Chapter 8: Operational Impacts*.
- Mitigation measures to manage the impact of population in-migration onto the Buhuka Flats as described in Section 7.2.3 in *Chapter 7: Construction Impacts of the Production Facility*.
- Preparation of a Pollution Prevention and Response Management Plan, an Influx Management Plan, a Lakeshore Works Management Plan and a Water Management Plan (see Operational Environmental and Social Management Plan in Volume 2).

- Abstraction of lake water: The utilisation of lake water during the operational period of the CPF has been assessed. The maximum consumption levels drawn from the lake are not regarded as material in relation to the lake water balance and consequently are not regarded as causing any transboundary impact. A Water Abstraction System will be installed in Lake Albert to provide water for the commissioning and Operations Phase of the Project, including for reinjection, construction, and other industrial uses. If required, water may also be abstracted from Lake Albert during Site Preparation and Enabling Works and Construction and Pre-Commissioning Phases.
  - Mitigation: A number of design control measures have been incorporated into the Project's design to limit the amount of water required, and to ensure water is re-used wherever possible. The total volume of abstraction is not expected to affect the lake's water levels or hydrodynamic regime (the peak water abstraction volume is estimated to be 2,669,245 Ml/annum, which equates to around 0.00654 % of the annual inflow to Lake Albert). The impact on Lake Albert and the ecosystem it sustains is therefore expected to be insignificant and unlikely to cause impacts on DRC or any countries the Nile River flows into such as South Sudan, Sudan, or Egypt
  - The impact of the project on water levels in Lake Albert is discussed in Section 8.1.2 in Chapter 8: Operational Impacts. The utilisation of lake water is not regarded as causing any transboundary impact.
  - Preparation of a Water Management Plan and Lakeshore Works Management Plan (see *Operational Environmental and Social Management Plan* in Volume 2). Includes acquisition of

requisite permits and maintenance of appropriate screens at the water intake to avoid entrainment and impingement of aquatic plants and animals.

- Air quality deterioration; The potential effect of the CPF during its operation has been modelled in some detail. The Project will emit atmospheric pollutants including GHG, as described in Chapter 8: Operational phase. Air pollutants tend to impact the near environment, within the first couple of kilometres of the source, or up to 10 km for emission sources with high exit temperatures and velocities, such as gas turbines and flares. No regional impact associated with air-quality effects has been identified. The effect of emissions to the air from the CPF have been shown to be localised within the immediate proximity of the project infrastructure and not creating lasting effect. GHG emissions however have the potential to contribute to climate change on a national and global scale, and are a transboundary issue.
  - Mitigation: In-built design measures, such as appropriate stack heights, implementation of no operational flaring, and ensuring that emission sources have high efficiency will minimise the Project's GHG emissions and related impacts. The project proposes to restore the affected land within the KFDA after Project completion and this should help offset some of the adverse impacts as this would reintroduce vegetation cover that will act as a future carbon stock source. The reinstatement of the sites through the implementation of the Environmental Management Plan and associated restoration plans will minimise impacts related to GHG. Taking this into consideration, the potential transboundary impact associated with GHG emissions is considered to be Low Adverse significance.
  - Mitigation and monitoring measures to address air quality effects of the CPF during its operation as described in Section 8.1.1 in Chapter 8: Operational Impacts.
  - Preparation of an Air Quality Management Plan and Greenhouse Gas Management Plan (see *Construction Environmental and Social Management Plan* and *Operational Environmental and Social Management Plan* in Volume 2).
- Impact upon fish stocks; The combination of good quality road access to the Buhuka flats which has seen a significant change in fishing behaviours, the influx of people to the region (both opportunistic and fleeing conflict in DRC), and the potential structured densification of settlement patterns on the lake shore (Physical Development Planning process) places considerable pressure on fish stocks. There is already strong evidence of decline in key species populations and the age cohort reflected within catches. This is exacerbated by the over exploitation of silverfish as discussed earlier in this document. These factors are likely to see a material negative impact develop in relation to the Lake fisheries which will require management and has the potential to impact upon the fishing industry (both commercial and subsistence) on both shores of the lake. However, this is not directly attributable to oil development but a consequence of multiple factors and specifically the introduction of good quality road access to the lakeshore, an unregulated "border" from which produce moves freely between the countries and the free movement of people between the countries (and predominantly into Uganda) driven by the ongoing conflict in Western DRC.
  - Mitigation: HDD drilling will be used for the proposed wells, which are predominantly below the lake waters and remote from Lake Albert waters or the Nile waters with the exception of a few components (Water Abstraction System, Jetty) and the other project facilities will be onshore. Where works are happening within the water or shoreline, they will be relatively localised and unlikely to affect fisheries in the region or in neighbouring countries.
  - Mitigation and monitoring measures for impacts of population in-migration and community health, safety and security as described in Section 7.2.3 and Section 7.3.4 in Chapter 7: Construction Impacts of the Production Facility.

- Preparation of a Biodiversity Management Plan, a Water Management Plan, a Lakeshore Works Management Plan, and a Community Health, Safety and Security Management Plan (Environmental and Social Management Plans in Volume 2)

- Influx; As briefly discussed above the conflict in western DRC constitutes a strong push factor driving the movement of people eastwards across the lake into Uganda. This considerably overshadows any pull factor attributable to opportunistic settlement in proximity to potential oil development sites. Notwithstanding this, it is an issue that will require careful and structured management by the Government of Uganda in order to avoid considerable overexploitation of Uganda natural resources to the detriment of the long-term sustainability of the landscape. The ease with which people can cross the lake and move freely into Uganda, combined with the favourable Ugandan policies in relation to settlement of refugees, does make the movement of people into the Lake Albert Eastern Shore region difficult to manage. As well as fishing, accidental spills could also affect fish stocks.

  - Mitigation: Additional fishing activity in the occurring as a result of in-migration and population pressures is expected to be small relative to the size of these waterbodies and will be localised within the Project area of influence in Uganda (as the fish landing sites are known) and small in scale, and there would be a low potential for transboundary impacts on fisheries. Regarding accidental spills, with appropriate control measures and monitoring in place, the probability of unplanned events, including accidental spillages is reduced. Details of the potential impact as a result of unplanned events and appropriate mitigation measures are addressed in Chapter 10: Unplanned Events. The magnitude of transboundary impacts associated with increased fishing in Lake Albert is
    expected to be low magnitude and of low adverse significance.

  - Mitigation and monitoring measures for impacts of population in-migration as described in Section 7.2.3 in Chapter 7: Construction Impacts of the Production Facility.

  - Preparation of an Influx Management Plan and a Community Health, Safety and Security Management Plan (Environmental and Social Management Plans in Volume 2).

- Health risks: As an extension of the issue of influx discussed above, the relatively free movement of people across the international boundary (and predominantly into Uganda) does introduce a set of risks to human health on the eastern shore of Lake Albert. This is not a project induced transboundary impact. It is however a risk which warrants highlighting and careful consideration during the operational phase of the KFDA has highlighted most recently by the current outbreak of Ebola virus in Weston DRC and the continued risk of spread of the virus to Western Uganda.

  Labour and social migration through the Project has the potential to increase the prevalence of communicable diseases and sexually transmitted infections (influx is likely to increase the presence of commercial sex workers and increase risk taking behaviour between workers, migrants, and host communities, which can lead to increased transmission of disease). Many infectious diseases, such as cholera, influenza and meningitis, can be rapidly and easily spread across national borders, particularly when a project attracts a large influx of potential job seekers during a construction phase.

  - Mitigation: The developer will prepare a series of management plans that will aim to safeguard community health, such as an Influx Management Strategy and Community Impact Management Strategy. CNOOC will work with local government, the Ministry of Health, District Health Teams and selected NGO partners to deliver education and communication on key public health issues. Following implementation of control measures outlined in health impact assessment report (Appendix B, Volume 4), it is considered the potential transboundary risk and impacts to community health are Low magnitude and of low adverse significance.

  - Mitigation and monitoring measures for impacts of population in-migration and community health, safety and security as described Section 7.3.4 in Chapter 7: Construction Impacts of the Production Facility.

- Preparation of an Influx Management Plan and a Community Health, Safety and Security Management Plan (Environmental and Social Management Plans in Volume 2).

17.7 Buhuka Flats Physical Development Plan

17.7.1 Context

The Government of Uganda, through the Ministry of Lands Housing and Urban Development (MoHLUD) are in process of developing a Physical Development Plan for the Buhuka Growth Centre in the Kikuube District. This planning process recognises that the Albertine Region constitutes one of two identified special planning areas in Uganda. The Albertine Region is expected to experience growth attributable in part to the development of the oil industry within the area. The planning process recognises the need for selected urban centres within the region and that these growth centres will require physical development plans to guide the development process in a sustainable manner.

While this process has been underway for a number of months and CNOOC has provided some logistical assistance and in-kind support to the team developing the Physical Development Plan, the plan itself only became available towards the end of the first quarter 2018 at a point in time when the ESIA was largely drafted.

The intent of this section is not to describe the content, approach or summarise the deliverables of the Physical Development Planning process. This section intends merely to reflect the preliminary plan in the ESIA for benefit of the reader in the form initially released by MoHLUD[2] (Figure 17-4) and then for clarity to also reflect this initial Physical Development Plan in a manner consistent with the mapping of the ESIA and reflecting the infrastructure footprint that has been considered in this ESIA (Figure 17-5).

17.7.2 Comment in relation to Physical Development Planning

Given the disconnect in timelines between completion of the ESIA process and the development of the preliminary physical development plan the two processes have run independently of one another and without benefit of sight of information and planning being developed through either process. The ESIA process had largely run to completion by the time that the physical development planning process was gearing up to release preliminary information, consequently the physical development plan has not, in its first release, had opportunity to respond to additional information available through the Kingfisher development ESIA or respond to recommendations of the ESIA in relation to any restriction recommended in relation to Kingfisher infrastructure. Similarly, other than this cursory reflection of the preliminary physical development plan, the ESIA is not able to respond in any meaningful detail to the proposed physical development plan as it is too early in its genesis to be thoroughly considered.

This creates both a number of interesting challenges and opportunities. For benefit of the authorities we believe it is pertinent and appropriate to share the insight of the ESIA team at this point. We are going to discuss these points broadly in the subsections below with the intent of communicating key concerns, suggestions for mutual benefit and insights which may benefit both the authorities and planning consulting teams going forward. This section also serves to capture the insights of the EIA team in relation to the proposal to quite fundamentally change the local social fabric.

17.7.2.1 Kingfisher development ESIA and the physical development plan

It is important to understand that because there was no physical development plan approved and in place at the time that the Kingfisher development ESIA has been undertaken, and the first draft of the plan was only

[2] The preliminary Physical Development Plan was obtained through CNOOC from the lead consultant in the planning process PRAID Consultants Ltd, who kindly also made available GIS shape file data to enable the Physical Development Plan to be remapped by the Consultant as presented in Figure 17-5. In addition to the physical plan the Consultant has had sight of the *Draft Situation Analysis Report* and Record of the *Stakeholder Consultation and Engagement for Situation Analysis and IEC Strategy for Physical Planning of Buhuka Growth Centre, Kikuube District*

released after drafting of the Kingfisher development ESIA. Consequently, the physical development plan receives no structured consideration in this ESIA.

What this means is that the Kingfisher development ESIA correctly evaluates impact on the current landscape of the Buhuka flats and the current social fabric of the area. The ESIA takes account of the influx that is taking place into the area within context of the local social fabric and the extent to which this can be attributed to oil development. However, fundamentally it assumes a largely rural and undeveloped landscape in which the majority of people live in discrete villages and follow largely traditional lifestyles comprising a combination of fishing and livestock grazing.

This is an important point because the assessment of impact of the Kingfisher Development project assumes a surrounding semi-rural landscape, within which there are five clearly identified villages on the Buhuka flats. Similarly, the mitigation proposed in response to identified impacts takes account of the same semirural character of the landscape, the corresponding lifestyles of people on the Buhuka flats and the land uses currently in effect. The Kingfisher development ESIA does not assess the development within the context of a surrounding urbanised landscape, because that is not the case at this point in time.

The impacts of the Kingfisher development on an urbanised environment, in essence the development of major petroleum infrastructure inside a town environment, may well yield a different magnitude of impact and require different mitigation.

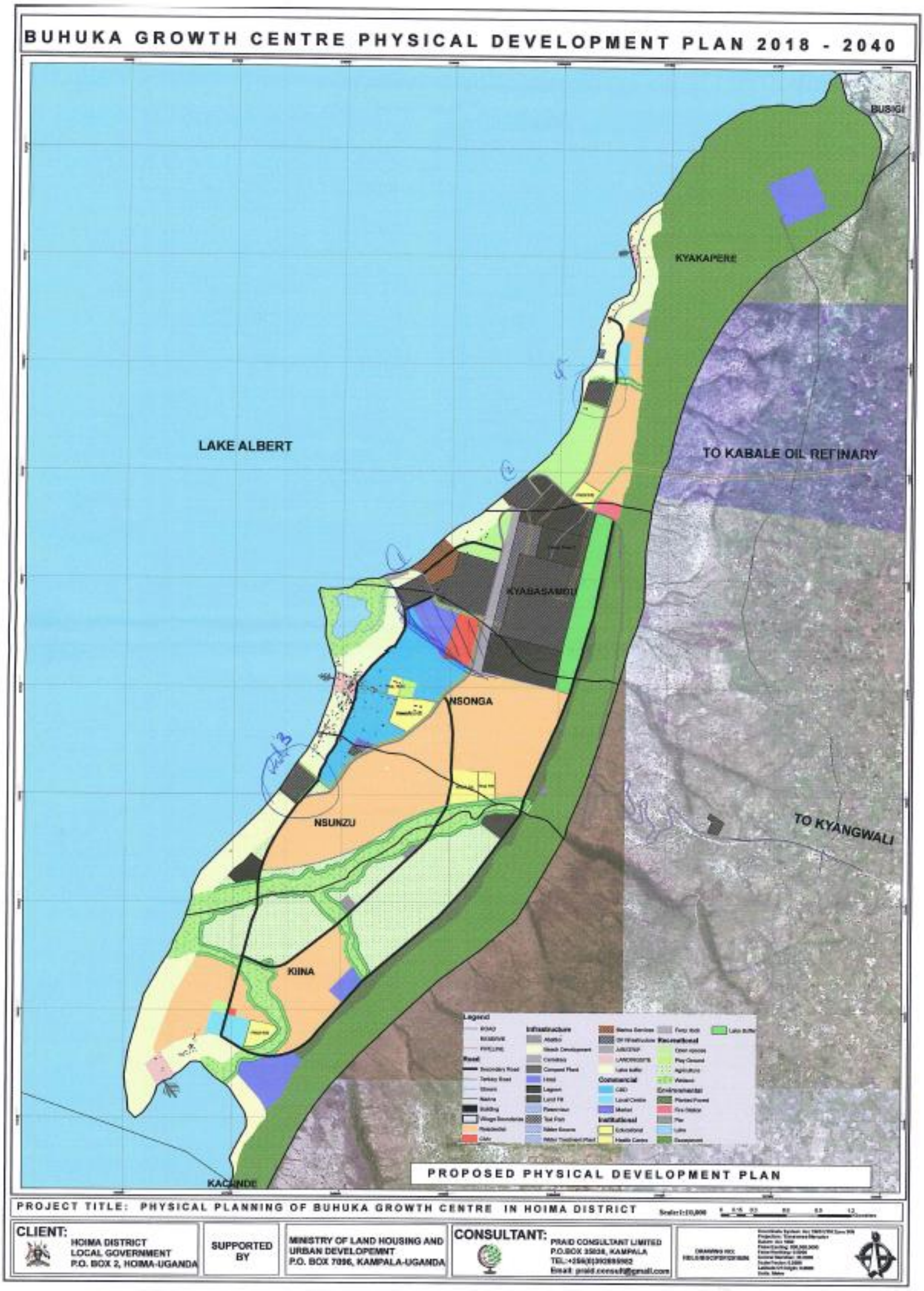

Figure 17-4: Proposed physical development plan

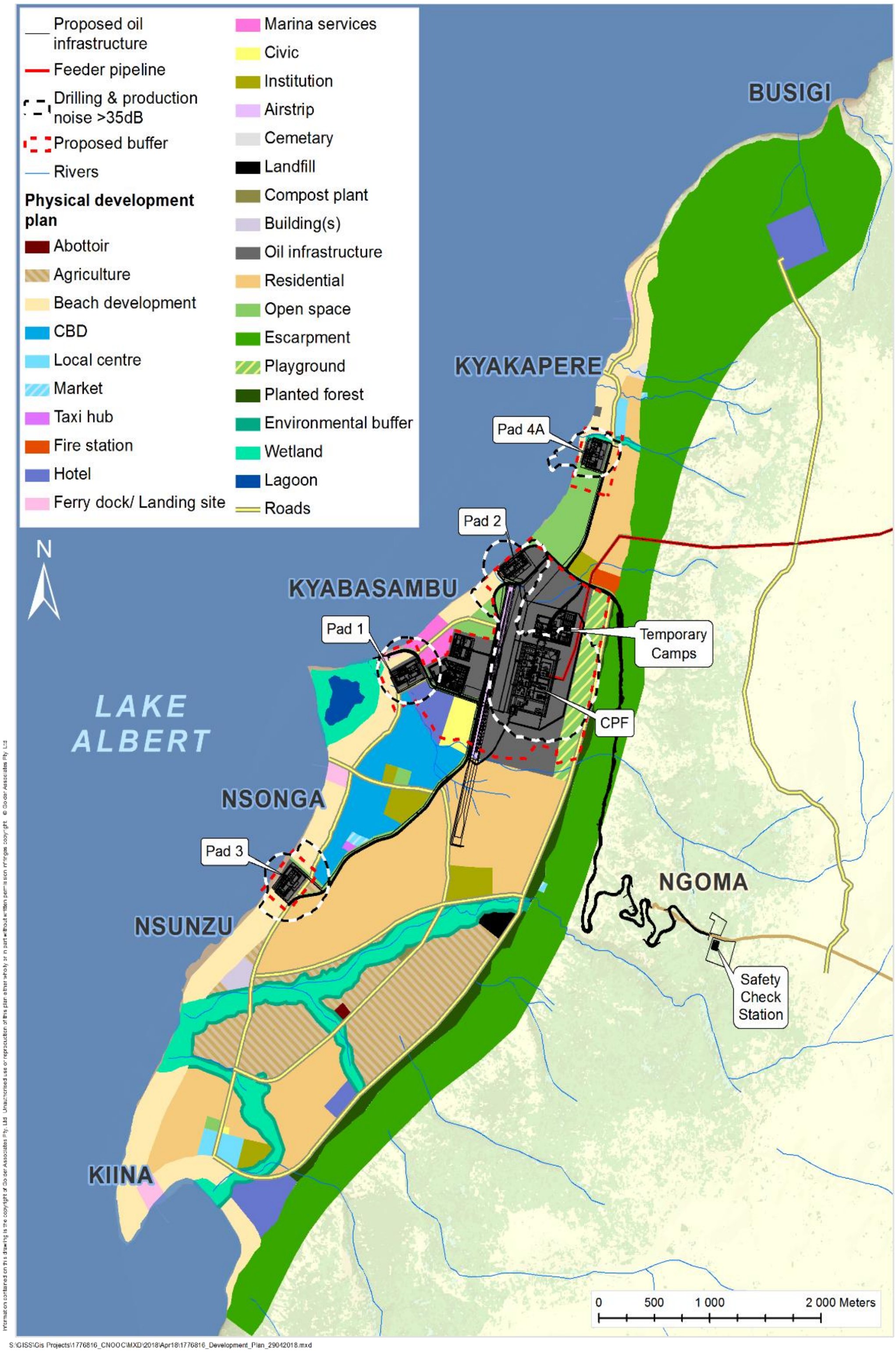

Figure 17-5: Proposed physical development plan remapped to take account of the Kingfisher development infrastructure layout as reflected in the ESIA and reflecting proposed buffers around key infrastructure

We draw the attention of NEMA and MoHLUD specifically to this point as, in the view of the ESIA team, the physical development plan will need to take account of potential impact of Kingfisher development infrastructure and any ESIA evaluating the impact and consequence of implementing the physical development plan will need to specifically take account of constraints posed by Kingfisher development infrastructure on the layout of the physical development plan. We highlight a number of points below:

- All predictions of impact in relation to people resident on the Buhuka flats take account of where people currently are (as one would expect). The physical development plan in its first iteration has been developed without sight of the findings of the impact assessment. This has created the situation where certain components of the plan are in conflict with identified areas of impact or recommended buffer areas which are outcomes of the ESIA process. These will need to be taken into account in future iterations of the development plan to ensure that the physical development plan does not, in its final form, introduce conflict between the Kingfisher development infrastructure and future urbanised development.
- As the physical planning process advances it will be necessary to reconfirm the impacts associated with the Kingfisher Development Area infrastructure to the extent that it may impact on the proposed physical development plan. The current EIA has been developed to evaluate the impact of oil and gas development and its associated infrastructure on a relatively undeveloped and largely rural landscape. All modelling undertaken as part of the ESIA works from the space. The potential impact on an urbanised economy has not been evaluated and it would not be appropriate to do so at this point in time. Rather, the responsibility for ensuring that the proposed physical development plan reflects the best utilisation of available space taking account of the industrial development within the north central portion of the Buhuka flats rests with the planning team and must, at an appropriate point in time, be undertaken to ensure that there are not unintended consequences created through finalisation of the plan in isolation of reconsideration of primary impacts associated with oil and gas development. Without this, there will be potential for the physical development plan to create unintended conflict between the planned urban development growth centre and the Kingfisher Development Area; a scenario which all parties would seek to avoid through appropriate planning and rigourous scientific consideration.
- The physical development plan does not recognise the sensitive areas identified through the Kingfisher Development Area ESIA as these were not available to the physical development plan team at the time that they concluded their initial planning. Specifically, in this regard we draw the attention of the planning team to the following;
  - The sensitivity of the Kamaniseng river which is located to the immediate south of the CPF and feeds the lagoon which is itself highly sensitive from both a biodiversity and cultural heritage perspective
  - The sensitivity of the lagoon and its importance in relation to fish stock and cultural practices in the area and the need to ensure that the drainage feeding to this area is not compromised through inadvertent restriction of flow within the upstream wetland or contamination from associated development
  - Similarly, the sensitivity and importance of the large wetland system which drains the southern portion of the Buhuka flats. The system is currently largely unaffected by the proposed Kingfisher development which has specifically aggregated in the northern central portion of the flats to limit the footprint of impact on both biodiversity and traditional lifestyles. While the planned utilisation of the areas surrounding these southern wetland areas in the physical development plan remain, to a large extent, of an agricultural nature, there are a number of proposed structures which do pose some risk to the integrity of the wetland system. These include proposed land fill in the upper reach of this system and a proposed abattoir in the mid-lower reach of the system. Both of these infrastructure types of potential to impact upon the wetland system and may be best considered at locations not immediately adjacent to wetlands.
  - The location of any proposed landfill on the Buhuka flats should be carefully considered given the relatively shallow water table, notwithstanding that the quality of water in the ground is poor. Should it be deemed unavoidable that a land fill must be developed in close proximity to the proposed

development node, and on the book of flats, then citing such land for away from both wetland and surface water resources will be important

- The need for any crossing points across streams and wetlands on the book of fats to be carefully designed to ensure that the flow regime is not unduly compromised given the importance and limited number of wetlands within the Buhuka flats. As an example, the current road to Nsunzu has a single pipe culvert under it with corresponding desiccation of downstream wetland areas. This will be corrected during the upgrade of this road in preparation for drilling at Pad 3 but it highlights an important lesson which needs to be heeded as road networks expand within the Buhuka flats and there is a need to bridge the southern wetland areas to gain access to Kinia Village and associated areas, as reflected in the physical development plan were two such road crossings of this wetland system are indicated

- The multiple cultural heritage sites identified and documented as part of the ESIA process which require management, protection and possibly appropriate recovery of artefacts or relocation of sites of living cultural heritage to give effect to the proposed plan and structure development of the flats, and

- The need for some form of buffer to create separation between planned structured urbanisation of the Buhuka flats and the CPF which is a heavy industrial facility. The plan does not recognise this at the moment and seeks rather to aggregate certain types of infrastructure in close proximity to the CPF, something which the planning team may wish to reconsider, and which CNOOC would be advised to actively engage in discussion on to ensure that the need for a workable buffer around the facility is not compromised through development planning, and

- An opportunity to formalise urban drainage from identified new residential areas with a particular focus placed on stormwater control infrastructure designed to trap and remove plastic and man-made debris from stormwater prior to its entry into the lake system. Following the introduction of road access to connect the Buhuka flats, there has been a concerning increase in litter observable to the specialist teams conducting the Kingfisher development ESIA. This is not unexpected given that there are no facilities in place to manage non-biodegradable urban litter streams at this point in time, and there has been no education of these isolated communities on the need to manage such litter streams to avoid unintended pollution of their immediate surrounding environment. Easy road access to the Buhuka flats has allowed the introduction of synthesised products that were previously not in common use within this community prior to development of the road (food wrappers, bottles and cans et cetera). The physical development planning team is encouraged to pay careful consideration to this point to avoid urban litter (and plastic litter in particular) polluting the lake water environment. It is the view of the EIA team that consideration to move people into urbanised areas should be accompanied by proper urban drainage design to avoid uncontrolled discharge of urban run-off into the lake environment.

17.7.2.2 Lake Shore Dwellings

While this matter is not clearly articulated in the preliminary documentation associated with the Physical Development Plan the ESIA team have been exposed to a number of anecdotal accounts and conversations suggesting that the Government of Uganda is progressing plans to reduce the settlement density on the immediate shoreline of water bodies classified as strategic water resources. This would include Lake Albert which holds this legislated classification. In this regard a) a no settlement zone within 200 m of the shoreline and b) a limited development zone within 400 m of the shoreline with such development being regulated and deviations requiring approval.

In relation to the Buhuka flats we understand that there has been some discussion between government and local communities around the no settlement or restricted settlement zones and the ESIA team is led to believe that meetings have been held on the Buhuka flats with potentially affected communities. This thinking appears to be reflected in the beach development zones and beach buffer zones which reflect in the physical development plan.

The proposed urbanisation of this area reflected in the physical development plan will aggregate people who are currently electing to live apart in distinct groupings. Similarly, the aggregation of people within urban development areas will in effect bring people closer in part, to Kingfisher Development Area industrial infrastructure. Most importantly, possibly changing the semirural nature of the social landscape and certainly reducing the availability of grazing for livestock practices currently taking place on the Buhuka flats. Consequently, this aspect warrants careful consideration, particularly as it relates to driving the aggregation of peoples who are currently choosing to live apart in five separate and distinct villages on a relatively small landmass that is the Buhuka flats.

17.7.2.3 Social fabric and livelihoods

While the short-term drivers for densification and urbanisation of the area are understood, careful consideration will need to be given to the long-term sustainability of this development node, should structured development of the area proceed, to ensure that it is structured in a manner that will allow the area to be self-sustaining beyond the relatively short-term tenure of the oil and gas industry.

Importantly here, in the short term, will be to ensure that there are appropriate livelihoods to sustain the populations currently resident on the Buhuka flats who derive income predominantly from a combination of fishing and extensive agriculture (livestock grazing). In relation to livestock, there is already insufficient grazing land to sustain the current livestock numbers. The proposed physical development plan will result in the aggregation of people, further reduction in the availability of grazing land with a corresponding reduction in the number of livestock that will be able to be sustained in the local area. This will have the unintended consequence of forcing a change in the lifestyle for many of the residents in the local villages which will require careful and structured planning to avoid undue impact on vulnerable communities. Furthermore, the ability of many of the local population who are living a simple near subsistence lifestyle to migrate into a more structured cash-based economy is questionable and specific focus will need to be given to management of the potential negative impact on livelihood that are likely to result. This will be exacerbated by the pressure brought to bear on natural resources, in particular on fish stocks, because the move into a more structured urban economy is also likely to be accompanied by less movement within the transient fishing populations who are well documented to move from location to location along the lakeshore, crossing freely between Uganda and DRC, as fishing catches dwindle geographically in response to a variety of variables but particularly fishing pressure.

The local communities of the Buhuka flats are changing rapidly due to high numbers of people that are moving across the lake, predominantly from the DRC. There are also speculative entrants to the local area from elsewhere in Uganda seeking to establish a foothold in proximity to the growing rural development. As these communities grow their social fabric changes, traditional residence run the risk of being marginalised as their traditional lifestyles (fishing and livestock) commonly do not yield sufficient ready cash to meaningfully participate in a more urbanised society.