ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

2019

Proposed Additional LPG Import Pipeline & Phase 1C Bulk LPG Mound

Location: Plot No. MN/VI/4838 Miritini, Mombasa County

Coordinates:

AGOL LPG Terminal: Latitude: 4° 1'14.94"S Longitude: 39°35'10.77"E

AGOL Jetty: Latitude: 4° 3'30.28"S Longitude: 39°36'2.39"E

PROPONENT:

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Project Proponent: African Gas and Oil Company Limited (AGOL)

Assignment Title: Environmental Impact Assessment Study for the Proposed Construction of Additional LPG Import Pipeline & Phase 1C Bulk LPG Mound at AGOL Terminal on Plot L.R. No. MN/VI/4838 in Miritini, Mombasa County.

Report Submitted by:

Signature:…….Date: ……..

For Gomake Consultancy Company Limited,
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List of Abbreviation

ANSI	-	American National Standards Institute
API	-	American Petroleum Institute
AS	-	Australian Standards
ASME	-	American Society Of Mechanical Engineers
ASTM	-	American Society for Testing and Materials
BLEVE	-	Boiling Liquid Expanding Vapor Explosion
BS	-	British Standard
BSI	-	British Standards Institution
CBD	-	Convention on Biological Diversity
CBO	-	Community Based Organisations
CSR	-	Corporate Social Responsibility
DIV	-	Dutch Intervention Values
EA	-	Environmental Audit
EEMUA	-	Engineering Equipment and Materials Users Association
ESIA	-	Environmental & Social Impact Assessment
EMCA	-	Environmental Management and Coordination Act
EMP	-	Environment Management Plan
EPRA	-	Energy & Petroleum Regulatory Authority
ESIA	-	Environmental and Social Impact Assessment
ESMP	-	Environmental and Social Management Plan
IEC	-	International Electrotechnical Commission
IFC	-	International Finance Corporation
ISA	-	International Society of Automation.
ISO	-	International Organization For Standardization
KAA	-	Kenya Airports Authority
LPG	-	Liquefied Petroleum Gas
MIA	-	Moi International Airport, Mombasa
NEMA	-	National Environment Management Authority
NFPA	-	National Fire Protection Association
NGO	-	Non–Governmental Organization
OP	-	Operational Policy
OSMAG	-	Oil Spill Mutual Aid Group Society
PCM	-	Public Consultation Meeting
PPE	-	Personal Protective Clothing
SE4All	-	Sustainable Energy for All
SGR	-	Standard Gauge Railway
TPH	-	Total Petroleum Hydrocarbon
WB	-	World Bank
URTI	-	Upper Respiratory Tract Infections

Acknowledgement

We extend our special thanks to the management of AGOL for contracting Gomake to prepare this ESIA Study Report for the Proposed Additional LPG Import Pipeline & Phase 1C Bulk LPG Mound, Miritini in Mombasa County.

We further register our gratitude to the Synergetic Energy Partners for their unwavering technical support and guidance towards the preparation of this ESIA Study Report.

We would like to thank also various stakeholders consulted during public stakeholder consultation for their invaluable contribution, support and cooperation. Their input contributed enormously towards successful completion of this Report.

Executive Summary

Introduction

The Proponent, African Gas and Oil Company Limited (AGOL), is a privately owned company that owns, operates and maintains a modern Common-user Bulk LPG Import and Distribution Terminal located in Miritini, Mombasa County.

The Proponent has also constructed a new onshore 20,000MT storage facility in 12 mounded bullets that is capable of offloading an entire ship, therefore eliminating the need for the previously stationed floating storage vessel at the anchorage and thereby reducing the running costs. The project also involved the expansion of the Loading Gantry to 8 Loading Bays for efficient loading of the tankers.

In addition to this, the Proponent seeks to install of an Additional LPG Import Pipeline from the ship offloading jetty and construct an additional 10,000MT mounded storage tanks on Plot **L.R. No. MN/VI/4838** in Miritini, Mombasa County. The augmenting of the on-land storage will ensure product is readily available to customers.

The Proposed Additional LPG Import Pipeline & Phase 1C Bulk LPG Mound is listed in the EMCA Amended Second Schedule under High Risk Projects under Hydrocarbon projects including depots and refinery facilities for hydrocarbons. The proposed project has the potential of causing impacts to the environment. It is against this backdrop that AGOL commissioned Gomake Consultancy Company to carry out an Environmental Impact Assessment (EIA) Study for the project.

Project justification

Universal access to modern energy services by 2030 is one of the three goals of the Sustainable Energy for All (SE4All) initiative launched by the United Nations in 2011. After Kenya joined SE4All in 2012, a stocktaking revealed that Kenyans relied predominantly on traditional sources of cooking energy. About 84 percent of the population cooked with solid fuels (wood, charcoal, or agricultural residue), and 5 percent used kerosene. Cooking with these fuels affects the health of millions of Kenyans while causing environmental and social damage. An estimated 15,000 Kenyans die each year from air pollution, and at least 40 percent of childhood deaths are caused by respiratory illness (According to the 2016 Global Burden of Disease study, the figure was 16,600).

Meanwhile, wood resources are being depleted faster than they can be replenished. (Between 1990 and 2005, Kenya lost 5 percent of its forest cover.) Wood fuel production, household cook stoves, and heating technologies are generally inefficient and wasteful. To deal with the problem, Kenya's government set a long-term goal of having 42 percent of households adopt clean cooking fuels. The goal was embedded in Kenya's Vision 2030 Second Medium-Term Plan (2013–17) in alignment with the SE4All country action agenda. Liquefied petroleum gas (LPG) was to contribute 35 percent, biofuels 5 percent, and electricity 2 percent. A strategy was developed to reduce the cost of LPG and thereby expand its use among lower-income Kenyans.

The proponent's effective project would not only augment their current LPG storage capacity, but also the overall capacity in Kenya by an additional 10,000MT, making it the largest installation in

East and Central Africa. Given the urgent energy requirements of the country, and the growing use of LPG in the market, this would be a nationally important and landmark achievement.

Terms of Reference for ESIA

Terms of Reference for the Study was formulated and submitted to NEMA for approval and is attached in Annex 1. The process involved having discussions with the Proponent on the key issues and collection of primary and secondary data on the same. The primary data was collected using both qualitative and quantitative methods of data collection through field visits/site walks, public and stakeholders consultation. Secondary data was collected through literature review which included the review of policies, Acts and regulations; County Development Plans; project area maps; previous project area reports among others.

This exercise was designed to meet the requirements of EMCA 1999 (Amended 2015) and the IEIA Regulations of 2018. For the most part, the exercise involved studying the proposed design of the Proposed Additional LPG Import Pipeline & Phase 1C Bulk LPG Mound, the operational mechanisms of each component, the input and outputs of the facility and determining the impacts that may manifest during design and construction. In addition, baseline information was obtained through desk studies, physical investigation of the project areas, public and key informant consultations. The study adopted an integrated approach whereby a multi-disciplinary team was engaged in the data collection and analysis.

Generally, the key activities that fed in to the EIA Study entailed, but are not limited to the following:

- A sit visit to collect baseline information of the project area;
- A comparative analysis of the project with existing land uses in the neighbourhood;
- A review of relevant policy and legislation;
- Discussions with the project proponent to obtain information on various project aspects;
- Identification of health and safety concerns that may be occasioned by the project;
- Seeking views and input through discussions and interviews with the public and key informants;
- Assessment of the site to detail the various existing and likely impacts; and
- Proposal of mitigation measures to avert or minimize negative impacts.

Both positive and negative impacts of the proposed project have been identified and appropriate measures to abate any adverse effects that may emanate from the project activities.

Review of the policy, legal and administrative framework

Environmental Management and Coordination Act 1999 Amended 2015 with all its subsidiary legislation and other sectoral laws were reviewed to establish their bearing on the proposed project. Legislation reviewed included:

- The Constitution of Kenya (2010)
- Environmental Management and Coordination Act 1999, Amended 2015
- Environmental (Impact Assessment and Audit) Regulations, 2003 Amended 2019
- Environmental Management and Co-ordination (Water Quality) Regulations 2006
- Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009
- Environmental Management and Co-ordination (Waste Management) Regulations 2006

- Environmental Management and Co-ordination (Fossil Fuel Emission Control) Regulations 2006
- Environmental management and co-ordination (conservation of biological diversity and resources, access to Genetic resources and benefit sharing) Regulations, 2006
- Environmental Management and Coordination (Air Quality) Regulations, 2014
- The Public Health Act (Cap 242)
- Occupational Safety and Health Act (OSHA), 2007
- The Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005
- Water Act 2012
- Water Resource Management Rules 2007
- The Energy Act 2019
- The Energy (Energy Management) Regulations 2012
- Liquefied Petroleum Gas (LPG) Regulations, 2009
- Land Registration Act, 2012 (Act No. 3 of 2012)
- Physical Planning Act Cap 286
- Land Act, 2012 (Act No. 6 of 2012)
- National Construction Authority Act. (Cap.449A)
- National Construction Authority Regulations, 2014The Standards Act, Chapter 496
- The Weights and Measures Act, Chapter 513
- The Traffic Act, Cap 403
- Public Roads and Roads of Access Act Cap. 399
- The KMA Act
- The BMU Regulations, 2007
- Employment Act No 11 of 2007

The assessment also reviewed IFC Performance Standards on Environmental and Social Sustainability that the Proponent will comply with through the life of the proposed project:

- **Performance Standard 1:** Assessment and Management of Environmental and Social Risks and Impacts;
- **Performance Standard 2:** Labour and Working Conditions;
- **Performance Standard 3:** Resource Efficiency and Pollution Prevention;
- **Performance Standard 4:** Community Health, Safety, and Security;
- **Performance Standard 5:** Land Acquisition and Involuntary Resettlement;
- **Performance Standard 6:** Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- **Performance Standard 7:** Indigenous Peoples; and
- **Performance Standard 8:** Cultural Heritage

The proposed project is expected to start immediately this Study report is approved by the relevant authorities including EPRA and County Government of Mombasa.

Project Location

The AGOL LPG Terminal is located in Miritini, a suburb of Mombasa in Kenya, just west of the Moi International Airport. Latitude: 4° 1'14.94"S Longitude: 39°35'10.77"E.

The Jetty is located approximately 2.5 km offshore in the Port Reitz area in the port of Mombasa. Latitude: 4° 3'30.28"S Longitude: 39°36'2.39"E.

Project Objectives

The proposed project aims to increase the supply capacity of LPG to industrial, commercial and residential customers throughout Kenya and East Africa thereby promoting reliance on LPG as opposed to wood fuel and charcoal in order to enhance the biodiversity and environmental conservation. The Proposed Project will also stabilize the current fluctuating LPG prices by securing the supply, reduce the deficit and meet the increasing demand of LPG.

Project Description

Additional LPG import pipeline

The proposed construction of an additional LPG import pipeline will be within the existing layout design infrastructure of the existing pipeline. The new pipeline will provide redundancy for the existing pipeline from the jetty to the new storage facility and will be split into three sections:

- Underwater section from the jetty to shore shelter;
- Underground section from the shore shelter to the booster pump station; and
- Underground and above ground section from the booster pump station to the new storage facility.

Phase 1C mounded storage tanks

This scope of the project will involve the construction of six (6) mounded LPG bullets having a total capacity of 10,000 MT. Mounded LPG Bullets are large, buried, horizontal cylindrical steel bullets with dished ends having a diameter of 8.0 meters and a length of 72 meters.

Potential Impacts of the Project

The proposed project is expected to have minimal impacts on the environment. Evaluation of the potential impacts shows that their significance will range between very low to medium low in the absence of the mitigation measures.

The impacts will reduce further with the implementation of the proposed mitigation measures.

The potential impacts anticipated include:

- **Socio-economic impacts**

The proposed project is expected to create job opportunities for both skilled and unskilled Labor during construction and operation phases. It is anticipated that the proposed project will provide opportunities for local employment and provision of goods and services to construction workers. The proposed project is also expected to contribute in government revenue through payment of taxes.

On the other hand negative impacts may include behavioural change among the construction crew and the residents as they socialize resulting in upsurge in prostitution, family break ups and sexually transmitted diseases including HIV/AIDS. Temporary work may be taken by "outsiders" rather than local residents, creating tensions thereby affecting project implementation.

- **Impacts on air quality**

The proposed project is anticipated to generate negative air quality impacts. Increase in dust generated during construction and exhaust gases from construction vehicles and machines/equipment may be a health hazard and could lead to chest problems, coughs, flu and have serious effects on asthmatic and sinus sufferers. It may also result in increased medical care for the residents.

- **Pollution from waste**

Solid and liquid wastes are going to be generated during construction and operation phases of the facility. During construction the waste that is going to be generated include used oils and other chemicals, left over construction materials, wrapping materials which may include non-biodegradable plastics and broken glass. During construction, the Contractors camp will generate domestic waste foods, plastics, papers, broken glass, grey water from the bathrooms and black water from the toilets. Other wastes are wood and metals from repairs and other commercial activities. During operation used oils and other chemicals will be generated.

The decommissioning activities are likely to generate residue materials at the project site.

- **Impacts on ambient noise quality**

During the construction phase the proposed project will utilize machineries such as hydraulic excavator, mobile service crane, dump trucks and tipper Lorries including drilling and blasting of bedrock when excavating foundations are likely to generate noise. The contractor at site will be expected to provide proper protective equipment and well planned programs for equipment usage.

- **Health and safety impacts**

A number of activities undertaken during development of the proposed project have potential risks to health and safety of the workers. During the construction phase, the potential H&S risks the workers are likely to be exposed to include: Injuries resulting from falling from heights; Injuries resulting from operation of machinery, equipment, tools and construction vehicle, Exposure to diseases, including, typhoid etc. and road accidents.

The potential occupational health and safety impacts during operation phase include injuries to workers from, routine monitoring and maintenance and deaths and injuries from major disasters e.g. explosions and fire outbreaks. During the operation phase, the workers may come in contact with liquid LPG and suffer from severe cold burns whereas during decommissioning, the potential H&S risks include injuries occasioned by dismantling of the facility. The proposed project could be of great public concern especially in the event of a major disaster such as explosions and fire outbreaks. Liquefied Petroleum Gas is a highly flammable product and can be detrimental to the public safety if measures are not put in place.

Analysis of alternatives

During the course of formulating the proposed project, several project alternatives were considered and evaluated to ensure that the best option of project development was adopted. The alternatives considered include: Storage Type alternatives, LPG Storage Technology alternatives, Alternative to Additional Import Pipeline Design, Alternative to the proposed location of the Additional LPG Import Pipeline and the “No Action” Alternative

On the basis of the above considerations, the Consultant concludes that the proposed project satisfies the overall economic, technical, environmental considerations. AGOL's effective project would not only augment their current LPG storage capacity, but also the overall capacity in Kenya by 10,000MT, making it the largest installation in East and Central Africa. Given the urgent energy requirements of the country, and the growing use of LPG in the market, this would be a nationally important and landmark achievement.

Public Consultation

Public stakeholder consultation was undertaken in order to obtain the views and concerns of the stakeholders regarding the proposed project.

The ESIA employed three main methods of consultations to get the data presented in this report. These are:

- Meetings and discussions with Key Stakeholders;
- Questionnaire administration and interviews; and
- Convening of Public Consultation Meetings within the project area.

The EIA team consulted the following key stakeholders or received no objection letters regarding components of the proposed project:

- NEMA Mombasa County;
- Kenya Navy;
- Kenya Ports Authority;
- Kenya Airports Authority (Moi International Airport, Mombasa);
- Oil Spill Mutual Aid Group Society (OSMAG)
- Energy & Petroleum Regulatory Authority (formerly ERC);
- Kenya Forest Service;
- Mombasa County Government;
- Jomvu Sub County Administration.

Generally, the project is accepted by all those who were consulted and those who attended the Public Consultation Meetings since there is potential for job opportunities and the lowering of the price of gas. However, they called upon the proponent to ensure that employment opportunities are given first to youths from the community. They also urged the proponent to involve the community in Corporate Social Responsibilities such as building hospitals/clinics, sponsoring needy bright students from the area etc. Another aspect was to ensure safety measures are top notch and have in place a disaster response plan. The pertinent issues raised by the stakeholders have been addressed in the environmental management plan.

Project Cost Estimate

The proponent has undertaken a preliminary estimate of the total project cost using experienced consultants. The project is estimated to cost the Proponent USD 20,000,000 (US Dollars Twenty Million) to implement.

Conclusion and Recommendations

- **Conclusion**

The project, including the construction and operation of the Proposed Project is anticipated to provide efficient and seamless transfer of LPG from the receiving jetty to the storage terminal in addition to the provision of sufficient stock of LPG to augment AGOL's current LPG storage capacity thereby increasing the supply capacity of LPG to industrial, commercial and residential customers throughout Kenya and East Africa. This will also reduce the deficit and meet the increasing demand of LPG and therefore promote LPG as environment friendly fuel source.

The potential adverse impacts associated with the proposed project are possible to mitigate successfully. The impacts before implementation of mitigation measures are assessed as very low to medium low and the ratings are expected to improve further with the implementation of the proposed mitigation measures. In particular, the LPG facility will be designed, constructed and operated according to the latest industry norms and standards. Programs and plans developed and implemented through the EMP will be monitored and audited to ensure compliance with current regulations and cleaner production practices.

- **Recommendation**

The Consultant recommends that the proposed development should be allowed to proceed taking into account the implementation of the proposed Mitigation Measures and Environment Management Plan (EMP). An environmental audit is recommended upon the completion of construction works to corroborate the implementation of the proposed mitigation measures. Any unforeseen project impacts shall be identified and addressed through annual environmental audits.

1 Project Introduction and Background

1.1 Introduction

The Proponent, African Gas and Oil Company Limited (**AGOL**), is a privately owned company that owns, operates and maintains a modern Common-user Bulk LPG Import and Distribution Terminal located in Miritini, Mombasa County. During the initial phases of the conceptualization of the facility, the firm received support from the Ministry of Energy, Ministry of Finance, Ministry of Transport and the Kenya Ports Authority. This was mainly due to the fact that the AGOL Terminal was designed so as to serve as a link between the importers of bulk LPG and the retailers and end-users of LPG (both domestic and industrial). Ownership documents of the project site is given as Annex 2.

The Proponent has also constructed a new onshore 20,000MT storage facility in 12 mounded bullets that is capable of offloading an entire ship, therefore eliminating the need for the previously stationed floating storage vessel at the anchorage and thereby reducing the running costs. The project also involved the expansion of the Loading Gantry to 8 Loading Bays for efficient loading of the tankers.

In addition to this, the Proponent seeks to install of an Additional LPG Import Pipeline from the ship offloading jetty and construct an additional 10,000MT mounded storage tanks on Plot **L.R. No. MN/VI/4838** in Miritini, Mombasa County. The augmenting of the on-land storage will ensure product is readily available to customers.

Onshore, the new line will be within the existing servitudes of the existing pipeline, while the offshore pipeline will be as distant as possible from the existing line to eliminate any possibilities that could affect the flow of gas from the import facility to the onshore plant. The new LPG Import Pipeline will provide redundancy for the existing pipeline from the jetty to the new storage facility. In a worst-case incident where the existing pipeline has developed a leak and need to be shut down, the new LPG Import Pipeline shall be used as a backup until the existing pipeline is repaired and vice versa.

The additional 10,000MT of bulk storage will involve the construction of an additional six (6) mounded bullet tanks to be used with commercial grade propane and LPG.

The Proposed Additional LPG Import Pipeline & Phase 1C Bulk LPG Mound is listed in the EMCA Amended Second Schedule under High Risk Projects under Hydrocarbon projects including depots and refinery facilities for hydrocarbons. The proposed project has the potential of causing impacts to the environment. It is against this backdrop that AGOL commissioned Gomake Consultancy Company to carry out an Environmental Impact Assessment (EIA) Study for the project.

The Proponent has complied with the above legal requirement including compliance to The IFC Performance standard 1: Assessment and management of environment and social risks and impacts. The Proponent engaged Gomake Consultancy Company Ltd who conducted a process of environmental and social assessment, and has produced a report establishing and maintaining an ESMS appropriate to the Proposed LPG Infrastructure Expansion project which has addressed all grievances raised by

stakeholder during stakeholders consultation process including emergency preparedness and response system that shall be put in place together with the community and neighbouring facilities. The emergency preparedness and response activities will be periodically reviewed and revised, as necessary, to reflect changing conditions.

1.2 Objectives of the Environmental and Social Impact Assessment (ESIA)

The main objective of this ESIA is to ensure that the construction and operation of the proposed project is undertaken in an environmentally friendly manner compatible with economic and operational parameters. The following are the ESIA objectives:

- To fulfil the legal requirements as outlined in Environmental Management and Coordination Act, EMCA 1999 (Amended 2015) and the Integrated Environmental (Impact Assessment and Audit) IEIA/EA Regulations 2018;
- To obtain background biophysical information of the site and legal and regulatory issues associated with the Project;
- To assess and predict the potential environmental and social impacts during site preparation, construction and operational phases of the Project;
- To make suggestions of possible alterations to the proposed design, based on the assessment findings;
- To propose mitigation measures for the potential significant adverse environmental impacts and safety risks;
- Disclosure and initiate public participation;
- To lower project cost in the long term; and
- To prepare an Environmental and Social Management Plan (ESMP).

1.3 Project Justification

In developing nations of Sub-Saharan Africa like Kenya, providing households with modern energy services is a critical step towards development. A large majority of households in the region rely on traditional biomass fuels mostly wood for cooking, which represent a significant proportion of energy used in the domestic setting. The disadvantages of these fuels are many: they are inefficient energy carriers and their heat is difficult to control; they produce dangerous emissions; and their current rate of extraction is not sustainable to the environment. Transition to clean fuels such as liquefied petroleum gas (LPG) would resolve many of these issues as they do not produce dangerous particulate emissions, and are commercially viable, offering a number of socio-economic advantages over traditional options.

Universal access to modern energy services by 2030 is one of the three goals of the Sustainable Energy for All (SE4All) initiative launched by the United Nations in 2011. After Kenya joined SE4All in 2012, a stocktaking revealed that Kenyans relied predominantly on traditional sources of cooking energy. About 84 percent of the population cooked with solid fuels (wood, charcoal, or agricultural residue), and 5 percent used kerosene. Cooking with these fuels affects the health of millions of Kenyans while causing environmental and social damage. An estimated 15,000 Kenyans die each year from air pollution, and at least 40 percent of childhood deaths are caused by respiratory illness (According to the 2016 Global Burden of Disease study, the figure was 16,600).

Meanwhile, wood resources are being depleted faster than they can be replenished. (Between 1990 and 2005, Kenya lost 5 percent of its forest cover.) Wood fuel production, household cook stoves, and heating technologies are generally inefficient and wasteful. To deal with the problem, Kenya's government set a long-term goal of having 42 percent of households adopt clean cooking fuels. The goal was embedded in Kenya's Vision 2030 Second Medium-Term Plan (2013–17) in alignment with the SE4All country action agenda. Liquefied petroleum gas (LPG) was to contribute 35 percent, biofuels 5 percent, and electricity 2 percent. A strategy was developed to reduce the cost of LPG and thereby expand its use among lower-income Kenyans.

In keeping with the Kenya Vision 2030 and the Sustainable Development Goals, the Proponent is committed to ensuring access to affordable, reliable, sustainable, and clean LPG for all by 2030. The proposed project will seek to fulfil the following objectives:

- To achieve faster offloading of gas from the import ships to the storage facility and thus reduce the cost of leasing an offloading ship at the sea thus ensuring that LPG is readily available at more competitive prices;
- To increase the market distribution supply of LPG along with commercial grade propane;
- To promote reliance on LPG as opposed to wood fuel and charcoal and thereby enhance biodiversity and environmental conservation;
- To increase the number of employment opportunities for the community within the area; and
- To increase revenue for AGOL and the Nation through exports and increased sales.

1.3.1 Need for the expansion project

Since inception, the overall project was divided into three (3) main components during implementation. These sections were as follows:

i. Bulk LPG Storage Terminal;
ii. Marine Terminal & Transfer Pipeline; and
iii. Distribution Terminal & Cylinder Filling Plant.

During the preliminary and detailed design stages, the proponent obtained separate statutory approvals and licenses for the three (3) sections meaning that separate EIA licenses were issued for the three proposed sections. The list below indicates the project components and relevant original licence and variation certificate numbers.

a. Bulk LPG Storage Terminal

Proponent: African Gas and Oil Company Limited
Licence No: Application Ref: EIA/455 (EIA Licence No: 0004501)
Project Name: Proposed Development of Common User Facilities for Storage of Liquefied Petroleum Gas (LPG)
Objective: Development of a 28,000MT Bulk Proposed Project Facility to which will provide a large infrastructure for the receipt, storage and distribution of LPG in Kenya.
Variation: (i) Installation of four (4) aboveground LPG Bullets, with a total capacity of 500MT that will be at the distribution terminal for the onshore storage

(ii) Extension of EIA license validity period for an additional twenty-four (24) months
(iii) Reduction in overall storage capacity from 28,000MT to 20,000MT.
(iv) Relocation of the project site to a new location within Plot L.R. No. MN/VI/4838, Miritini area, Mombasa County.

Location: Miritini Division, Mombasa County.
Issue Date: 27th October 2009 (Variation - 11th April 2016)

b. Marine Terminal & Transfer Pipeline

Proponent: African Gas and Oil Company Limited
Licence No: Application Ref: EIA/398 (EIA Licence No: 0003534)
Project Title: Proposed Development of Common User Facilities for Receipt of Liquefied Petroleum Gas (LPG)
Objective: Construction of a Conventional Buoy Mooring (CBM) System, a Subsea LPG Pipeline approximately 4,200m in length and a Common User Manifold.
Variation: (i) Installation of a 14,000MT Vessel to be moored at the Conventional Buoy Mooring (CBM) point as the main storage facility.
(ii) Extension of EIA licence validity period for an additional twenty-four (24) months.
Location: Off-shore and KAA Right-of-Way strip, Mombasa County.
Issue Date: 02nd June 2009 (Variation - 18th July 2012)

c. Distribution Terminal & Cylinder Filling Plant

Proponent: African Gas and Oil Company Limited
Licence No: Application Ref: EIA/608 (Registration No: 0007340)
Project Name: Proposed Development of a Liquefied Petroleum Gas (LPG) Distribution Terminal
Objective: Construction of an LPG Distribution Terminal aimed to increase the LPG Distribution capacity for markets in Kenya, East Africa and the Great Lakes Region.
Location: Plot Nos. MN/1515, MN/V/1798, 1673, 1674, Miritini Division, Mombasa County.
Issue Date: 4th November 2010

Before construction of the existing 20,000MT mounded storage tanks in Phase 1A and 1B facility between 2017 and 2019, the AGOL project was to include the installation of 28,000MT capacity on-land mounded storage tanks. However, the project was phased out due to tight timelines to ensure project delivery and to eliminate the high costs of running the 14,000MT off-shore storage barge.

The Proponent is now ready to complete the construction of additional 10,000MT of mounded bulk storage tanks as part of Phase 1C and incorporate an additional import pipeline to provide redundancy for the existing pipeline from the jetty to the new storage facility.

The Kenyan Government has increased the incentives for LPG use in the region, however, the consumption has generally been low due to multiple factors such as insufficient supply sources, smaller tankers utilised for importation, inadequate storage

facilities in the region, limitation of operation of facilities to daylight hours as well as severe traffic issues experienced at the main import port of Mombasa.

The current location of existing facility as well as the proposed additional infrastructure therefore addressed the above factors as it allows for easy connection to the rest of the country and neighbouring nations due to the ongoing construction of the Dongo-Kundu bypass road as well as the Standard Gauge Railway (SGR). This would allow easy supply for all major market requirements of LPG for power generation, major industries, commercial and residential customers, connected via the existing infrastructure developments.

The proponent's effective project would not only augment their current LPG storage capacity, but also the overall capacity in Kenya by an additional 10,000MT, making it the largest installation in East and Central Africa. Given the urgent energy requirements of the country, and the growing use of LPG in the market, this would be a nationally important and landmark achievement.

Finally, not only will the project yield substantial revenues for AGOL due to its increased capacity allowing higher projected throughputs, but the additional investment shall mean further development in the area allowing additional community employment. The LPG market will also receive a boost and curtail shortages.

1.4 Scope and Terms of Reference for the ESIA

This assessment evaluates the environmental and socio-economic impacts of the following aspects of the Project:

- Site preparation and earthworks;
- Construction;
- Commissioning and operation; and
- Decommissioning

Terms of Reference for the Study was formulated and submitted to NEMA for approval and is attached in Annex 1. The process involved having discussions with the Proponent on the key issues and collection of primary and secondary data on the same. The primary data was collected using both qualitative and quantitative methods of data collection through field visits/site walks, public and stakeholders consultation. Secondary data was collected through literature review which included the review of policies, Acts and regulations; County Development Plans; project area maps; previous project area reports among others.

This exercise was designed to meet the requirements of EMCA 1999 (Amended 2015) and the IEIA Regulations of 2018. For the most part, the exercise involved studying the proposed design of the Proposed Additional LPG Import Pipeline & Phase 1C Bulk LPG Mound, the operational mechanisms of each component, the input and outputs of the facility and determining the impacts that may manifest during design and construction. In addition, baseline information was obtained through desk studies, physical investigation of the project areas, public and key informant consultations. The study adopted an

integrated approach whereby a multi-disciplinary team was engaged in the data collection and analysis.

Generally, the key activities that fed in to the EIA Study entailed, but are not limited to the following:

- A sit visit to collect baseline information of the project area;
- A comparative analysis of the project with existing land uses in the neighbourhood;
- A review of relevant policy and legislation;
- Discussions with the project proponent to obtain information on various project aspects;
- Identification of health and safety concerns that may be occasioned by the project;
- Seeking views and input through discussions and interviews with the public and key informants;
- Assessment of the site to detail the various existing and likely impacts; and
- Proposal of mitigation measures to avert or minimize negative impacts.

Both positive and negative impacts of the proposed project have been identified and appropriate measures to abate any adverse effects that may emanate from the project activities.

1.5 ESIA Activities

1.5.1 Literature Review

Literature review pertaining to the project development and operation activities have been done. This included documentary review on the nature of the proposed activities, project documents, relevant policies and legislative framework as well as the environmental setting and socio-economic data of the area and discussions with the Proponents contact person. This has included the review of the appropriate national legislation and other relevant studies and reports on the construction of Bulk LPG Storage facilities.

1.5.2 Site Visits for Data Collection

Project area site visit and execution of other activities took place between Monday June 24th and Friday July 5th, 2019

Activities during the field trip include the following:

- Project Start up meeting and site reconnaissance survey;
- Project area data collection;
- Interviews with key stakeholders and local community and administration of questionnaires;
- Holding discussions with key stakeholders and administration of key informant interviews;
- Evaluation of the geographical location of the project including the physical area that may be affected by the project's activities and physical limits for the ESIA area;
- Obtain project baseline data covering socio-economic and bio-physical aspects including air, soil and noise; and
- Convening of Public Consultation Meeting (PCM).

1.5.3 ESIA Study report Preparation

A comprehensive ESIA Study report containing the findings has been compiled by the Consultant in accordance with NEMA guidelines for consideration and approval. In preparing the report, the Consultant paid attention to the following issues as specified in the second schedule of the Environmental (Impact Assessment and Audit) Regulations, 2003 Amended 2019:

- Ecological considerations including: Biological diversity, sustainable use, and ecosystem maintenance;
- Social consideration including: Economic impacts, social cohesion or disruption, effect on human health, communication, and effects on culture and objectives of culture value;
- Landscaping including: views opened up or closed, visual impacts (features, removal of vegetation, etc), compatibility with surrounding area, and amenity opened up or closed e.g. recreation possibilities;
- Land use including: effects of proposal on current land uses and land use potentials in the Project area, possibility of multiple use, and effects of the proposal on surrounding land uses and land use potentials; and
- Water including: water sources (quantity and quality) and drainage patterns/drainage systems.

1.6 Field Data Collection Schedule

Baseline data was collected on the proposed project site and the immediate neighbourhood. The data collected was on aspects such as: topography; local flora and fauna; soils and geology; existing and past activities including human settlements; local surface and ground water resources; ambient air quality and noise levels (qualitative); waste management practices; and natural resources and cultural heritage aspects of the project area.

1.7 Impact Assessment Methodology

To identify potential and assess impacts associated with or resulting from Project activities, the ESIA team used professional judgment, fieldwork, and desk-top analysis to identify potential impacts and their interactions. The significance of potential impacts that may result from the proposed Project was determined to assist in preparing recommendations for evaluation of the proposed Project. The methodology that was used to identify and assess potential impacts of the proposed project is described below:

1.7.1 Steps of impact assessment

Impact Assessment took place as follows:

- Characterize the baseline – the existing conditions before the Project is undertaken and any effects are generated;
- Identification of sources of impacts and the impacts themselves that are generated by any aspect of the Project;
- Recommend mitigation and enhancement measures to address the impact; and
- Rate impacts after mitigation to produce a “residual” impact rating.

1.7.2 Rating Impacts

Potential ESIA impacts are rated to:

- Provide a basis for prioritization of impacts to be dealt with;
- Provide a method of assessing the effectiveness of proposed mitigation measures; and
- Provide a scale which shows the level of impact both before and after a proposed mitigation measure has been applied.

1.7.3 Impact rating Criteria

An impact rating is the product of two elements: (1) the severity of the potential impact and (2) the likelihood of the “event” occurring.

1.7.4 Severity Criteria

The severity or enhancement of each impact was rated using the criteria identified in Table 1 and Table 2.

Table 1: Impact Rating Criteria

Severity	Negative Social/Health Impacts					Negative Environmental Impacts
	Duration	Geographic Extent	Ability to Adapt	Socio-cultural effect	Health Effects	
• Low	• Short-term • <1 year • Low frequency	• Individual • household	• Those affected will be able to adapt to the changes with relative ease, and maintain pre-impact livelihoods, culture, quality of life and health.	• Inconvenience but with no consequence on long-term Livelihoods, culture, quality of life, resources, infrastructure and services.	• Event resulting in annoyance, minor injury or illness that does not require hospitalization.	• Affects environmental conditions, species, and habitats over a short period of time, is localized and reversible.
• Moderate	• Medium-term 1-6 years • Medium or intermittent frequency	• Small number of households	• Those affected will be able to adapt to change, with some difficulty, and maintain pre- impact livelihoods, culture, quality of life and health but only with a degree of support	• Primary and secondary impacts on livelihoods, culture, quality of life, resources, infrastructure and services	• Event resulting in moderate injuries or illness, which may require hospitalization	• Affects environmental conditions, species and habitats in the short to medium term. Ecosystems integrity will not be adversely affected in the long term, but the effect is likely to be significant in the short or medium term to some species or receptors. The area/region may be able to recover through natural

Severity	Negative Social/Health Impacts					Negative Environmental Impacts
	Duration	**Geographic Extent**	**Ability to Adapt**	**Socio-cultural effect**	**Health Effects**	
• High	• Long-term/ • Irreversible • > 6 years Constant frequency	• Large part of/ full settlement	• Those affected will not be able to adapt to changes and continue to maintain pre-impact livelihood	• Widespread and diverse • Primary and secondary impacts likely to be impossible to reverse or compensate for.	• Catastrophic event • Resulting in loss of life, severe injuries or chronic illness requiring hospitalization.	• Affects environmental conditions, species and habitats for the long term (i.e., over the life of the Project) may substantially alter the local and regional ecosystem and natural resources, and may affect sustainability. • Regeneration to its former state would not occur without intervention. • Affects environmental conditions or media over the long term, has local and regional affects and/or is

1.8 Likelihood Criteria

Likelihood of the event occurring is comprised of the following categories:

- Low likelihood – Rare (e.g., few or no occurrences in related projects);
- Medium likelihood – Uncommon (e.g., documented occurrences in related projects); and
- High likelihood – Common (e.g., occurs within the LPG projects).

1.8.1 Determining Rating

The overall rating of the impacts will be determined by using the following matrix (Table 2). It should be noted that these matrices act as a guide and there may be situations where their rigid application is inappropriate and where stakeholder perceptions and feedback have a significant role to play. For specific impacts where this is the case, the rating is clearly explained in the evaluation of the impact.

Table 2: Overall rating of Impacts

Severity/Enhancement	Likelihood		
	Low	Medium	High
High level of Enhancement	Moderate	Major	Major
Medium level of Enhancement	Minor	Moderate	Major
Low level of Enhancement	Insignificant	Minor	Moderate
Low severity	Insignificant	Minor	Moderate
Medium severity	Minor	Moderate	Major
High severity	Moderate	Major	Major

Criteria for assessing the significance of impacts stem from the following key elements:

- Status of compliance with relevant Kenyan legislation, policies and plans and any relevant Kenyan or industry policies, standards or guidelines;
- The magnitude (including nature, scale and duration) of the change to the natural or socio-economic environment (e.g. An increase in noise, an increase in employment opportunities), expressed, wherever practicable, in quantitative terms. The magnitude of all impacts is viewed from the perspective of those affected by taking into account the likely perceived importance as understood through stakeholder engagement;
- The nature of the impact receptor (physical, biological, or human). Where the receptor is physical (e.g. the air shed) its quality, sensitivity to change and importance are considered. For a human receptor, the sensitivity of the household, community or wider societal group is considered along with their ability to adapt to and manage the effects of the impact; and
- The likely that the identified impact will occur.

An impact of minor significance (a 'Minor impact') is one where an effect will be experienced, but the impact magnitude is sufficiently small (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.

An impact of moderate significance (a 'Moderate impact') is one within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which

the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that 'Moderate' impacts have to be reduced to 'Minor' impacts, but that moderate impacts are being managed effectively and efficiently.

An impact of major significance (a 'Major impact') is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of ESIA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones such as employment, in coming to a decision on the Project.

1.8.2 Mitigation Measures

In developing mitigation measures, the first focus is on measures that will prevent or minimize impacts through the design and management of the Project rather than on reinstatement and compensation measures. A 'hierarchy' of mitigation measures for planned activities and unplanned events is outlined below:

Avoid at Source; Reduce at Source: avoiding or reducing at source through the design of the Project (e.g. avoiding by sitting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity);

Abate on Site: add something to the design to abate the impact (e.g. pollution control equipment);

Abate at Receptor: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g. traffic measures);

Repair or Remedy: some impacts involve unavoidable damage to a resource (e.g. material storage areas) and these impacts require repair, restoration and reinstatement measures. Compensate in Kind; Compensate Through Other Means where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g. financial compensation for degrading agricultural land and impacting crop yields). It is emphasized that compensation to individuals with residual impacts to livelihood or quality of life will generally be non-financial and will have a focus on restoring livelihoods.

Control: this aims to prevent an incident happening or reduce the risk of it happening to as low as reasonably practicable (ALARP) through reducing the likelihood of the event (e.g. preventative maintenance regimes, traffic calming and speed limits, community road safety awareness training);

Reducing the consequence (e.g. Bunds to contain hazardous substance spills); and a combination of both of these;

Recovery/Remediation: this includes contingency plans and response, e.g. Emergency Response Plans and Procedures.

1.9 Method used for Gathering Opinions on the Proposed Project

Stakeholder consultations were carried out in order to: inform project stakeholders of the proposed project; to explain the likely impacts (positive/negative) of implementing the project; and to obtain views, concerns, comments and suggestions from interested and affected parties regarding the proposed project.

Four categories of stakeholders were identified. These included:

a) **Internal Project Stakeholders:** These were the project 'insiders' who worked closely with the Consultant to ensure successful execution of the ESIA. They provided the Consultant with the project brief, information on the project area and on other stakeholders.

b) **The Local Community:** These were the key stakeholders important in the mapping of impacts and their magnitude/significance. Information from these stakeholders was gathered through questionnaires administered to a sample of the neighboring population and through public barazas held in each of the two villages (Ufuta and KCC) neighbouring the project site on the 24th and 25th June 2019 respectively.

c) **Other Stakeholders:** These are the business community / service providers within the project area. They are likely to be affected by the project both directly or indirectly. They provide services that are consumed by the project area community. They include factories and other manufacturers and shopkeepers. They were consulted through questionnaire administration.

d) **Key Informants:** These were the key stakeholders who the Consultant selected on the basis of their knowledge of the goings-on in project host community, as well as their knowledge of the proposed LPG works. They included both Central Government officials (The Assistant County Commissioner, Jomvu Sub County, Mombasa County Government, KPA, Kenya Forest, NEMA County Director, Chief and community elders).

1.10 Socio-economic Survey

The Consultant undertook socio-economic survey in order to establish the current social and economic status of the project area community. This was to assist the Consultant in identifying how the project is likely to change the socio-economic dynamics of the project area so as to proposed cost effective mitigation measures. The exercise was conducted with the aid of a public stakeholder checklist designed to capture several pertinent issues which included:

- Personal information of the respondents including age and level of education;

- Sources of income;
- Sources of energy for lighting and cooking;
- Quality of housing;
- Issues and concerns related to the project; and
- Suggestions for improving the environmental operations of the proposed Project.

2 Project Description

2.1 Objective of the Project

Government of Kenya has earmarked LPG as the major energy source to be utilized in household both in the urban and rural areas. As such, due to the imminent increase in demand, AGOL has embarked on this capacity expansion project as part of its mandate to meet the minimum market requirements. The objectives therefore shall be as follows:

- To increase the supply capacity of LPG to industrial, commercial and residential customers throughout Kenya and East Africa;
- To promote reliance on LPG as opposed to wood fuel and charcoal and thereby enhance the biodiversity and environmental conservation;
- To stabilize the current fluctuating LPG prices by securing the supply;
- To reduce the deficit and meet the increasing demand of LPG;
- To promote LPG as cheaper option due to economies of scale; and
- To promote LPG as environment friendly fuel source LPG to residential, industrial and commercial customers throughout Kenya.

2.2 Location of the Proposed Project

The AGOL LPG Terminal is located in Miritini, a suburb of Mombasa in Kenya, just west of the Moi International Airport. Latitude: 4° 1'14.94"S Longitude: 39°35'10.77"E.

The Jetty is located approximately 2.5 km offshore in the Port Reitz area in the port of Mombasa. Latitude: 4° 3'30.28"S Longitude: 39°36'2.39"E.

The area is designated as an industrial area. The neighbouring facilities are industries and commercial establishments which include New KCC, Trans Africa Motors, KTDA, Kassam Haulers Awale Transporters, Signon among others.

Copy of certificate of title of the land is appended at the end of this report (Annex 2).

Figure 1 below is a map showing the location of the project site.

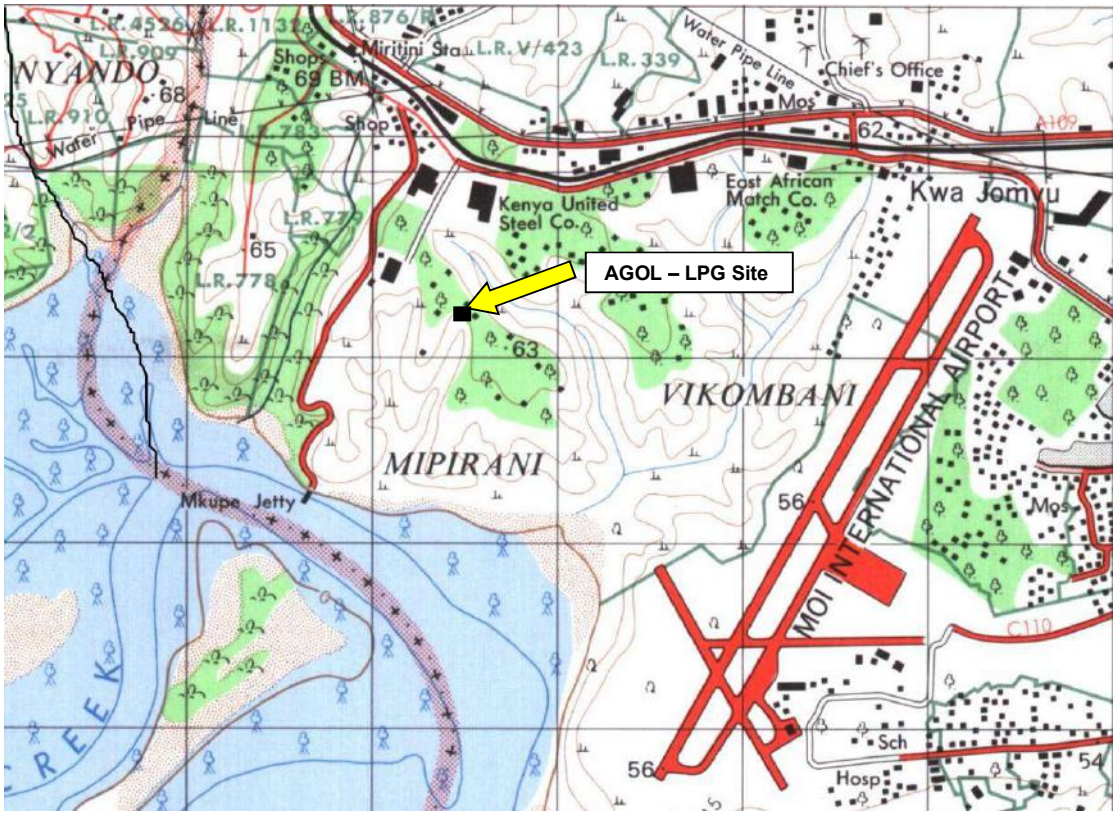


Figure 1: Map showing location of the Site

2.3 Additional Import pipeline

The proposed construction of an additional LPG import pipeline will be within the existing layout design infrastructure of the existing pipeline. The new pipeline will provide redundancy for the existing pipeline from the jetty to the new storage facility and will be split into three sections:

- Underwater section from the jetty to shore shelter;
- Underground section from the shore shelter to the booster pump station; and
- Underground and above ground section from the booster pump station to the new storage facility.

Figure 2: Map showing pipeline route from the jetty to AGOL Terminal

The pipeline shall be designed in accordance with Pipelines shall be designed in accordance with ASME 31.4 for liquid hydrocarbon for the Location Class 4. The pipeline shall withstand all installation, testing and operating condition/ loads. All necessary calculations shall be carried out to verify structural integrity and stability of the pipeline for the combined effect of pressure, temperature, bending (elastic), soil/pipe interaction, external loads and other environmental parameters as applicable during all phases of work from installation to operation. Allowable stress limit shall be as per ASME B 31.4 / ASME B31.3. Such calculations shall include, but not limited to the following:

- Buoyancy control and stability analysis for pipeline section to be installed in areas subjected to subsea portion/flooding /submergence.
- Stress analysis at the crossing of major rivers and highway etc.
- Pipeline expansion and its effect on station piping (above ground/below ground).

It shall also be checked for adequacy against anticipated earthquake loading and any special measures such as an increase in wall thickness/ grade/ select backfill etc. as required to ensure safety and integrity of the pipeline system shall be implemented. Select backfill shall also be provided as applicable for areas prone to seismic activity. Pipeline route shall be examined to establish any drainage requirement in hilly terrain. In case required, the drainage shall be designed to prevent trench flooding during construction and protect.

2.3.1 Pipeline burial

The pipeline shall be buried normally at a depth of a minimum of 1.0 meter below natural ground level except river/ rail/ road/ canal/waterways crossing. Additional soil cover other than specified above shall be provided at locations indicated by statutory/ local authorities or in areas likely to have an increased risk of impact damage or third party interference as per agreements between COMPANY and authorities.

Select back fill shall also be provided as applicable for areas prone to seismic activity. Pipeline route shall be examined to establish any drainage requirement in hilly terrain. In case required, the drainage shall be designed to prevent trench flooding during construction and protect.

2.3.2 Scraper stations

Scraper traps shall be provided at the Dispatch & receipt on piggable lines. The scraper traps shall be capable of handling all type of cleaning/scrapping pigs. The launching and receiving barrels shall be designed in accordance with the requirements of ASME B 31.4, as applicable and its end closure shall be designed and fabricated according to ASME Section VIII, Div.1. Adequate arrangements for launching, retraction, handling and lifting of cleaning and instrumented pigs shall be provided at the scraper stations. Traps shall be accessible by walkway/road for movement of equipment, pigs, etc. These stations shall be provided with an access road from the nearest metalled road.

Corrosion resistant coating shall be provided on the pipeline up to a minimum length of 500 mm after it comes aboveground at terminals and scraper stations. Centreline elevation of scraper trap shall be at a suitable height from grade level. Suitable arrangements shall be provided for handling & lifting of pigs.

2.3.3 Welding

The main pipeline welding shall be carried out in accordance with API 1104, the specification for welding and welding charts. All mainline welds shall be 100 % radiographed.

2.3.4 Insulating joints

Insulating joints shall be provided to electrically isolate the buried pipeline from above ground pipeline. Insulating joints shall be monolithic type and shall allow smooth passage of pigs. They shall be installed in the above-ground portion of the pipeline, immediately after the buried/aboveground transition at the scraper stations.

2.3.5 Crossings

The pipeline at road crossing should comply with the requirement of API RP 1102. Pipeline at Metalled /District Roads, State/National Highways, Railways, Lined Canal shall be provided with Casing pipe. Un-metalled road, Nallah, unlined canal, channels & other water bodies shall be uncased (open-cut) crossings. Size of casing pipe shall be minimum two sizes greater than carrier pipe. The casing pipe shall be installed by trenchless method like ramming/ boring/ jacking/HDD. Before insertion Hydro testing shall be done for carrier pipe for minimum 2 hours prior to joint coating of welded joints.

Casing pipe shall be coated using epoxy, 500 micron thick on the external surface and 200 micron thick on the internal surface of the casing pipe. The carrier pipe shall be electrically insulated from the casing by making use of insulating spacers of the proper size and in sufficient numbers. Spacing between two spacers shall not be more than 1.0 meter. Casing pipe shall be protected by a set of sacrificial anodes.

2.3.6 Hydrostatic testing

After installation, the entire pipeline system shall be hydro tested with inhibited water. The minimum hydrostatic pressure shall be 1.25 times design pressure as per B 31.4 for liquid hydrocarbon pipeline. Mainline valves shall be installed after successful completion of hydro testing. The maximum hydrostatic test pressure at any location of the pipeline shall not exceed the pressure required to produce hoop stress equal to 95% of SMYS of the pipe material based on minimum wall thickness in the test section. The test duration shall be a minimum of 24 hours.

2.3.7 Health, safety, and environment

Contractor shall strictly comply with all the statutory requirements related to Health, Safety & Environment for design and installation of the complete pipeline system.

2.3.8 Material properties

1. Steel properties line pipe

Pipeline steel grade will be ASTM A333 Gr. 6 with wall thickness of sch. 80 (17.48). The considered corrosion allowance is 3mm.

2. Bends, flanges and fittings properties

The radius of bends to be used in jumper fabrication will be 3D. All bends shall be provided with straight tangents on each end. Tangent length shall be 500mm or pipe diameter in length whichever is greater unless otherwise stated.

3. External anti-corrosion coating

External corrosion protection will be achieved using a 3-layer polyethylene (3LPE) coating, which will be used for all pipelines having a coating thickness of 3mm.

4. Concrete weight coating

The pipelines will require weight coating along the shallower sections of the route to satisfy stability and/or impact protection requirements. On-bottom Stability Report shall be referred for final concrete weight coating thicknesses.

5. Cathodic protection onshore design

To protect the onshore pipelines from the landfall point (LFP) to onshore terminal facilities (OT) against corrosion a Cathodic Protection System based on sacrificial Magnesium anodes has been designed. Existing CP system will be used for the proposed pipeline as per the CP adequacy report.

6. Cathodic protection offshore design

For the offshore sections of the pipeline, protection is to be afforded by a sacrificial anode system in accordance with the requirements of DNV-OS-F101 and DNV-RP-F103. Typical anode parameter values are summarized in the table below:

Table 3: Typical anode parameter

Property	Typical Value
Anode Material	Indium-activated Aluminium (Al-Zn-In)
Type	Half Shell Bracelet or Tapered
Density (kg/m3)	2700

Where the pipeline has a weight coat, bracelet anodes shall be designed to fit flush, or slightly recessed, with the outer concrete coat surface. In the event that sections of the pipeline do not have a weight coat, tapered anodes will be specified. Where pipelines are piggy-backed, anodes shall be fitted to the main line. Piggy-back lines shall be Cathodically protected by additional cable tails from the main pipeline.

2.4 Phase 1C mounded storage tanks

This scope of the project will involve the construction of six (6) mounded LPG bullets having a total capacity of 10,000 MT as indicated on the site layouts.

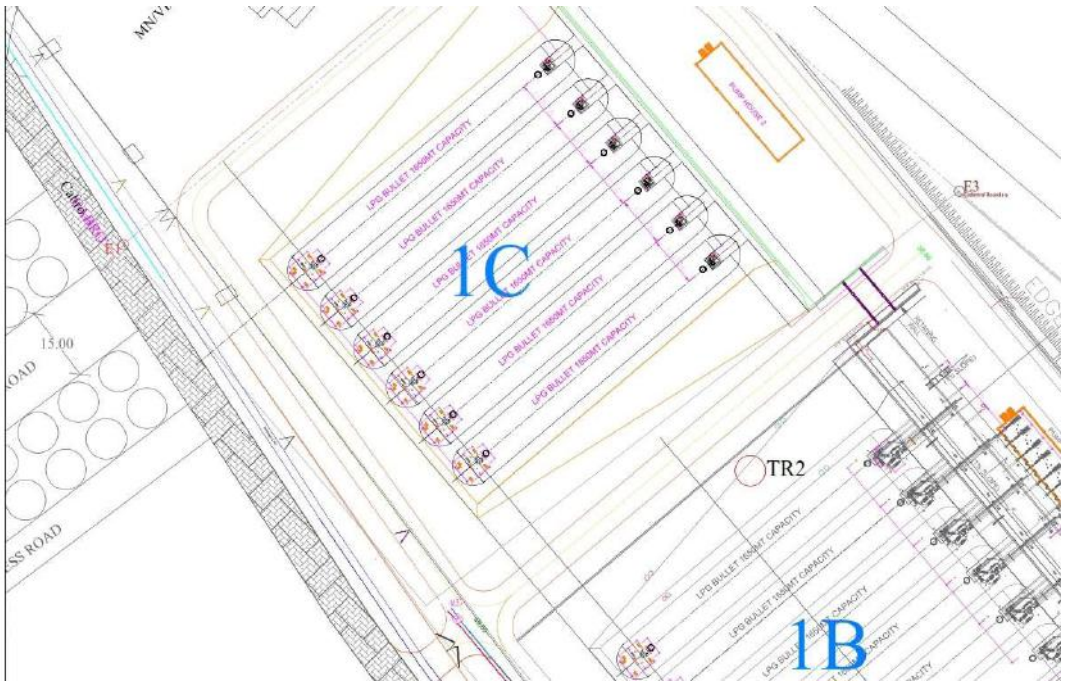


Figure 3: Phase 1C site layout for LPG mounded vessel

Mounded LPG Bullets are large, buried, horizontal cylindrical steel bullets with dished ends having a diameter of 8.0 meters and a length of 72 meters. Proposed Project has an added advantage that the load is distributed over a larger area thus the problem of uneven settlement/collapse is largely reduced as the bullets shall be placed on subgrade

ground and completely covered with sand which will be compacted up to 98%. The Mound will be been designed as per EEMUA 2000 (Publication No.190).

In addition to having the capacity to store LPG, AGOL intends to utilize these same tanks to hold commercial grade propane. The use of commercial grade propane, whose storage temperature of about 5 to 10 degrees Celsius, will require a refrigeration unit to maintain the gas at optimal pressure. Additionally, there will be a blending unit adjacent to the refrigeration unit, whose function is to blend butane and commercial grade propane. Propane received from Jetty is about 12-21°C and the bullets are to be maintained around 5-10°C. Only one bullet is considered under refrigeration at a time. Only one bullet is considered under unloading at a time.

The project will apply civil, structural, mechanical, process, electrical and Instrumentation principles in the design and the construction. The full scope of phase 1C will involve the following;

- Civil works including stabilization, R.C. foundations, R.C retaining wall, Inspection tunnel, and sand compaction.
- Construction of six (6) 1650MT mounded tanks which will involve rolling and welding.
- LPG equipment and piping network complete with compressor units, pumps, blending and refrigeration units, piping, valves, and other mechanical accessories
- Compressed air network and/or hydraulic network.
- Firewater network with pump, piping, valves, and equipment.
- Electrical network complete with L.V. switchboard, MCC, cables, and accessories.

2.4.1 Refrigeration system concept

Propane is to be cooled from a temperature of 21°C to 5°C by means of a refrigeration unit. Propane mass circulation rate of 100 m3/hr around refrigeration unit has been considered. With this circulation rate, about 4 days' time would be required to cool one bullet mass. There are below-mentioned options for providing recirculation pumps.

Option-1:

a) A separate pump set of 100 m3/hr (1W + 1S) which will circulate the bullet mass around the Refrigeration unit.
b) 8 pumps (of 50 m3/hr) will be dedicatedly available for tanker loading purpose.

Option-2:

a) 3 pumps (out of 8 pumps) shall be dedicatedly used for Refrigeration purpose (2W + 1S).
b) Remaining 5 pumps to be used for tanker loading purpose.

It shall be noted that both the options would require a provision of an independent suction header for refrigeration unit and tanker unloading. The separate suction header which will assist in providing ease of operation.

Based on the requirement, a Refrigeration unit has been considered which will have below mentioned details:

- Only one bullet refrigeration at a time.
- Recirculation flow rate of 100m^3/hr will circulate the bullet content around the Refrigeration unit.
- About 4 days' time will be required to cool a bullet from 21°C to 5°C with the considered pump around flow rate of 100 m^3/hr.
- Refrigerant temperature of -10°C is required considering the minimum process out temperature as 0°C (to achieve the resultant Bullet temperature of 5°C).
- In the refrigeration system; Air Cooled Condenser has been considered. Accordingly, considering maximum ambient Air temperature of 38°C, the process side Air Cooled Condenser outlet temperature of 53°C is required.
- Propane is considered as the Refrigerant as it is suitable for the above requirement.

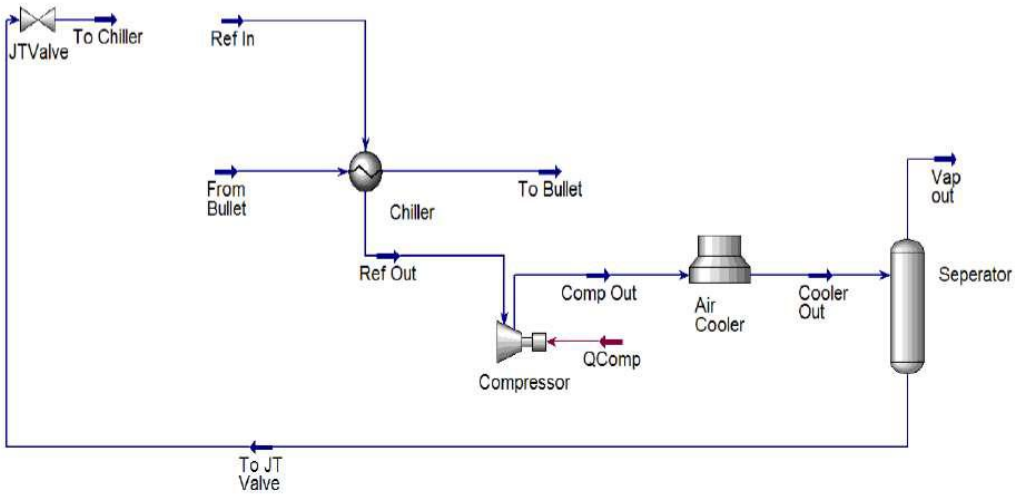


Figure 4: Refrigeration scheme

The mentioned refrigeration scheme is preliminary. The flowrates may get revised based on refrigeration package vendor inputs in further stage of engineering. Also, requirement of economizer may be considered based on refrigeration package vendor input to reduce the vapor fraction of refrigerant entering into the Chiller (Vaporizer).

2.4.2 Blending of propane and LPG

The commercial grade propane is cooled to 5°C by refrigeration unit and stored in the mounded propane bullets in phase 1C. The stored refrigerated propane and LPG from Phase 1A/1B bullets will be pumped by using the transfer pumps to the blending unit. The ratio of propane and LPG will be set by the operator using a ratio controller as per the final product specifications. The mixed stream will be then sent to loading gantry for further distribution. The mixed product can be sent to jetty via export pumps if required.

2.5 Design Standards and Philosophies

2.5.1 Additional import pipeline

1. Design Life and Operating Days per Annum

The design life for the plant is 20 years and only applies to new mechanical equipment, piping and piping components for the plant. The LPG import transfer line is used to transfer LPG from a vessel to the onshore storage facility. The duration for a transfer depends on the amount of LPG transferred and the transfer rate. It will take approximately 84 hours (3 – 4 days) to fill up one phase of the new facility i.e. 10,000MT (21,000 m^3), at a transfer rate of 250 m^3/hr. The intervals vessels can be brought in depending on the amount of LPG distributed.

Currently between 1,000m^3 and 2,000 m^3 of LPG is distributed per day, which means that after phase 1A of the new storage facility upgrade, a vessel will be required every 10 to 20 days (2 – 4 weeks). This will quickly increase as LPG distribution increases.

2. Operating and Safeguarding Philosophies

The new piping and equipment will be designed for the maximum process conditions achievable during normal operation. Pressure safety valves will, however, be required on pressure vessels as per South African PER (R8). Thermal Safety Valves (TSV's) will be installed where pipe sections can be blocked in during normal operation. Operating personnel are required to inspect the LPG transfer line daily. The Additional LPG Import Pipeline shall be leak tested and all valves cycled in preparation for a vessel.

3. Fire and Explosion Protection Philosophies

Additional remotely activated emergency isolation valves will be installed to reduce the potential leak volume and thereby reduce the amount of LPG that can be released during such a scenario. Gas monitors should be used to determine any gas leaks along the Additional LPG Import Pipeline and must be used whenever a confined space is entered.

4. Isolation and Maintenance Philosophies

A double isolation philosophy will be used on all equipment that may require periodic maintenance so that it will not be necessary to empty a long section of transfer line to perform maintenance. Pipeline isolation valves may be credited when the section of pipe that needs to be emptied is relatively short. Excess flow valves will be installed wherever a single failure of a relatively weak point on the pressure boundary can lead to a large gas release e.g. at pressure instruments. Proper inspection, testing and maintenance procedures will be developed to ensure adequate availability of the import transfer line.

5. Emergency Isolation

The following emergency situations shall be considered for the Additional LPG Import Pipeline facility:

Table 4: Emergency Response Plan

No.	Emergency situation	Potential Response
1.	Fire	1) Inform Carrier to Stop LPG Transfer 2) Initiate Emergency Isolation 3) Close close-by manual isolation valves, if possible

		4) Protect nearby equipment 5) Remove liquid product, if possible
2.	Leakage from hoses or loading arm	1) Inform Carrier to Stop LPG Transfer 2) Initiate Emergency Isolation 3) Close close-by manual isolation valves, if possible 4) Monitor gas cloud and explosive limits 5) Remove liquid product, if possible
3.	Emergency on the jetty	
4.	Leakage from pipe flanged connections	
5.	Onshore tank overfilling	1) Initiate Emergency Isolation 2) Inform Carrier to Stop LPG Transfer 3) Manage the environment around the spill 4) Perform clean-up
6.	Rough seas, wind speed above 15m/s	1) Inform Carrier to Stop LPG Transfer 2) Initiate Emergency Isolation 3) Disconnect Marine Loading Arm

6. Pigging

The pigging facility shall be required on the transfer line in order to perform routine maintenance on the line. The existing pig launcher on the jetty will be interchangeable in the future between the existing pipeline and the new LPG Import Pipeline since pigging is not a regular requirement. A pig receiver will be installed at the pump station to receive the pig from the jetty. A pig launcher will also be installed at the pump station to facilitate pigging of the line from the pump station to the new storage facility. A pig receiver will be installed as close as possible to the new storage facility to receive the pig from the pump station.

7. Leak Detection

Leak detection will be performed on the transfer pipeline in order to have confidence in the integrity of the Additional LPG Import Pipeline and to have early detection of possible leaks in order to minimize any resulting spills and consequential environmental pollution. Leak detection will be performed by increasing the pressure (pumping up) of the entire transfer line to a pressure higher than the vapor pressure, isolating the line in sections and monitoring the pressures and temperatures of each of the sections to determine if the line is leaking.

8. Codes and standards

The principal design codes are listed below:

Table 5: Principal design codes

Design Area	Code	Title
Onshore Pipeline Design	ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and other Liquids

Piping Systems	ASME B31.3	Process Piping
Offshore Pipeline Design	DNV OS-F101	Submarine Pipeline Systems
Offshore Cathodic Protection	DNV RP-B401	Cathodic Protection Design
Pipeline Stability	DNV RP E305	On Bottom Stability Design of Submarine Pipelines
Pipeline Spanning	DNV RP-F105	Free Spanning Pipelines
Conformity Assessment	SANS 347 – 2012	Categorization and Conformity Assessment Criteria for all Pressure Equipment

9. International codes and standards

The principal design codes are listed below:

- **American Petroleum Institute**

  - ✓ API Spec 6D - Specification for Pipeline Valves, End Closures Connectors and Swivels.
  - ✓ API STD 1104 - Standard for Welding Pipelines and Related Facilities.
  - ✓ API RP 1102 - Steel Pipeline Crossing Railroads and Highways.
  - ✓ API RP 1110 - Pressure Testing of Liquid Petroleum Pipelines.
  - ✓ API RP 1111 - Recommended Practice for Design, Construction, Operation and Maintenance of Offshore Hydrocarbon Pipelines.

- **American Welding Society**

  - ✓ AWS D1.1 - Structural Welding Code Steel

- **American National Standards Institute**

  - ✓ ANSI B16.5 - Pipe Flanges and Flanged Fittings
  - ✓ ANSI B16.9 - Factory Made Wrought Steel Butt Welded Fittings

- **American Society of Mechanical Engineers**

  - ✓ AMSE B31.3 - Chemical Plant and Petroleum Refinery Piping
  - ✓ ASME B31.4 - Pipeline Transportation System for Liquid Hydrocarbons and other Liquids
  - ✓ ASME VIII - Rules for Construction of Pressure Vessels

- **National Association of Corrosion Engineers**

  - ✓ NACE RP-0169 - Control of External Corrosion on Underground or Submerged metallic Piping Systems
  - ✓ NACE RP-0175 - Control of internal Corrosion in Steel Pipeline and Piping Systems
  - ✓ NACE RP-0286 - Electrical Isolation of Cathodically Protected Pipelines
  - ✓ NACE RP-0675 - Control of Corrosion in Offshore Steel Pipelines

- **DNV Codes**

  - ✓ DNV CN 30.4 - Foundations
  - ✓ DNV CN 30.5 - Environmental Conditions and Environmental Loads
  - ✓ DNV RP F107 - Risk Assessment of Pipeline Protection

2.5.2 Phase 1C mounded storage tanks

The following Kenyan Standards and International Standards for the LPG Industry would be fully implemented in the proposed 10,000MT storage facility project. Again, it should be noted that the Kenyan standards will take preference should there be conflicting issues within the various standards.

- API Std 520 – Sizing, Selection and Installation of Pressure-relieving Devices in Refineries – Part 1, Sizing and Selection
- API Std 520 – Sizing, Selection and Installation of Pressure-relieving Devices in Refineries – Part 2, Installation
- API Std 521 – Guide for Pressure-relieving and Depressurizing Systems
- API Std 610 – Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industry
- API Std 661 - Petroleum, Petrochemical, and Natural Gas Industries Air-Cooled Heat Exchangers
- ASME B16.5 - 2013 - Pipe Flanges and Flanged Fittings

1. Mechanical & process Works:

- API Std 520 – Sizing, Selection and Installation of Pressure-relieving Devices in Refineries – Part 1, Sizing and Selection
- API Std 520 – Sizing, Selection and Installation of Pressure-relieving Devices in Refineries – Part 2, Installation
- API Std 521 – Guide for Pressure-relieving and Depressurizing Systems
- API Std 610 – Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industry
- API Std 661 - Petroleum, Petrochemical, and Natural Gas Industries Air-Cooled Heat Exchangers
- ASME B16.5 - 2013 - Pipe Flanges and Flanged Fittings
- KS 1938 Part 3: Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 9000L.
- EEMUA 2000: Guide for the design, construction and use of mounded horizontal cylindrical vessels for pressurized storage of LPG at ambient temperature.

- API 2510: Design and Construction of LPG Installations
- API 2510A: Fire Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities.
- NFPA 58: Liquefied Petroleum Gas (LPG) Code.
- ASME B 16.9: Factory made wrought steel butt welding fittings.

2. Electrical & Instrumentation Works:

- BS 5467 Specification for XLPE Insulated Cables
- BS 5486 Low Voltage Switchgear and Control Gear Assemblies
- BS 5501 Electrical Apparatus for Potentially Explosive Atmospheres
- IP Part 1 Electrical Safety Code
- BS 5308 Instrument Cables
- BS 6739 Code of Practice for Instrumentation in process Control Code of Practice for Earthing

3. Civil & Structural Works:

- BS 8110 Structural use of concrete
- BS 8004 Code of practice for foundations
- BS 5328 Specification for concrete
- BS 6032 Code of practice for earthworks

2.5.3 Ground Improvement & Sand Bed

Murram / sand shall be used for the ground improvement work as follows:

i. Murram shall be laid in layers, each layer in loose state shall not be more than 200mm in thickness. Water as per OMC requirement shall be sprinkled on the layer and after allowing for soaking, compaction shall be done using a vibratory roller (10 MT static weight) of 20 MT – 30 MT weight in dynamic state. The layer shall be compacted to obtain a degree of minimum 95% with respect of the max. dry density. Each layer shall be tested for compaction at rate of 1 test per every 500 sq.m area. Each test shall consist of 6 samples.

ii. The bullet bed material shall be sand laid in layers, each layer in loose state shall not be more than 300 mm in thickness so as to give compacted thickness of 200-150 mm. Water to the tune of 3 to 5 lit/ sq.m shall be sprinkled on the sand layer and after allowing for soaking. Compaction shall be done using a vibratory roller (10 MT static weight) of 20 MT – 30 MT weight in dynamic state. The required sand filling shall be completed in layers as above to reach the desired level up to the bottom of the bullets.

iii. The sand bed shall be laid to the falls & to the levels and full depth as shown on the drawings and the bed for the bullets shall be excavated out of the fully compacted bed using a template formed to the exact shape and size of the bullets.

iv. If welding trenches are to be used they shall be backfilled with sand compacted in accordance with the above clauses. The trenches shall be adequately propped and braced to ensure that there is no loss of compaction of the adjacent sand bed.

2.5.4 Sand Surround/ Filling between Bullets

i. The sand surround to each bullet shall be material in compliance with the sand specification and laid around the bullet during the mounded filling operation to a 300 minimum thickness and shall be compacted to a 90% maximum dry density.
ii. The filling material between the bullet surround shall be sand in compliance with the sand specification laid in maximum 200 mm layers.
iii. Compaction shall be sufficient to avoid significant settlement of the sand filling/mound surface but shall be such as not to impose undue stresses on the bullets.
iv. The sand filling shall be placed equally, in maximum 300 mm layers (uncompacted depth), on each side of the bullets so as to avoid any lateral displacement/rotation of the bullets during compaction.
v. Sand filling shall be brought up to the levels and slopes as shown in the drawings to below the drainage layer.

2.5.5 Material Specification

i. The sand for the bullet bed, bullet surround and filling between bullets shall consist of material complying with the following specification:-
   a) Good quality clean, non-aggressive sand with a maximum organic material content of 3% by weight.
   b) A max. silt content of 10% by weight (particles smaller than 0.063mm)
   c) A maximum particle size of 5 mm.
   d) A grain size distribution uniformity coefficient (D60/D10) of between 2 & 8.

ii. The Tile / paver to the top of the mound shall consist of clean, well grated stone free from all organic material, sulphates, or any other detritus material, and with a particle size of 5mm to 50 mm. Depth varies from 80mm minimum to 100mm maximum.
iii. The side slopes to the mound shall be protected by good quality stone pitching constructed out of stones of size 225 average and grouted together to form an impermeable finish, all as denoted on the drawings with 1:4 cement mortar for joints. Raised pointing is to be carried out with 1:2 cement mortar.

2.6 Fire Fighting System

2.6.1 Fire Fighting System Requirements

Storage facilities for LPG shall be provided with a fire water system.

2.6.2 System Design

- A looped Fire water system shall be provided around the storage and handling portions of an LPG facility;
- Sufficient isolation valves shall be provided in the Fire water grid to prevent loss of the grid due to a single break in the water main. Block valves shall be arranged so that all parts of the plant can be protected by a portion of the Fire water main system when an impaired section is isolated for repair;
- Pipe used for Fire water mains and branch lines to hydrants shall be at least 6 NPS in size. Branch lines to deluge, monitor, or spray systems are permitted to be smaller,

provided hydraulic calculations show that the size selected will supply the design demand at the required pressure;

- The Fire water system shall be functional in all seasons and shall be capable of delivering 100% of the design rate for at least 2 hours;
- The Fire water system shall be designed to provide water for cooling to the protected equipment within 60 seconds of activation to achieve design water delivery rates within 10 minutes of system activation;
- The Fire water system shall be designed to facilitate testing to assure reliability, adequate flow rate, and adequate coverage of the protected equipment; and
- The Fire water systems shall be tested to verify that their performance is as designed. Since the capacity of the water grid can deteriorate gradually as a result of scale build up in the water mains, a Hazen-Williams coefficient no greater than 100 shall be used for unlined steel pipe.

2.6.3 Fire Water Application Methods

LPG mounded vessels shall be protected by water fixed monitor, water spray systems, at loading gantry.

a) Fixed monitors

Fire water monitors permanently connected to the fire water grid can be used to apply cooling water to the mounded vessel / LPG bowser. Where protection by means of monitors is selected, the system shall include the design features as described below:

- The entire surface of each vessel shall be reached with streams from the monitors;
- Each monitor shall be accessible during a fire or shall be remotely activated and controlled; and
- Monitor nozzles shall be adjustable for fog or straight stream, as required, to provide the most effective coverage of the protected vessel.

b) Water spray system at loading area

A water spray system uses many spray nozzles arranged in a grid pattern to distribute the water evenly over the LPG bowser. When a water spray system is selected for the protection of cooling purpose, it shall include the design features as described below:

- The system shall be designed so that the water is applied evenly over the entire surface of the vessel that may be exposed to fire. Allowance for rundown is permitted. The adequacy of the water coverage shall be determined by performance tests;
- The spray system shall be an open-head system, with all nozzles supplied from the top of the supply branch line and each branch line shall be from the top of the water distribution main line. Spray orifice size shall be at least 0.25 in. Larger orifice sizes will reduce the tendency of the nozzles to become clogged;
- The system shall be manually operated from a safe location that is outside the spill containment area and that is at least 50 ft from the vessel being protected. The location of the actuating valve shall be clearly and prominently marked.
- Flush-out connections shall be installed in the system to permit flushing at periodic intervals. Accessible low-point drain connections shall also be provided.

- The sizing of all piping shall be based on hydraulic calculations. Pipe used for main water distribution lines shall have a diameter of at least 3 in. Pipe used for branch lines to spray heads is permitted to not be less than NPS 3/4 in size;
- A full-flow strainer with a valved blow-off connection shall be installed in the main feeder line to the spray system. The maximum size of the opening in the strainer shall be 0.25 in. A full-size valved bypass shall be provided. Galvanized piping shall be considered downstream of the strainers to reduce the potential for rust scale plugging spray nozzles.

2.6.4 Fire Water Application Rates

The minimum required fire water application rate depends on the method of application. In determining fire water application rates, the surface area of the vessel that could be exposed to fire shall be the surface area of the vessel above the level of the liquid contents at the vessels lowest operating level.

Fixed deluge or water spray systems shall be designed to protect against pool fire exposure to the vessel with a minimum fire water application rate of 0.10 gallon per minute per square foot of exposed vessel surface. If there is concern or risk of a vessel being engulfed by flame or subject to substantial flame contact, supplemental cooling streams should be provided or the application rate should be increased to 0.25 gpm/ft^2.

To compensate for losses due to wind and vaporization that occur before the stream reaches the vessel wall, fire water monitor systems shall be designed to protect against pool fire exposure to the vessel with a minimum water application rate of 0.20 gallon per minute per square foot of exposed vessel surface.

2.6.5 Fire Extinguishers

Portable fire extinguishers shall be used to extinguish an LPG fire only after the source of LPG has been shut off, to prevent the formation of a hazardous vapour cloud. Dry chemical fire extinguishers shall be provided at strategic locations such as those near pumps and loading racks so that they are readily available for operator use.

2.6.6 Fire-Fighting Foam

Fire-fighting foam shall not be used to extinguish LPG fires.

2.7 Construction Phase

2.7.1 Soil Excavation Activities

Soil excavation will take place to facilitate the construction of various components of the proposed Project and other components. A significant amount of soil will be excavated to provide a secure base for placing the 6 LPG Bullets which are 72m long and 8m in diameter. The contractor is going to carry out the soil excavation process with utmost care to ensure that the excavated soil is not improperly heaped or carried away by any surface flows to any nearby surface water courses like the streams on the eastern side causing siltation.

Environmental protection during the construction phase will address management of hazardous materials, dust, erosion and sedimentation control. The site will be maintained in accordance with relevant erosion and sedimentation control standards for construction sites.

2.7.2 Construction Materials

The exact quantities of materials required for the construction of the proposed project as enumerated in other sections of this chapter are not known at this stage of the project As much as possible, the proponent intends to use locally available materials for the construction of the various structures and equipment. Only where such materials shall not be available locally will they be brought in from outside the project area. The Contractor will be in charge for the transport of raw materials to site during construction process.

2.7.3 Commissioning

After the full construction of the additional storage facility, all commissioning procedures shall be followed upon which the facility shall be rendered operational. Commissioning work will include purging air from tank and pipelines with an aim of ensuring that the Facility has been constructed in accordance with the design and that it is ready for operation.

2.8 Operation Phase

The facility shall be receiving LPG via marine. The gas shall then be pumped offshore to the constructed and existing mounded storage tanks using an already existing pipeline and the additional import pipeline. Once in the facility the gas shall be added an odourant to enable it be detected in case of leakage as LPG is odourless. This shall be done using an odourant system existing in the facility.
At the facility the operations shall include loading LPG to the trucks and Rail wagons. The gas shall be loaded to the trucks and wagons by use of pumps of appropriate capacity and LPG vapour shall be handled by use of compressors. In case of any eventuality and a truck or a wagon need to be offloaded of the product, the compressor shall offload the gas back to the storage tanks.

2.9 Project Decommissioning Phase

The proponent owns the land where the Mounded LPG Vessels will be installed. However should the lease lapse, the proponent shall be expected to decommission & demolish the facility and restore the host environment close to its original state prior to use of the site as a Fuel Storage and Distribution Terminal.

The decommissioning exercise shall involve the following:

- The Mounded LPG Bullets and other LPG holding facilities must be degassed before decommissioning and removal;
  - ✓ First, any remaining Liquid LPG must be removed from the system and storage tanks
  - ✓ After removal, any remaining LPG that cannot be removed must be flared.
  - ✓ Once the flare will no longer burn, the system must be purged of residual vapours.

- ✓ Purging is typically done using Nitrogen or Air.
- ✓ Once the tanks have been completely purged, the tanks are excavated (since they will be mounded.
- ✓ The contractor should verify that all data plates are legible & intact, otherwise the tanks may have to be re-certified, before being resold or reused for pressurized service.

- After excavation, tanks, vaporizers, compressors and other equipment will be dismantled and prepared for transport;
- All piping will be cut and capped;
- Hazardous material like ethylene-glycol and mercury switches, if any, will be collected for appropriate disposal;
- Proper cranes will be used to lift the bullets from their piers onto trucks for transport;
- All concrete works will be demolished;
- Other structures within the plant will also be demolished;
- Careful removal of all the electrical fittings and associated cables will be done; and
- There will be proper handling of the demolished materials and have an authorized and guided transportation and disposal away from human settlement and water bodies in accordance with the County government and NEMA Regulations and guidelines.

The host environment shall thereafter be rehabilitated and restored to its former state through:

- Approved and appropriate landscaping methodology;
- Removal of any soils that may have been impacted by oils for offsite (away from the project area) remediation;
- Bringing in of clean soil to replace impacted soil that has been excavated and removed; and
- Planting of indigenous vegetation and nurturing them to ensure they grow to the status where they can grow to maturity unattended.

2.10 Cost of Proposed Project

The project is estimated to cost the proponent USD 20,000,000 (US Dollars Twenty Million) to implement.

3 Environmental and Baseline Setting

The baseline environmental condition of the proposed project is described in terms of the existing physical, biological, and social environment.

3.1 Physical Environment

3.1.1 Topography

Mombasa County is located on coastal lowland with extensive low-lying areas rising from an altitude of 8 m in the east to about 100 m in the west. The Island and Kisauni area are basically flat alluvial plains while the Changamwe region consists of Jurassic plains. Near the sea, the land is composed of Pleistocene coral reef which is commercially exploited as a source of limestone for the cement industry, and also as a source of building stone. The town of Mombasa is centered on Mombasa Island, but extends to the mainland. The island is separated from the mainland by two creeks, Port Reitz in the south and Tudor Creek in the north.

Figure 5: Topography of the Project Location

The site area topography is generally uneven with hills and valleys. The land area where AGOL facility is located lies on a ridge that runs south east from the Magongo Road with relatively steep slopes on the eastern and western side. On the eastern side, the slope changes gradient from 60m to 40m over a distance of approx. 70m. On the southern side of the site area, the slope gradient changes from 60m to 0m over a distance of 700m.

3.1.2 Soil and Geology

The seashore has extensive sandy beaches which make the town an attractive tourist destination. The soil types are broadly associated with the geological formations along the physiographic zones in the district. Along the coastal lowlands four soil types predominate.

1. On the raised reefs along the shore well-drained, shallow (< 10 cm) to moderately deep, loamy to sandy soils predominate.
2. On unconsolidated deposits in the quaternary sands zone (Kilindini sands) are well drained moderately deep to deep, sandy clay loam to sandy clay, underlying 20 to 40 cm loamy medium sand.
3. On the Kilindini sands are also found areas with very deep soils of varying drainage conditions and colour, variable consistency, texture and salinity.
4. Also found on the Kilindini sands are well-drained very deep, dark red to strong brown, firm, sandy clay loam to sandy clay, underlying 30 to 60 cm medium sand to loamy sand soils.

On the coastal uplands, composed of the raised areas in Changamwe and western parts of Kisauni, 2 soil types are dominant;

1. Soils developed on unconsolidated sandy deposits in the Magarini formation, composed of sandy to loamy soils. These are well drained, very deep, sandy clay loam to sandy clay, with a topsoil of fine sand to sandy loam.
2. Soils developed on shales composed of heavy textured soils constitute the relatively high agricultural potential area in the district. The soils are dominated by well drained to imperfectly drained, shallow to moderately deep, firm to very firm clay, and imperfectly drained deep, very firm clay, with a humic topsoil and a sodic deeper subsoil.

The area is underlain by Shales of Jurassic age. The Shales are covered by unconsolidated sediments of Pleitocene age, the Magarini Formation. This superficial cover of Magarini Sediments includes alternating layers of silty sand, clayey silt and silty clay that that together vary in thickness from a few metres to up to a maximum of 15m.

The site area is composed of Arenosols which are excessively drained to well drained, very deep, reddish yellow to white, loose sand to loamy sand. These soils develop gullies quickly. The relatively steep slopes at the site area can accelerate development of gullies when there is surface runoff on bare soil.

The area is underlain by Shales of Jurassic age. The Shales are covered by unconsolidated sediments of Pleitocene age, the Magarini Formation. This superficial cover of Magarini Sediments includes alternating layers of silty sand, clayey silt and silty clay that that together vary in thickness from a few metres to up to a maximum of 15m.

3.1.3 Hydrology

Mombasa town, like many other towns in Kenya receives its water supply from distant areas. Its main source of water supply is the Mzima springs some 300 km away in the Chyulu hills (Taita Taveta District). These springs are believed to be part of the

Kilimanjaro Mountain system but generally this falls under the Athi River drainage basin, generally referred to as Sabaki in the coastal zone.

Apart from the Mzima springs, Mombasa town and the coastal region in general receives surface water supplies from Baricho, Marere and from the Tiwi boreholes in the south coast area.There is a small stream running starting approximately 400m to the north of the site and passes about 150m east of the site. It drains south-east wards and joins another stream and changing flow direction southwards into Port Reitz Creek. The stream runs for about 1.8km before joining the sea. Surface runoff from the site is likely to flow eastwards to join this stream and eventually end up in the sea.

Water will be needed for construction, for drinking and hygiene purposes. The sources of the water will be from the existing bore hole located in the same area.

3.2 Biological Environment

3.2.1 Flora & Fauna

The marine and coastal zone is rich in biodiversity which is the mainstay of the fishing and tourism industry. Mangroves are found along the shores of Makupa, Tudor and Mtwapa Creeks in the County. Further inland, the vegetation cover is mainly shrubs and grass. Most common tree species include *Azandirachta indica*, *Leucena lucocephala*, Daum palms and *Adansonia digitata*. The main grass species include *Cenchrus ciliaris*, *Blephasis stuhlmanii* and *Lactuca captensis*.

Coastal birds concentrate usually on inter-tidal areas especially mud flats, estuaries, reef flats and beaches.

Over 80% of the project site is dominated by agricultural land. However, a remnant bushland/thicket of indigenous vegetation exists to the east of the new project site. This is dominated by shrubs of less than 6 metres such as *Ziziphus mauritiana*, *Senna singueana*, *Lantana camara*, *Flueggea virosa*, *Thespesia danis*, *Dalbergia vaccinifolia*, *Dichrostachys cinerea*, among others. Common herbs include *Commelina* spp., *Clitoria ternatea*, *Sida* spp. and grasses such as *Panicum maximum, Chloris roxburghiana*, *Brachiaria deflexa*, *Digitaria* spp. and *Eleusine indica*.

Figure 6: View of the vegetation along the pipeline ROW

3.2.2 Marine resources and protected areas

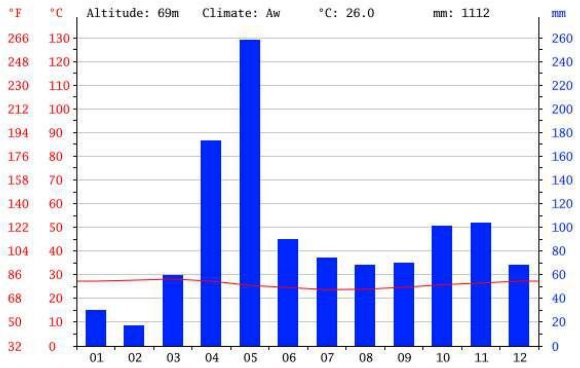
There are strands of mangrove forest and some coral reefs that fringe the seashore near the additional pipeline project site that support the artisanal fishery. The mangroves are protected under the Forest Act, while the coral reefs are protected as marine resources under the Fisheries Act.

Figure 7: Strand of mangrove forest supporting fisheries

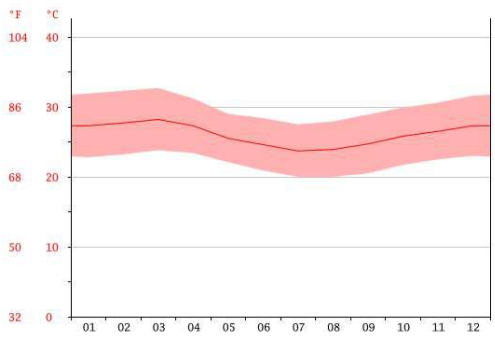
3.3 Climate

Climatic condition variations in the County are attributed to South East Monsoon winds (blowing between April and September) and the North East Monsoons (October to March) and oceanic influence. The mean rainfall in the coast region ranges from 1,397 mm in the south decreasing to 889 mm in the north and occurs in two periods. The rains occur during the inter-monsoonal period, with the long rains starting from March to June, while the short rains occur from October to December.

Miritini's climate is classified as tropical. In winter, there is much less rainfall than in summer. This climate is considered to be Aw according to the Köppen-Geiger climate classification. The temperature here averages 26.0°C. Precipitation here averages 1112 mm. Precipitation is the lowest in February, with an average of 17 mm. Most precipitation falls in May, with an average of 258 mm. At an average temperature of 28.2°C, March is the hottest month of the year. In July, the average temperature is 23.7°C. It is the lowest average temperature of the whole year.



Rainfall Graph



Temperature Graph

Figure 8: Rainfall and Temperature Graphs for Miritini Area

(Source: http://en.climate-data.org/location/103615/)

Between the driest and wettest months, the difference in precipitation is 241 mm. The average temperatures vary during the year by 4.5 °C.

month	1	2	3	4	5	6	7	8	9	10	11	12
mm	30	17	59	173	258	90	74	68	70	101	104	68
°C	27.3	27.7	28.2	27.3	25.5	24.6	23.7	23.9	24.7	25.8	26.5	27.3
°C (min)	22.8	23.2	23.8	23.4	22.1	20.9	20.0	20.0	20.5	21.7	22.5	23.0
°C (max)	31.9	32.3	32.7	31.2	29.0	28.4	27.5	27.9	28.9	29.9	30.6	31.6
°F	81.1	81.9	82.8	81.1	77.9	76.3	74.7	75.0	76.5	78.4	79.7	81.1
°F (min)	73.0	73.8	74.8	74.1	71.8	69.6	68.0	68.0	68.9	71.1	72.5	73.4
°F (max)	89.4	90.1	90.9	88.2	84.2	83.1	81.5	82.2	84.0	85.8	87.1	88.9

Figure 9: Miritini Climate Table

3.4 Physical Infrastructure

3.4.1 Road and Railway Network

The project area is characterized by road and railway network of the newly built Dongo Kundu Bypass and the SGR. The pipeline runs parallel to the road and SGR but crosses the road and the SGR at some points from the onshore pump house to the newly built terminal. Other roads serving the project area are the Mombasa-Mariakani A109 Road and the Magongo Road both running east to west and then changes direction to northwards in Miritini Centre. The Magongo Road also end at Miritini. The road that leads to the site area from Magongo Road is made from concrete paving blocks. This road serves AGOL and other industries like the New KCC. From the New KCC, the road to AGOL and slightly beyond is a private road.

Figure 10: Pipeline Route between the SGR and the Road

3.4.2 Sanitation Facilities

The existing AGOL site has adequate and modern sanitation facilities for the workers, visitors and truck drivers who come to collect LPG. The proposed project site is located adjacent to the existing facility. The workers at this site be provided with sanitation facilities on site and will also have access to the existing ones.

3.4.3 Telecommunication

Miritini area is well served with proper communication network including mobile network (Airtel, Safaricom and Orange) and land line telephone network from telecom. The communication networks have good signals.

3.4.4 Electricity Supply

The AGOL site area is well served with electricity supply from the national grid. The proposed project site will also use the electricity supply to run its operations. A standby generator with the capacity to operate the facility will be installed.

3.4.5 Nearest Shops and Market Centre

The closest shops to the site are located at the outer gate/entrance to AGOL Facility. It is 600m away from the site. Miritini Centre which is the main market centre serving the area is located approx. 1km away to the north-west.

3.4.6 Nearest Fire and Police Response Teams

The existing AGOL facility has its own fire station within the site. The nearest police station is located at Miritini Centre approx. 1km away.

3.5 Health Status

3.5.1 Most Prevalent Diseases

According to the 2015 Kenya National Malaria Strategy, although malaria prevalence has dropped in the country, from 11 to 8 per cent, it has increased from 4 to 8 percent in the coast. In 2015, the county reported 282,000 malaria cases in the health facilities across the county, translating to 23 per cent of all outpatient visits. Source: Daily Nation Tuesday April 26 2016

According to Mombasa County Health at Glance report, HIV/AIDS, Tuberculosis and Malaria are the major diseases in the county as per Table 6 below.

Table 6: Most Prevalent Diseases in Mombasa County (HIV/AIDS, TB, Malaria)

Indicator	County 2012	County (Current)	Kenya (Current)
No. of people tested for HIV	259,638	267,427	7,161,215
No. of people living with HIV on antiretroviral treatment	26,442	28,075	561,225
Mother-to-child transmission of HIV (%)	7.9	9.1	8.5
Malaria test positivity rate (%)	22.9	54.0	41.0
Malaria cases[8] (per 100,000 people)	16,893	14,823	20,252
Malaria admission	3,646	1,287	179,966
Tuberculosis (TB) prevalence (per 100,000 people)	519	444	208
Tuberculosis incidence (per 100,000	222[11]	186	79

Indicator	County 2012	County (Current)	Kenya (Current)
people)			

Source: Mombasa County Health at Glance report

Diseases common in the three villages surrounding AGOL include Respiratory tract infections, Asthma, Ulcers, Diarrhea and Typhoid.

3.5.2 Health Facilities

MIRITINI Location has eight health facilities some of which are public while others are private. The facilities include Jomvu Kuu (MCM) Dispensary, Miritini (CDF) Health Centre, Miritini (MCM) Dispensary, Kahada Medical Clinic, Judy Medical Clinic, New Jamin Medical Clinic, Ansar Medical Clinic and Canaan Medical Clinic. The nearest public health facility to the project site Miritini (CDF) Health Centre. It is situated approximately 3 km away from the proposed project site.

3.5.3 Disease Vectors

It was established during the consultation with the community that dust emissions is a concern and cause of coughs in a number of people. Others stated that pungent smell experienced from release of gas to the atmosphere could cause problems in breathing and even some alluded it to TB problem in the area. These were fears expressed by the public and not based on any scientific evidence.

3.6 Socio-economic Status

Employment issues were a major concern in the area. Most youths lack employment and have become a challenge to the security in the area. More than 80% of the community stakeholders encountered were either unemployed or engaging in small businesses such as water vending and selling vegetables. Owing to this most families are poor.

3.6.1 Settlement Patterns

The houses are mostly semi-permanent. They are concentrated within the three villages surrounding the proposed project site. The villages are Ufuta, KCC and Vibokoni.

3.6.2 Ethnic Groups

Miritini area is occupied by different ethnic groups. The groups are Mijikenda, Rabai, Luo, Luhya, Digo, Kikuyu etc. The majority ethnic group is Mijikenda.

3.6.3 Employment Opportunities

There are a number of employment opportunities in the area. The area is home to many companies that carry operations from Miritini. However, based on the qualifications of the local community only a few are eligible for employment opportunities for positions that require formal education or skills. Majority can only offer services in the areas that do not require formal education or specialized skills.

3.6.4 Land Use and Land Tenure

Statistical Abstract 2009 shows that the percent of wage employment by industry in Mombasa in 2007 was high in manufacturing (20%) and transport and communication (23%), and low in agriculture and forestry (less than 1%). These percentages may indicate characteristics of a port industrial city of Mombasa. The unemployment rate of Coast Province was estimated to be 11.7%.

The land in the project area is mainly used for commercial settlements involving oil installations. Families that were living in the land initially mainly used the land for housing and agricultural purposes before relocation. Other similar businesses as AGOL are Kenya Petroleum Refineries Limited (KPRL) crude oil receiving and storage facilities and Kenya Pipeline Company Limited. Most of the new developments in the area are commercial/industrial which have displaced the few villagers that were remaining area.

Land tenure regimes in Mombasa County are public, private and community owned. Within the private ownership a tenure regime namely tenancy-at-will is found. The county's rapid population growth has resulted in high urbanization and mushrooming of informal settlements like Bangladesh, Magongo, Likoni, Longo, Kisauni and Bamburi. In many instances the way land is owned has made it difficult to undertake county physical planning. Among the key challenges is the provision of housing units to meet the ever increasing need for accommodation.

3.6.5 Population and Demography

In 2009 total population of the county was 939,370 persons comprising 486,924 males and 452,446 and females. Looking at the Mombasa County population, its settlement patterns and growth trends, several issues emerge.

According to the 2009 Population Census Survey, Miritini Sub-Location had a total population of 25,934 (Men 13,644, Women 12,290) Majority of the population within the project area are living in Vibokoni, Ufuta and KCC Villages.

3.7 Water Supply

3.7.1 Water Supply and Surface Drainage (Rivers and Streams)

AGOL currently receives piped water at its facility. They complement this water supply by getting water from a nearby spring. The stream that drains the project area passes on the eastern side of the site. It originates approx. 500m north of the project site. It passes approx. 200m on the eastern side and drains southwards to the sea.

3.7.2 Surface Water Drainage

The surface drainage at the proposed facility area is largely to the east and south east of the proposed site. The surface runoff water joins the stream that drains the area and proceeds southwards to the sea.

3.7.3 Water Supply for the Planned Construction Activities

The construction of the Proposed Project will be constructed using water obtained from the existing AGOL Plant. Extra water will be obtained from the spring and the Mombasa Water and Sewerage Company piped network.

3.7.4 Water Supply for Operation Activities

The water that will be used for operations of the upcoming facility will be obtained from the current sources of spring water and from the Mombasa Water and Sewerage Company piped network.

3.8 Community Based and Non-Governmental Organizations (CBOs/NGOs)

The county has over 214 registered co-operative societies and a total membership of 35,987. The number of active women groups and youth groups in the county are 877 and 884 respectively while self-help groups in the county are 782. There are several NGOs in the county with the main ones being The Kenya Red Cross Society, Action Aid (K), World Vision, APHIA Plus Coast and Care International. These NGOs have played a critical role in supporting development issues (both social and economic) and also in mitigating disasters whenever they occur in the county.

The following CBOs and NGOs in Table 7 are found in the project area:

Table 7: CBOs and Organizations Offering Services to the Community

#	Organization	Base/Focus
1	North Star Alliance	Provide long distance truck drivers, sex workers and surrounding communities with sustainable access to basic health care and safety through: • Setting up of Roadside Wellness Centres (RWC) • Provision of Health Care Services
2.	Action Aid	Community development
2.	United States Agency for International Development (USAID) and UNAIDS	HIV/AIDS education programme
3.	Care International	Community development

Source: *ESIA Socio-economic Survey – Proposed Additional LPG Import Pipeline & Phase 1C Bulk LPG Mound - AGOL*

3.9 Measurements and Lab Analysis Results

The following previous baseline measurements were incorporated in the report.

3.9.1 Noise Quality

Noise measurements were carried out in the project area to establish the baseline status. The scope of work was assessing the noise exposure levels at various existing work stations within the AGOL Terminal, general compound and environmental noise within the proposed expansion site and around the boundary fence of the plant.

Reported ambient sources noise values at the fire pump are and the loading gantry 1 and 2 areas were 98 dB (A) and 85.7 dB (A) respectively; this noise ratings surpassed the acceptable limits of 85 dB (A) as stipulated by the Factories and Other Places of Work (Noise Prevention & Control) Rules, 2005.

The other workplace noise measurement points returned results below the Factories and Other Places of Work (Noise Prevention & Control) Rules 2005.

Similarly, the environmental noise measurement results as monitored from facility's boundary wall were compliant with the regulation.

Recommendations

- Workers should be informed of the noise monitoring results, the minimal risk of hearing loss, and the roles of hearing protection and audiometric testing;
- Make earplugs available at the entrance to these noisy working areas;
- Areas to be posted with signs warning about high noise levels and the requirement to wear hearing protection; and
- Shorter exposure periods can also be considered for the workers at these points.

The construction activities are likely to result in slight increase in noise levels. However, the increase will be intermittent and of short-duration. Details of the measurements are provided in in Annex 6 of this report.

3.9.2 Ambient Air Quality

Results of Ambient Air Quality shows the following:

- Traces of VOC's (toluene and Xylene) have been detected at the boundary wall behind the administration office at a range of 0.09µg/m^3 and 0.04µg/m^3; however, this concentrations were consistent with the EMC (Air Quality) regulations 2014 of 600µg/m^3 for total VOC's;
- The other monitoring points including behind the fire pump, adjacent to filled truck parking and behind the LPG bullets have recorded the VOC's below the analytical methods detection limits of 0.1 mg/sample;
- Petroleum hydrocarbons concentrations at all the monitoring points have been reported below the analytical method detection limit of 0.01 mg/sample.

All the gaseous pollutants are within the limits set out in the Environmental Management and Co-ordination (air quality) regulations, 2014 for all areas assessed. The air quality is expected to be impacted by construction and demolition activities during decommissioning of the project; however, implementation of the proposed recommended measures will keep the levels within the acceptable limits. Details of the measurements are provided in in Annex 7 of this report.

3.10 The Socio-Economic Profile

Mombasa has a vibrant economy and is known for its varying hospitality amenities and beautiful beaches that makes it a popular tourist magnet. Mombasa is also a Kenya's second major industrial hub after Nairobi with various industries such as mining, manufacturing, Energy (Oil Refining) set up at the County.

Tourism is definitely one of the most lucrative activities in Mombasa County. This is attributed to the many tourist attraction sites and the warm temperatures experienced all year round. Mombasa port is the leading trading centre that has one of the largest sea port called the Kilindini Harbour that mean "deep" in Swahili and the harbour is used for

trading. The good road network eases transportation of goods from the port to designated destination. Moi International Airport is important because visitors use it to travel into the county, a lot of people to travel to the county due the good infrastructure that have being put in place by the government in a bid to enhance the tourism.

Mombasa County has a lot of tourist attraction that has made people to travel there due to the availability of clean beaches that stretch from north to the south of the county. Such beaches include the Fort Jesus which is the main tourist's attraction site in the county that was built in the 16th century by the Portuguese. It shows various artefacts and the monumental still stand to today. Other economic activities carried out in the area include Chrome mining, Cement manufacturing and fishing which supply sea food to the residents and other towns such as Nairobi. There are several food processing factories that are involved in the packaging and export of food products and flowers to other continents.

3.11 Population Demography

The Proposed Additional LPG Import Pipeline & Phase 1C Bulk LPG Mound project is located in Miritini Sub-Location, Mombasa County on the southern side of Miritini Centre.

The population demographic data is secondary data obtained from Population and Housing Census - Kenya National Bureau of Statistics (2009). The data used to evaluate the socio-economic status of the project area community is primary data obtained from the socio-economic survey conducted by the ESIA team during this assessment.

The Government of Kenya carried out a National Population and Housing Census in 1999 and 10 years later in 2009. The Kenya National Bureau of Statistics (KNBS) provides the population data as given in Table 8. The 2009 Census covered a smaller area of Miritini Sub-location than the 1999 (almost half) and the population density is 3 times higher. This shows how Miritini has seen high population growth in the past few years. This is largely due to increased business brought about by the industries and the large number trucks that use the area as a stopover.

Table 8: Mombasa County Population in 1999 & 2009

#	County	Year	Male	Female	Total
1	Mombasa	1999	363,552	301,466	665,018
2	Mombasa	2009	486,208	451,923	938,131

Source: *Population and Housing Census - Kenya National Bureau of Statistics (1999 & 2009).*

Table 9: Miritini Sub-Location Population in 1999 & 2009

#	County	Year	Male	Female	Total
1	Miritini	1999	8,668	6,504	15,172
2	Miritini	2009	13,644	12,290	25,934

Source: *Population and Housing Census - Kenya National Bureau of Statistics (1999 & 2009).*

The County had a population density of 6,131 persons per Km^2 in 2009 which was projected to increase to 6,640.5 persons per Km^2 by 2015 owing to high population growth contributed to by the increased numbers of people seeking employment in the manufacturing, service and processing industries, the Port of Mombasa, Kenya Ferry Services, Container Freight Terminals, go downs and hotels. Highly populated areas are in Majengo, Bamburi, Bangladesh, Mikindani, Jomvu, Miritini, Migadini, Port Reitz, Mishomoroni and Bombolulu among others.

The high population densities in Mvita, Changamwe and Nyali are attributed to proximity to vital infrastructure such as roads, water, electricity and employment opportunities due to the presence of industries like the Export Processing Zones and other physical facilities such as the Port of Mombasa and the Moi International Airport, Mombasa. Kisauni (2,188 persons / Km^2), Jomvu (3,537 persons/Km^2) and Likoni (4,040 persons/Km^2) are the least densely populated sub-counties in the county. This implies that Changamwe, Nyali and Mvita require more resources towards expansion and erection of additional social amenities. Low densities in Likoni and Kisauni can be attributed to inadequate social amenities and poor road network.

3.12 Socio-economic Survey Results

This section looks at the social terrain of the project area. It focuses on the general demographic and socio-economic characteristics of the community in the project area with a view to providing a picture of the baseline socio-economic situation and to provide a basis for anticipating socio-economic impacts and designing appropriate mitigation measures.

The main crops under cultivation in the county include cassava, cucurbits family, maize, vegetables, millet and sorghum. These are most preferred due to their resistance to diseases and pests. The climatic conditions of the county make plants very prone to diseases and pests and therefore, highly resistant varieties are encouraged. The total acreage under food crop stands at 400 ha while the total acreage under cash crop is 500 ha. The County is generally a net importer of food and other agricultural products and this makes the cost of food high and inaccessible to most of the low income earners. There is need to invest more in value addition for agricultural products and better post-harvest management systems and facilities. Livestock keeping and fishing is also practiced in the County.

3.12.1 Gender of Respondents

There was equal representation of both gender at the survey at 50%.

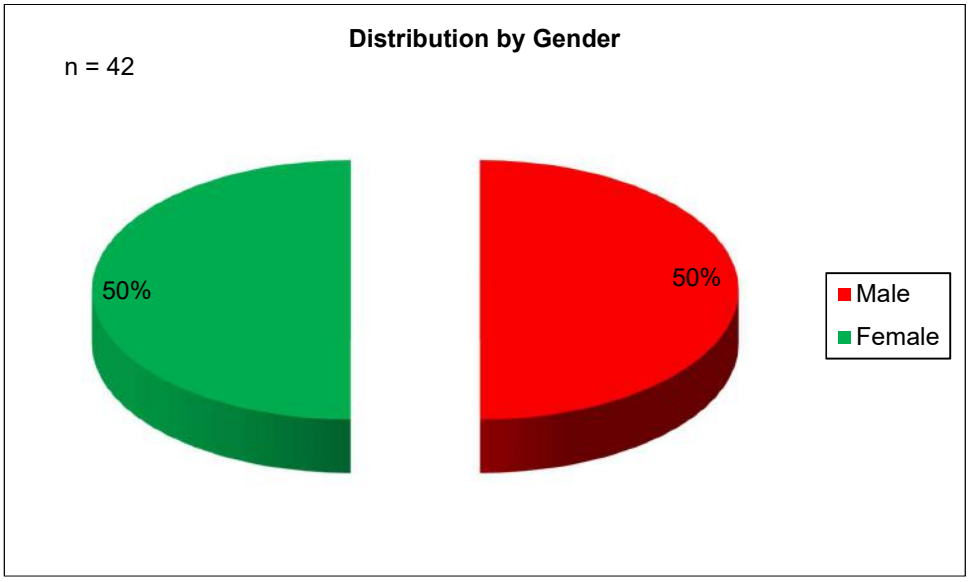


Figure 11: Gender of Respondents

3.12.2 Age Distribution of Household Heads

Age is important indicator of the welfare needs of any community. At the project area as shown in the figure below. Majority (64%) of the respondents were generally middle aged people (between 36 - 60 years). 19% were young people of 35 years and below, while only 17% were above 60 years (n=42). This implies that the population in the project area are largely economically active.

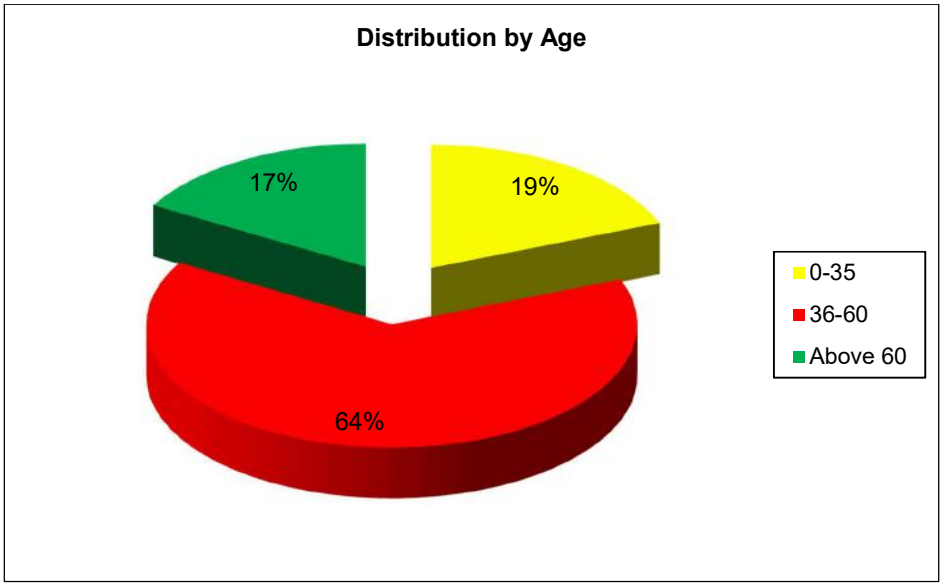


Figure 12: Age Distribution of Respondents at the Project Area

3.12.3 Quality of Housing

The areas of Ufuta, KCC and Vibokoni have informal settlements. A number of informal settlements exist in the County. The growing population continues to exert pressure on existing units of housing, creating a huge demand for quality and affordable housing.

Majority of the respondents at 88% lived in semi-permanent housing consisting of mud walled houses with iron sheet roofing. Only 12% of the respondents had permanent block housing.

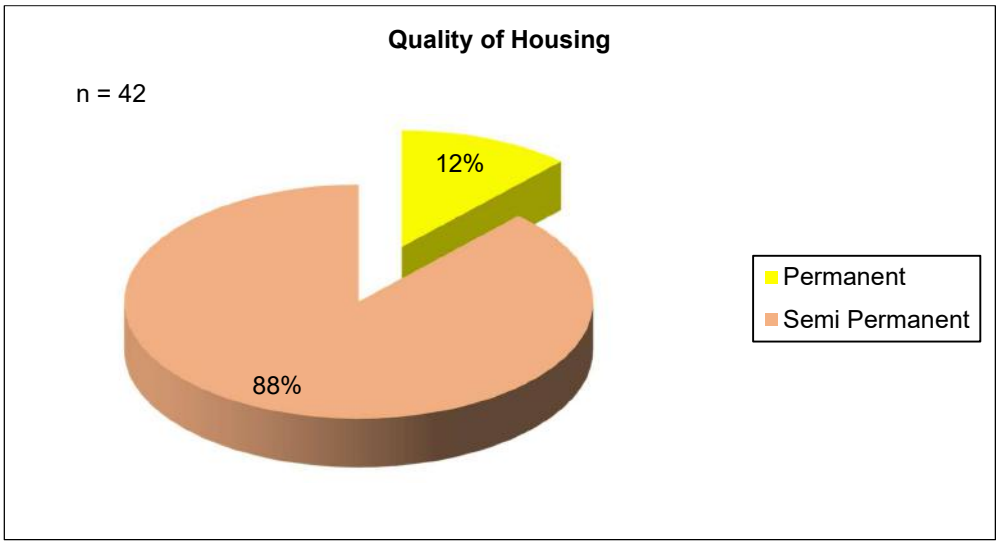


Figure 13: Quality of housing at the Project Area

3.12.4 Religious Following

Mombasa has a cosmopolitan population, with the Swahili people and Mijikenda predominant. Other communities include the Akamba and Taita Bantus as well as a significant population of Luo and Luhya peoples from Western Kenya. The major religions practiced in the city are Islam, Christianity and Hinduism. Over the centuries, many immigrants and traders have settled in Mombasa, particularly from the Middle East, Somalia, and the Indian sub-continent, who came mainly as traders and skilled craftsmen. Majority of the community members follow the Islam faith (79%) followed by Christians (21%). Being an area where industries are growing fast, the population growth is largely driven by commercial activities and therefore cosmopolitan.

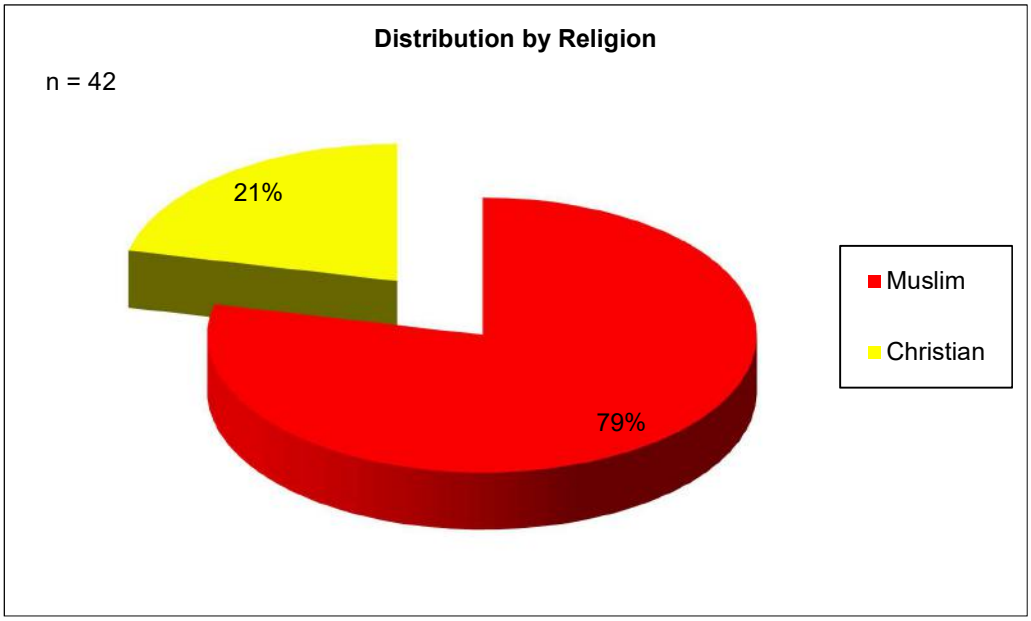


Figure 14: Distribution of Respondents According to Religion

3.12.5 Drinking Water Source

The County of Mombasa is severely deficient in reticulated domestic water supply. It is only able to meet 24% of its water demand, production being 43,000m^3/day, against a demand of 182,000m^3/day. The shortfall is as a result of an old water reticulation system which results in frequent breakdowns leading to water losses and disruption of supply. The other cause of water scarcity is the lack of water sources within the county. This is further complicated by the county's rapidly growing population. The water problem is negatively impacting development of the county as most of the industries are relocating their operations to other Counties. This has also led to the emergence of water vendors who not only sell water at exorbitant prices but also sell water whose quality has not been certified.

In the project area, most of the residents get their water from community water tanks installed by the County government and well-wishers within the community.

3.12.6 Source of Energy for Cooking

Majority of the community stakeholders who responded said that they use charcoal, kerosene and firewood for cooking. They stated that LPG was expensive thereby causing them to opt not to use it. Some had a notion that LPG is so dangerous and should not be used at home.

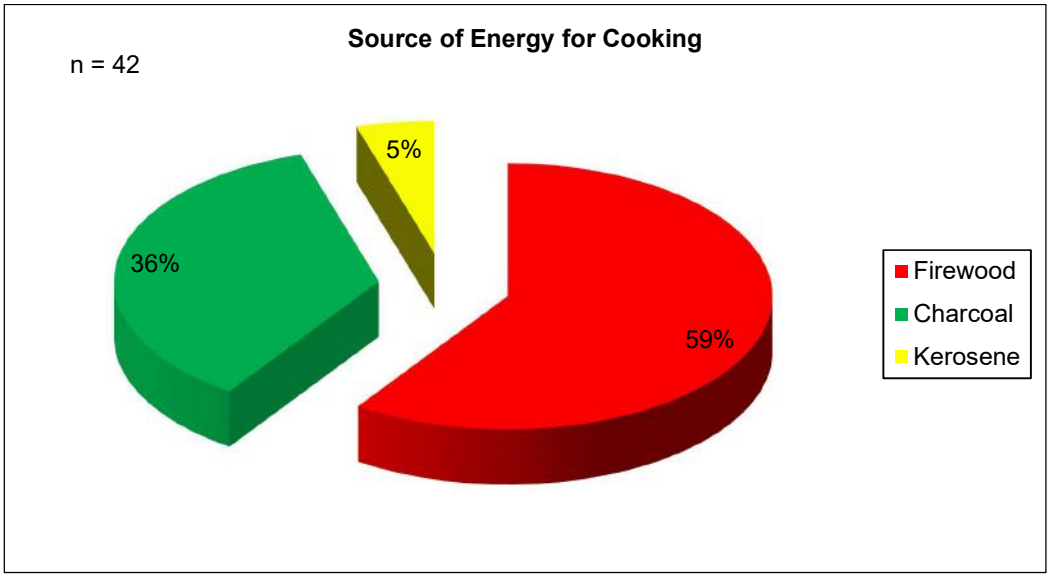


Figure 15: Source of Energy for Cooking

Smoke from these sources contributes to the observed high Upper Respiratory Tract Infections (URTI) that are recorded in the health institutions. A lot of sensitization and enabling measures are required to make the low income groups afford clean energy like LPG.

3.12.7 Source of Energy for Lighting

The Kipevu power plant produces power which is fed into the national grid. The county has a high potential for generation of solar and wind energy, but this remains unexploited. Though the area is connected to electricity supplied by KPLC, 52% of the questionnaire respondents stated that they use kerosene lamps. Approximately 38% are connected to electricity in their homes while 10% are connected to solar as their main source of lighting. Kerosene lumps are also a major contributor URTI. Sensitization of the community is required so as to make them appreciate the importance of using clean sources of energy for lighting e.g. solar and electricity.

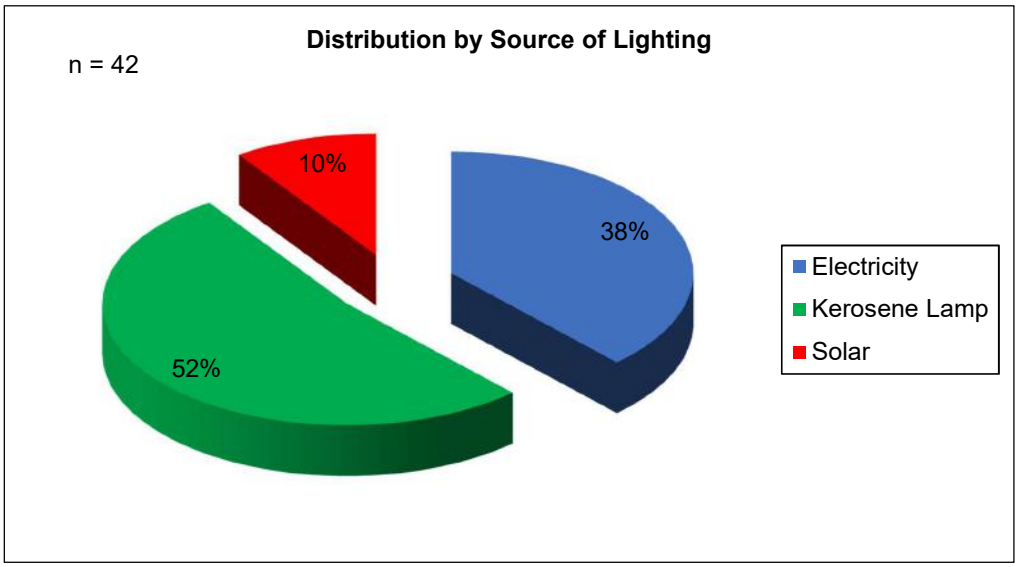


Figure 16: Source of Energy for Lighting

3.12.8 Distance to Health Centre/Dispensary

Most health facilities in the area are located around Miritini and Jomvu Centers. Majority of the respondents (60%) can easily access a health facility at a distance of 2.5k from their home. However approximately 40% are far from the nearest health facility at a distance of over 5km.

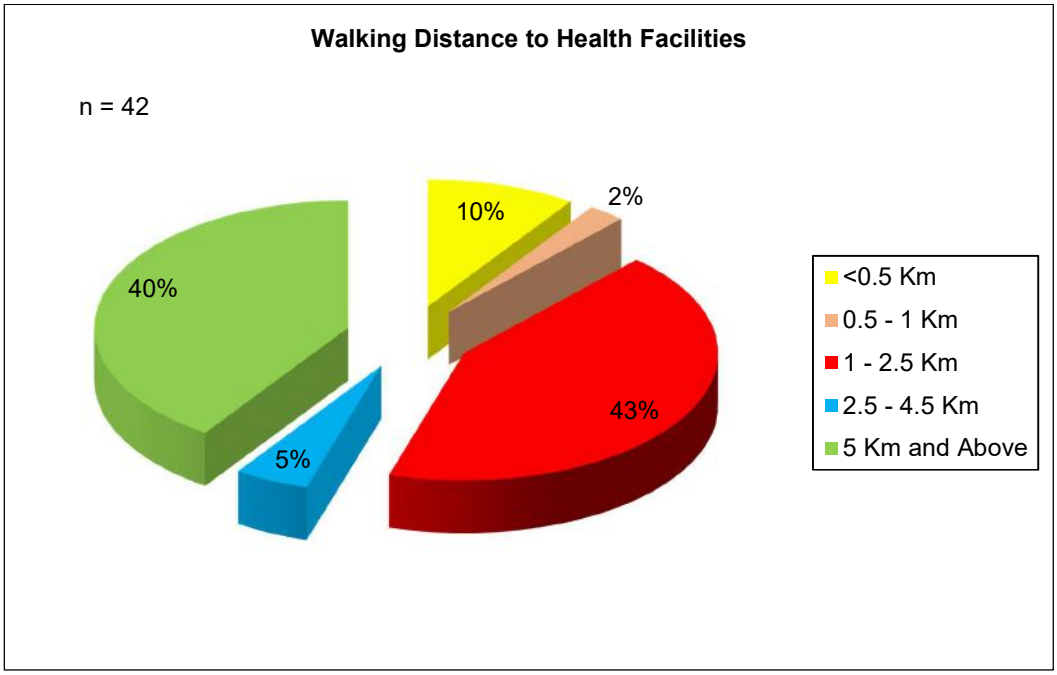


Figure 17: Walking distance to health facility

3.12.9 Main Source of Income

Unemployment in the county is high particularly among youth. Youth population comprises 41 per cent of the population in the county and 61 per cent of the county's labour force.

Efforts need to be stepped up to ensure youth become gainfully employed. Current estimates indicate that 38 per cent of the population in the county is poor. A big number of the youths in the project area are bodaboda riders and women operate small businesses such as water vending and vegetable selling.

In the project area, majority of the community members are self-employed carrying out small scale businesses (66%). Any dynamics that changes the commercial set up the area is likely to affect a large population of the community who are self-employed. 5% of the population do not have any gainful employment. The rest are either in Mainstream Employment (5%) or Casual Laborers (24%).

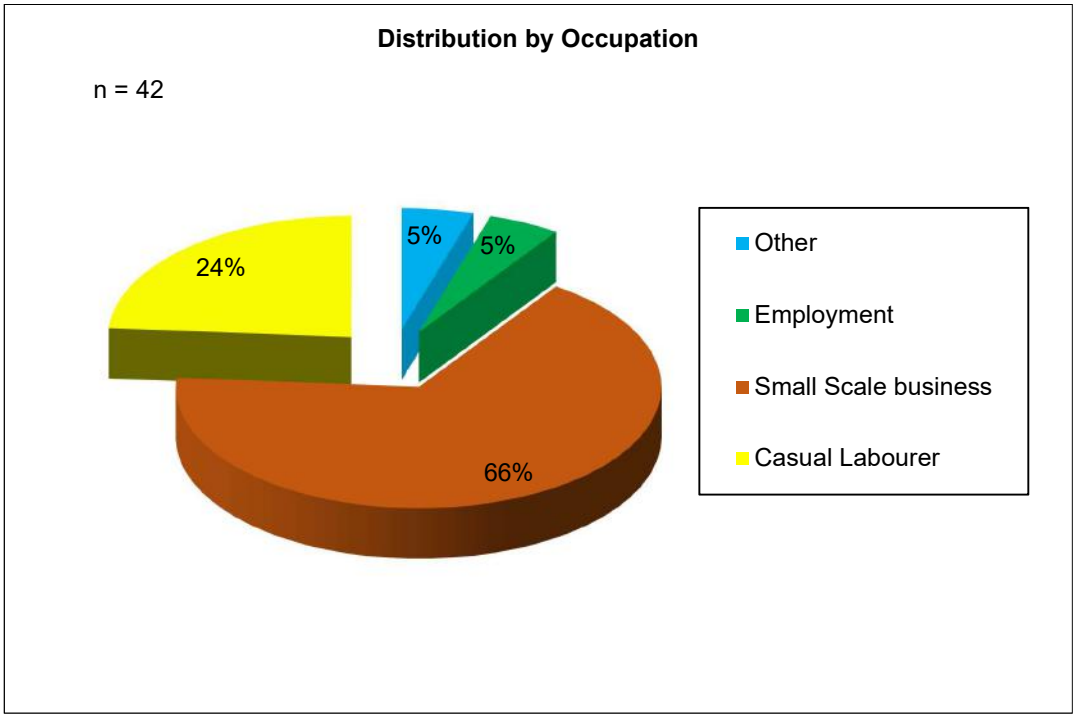


Figure 18: Distribution of Respondents according to Occupation

3.12.10 Sanitation Facilities

Most of the households around the project area (Ufuta, KCC and Vikobani) are using pit latrines.

3.12.11 Level of Education

Mombasa County Government recognizes that education and training is one of the levers that will make the county into becoming a vibrant modern regional commercial hub with a high standard of living for its residents. Literacy levels in the county are relatively low at 86.3 per cent. Net Enrollment Ratio in ECD, Primary school and secondary school is 57.4%, 81.1% and 32.5% respectively. The challenge for the county is being able to provide adequate school infrastructure such as desks, chairs, classrooms, laboratories and staffing. The chart below shows the breakdown.

Project area community have gone through some formal education. 93% have been to Primary School, 5% have been to Secondary School while 2% have been to Tertiary Institutions. This is a strong indication that the community is enlightened and can easily be directly involved in Education or Sensitization activities.

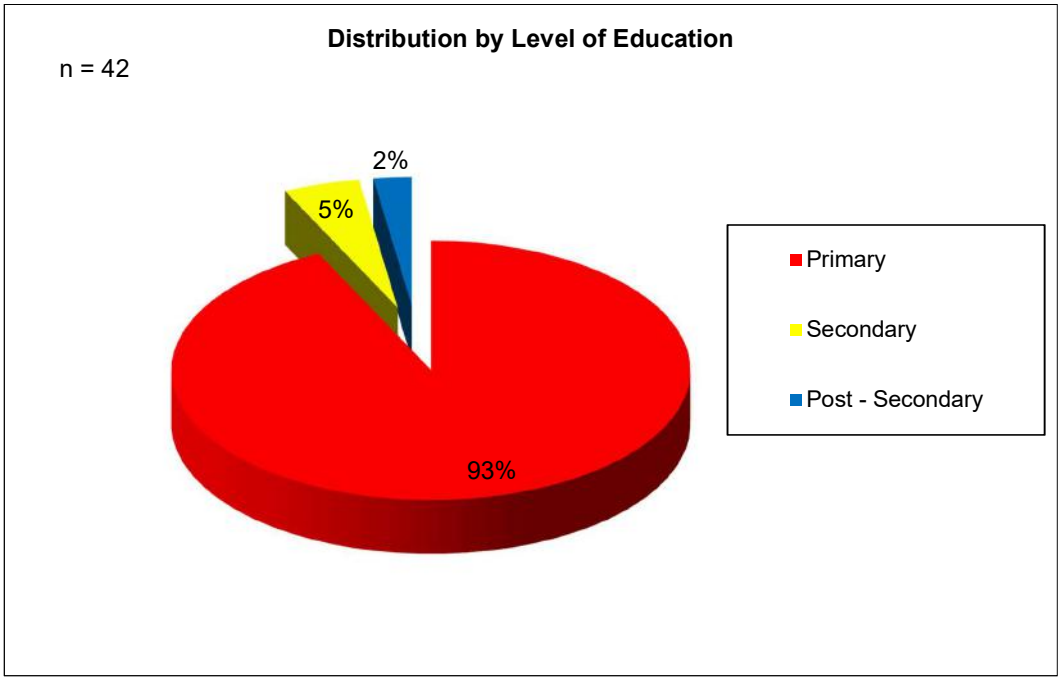


Figure 19: Level of Education of Project Area Respondents

4 Policy, Legal and Institutional Framework

This section of the report discusses the policies, applicable EHS legislations and institutional framework governing the Proposed Project.

4.1 National Policies and Regulations

In Kenya there are various sector specific legal instruments that cover environmental and social issues such as public health; soil erosion; protected areas; endangered species; water rights and water quality; air quality, noise and vibration; cultural, historical, scientific and archaeological sites; land use; resettlement; etc.

The main piece of legislation governing environmental management in Kenya is the Environmental Management and Co-ordination Act (EMCA) of 1999, Amended 2015. The main objective of this Act is to provide for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya. EMCA provided for the establishment of a National Environment Management Authority (NEMA), which became operational in July 2002. NEMA has the statutory mandate to coordinate all environmental activities.

The EMCA has given rise to various regulations that govern environmental Impact Assessment and Audit and also regulations governing Water Quality, Air Quality, Noise and Excessive Vibrations, Waste Management, Wetlands, River Banks, Lake Shores and Sea Shore Management and Conservation of Biological Diversity.

The Act makes environmental impact assessment mandatory for activities specified in its Second Schedule, including the installations of LPG Import Pipeline & Phase 1C Bulk LPG Mound.

4.2 National Policies

Table 10 below shows the National Policies relevant to the Proposed LPG Import Pipeline & Phase 1C Bulk LPG Mound.

Table 10: Relevant National Policies

National Policy	Community development
The National Environment Policy, 2013	• The National Environment Policy aims to provide a holistic framework to guide environmental and natural resource management in Kenya. • It also ensures that the link between the environment and poverty reduction is integrated into all government processes and institutions in order to facilitate and realize sustainable development at all levels in the context of a green economy, enhancing social inclusion, improving human welfare, creating employment opportunities and maintaining a healthy functioning of the ecosystem.
Draft National Energy and Petroleum Policy, 2015	• The Government to ensure that there are strategic petroleum reserves in the country. Increased use of LPG shall be encouraged with a view to eliminate the use of kerosene,

National Policy	Community development
	charcoal and firewood in households. The Government is also evaluating the possibility of using natural gas to support commEPRAial and industrial activities including transportation. • Government to ensure compliance with the environmental laws on restoration and decommissioning of projects • Government to develop and implement a compliance mechanism for safety and environmental pollution • Government to mainstream ecosystem and biodiversity management in energy and petroleum sector • Government to establish a Disaster Preparedness, Prevention and Management (DPPM) Unit to spearhead response to accidents and disasters in the energy and petroleum sector • Government to provide security for all energy and petroleum installations, which shall be gazetted as national protected zones
Sessional Paper No. 4 On Energy, 2004	• Envisions equitable access to quality energy services at least cost while protecting the environment • Requires the government to give legal authority to the Energy & Petroleum Regulatory Authority to permit and license generation, transmission and distribution. EPRA is also given mandate to facilitate issuance of permits and licences by concerned authorities including NEMA • The Paper tasks the government to ensure environmental rehabilitation on project completion or abandonment • Encourage private sector investment in additional capacity for handling, storage and distribution of LPG; • Consistent with this policy, Government will pursue implementation of:: – Construction of LPG import handling, storage and distribution facilities in the short term. Storage and filling facilities will also be constructed in Nairobi, Kisumu, Nakuru, Eldoret and Sagana and in other parts of the country in tandem with rising incomes and demand. – Promoting wider use of both kerosene and LPG in households, as an alternative fuel to improve the quality of household energy and mitigate demand on woodfuel • Government will continue to promote distribution of petroleum fuels including liquefied petroleum gas (LPG) as part of the energy infrastructure to stimulate both on and off-farm income generating activities, in addition to providing clean energy for rural household use.

National Policy	Community development
The Kenya Health Policy 2012 – 2030	• The policy is based on the Constitution of Kenya 2010, Vision 2030 and global health commitments. • Its broad aim is to ensure equity, people-centeredness and participation, efficiency, multi-sectoral approach and social accountability in delivery of healthcare services. • It sets out the goal, objectives, guiding principles and policy directions aimed at achieving Kenya's health agenda and a comprehensive implementation framework. Also included is the institutional management plan under the evolved system of government taking into account the varied roles of the national and county levels of government. • The policy also sets out a monitoring and evaluation framework to track progress in achieving the policy objectives.
The National Environmental Sanitation and Hygiene Policy 2007	• The Environmental Sanitation and Hygiene (ESH) Policy is intended to improve people's health and quality of life. Strategic interventions have been developed to determine the success of the policy implementation. • One of the key purposes of this policy is to clarify the various roles in order to enhance the existing legal and constitutional framework and to encourage the private sector, civil society and community participation in the planning, implementation and ownership of ESH services. • Sanitation and the Environment: One of the key objectives of the policy is to protect the environment from pollution and its negative effect on human health. The government will seek to minimize negative impacts arising from various types of sanitation systems, and maximize positive effects. • Well-functioning sanitation and hygiene systems are a means of protecting the environment. • The health risks associated with poor ESH increase poverty. The government envisages that this policy is an important step towards poverty reduction.
National Policy On Water Resources Management and Development (Seasonal Paper No.1 of 1999).	• Recognises the need to avoid the pollution of water resources and thus proposes development of strict stream effluent discharge standards for controlling the discharge of wastes into water bodies. Also recognises the need to make water abstraction and disposal permits dynamic and economic instruments for water pollution control • Proposes a process of water quality monitoring of all water bodies and pollution control inspection of potential polluting sources. Proposes that all factories and other waste water generating concerns be required to incorporate in their designs waste water treatment devices • Proposes the monitoring of water quality parameters to provide baseline data for the purposes of pollution control. Also proposes monitoring of water abstraction and water use

National Policy	Community development
	to work out naturalised river flows, misuse and over abstraction
Land Policy (Sessional Paper No. 3 of 2009).	• Envisions the efficient, sustainable and equitable use of land for prosperity and posterity • Seeks to secure rights over land and provide for sustainable growth, investment and the reduction of poverty in line with the Government's overall development objectives. • Seeks to offer a framework of policies and laws designed to ensure the maintenance of a system of land administration and management that will provide inter alia, economically viable, socially equitable and environmentally sustainable allocation and use of land, efficient and effective utilisation of land and land-based resources. • Commits the government to restoration of the environmental integrity of land and facilitation of the sustainable management of land based resources. This is through incentives to encourage the use of technology and scientific methods for soil conservation; encouraging use of traditional land conservation methods; establishing measures to control degradation of land through abuse of inputs and inappropriate land use practices; and establishing institutional mechanisms for conservation of quality of land for environmental conservation purposes • Government shall develop a comprehensive and integrated land use policy having regard to fragile areas and the needs of neighbouring communities and individuals in such areas • Government shall ensure that environmental impact assessments and audits are carried out on all proposed projects, programmes and activities on land that have a likelihood to degrade the environment.
The Kenya National Biodiversity Strategy and Action Plan, 2000	The overall objective of the NBSAP is to address the national and international undertakings elaborated in Article 6 of the Convention on Biological Diversity' (CBD). It is a national framework of action for the implementation of the Convention to ensure that the present rate of biodiversity loss is reversed, and that present levels of biological resources are maintained at sustainable levels for posterity.

4.3 National Legislation

The following legislative provisions and regulations are considered key to management of the environmental, health and safety aspects related to the proposed development.

Table 11: Summary of Reviewed National Legislation

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
1	The Constitution of Kenya (2010)	• The Constitution has enhanced protection and enforcement of fundamental rights amongst other gains. It provides for a two tier structure of government, i.e. the National and the County Governments. It distributes the functions and powers between the two levels as detailed in Chapter Eleven and the Fourth Schedule. • Specifically in relation to the energy sector, Part 1 of the Fourth Schedule provides that the National Government shall be responsible for: - (a) Protection of the environment and natural resources with a view to establishing a durable and sustainable system of development including water protection, securing sufficient residual water, hydraulic engineering and the safety of dams (b) Energy policy including electricity and gas reticulation and energy regulation; and (c) Public investment. • In relation to the County Governments, Part 2 of the Fourth Schedule provides that they shall be responsible for county planning and development including electricity and gas reticulation and energy regulation.	• The project shall be implemented in consultation with both the national government and the county government including the relevant authorities;
2	Environmental Management and Coordination Act 1999, Amended 2015	• Provides for protection and conservation of the environment, environmental impact assessment, and environmental auditing and monitoring. • Provides that all reasonable measures shall be taken to mitigate any undesirable effects not contemplated in the ESIA and an environmental audit report on those measures be prepared and submitted to NEMA	• Project has initiated this ESIA in compliance with regulations

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
3	Environmental (Impact Assessment and Audit) Regulations, 2003 Amended 2019	• Provides for the procedure for carrying out the Environmental and Social Impact Assessment (ESIA). • Provides for the contents of an ESIA Study Report.	• The ESIA to be carried out in accordance to the regulations.
4	Environmental Management and Co-ordination (Water Quality) Regulations 2006	• Provides for the protection of ground and surface water resources. • Provides for the parameters in the quality of wastewater discharged from any facility/activity into the environment or sewer.	• Any discharges to the surface water courses during operation phases to be monitored for conformance with the standards
5	Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009	• Prohibits the generation of unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. • Provides for the maximum noise levels permissible in various environmental set ups such as residential areas, places of worship, commercial areas and mixed residential. • Provides that where a sound source creates or is likely to emit noise or excessive vibrations, or otherwise fail to comply with the provisions of these Regulations, a license is required	• Sound level limits of 60dB (day) and 35dB(night) to be observed during operations • License to emit noise/vibrations in excess of permissible levels to be acquired if necessary
6	Environmental Management and Co-ordination (Waste Management) Regulations 2006	• Provides for standards for handling, transportation and disposal of various types of wastes including hazardous wastes. • Requirements to ensure waste minimization or cleaner production, waste segregation, recycling or composting. • Provides for licensing of vehicle transporting waste. • Provides for the licensing of waste disposal facilities	• Disposal of generated waste from operations under the Project; • Generation of hazardous wastes such as used oil and oily parts from servicing of equipment and vehicles
7	Environmental Management and Co-ordination (Fossil Fuel	• Provides for emission standards for internal combustion engines.	• Use of diesel-powered generators and compressors in operations • AGOL vehicles in use by staff

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
	Emission Control) Regulations 2006		
8	Environmental management and co-ordination (conservation of biological diversity and resources, access to Genetic resources and benefit sharing) Regulations, 2006	• Provides that a person shall not engage in any activity that may have an adverse impact on any ecosystem; lead to the introduction of any exotic species; or lead to unsustainable use of natural resources, without an Environmental Impact Assessment License • Provides for the imposition of bans, restrictions or similar measures on the access and use of any threatened species in order to ensure its regeneration and maximum sustainable yield • Provides for the inventory and monitoring of the status of threatened, endangered or rare species	• Pipeline Project activities are within the mangrove ecosystem
9	Environmental Management and Coordination (Air Quality) Regulations, 2014	• Provides for ambient air quality tolerance limits. • Prohibits air pollution in a manner that exceed specified levels. • Provides for installation of air pollution control systems where pollutants emitted exceed specified limits. • Provides for the control of fugitive emissions within property boundary. • Provides for the control of vehicular emissions. • Provides for prevention of dispersion of visible particulate matter or dust from any material being transported. • Provides for acquisition of an emission license.	• Exhaust/stack emissions from equipment at the Gas facility • AGOL vehicles in use by staff
10	The Public Health Act (Cap 242)	• Provides for the prevention of the occurrence of nuisance or conditions dangerous/injurious to humans	• Generation of wastes from operations under the AGOL Facility • Handling, storage and disposal of waste at the AGOL Facility

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
11	Occupational Safety and Health Act (OSHA), 2007	• Provides that every occupier shall ensure the safety, health and welfare at work of all persons working in his workplace • Provides that before any person occupies or uses any premises as a workplace, he shall apply for the registration of the premises • Provides that workplace shall be of sufficient size for work to be carried out with ease and shall further have the necessary free space and, having regard to the nature of the work, an adequate amount of air for each employee, the minimum permissible being ten cubic metres per person • Provides that an occupier shall ensure that effective and suitable provision is made for securing and maintaining, by the circulation of fresh air in each workroom, the adequate ventilation of the room • Provides that an occupier shall ensure that effective provision is made for securing and maintaining sufficient and suitable lighting, whether natural or artificial, in every part of his workplace in which persons are working or passing • Provides that sufficient and suitable sanitary conveniences for the persons employed in the workplace shall be provided, maintained and kept clean, and effective provision shall be made for lighting the conveniences; and, where persons of both sexes are or are intended to be employed (except in the case of workplaces where the only persons employed are members of the same family dwelling there), such conveniences shall afford proper separate accommodation for persons of each sex • Provides that all plant, machinery and equipment whether fixed or mobile for use either at the workplace or as a workplace, shall only be used for work which they are designed for and be operated by a competent person	• Site registration as a workplace • Safety measures are required in use of tools and machinery on sites • Protection of the workers and general public with any form of interaction with the sites is necessary

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
		• Provides that every steam receiver and all its fittings shall be of good construction, sound material, adequate strength, and free from patent defect, and shall be properly maintained • Provides that every steam receiver and all its fittings shall be thoroughly examined by an approved person, so far as the construction of the receiver permits, at least once in every period of twenty-four months or after repairs • Provides that where work has to be done inside a confined space in which dangerous fumes are liable to be present, the confined space shall be provided with adequate means of egress. • No person shall enter the confined space for any purposes without taking measures to remove any fumes which may be present and to prevent any ingress of fumes and, unless it has been ascertained by a suitable test that the space is free from dangerous fumes • Persons entering a confined space shall wear a suitable breathing apparatus. A sufficient number of the persons employed shall be trained and practiced in the use of such apparatus and in the method of restoring respiration; • Provides that in every workplace or workroom, there shall be provided and maintained, and conspicuously displayed and free from any obstruction so as to be readily accessible, means for extinguishing fires	
12	The Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005	• Rules provide for the maximum noise exposure levels for workers in places of work and for the provision of protective equipment for those exposed to high noise levels. • Provides that an occupier shall also institute noise reduction measures at the source of noise in the workplace.	• Noise emitted during the operation of the emergency diesel generator require provision of PPE to workers and minimization of noise exposure to the public

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
13	Water Act 2012	• Provides that a permit shall be required for any use of water from a water resource, especially where there is abstraction and use of water with the employment of works.	• Use of water abstracted from the natural spring requires an abstraction permit
14	Water Resource Management Rules 2007	• Provides for application by all those intending to abstract ground water. • Provides that where any borehole or well is intended to be equipped with a motorized pump the application shall be accompanied by a hydrogeological assessment report.	• Depending on the proposed source of water for construction activities, permits may be required
15	The Energy Act 2019	• It sought to consolidate the laws relating to energy, to provide for National and County Government functions in relation to energy, to provide for the establishment, powers and functions of the energy sector entities; promotion of renewable energy; exploration, recovery and commercial utilization of geothermal energy; regulation of midstream and downstream petroleum and coal activities; regulation, production, supply and use of electricity and other energy forms; • Enforcement and review environmental, health, safety and quality standards • Need to promote environmental protection and compliance with environmental, health and safety requirements • Construction permit request to be accompanied by ESIA Study Report	• Applicable for importing, transporting, refining, storing and selling petroleum or petroleum products; • Construction permit shall be sought from EPRA.
16	The Energy (Energy Management) Regulations 2012	• Provides for the development of an energy management policy with inter alia, commitment to improve energy efficiency and conservation, and commitment to provide resources necessary to achieve energy efficiency and conservation. • Provides for maintenance of energy consumption records.	• Development and implementation of an Energy Management Policy by AGOL is required since the existing complex is connected to the national grid • Energy audits should also be carried out on the facilities to identify opportunities for improving efficiency
17	Liquefied Petroleum	• Promulgated for Management of LPG Business in Kenya. It	The Regulations requires the Proponent to:

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
	Gas (LPG) Regulations, 2009	covers on import, export, transport, storage, wholesale and retail of LPG.	• Apply for/obtain license from EPRA prior to operating bulk LPG storage facility. Application for the license should be accompanied by the follow: • EIA License issued in accordance with EMCA 1999, Amended 2015 • Proof of compliance with OSHA 2007 and Public Health Act; • Certificate of compliance issued in accordance with Physical Planning Act of 1986; • Copy of approved drawing accordance with County Government Act, with specifications and plans in duplicate; • A clearance certificate from Chief Fire Officer; • A declaration of the intended use of LPG that is to be stored • A copy of certificate of adherence to the KS1938(1-5) • Transport LPG by road in accordance with the Act and terms and conditions of a valid license issued by the Commission;
18	Land Registration Act, 2012 (Act No. 3 of 2012)	• Provides for the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes.	• The proposed project site is registered and has a title deed.
19	Physical Planning Act Cap 286	• Provides for zoning of areas for storage, distribution and retailing of petroleum products and construction of electric power sub-stations and other infrastructure.	• The Proposed Project has been approved by the County's Physical Planning Department.
20	Land Act, 2012 (Act No. 6 of 2012)	• Provide for the sustainable administration and management of land and land based resources, and for connected purposes. The Act also provides for the repeal of the Way leaves Act (Cap. 292) and the Land Acquisition Act (Cap. 295).	• The proposed project site is registered and has a title deed

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
21	National Construction Authority Act. (Cap.449A) National Construction Authority Regulations, 2014	• Regulates construction activities and registration of contractors in Kenya.	• The Project shall seek development approval from the NCA and engage approved contractor during construction phase
22	The Standards Act, Chapter 496	• Provides for establishment of minimum quality specifications, mode, materials and apparatus used in the country	• The Project shall comply with this act in packaging and measurement.
23	The Weights and Measures Act, Chapter 513	• Regulation under which storage tanks and dispensing equipment for sale of petroleum products are calibrated and regulated for accuracy	• LPG Storage tanks
24	The Traffic Act, Cap 403	• Relating to traffic on all public roads. Key provisions include registration and licensing of vehicles; driving licenses; driving and other offences relating to the use of vehicles on roads; regulation of traffic; accidents; offences by drivers other than motor vehicles and other road users. It prohibits encroachment on and damage to roads including land reserved for roads	• Many types of equipment and fuel shall be transported through the roads to the proposed site. Their registration and licensing will be required to follow the stipulated road regulations.
25	Public Roads and Roads of Access Act Cap. 399	• Ensure non-interference with public roads when constructing the terminal and the pipeline infrastructure. Provision of safe passage	• The Proponent to apply proposed mitigation measures in the ESIA Study Report to minimize impact and safeguard against explosion and fire.
26	The KMA Act	• The KMA Act domesticates the ability of the Kenya government to implement IMO Conventions related to shipping and maritime safety that it has ratified	• KMA is the designated national competent oil spill authority responsible for the development and provision of guidelines for the management of oil spills in the maritime environment. Under Sec. 5 (i) of the Act, KMA is required to enforce safety of shipping, including compliance with construction regulations, maintenance of safety standards and safety navigation rules.
27	The BMU Regulations, 2007	The BMU regulations were gazette through a legislative supplement No. 67 of 2007 to serve the following purposes:	• KMA is the designated national competent oil spill authority responsible for the development and provision of guidelines

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
		• Strengthen the management of the fish-landing stations, fishery resources and aquatic environment • Support the sustainable development of the fisheries sector • Assist in alleviating poverty and improving fisher community livelihoods • Mainstream gender issues in the management of fisheries resources • Ensure the achievement of quality standards with regard to fish and fishery products • Build local fisher community capacities to effectively engage with other stakeholders in management of fisheries resources • Mitigate conflicts in resource use in the fisheries sector	for the management of oil spills in the maritime environment. Under Sec. 5 (i) of the Act, KMA is required to enforce safety of shipping, including compliance with construction regulations, maintenance of safety standards and safety navigation rules. • All ships operating at the jetty shall be registered and licensed by KMA • BMUs in the area are key stakeholders of the project as they crisscross the area to access fishing grounds and land their catch. Decisions taken by the proponent should be undertaken in consultation with the fishermen
28	Employment Act No 11 of 2007	• Prohibition Against Forced Labor • Prohibition of child Labor	• Project proponent undertakes to abide by the requirements of the Act
29	KS 1938:2006	• Code of practice for by KEBS for handling, storage and distribution of LPG in domestic, commercial and industrial installations • Part 3: LPG installation involving storage vessels of individual water storage capacity exceeding 500L.	The Standard provides guidelines for: • Design pressure; • Fire protection; • Construction and initial (production) testing of LPG vessel; • Filling ratio and volumes of storage vessel; • Storage vessel location; • Installation of LPG vessels; • Installation of vaporizers; • Periodic inspection and retesting; • Electrical equipment and other sources of ignition; • Filling point for bulk storage vessel; • Filling of portable containers; • Container storage areas; and • Filling shed for portable containers.

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
World Bank Safeguard Policies			
1.	Environmental Assessment: OP/BP 4.01	• Used to identify, avoid, and mitigate the potential negative environmental impacts associated with a project	• Project has potential to impact the environment through pollution of soil and water and social impact to local community
2.	Involuntary Resettlement: OP/BP 4.12	• The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts	• Involuntary Resettlement is not triggered since the proposed project will not result into displacement.
IFC Performance Standards			
1.	Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts	• Establishes the importance of integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects.	• The nature of the project and the existing local regulation since the proposed project falls in the category listed in the Second Schedule of the Environmental Management and Co-ordination Act (EMCA), 1999 Amended 2015 under Management of hydrocarbons including—the storage of natural gas and combustible or explosive fuels.
2.	Performance Standard 2: Labour and Working Conditions	• Recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers as guided by the ILO Conventions.	• The proposed project is expected to create job opportunities for both skilled and unskilled Labor during construction and operation phases.
3.	Performance Standard 3: Resource Efficiency and Pollution Prevention	• Recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels.	• The proposed project is anticipated to generate negative impacts during its life cycle, however the significance of the impacts will range between minor to moderate before mitigation and will further reduce after implementation of mitigation measures.
4.	Performance Standard 4: Community Health, Safety, and Security	• Recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts.	• The proposed project pauses great public concern especially in the event of a major disaster such as explosions and fire outbreaks. Liquefied Petroleum Gas is a highly flammable product and can be detrimental to the public safety if measures are not put in place.

No	Legislation/Regulation/ Standard	Provisions	Relevance to the Project/ License or Permit Required/ or Activity requiring regulation
5.	Performance Standard 5: Land Acquisition and Involuntary Resettlement	• Recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land.	• The proposed project will not create displacement since the project site is already developed with similar facility.
6.	Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	• Recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.	• The existence of plant biodiversity in the Project area even though according to the IUCN plants Redlist (2014), no threatened species were recorded.
7.	Performance Standard 7: Indigenous Peoples	• Recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population.	• There are no Indigenous persons affected by the proposed project and hence this performance standard will not be triggered
8.	Performance Standard 8: Cultural Heritage	• Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that Proponents protect cultural heritage in the course of their project activities.	• There is no protected cultural heritage within the project area hence this performance standard will not be triggered.

4.4 Institutional Framework

Table 12: Relevant Institutional arrangements

Institution	Role in proposed project	Project cycle stage required
NEMA	• Issuance of EIA license • Inspections and monitoring compliance with license and approvals conditions • Protect public interests	Throughout the project cycle.
Directorate of Occupational Health and Safety	• Registration of the facility as a work place • Enforce compliance with OSHA No. 15 of 2007 • Registration of the construction site as a work place • Enforcing compliance with Occupational Health and Safety Regulations at the construction site	Throughout the project cycle
Kenya Maritime Authority (KMA)	• Development and provision of guidelines for the management of oil spills in the maritime environment	Throughout the project cycle
Ministry of Energy and Petroleum (MOE&P)	• MOE&P is in charge of formulating and implementing policies so as to create an enabling environment for efficient operation and growth of the sector. It sets the strategic direction for the growth of the sector and provides a long-term vision for all sector players	Throughout the project cycle
The Petroleum Institute of East Africa (PIEA)	• The Petroleum Institute of East Africa (PIEA) is the professional body for the oil and gas industry in the East Africa region. The mission of the PIEA is to provide a forum for expertise and excellence in the oil industry, promote professionalism and free enterprise in the petroleum business supported by the highest operations and business standards.	Throughout the project cycle
Energy & Petroleum Regulatory Authority (EPRA)	The EPRA is established under the Energy Act, 2019 with the following objectives and functions: • Regulate the electrical energy, petroleum and related products, renewable energy and other forms of energy. • Protect the interests of consumer, investor and other stakeholder interests. • Maintain a list of accredited energy auditors as may be prescribed. • Monitor, ensure implementation of, and the observance of the principles of fair competition in the energy sector, in coordination with other statutory authorities.	Throughout the project cycle

5 Analysis of Project Alternatives

During the course of formulating the proposed project, several project alternatives were considered to ensure that the best option of project development was adopted. The consideration of alternatives is one of the more proactive approaches of environmental assessment. This process serves to enhance the project design through an examination of other feasible options instead of only focusing on the more defensive task of reducing adverse impacts of a single design. Project alternatives have been evaluated by the ESIA team to achieve project objectives while having least adverse environmental impacts. The alternatives assessed during this process include;

5.1 Storage Type alternatives

During the initial conceptualization stages of the project, multiple storage mediums were considered based on several factors such as spacial constraints, environmental factors and economic benefits. The first step in selecting the storage type was to begin between determining which of the two below options would be utilized.

i. Refrigerated Storage Tanks or
ii. Pressurized Storage Tanks

As per applicable standards and codes, Refrigerated tanks are ideal for large capacities of approximately 50,000MT or more. Pressurized storage tanks are applicable for capacities less than 50,000MT. Following the selection of the pressurized tanks, the next stage was to determine the ideal storage type within the proposed project site. Due to several factors such as large communities based in close proximity i.e. within 1km, to the site, as well as available space considerations, the following storage types were considered:

- Caverns;
- Spherical Tanks;
- Aboveground Tank; and
- Mounded Bullets.

The cavern type of storage was not considered in great detail due to the required capacity not meeting the minimum threshold to utilise this form of storage. As for aboveground bullets, the site limitations in terms of space and excessive requirement of firefighting capacity mean that this too was eliminated before further analysis. The assessment was then left between LPG spherical tanks and mounded vessels. Below is a comparison of the two, discussing both the benefits and shortcomings of either form of storage.

Figure 20: Image showing LPG Storage Types

(a)Spheres, (b) LPG aboveground bullets, (c)Model showing LPG cavern and a (d) Model showing LPG mounded vessels complete with piping network

5.1.1 LPG Spheres or LPG Mounded Bullets

The choice between a bullet and a sphere is a matter of economics and project logistics. So one is better than the other only in the matter of which has a cheaper overall installed cost and less of an environmental impact on the community. The sphere of course uses less material than a bullet for the same amount of liquid storage but is somewhat more difficult to fabricate. The diameter for shipping of a storage tank is in the order of 10 to 14 feet depending on the method of transport. This would limit a sphere's storage capacity if it is shop fabricated. For a 10 foot diameter tank, you can get 10 or more times the storage in a bullet than a sphere. For this reason, you usually only see spheres used for very large volumes (maybe in the order of 1,500m^3 or more) because they must be field fabricated to compete with the bullet in cost. For smaller storage capacities, the bullets are preferred because they can be shop fabricated and more easily transported. Although the storage capacity here is greater than 1500m^3, which allows for a further comparison, the effects on the environment and community should also be taken into consideration.

5.1.2 Advantages of LPG Mounded Bullets over LPG Spheres

a. Lower initial investment and financial risk in case of LPG mounded vessels/storage tanks as compared to sphere of similar or larger volume;
b. LPG sphere of similar volume requires more construction time as compared to LPG mounded vessels;
c. LPG mounded vessels take lesser implementation time making the project more economical, easier to install and operate thus making turnaround time from designs to operation shorter than for spheres;
d. LPG mounded vessels are much safer since their weight is distributed evenly over a larger area thus reducing chances of collapse as compared to spheres. This rings true for areas prone to earth quakes, cyclones and Tsunami;
e. Furthermore, LPG mounded vessels an added advantage that the load is distributed over a larger area thus the problem of uneven settlement /collapse is diminished;
f. In case of installations with mounded LPG vessels, if there is any problem/maintenance/repair/ breakdown of any one tank, then the tank can be isolated via shutting of relevant valves, allowing for operation to continue unimpeded, albeit with lesser capacity. Product can also be easily transferred from one tank to another thus increasing safety of the plant. In the case of spheres if there is any problem with the sphere or its valves or pipeline, then the entire plant comes to a standstill; and
g. Though there is a common notion that for the same volume a sphere has the least surface area and least thickness and hence lesser weight and less cost, it has been established that the weight saved whilst construction spheres is negated due to the wastage in the development of various sections (petals and crown) thus leaving little or no benefit of the weight saved.

5.2 LPG Storage Technology alternatives

Project has advocated the procurement of environment friendly LPG through import, in order to meet the primary and secondary demands of energy sector. Currently, the majority in the rural regions prefers inefficient wood fuel and charcoal for supply of heat energy. The technology alternatives for importation, refining, storage, handling and transportation of LPG are limited and have been greatly reduced after the only refinery in the region, Kenya Petroleum Refineries Limited (KPRL), ceased operations a couple of years ago. This therefore means that the only source of supply for LPG in the region is through imports. This is widely viewed as the most cost effective option.

5.3 Alternative to Additional Import Pipeline Design

Alternative designs for various components of the pipeline and other infrastructure components have been subjected to cost benefit analysis to select the best option considering safety, environment and cost. The EPC contractor will incorporate the LPG line with appropriate modifications. This will include enhanced monitoring, leak detection, fire suppression and firefighting. Enhanced evacuation mechanism will also be included in the safety procedures to be put in place to address occurrence of disaster.

5.4 Alternative to the proposed location of the Additional LPG Import Pipeline

The proposed additional LPG import pipeline has no alternative location. Alternative locations if any would have involved relocating people. The proposed Additional LPG Import Pipeline fits into this alternative since it being accommodated in the servitudes of the existing design with minimum alterations.

5.5 The "No Action" Alternative

Under the 'No Action" Alternative, the proposed project will not proceed.

The no action alternative would mean that: Limitations of product transfer to the newly built storage will persist since there will be

- No alternative LPG import pipeline.
- No additional storage facility
- No cost saving on demurrage charges due to lack of efficient LPG offloading services with no downtime.
- No creation of employment during design and construction stages
- No additional revenue to the government agencies tasked with necessary licensing
- Less LPG product to the market.

From the analysis above, it becomes apparent that the No Project Alternative is not a viable alternative to AGOL, the investors and the community at large.

6 Public Participation and Consultation

6.1 Purpose of Consultations with Community/Key Stakeholders

The main purpose of carrying out consultations with community and key stakeholders was to obtain views and concerns of the project area community and other interested parties regarding the project so as to incorporate their contribution into the project development to safeguard the environment and the interest of key stakeholders particularly the local community and project area leadership and agencies directly or indirectly affected by the project.

Stakeholder consultation was conducted to take the opportunity to elaborate the essence of the project, to inform the stakeholders of any potential negative impacts and elaborate on the positive aspects so that informed decision are made by the stakeholders.

The public consultation meeting was aimed at achieving the following specific objectives:

- Collection of additional baseline data/ information on the project area community;
- Conduct further stakeholder and community consultations and sensitization; and
- Provide the project area community and stakeholders with an opportunity to directly interact with the project developer through the ESIA Consultants and ask questions, raise issues and concerns pertaining to the proposed project and contribute to the identification of project impacts, mitigation measures and project alternatives.

6.2 Approach to Consultations with Community/Key Stakeholders

The Consultant visited key stakeholders in their offices and discussed the proposed project and administered questionnaires with them. For the community stakeholders, the Local Area Chief helped organize for a public meetings (Barazas) where the community was informed of the project and also sensitized on the benefits and dangers of LPG.

The ESIA employed three main methods of consultations to get the data presented in this report. These are:

- Meetings and discussions with Key Stakeholders;
- Questionnaire administration and interviews; and
- Convening of Public Consultation Meetings (PCMs) within the project area.

Key informants included local leaders and representatives from various Government Departments Private establishments.

Upon the conclusion of the meetings they filled questionnaires airing their views.

6.2.1 Consultation with Key Stakeholders

Consultations with the Key stakeholders enabled the consultant team to understand the project area well, especially regarding the magnitude of the project. The EIA team consulted the following key stakeholders or received no objection letters regarding components of the proposed project:

- NEMA Mombasa County;
- Kenya Navy;
- Kenya Ports Authority;
- Kenya Airports Authority (Moi International Airport, Mombasa);
- Oil Spill Mutual Aid Group Society (OSMAG)
- Energy & Petroleum Regulatory Authority (formerly ERC);
- Kenya Forest Service;
- Mombasa County Government;
- Jomvu Sub County Administration.

The team undertakes to make continuous consultation throughout the ESIA process.

6.2.2 Public Consultation Meetings

A total of 2 Public Consultation Meetings were convened within the villages where the project area communities reside namely Ufuta Village and KCC Village on 24th and 25th June 2019 respectively.

Minutes of the above meetings were recorded and are attached as Annex 4 while the filled stakeholder questionnaires have been given as Annex 5 of this report.

Figure 21: Photos of PCM at KCC Village at a local church

Figure 22: Photos of PCM at Ufuta Village

6.2.3 Analysis of Community/Key Stakeholder Feedback

Acceptance of the Project

Generally, the project is accepted by all those attending the meeting since there is potential for job opportunities and the lowering of the price of gas. However, they called upon the proponent to ensure that employment opportunities are given first to youths from the community. They also urged the proponent to involve the community in Corporate Social Responsibilities such as building hospitals/clinics, sponsoring needy bright students from the area etc. Another aspect was to ensure safety measures are top notch and have in place a disaster response plan.

The responses for concerns raised by the respondents during preparation of ESIA Study report are provided in Table 13 below.

Table 13: Summary of Comments raised by Stakeholders

Names	Organization/ Village	Positive Impacts	Negative Impacts	Recommendations
Agnes Wanjiru	Chai Trading	• Employment of locals • Improved Infrastructure • Carbon credit • Economic Growth in the area	• Environment degradation • Evacuation of people • Wrong perception of locals to the plant if no CSR	• Employment • Public participation • Compensation in case of Evacuation • Involve NEMA
P.Kiarie	Miritini CDF Health Centre	• Employment • Availability of gas	• Fire outbreaks	• Prepare to control fire outbreaks
Assistant County Commissioner	Jomvu	• Employment	• Explosions • Ocean interference	• Community Sensitization • Regular check on the lines • Replenish Disturbance caused to ocean
Mercy Mbogori	Chai Trading Ltd	• Infrastructure • Employment Opportunities	• Traffic jam • Soil & water Contamination • Fire hazard	• Enhanced safety measures • Voluminous transport
Arthur Pejwa	New KCC Ltd	• Clean gas • Cheaper to electric power	• Air pollution • Affect eco marine system	• Provide adequate water supply • Install firefighting equipment
Regina Wanjala	KCC Village	• Job creation	• Cracks of house • Diseases	• Carry out proper piping of the pipeline
Susan Chao	Ufuta Village	• Employment • Knowledge • experience	• Air pollution	• Avoid interfering with the community
Mishi Munga	KCC Village	• None	• None	• None
Ali Nassib Mwinyifaki	KCC Village	• Employment • Revenue • Improvement of gas	• Unemployment • unsafe	• Increase height of exhaust pipes
Daniel Omondi	Ufuta Village	• Compensation • Sponsorships	• Destruction of houses and plants	• Compensation of inhabitants

Names	Organization/ Village	Positive Impacts	Negative Impacts	Recommendations
		• Employment		
Benjamin Tsawa	Alpha school	• Employment • Education improvement • Improved business	• Spread of HIV/AIDS • Air pollution	• Proper disposal of gas waste
Joseph Nzaro	Ufuta Village	• Job creation • Positive behavior	• Corruption • Health issues	• Provide aid from management
Ali Mohammed	KCC Village	• Employment	• unemployment	• Increase the height of emission from exhaust pipes
Peter Muteshi	Pastor KCC Village	• Job opportunity • Life improvement	• Lack of safety • immigration	• Community awareness
Ali Nassib Mwinyifaki	KCC Village	• Employment • Revenue • Improvement of gas	• Unemployment • unsafety	• Increase the height of emission from exhaust pipes
Vincent Otieno	New KCC Ltd	• Clean energy	• Frequent fire outbreaks • Air pollution	• Install fire alarms, leak detectors and adequate fire lighting equipment
Mkaua Wabungo	Miritini Primary School	• Employment	• Noise pollution • Healthy issues related to the gases emission • Dangerous to animals and plants	• Minimize Infections • Minimize dust from the structure
Col. Wafula	Kenya Navy	• Employment • Government revenue	• Interfere with Marine ecosystem	• Proactive fire prevention risk • Prevent vessel collision risks
Eng. Anthony Okanga	OSMAG	• Employment • Increased Income • Increased LPG storage capacity	• Risk of fire • Influx of alien population • Alien culture	• Employ high standards during construction • Source labour locally; • Increase CSR and build local capacity in the industry
Owen Waithaka	KAA	• Employment • Cheaper LPG due to increased storage	• Risk of fire which may affect the Airport	• Enhance fire detection system and install firefighting equipment • Create awareness and work together with the MIA fire team

Names	Organization/ Village	Positive Impacts	Negative Impacts	Recommendations
Eng. Masha	KPA	•	•	•
Chrispine Ochieng	Kenya Forest Service	•	•	•

7 Environmental and Social Impact Assessment

Several environmental and social impacts (positive and negative) associated with the proposed project were identified through the use of experts' judgment and consultation methods. The following section highlights the impacts anticipated throughout the lifecycle of the proposed project. The associated impact assessment tables for each impact will be categorized according to project phases, prior to and post mitigation. Effects of activities are categorized as negative impact and or positive impact.

7.1 Assessment of impacts

Section **one** of this report presents the methodology used in assessing the potential impacts of the proposed project. The key impacts identified for the proposed project are highlighted according to the relevant project phases. The Consultant utilized precautionary principles to establish the significance of impacts and their management and mitigation.

7.2 Potential impacts of the proposed project

The proposed project is anticipated to generate the following impacts, however the significance of the impacts will range between minor to moderate before mitigation and will further reduce after implementation of mitigation measures:

- Soil Impacts
- Air quality Impacts
- Noise Impacts
- Impacts of waste generation
- Impacts on water resources
- Impacts on Biodiversity
- Socioeconomic impacts
- Health and Safety Impacts

7.2.1 Impacts on Soil

The proposed development is anticipated to have minimal impact on soil. The anticipated impacts are soil contamination by oil spills; and disturbance of project site top soil and geology during excavation activities leading to soil erosion. Construction vehicles and equipment are likely to release fugitive spills to the soil. Depending on the size and source of the spill, liquid and gaseous phase petroleum hydrocarbons may remain mobile for long periods of time, and can potentially pollute groundwater. Exposed soil during construction and decommissioning phases are likely to be exposed to agents of erosions mainly water and wind.

During operation phase impact on soil is not anticipated because of the presence of the concrete paved surface over the LPG storage which will protect soil from agents of erosion as well prevent any potential contaminant from reaching the subsurface layers, and is thus not assessed.

Table 14 and Table 15 below present summary of characteristics and significance respectively of impacts on soil during the project cycle.

Table 14: Summary of soil quality impacts

Project Phase	Impact	Significance
Construction Phase	Soil contamination; Soil erosion	minor negative
Operation Phase	Not anticipated	n/a
Decommissioning Phase	Soil contamination and soil erosion	Minor negative

Table 15: Summary of Soil Impact significance

Nature	Construction and Decommissioning activities will result in negative soil quality impact
Impact Magnitude –Low	**Extent**: The extent of the impact would be site specific as it is not likely to extend beyond the site boundary, **Duration**: the impact will be short-term during construction and decommissioning phases. **Intensity**: The intensity of the impact will be low
Likelihood	There is likelihood that the impact will occur

Mitigation Measures

The mitigation measures proposed for managing soil resources are:

- Minimise the areas to be excavated;
- Ensuring that vehicles/equipment used during construction and decommissioning phases are serviced regularly;
- Use excavated soils for backfilling while carry away excess soil for appropriate disposal.
- Carry out slope protection along the steep slopes to rehabilitate areas where excavation has taken place to prevent future collapse and erosion;
- Re-vegetating disturbed areas once construction and demolition works are completed during construction and decommissioning phases respectively.

7.2.2 Air quality

The existing air quality at the Project Site is influenced by industrial and traffic sources of air pollutants within the vicinity. The activities that influence air quality in the area include:

- Vehicle movement at the Plant and nearby roads; and
- Current emissions from operations of current facility and the neighboring industries

The potential sources of emissions from the project during construction stage will include exhaust emissions from vehicles and equipment; odour from paint work; dust released from construction materials and excavated grounds.

During operation phase minimal exhaust emissions will be generated by trucks coming for bulk LPG from the facility and other company vehicles.

During decommissioning phase will be exhaust emissions from vehicles and equipment used in demolition work and dust and odour from demolished materials/waste.

The above sources are anticipated to temporarily increase the local concentrations of particulate matter and exhaust gases but are likely to be short-term and localised. Dust generated during construction will be a health hazard to workers and project area community and could lead to chest problems, coughs, flu and have serious effects on asthmatic and sinus sufferers. Table 16 below present significance of air quality impacts during construction and decommissioning and operational phases, respectively of the project.

Table 16: Significance of Air Quality Impacts

Nature	Construction, Operation and Decommissioning activities will result in negative air quality impact
Impact Magnitude – Low	**Extent:** The extent of the impact would be local as it is likely to extend beyond the site boundary, but not beyond a 1 km radius from the site. **Duration:** the impact will be short-term during construction and decommissioning phases but long term operation phase as it will last life time of the Facility which is anticipated to be approximately 50 years. Intensity: The intensity of the impact will be low
Likelihood	There is likelihood that the impact will occur

Mitigation Measures

The mitigation measures proposed for managing air quality are as follows:

- Relevant legislative and Kenya Standard design requirements will be adhered to where appropriate;
- Vehicles and machinery will be regularly maintained;
- The speed of construction vehicles are to be controlled to avoid excess dust and smoke generation;
- Idling of vehicles and machinery is to be prohibited to avoid excess smoke generation;
- Water is to be sprayed during the construction phase on areas under excavation and dusty roads to reduce dust emission;
- Install standard leak detectors for hazardous area installations; and
- Any detected leaks will be repaired as a high priority.

7.2.3 Noise and vibration

The existing background noise environment at the Facility is typical of a commercial set up with moderately low levels of background noise dominated by noise from operational areas of the pump house, compressor shed and the standby generator areas where elevated noise levels were recorded.

Noise generated during the construction stage will be largely associated with heavy vehicles delivering and removing construction materials, and the operation of vehicles and equipment on-site. This will result in intermittent short-duration increases in noise levels within the immediate vicinity of the Facility during the daytime.

Table 17 below presents impact of noise during construction phase.

Table 17: Noise Impacts during construction phase

Nature	**Construction activities will result in negative noise impact**
Impact Magnitude – Low	**Extent:** The extent of the impact would be local as it would likely extent beyond the site boundary, but not beyond a 1 km radius from the site. **Duration:** the impact will be short-term as it will only last the duration of mounded tanks installation and removal respectively. **Intensity:** The intensity of the impact will be low since ambient noise level are fairly high
Likelihood	There is likelihood that the impact will occur

Operation phase

Noise during operational phase is expected to come from vehicle coming to load LPG from the facility and is expected to be low and therefore not considered further in this section.

Decommissioning phase

Decommissioning phase of the Project will be mainly demolition of the facility and offsite disposal of removed materials. Noise generated during the decommissioning stage will be largely associated with the transit of heavy vehicles carting away materials, and the operation of vehicles and equipment on-site. As is the case with the construction phase, it will result in intermittent short-duration increases in noise levels within the immediate vicinity of the Site during the daytime.

Mitigation Measures

The following hierarchy of noise management will be applied to the extent that it is reasonable to do so:

Avoid (e.g. locating an activity in an area that is not near a sensitive receptor).Minimise, in the following order of preference:

- Instruct machinery operators to avoid raving of engines;
- Carry out site preparation activities during the day;
- Use best available technology (e.g. noise abatement barriers or enclosures) and
- Post signs warning about high noise levels and the requirement to wear hearing protection.

AGOL and the Contractor will address noise nuisance, in the first instance, through complaints based process. Management and mitigation measures will be adopted to avoid environmental nuisance at any sensitive place. The mitigation measures proposed for managing acoustic quality are:

- Construction activities near sensitive places shall be restricted to normal working hours (typically 7.00 am to 6:00 pm, 7 days a week) unless otherwise agreed with the potentially affected stakeholder(s);
- Relevant legislative and Kenya Standard design requirements will be adhered to where appropriate;
- Adequate community notice of any scheduled, atypical noise events will be provided; and
- Equipment will be fitted with noise control devices where possible and appropriate.

7.2.4 Impacts of waste generation

A review of the construction methodology and LPG facilities was carried out to identify the wastes likely to arise from the construction of the proposed project and potential environmental impacts associated with the handling and disposal of the identified wastes. Waste streams anticipated during construction phase will include: excavation spoil, general waste; construction waste and sewage and wastewater.

Waste anticipated during operation phase will include redundant pipes replaced during maintenance; empty paint containers and waste packaging from maintenance and repair material. And during decommissioning phase, the anticipated waste will included redundant equipment, decommissioned LPG tanks and piping, concrete boulders, and scrap metals. Table 18 and Table 19 below present characteristics and significance, respectively, of impact of waste generation during the project phases.

Table 18: Waste Impact Characteristics

Project Phase	Project Aspect/activity	Impact type	Stakeholder /Receptor Affected
Construction phase	• Waste generated from construction activities: domestic waste from construction works; and excavation waste	negative	Surrounding areas
Operation phase	• domestic waste from operation personnel; • waste generated from maintenance works such as redundant equipment, metal parts • waste water from cleaning operations	negative	negative
Decommissioning phase	• Waste generated from demolition activities:	negative	Surrounding areas

Table 19: Waste Generation Impacts

Nature	Waste generated during construction, operation and decommissioning of the proposed development would result in a negative direct impacts if not managed properly.
Impact Magnitude – Low	**Extent:** The extent of the impact is site specific. **Duration:** The duration would be short-term for construction and decommissioning phases waste as the impacts will not persist after construction and decommissioning phases respectively. However, impact of waste generated during operation will be long term- lasting the life of the project. **Intensity:** the intensity can be considered low as the work will be temporary. Similarly intensity of impact of waste generated during operation is low as they are not anticipated to occur on a daily basis or frequently
Likelihood	There is a definite likelihood of waste generation throughout project cycle.
Impact significance	Low

Mitigation Measures

The waste management will be based on the objects and principle of waste and resource management hierarchy, that is that is, avoidance, re-use, recycling and disposal of waste. The mitigation measures proposed for managing waste generated from the project are:

- Develop strategies (waste management plan) for management of specific waste streams prior to construction phase.
- Provision of toilet facilities for use by the contractor staff and other workers during construction and operation phases respectively;
- Provision of solid waste collection bins to all the operation areas; the waste is segregated and collected for disposal at a designated site approved by Mombasa County Government and NEMA;
- Sensitization of the contractor staff and other workers on the appropriate usage of the bins including a programme for regular disposal;
- Stockpile and salvage reusable and recyclable wastes, such as timber skids, fibre/nylon rope spacers, pallets, drums and scrap metals.
- Store hazardous wastes such as used oils and other chemicals in bunded areas away from watercourses.
- Collect and remove (via NEMA approved waste handler) waste from site for recycling, reuse or disposal at facility licensed to accept such wastes.
- All personnel will be instructed in project waste management practices as a component of the environmental induction process.
- All litter and general waste disposal will be at a local municipal landfill utilising an approved waste contractor.
- Records of all controlled wastes stored, and removed from site will be maintained.
- Safety and response training will be provided for all personnel.
- Materials and equipment for responding to hazardous spill incidents will be provided and maintained.

Residual Impacts

If wastes that can be reused or recycled are recovered, if all those that are supposed to be disposed are disposed of correctly and if the quantity of the remaining wastes that need to be deposited at the landfill/dumpsites can be minimised, the residual impact associated with wastes generated the project should be of minor significance and of a short-term duration. The Proponent also undertakes to comply with IFC Performance standard 3 of Resource efficiently and pollution prevention throughout the project's life cycle. Project has advocated the procurement of environment friendly LPG through import and storage in mounded LPG Bullets in order to meet the primary and secondary demands of energy sector. The reliability and adequacy of the supply of LPG shall guarantee sustainable development and reduced reliance on wood fuel attributed to increased indoor air pollution causing Upper Respiratory Tract Infections (URTI) thus protecting the environment from overexploitation and degradation.

7.2.5 Water resources

The impact on water resources during project cycle are likely to arise through the following ways: use of water during construction and operation; and contamination of water during the entire project cycle. Water will be required during construction phase to provide:

drinking water for construction staff; concrete batching and dust suppression. Contamination of water during construction project phase may be caused by:

- Oils and grease from vehicles and equipment/machines used at the construction sites;
- Left over materials and waste containers that may have been holding classified materials for construction;
- Petroleum products and other chemicals released by trucks; and
- Sanitary and domestic waste from the construction camp.

During operation phase, water will be required for firefighting, welfare and hygiene and cleaning. Water contamination during this phase could arise from waste storage and handling and releases occasioned by abnormal events such as fire. There will be a potential for oil and fuel spills during the operations of the pipeline. Fuel handling equipment will be required for refuelling of boats visiting the jetty and inspecting the pipeline. Oil and fuel spills have a negative impact on marine ecosystems for example oil spills cause hypothermia, poisoning and internal damage, increased predation, bio-accumulation in food chains and fouling of habitats. Outboard engines mounted on boats have long been associated with polluting of waterways through passive discharge of fuel and lubricants.

During decommissioning of the facility the decommissioning of vessels and associated pipework; and removal of piles and foundation could cause contamination of water resources.

Table 20 and Table 21 below present characteristics and significance, respectively of impact of the proposed project on water resources.

Table 20: Characteristics of Impact on water resources

Project Phase	Project Aspect/activity	Impact type	Stakeholder /Receptor Affected
Construction phase	• Water usage – drinking, concrete batching and dust suppression • Water contamination	negative	Local water resources
Operation phase	• Water usage – firefighting, drinking and cleaning • Refuelling of boats visiting the jetty	negative	Local water resources
Decommissioning phase	• Contamination of water by demolition waste	negative	Local water resources

Table 21: Significance of Impacts on Water Resources

Nature	Some activities during construction and decommissioning phases would result in contamination of water resource.
Impact Magnitude – Low	**Extent:** The extent of the impact is site specific. **Duration:** The duration would be short-term for construction and decommissioning phases and long term for operation phase. **Intensity:** the intensity can be considered low as the work will be temporary.
Likelihood	There is a definite likelihood of impact on water resources.
Impact significance	Low

Mitigation Measures

- Develop strategies for management of water resources;
- Regular checking and maintenance of all plant and machinery to minimize the risk of fuel or lubricant leakages;
- Storing hydrocarbons, fuels, lubricants and chemicals to be used in bunded and lockable oil storage tanks, with hoses and gauges kept within the bund;
- Preventing wet concrete and cement from entering watercourse;
- Stockpiles to be kept away from watercourses;
- Prepare a spill contingency response plan and procure appropriate equipment for oil and fuel spill management;
- Develop a water quality monitoring programme for the channel in collaboration with relevant lead agencies; and
- Procure an oil spill response kit and build capacity of staff to respond effectively to potential oil spills;

Residual Impacts

With the application of the mitigation measures described previously, *No significant impacts* are likely to occur during construction, operation and decommissioning phases.

7.2.6 Impacts on Biodiversity

The construction of the pipeline and associated dredging works will result in albeit to a small extend the loss of the sub tidal seabed and the mangrove forest that provide habitats for organisms such as crabs, brittle stars, worms, starfish, sea urchins, etc. Preparatory work for excavations for the placement of the pipeline from the jetty will result in clearance of mangrove patch thus impacting negatively on the integrity of ecosystems that serve as critical habitats to a wide range of marine organisms. This will in turn affect marine fauna such as fish and crustaceans.

Temporal deterioration of water quality due to the increase of turbidity and suspended solids related to dredging activities can negatively affect the functioning of light-dependent organisms such as phytoplankton, coral polyps and visual predators, e.g. fish.

Table 22 and Table 23 below present characteristics and significance, respectively of impact of the proposed project on biodiversity.

Table 22: Characteristics of Impact on biodiversity

Project Phase	Project Aspect/activity	Impact type	Stakeholder /Receptor Affected
Construction phase	• Cutting down of mangrove vegetation • Dredging activities	negative	Biodiversity
Operation phase	• Introduction of invasive species	negative	Biodiversity
Decommissioning phase	• Trampling of vegetation	negative	Biodiversity

Table 23: Significance of Impacts on Biodiversity

Nature	Some activities during construction and decommissioning phases would result in loss of biodiversity.

Impact Magnitude – Low	**Extent:** The extent of the impact is site specific. **Duration:** The duration would be long-term for construction and decommissioning phases. **Intensity:** the intensity can be considered low as no threatened species were recorded.
Likelihood	There is a definite likelihood of impact on biodiversity.
Impact significance	Low

Mitigation Measures

- Construction work will be short term and localized to a particular area;
- Excavation for placement of pipeline should be undertaken during low tide period;
- Use of efficient excavation machinery and best technology so as to facilitate uptake of excavated soil materials and disposal in less sensitive areas of the sea;
- Ensure that site machinery have no leakage of oil or other lubricants. Oil change and machinery servicing shall be undertaken onshore; and
- Invasive species monitoring and control should be done during and immediately after the construction phase to keep the existing population in check. Plants should be controlled before they reach maturity and gain more germplasm for future proliferation.

Residual Impacts

With the application of the mitigation measures described previously, *No significant impacts* are likely to occur during construction, operation and decommissioning phases.

Compliance with IFC Performance standard 6: Biodiversity conservation and sustainable management of living natural resources

This performance standard shall be triggered since there exist biodiversity in the Project including the mangrove forest strip in the project area which according to the IUCN plants Redlist (2014) found 11 out of 70 mangrove species threatened with extinction. Mangroves form one of the most important tropical habitats that support many species, and their loss can affect marine and terrestrial biodiversity much more widely. The contractor is to be informed to carry out a survey of the channel to identify as far as practical areas that have low densities of mangrove for the placement of the pipeline. As part of the site restoration after construction activities, there is going to be concerted effort to plant mangrove trees to enhance the project area biodiversity. Local community will also be sensitized on the importance of environmental protection and conservation of the natural vegetation.

Moreover, the proposed project aims to increase the supply capacity of LPG to industrial, commercial and residential customers throughout Kenya and East Africa thereby promoting reliance on LPG as opposed to wood fuel and charcoal in order to enhance the biodiversity and environmental conservation.

7.2.7 Health and safety

Occupational health and safety

The development of the proposed facilities involves a number of activities that pose potential health and safety risks to the workers. The workers are potentially exposed to

risks as a result of working a height, operating tools and equipment and exposure to dust. During the construction phase, the potential H&S risks include:

- Exposure to excavation dust;
- Hazards of falling objects; and
- Occupational hazards when working at height.

The potential occupational health and safety impacts anticipated for operation phase include: injuries to workers from preventive and corrective maintenance especially of electrical equipment, work at heights and workers with boats using the channel especially at night.

During decommissioning phase, the potential H&S risks include hazards of falling objects; work at height hazards, injuries from operating tools and equipment.

Table 24 and Table 25 below present characteristics and significance, respectively of impact of the proposed project on Health and Safety.

Table 24: Characteristics of Impact on Health and Safety

Project Phase	Project Aspect/activity	Impact type	Stakeholder /Receptor Affected
Construction phase	• Construction activities, operation of construction equipment and tools.	negative	Construction workers
Operation phase	• Undertaking preventive and corrective maintenance.	negative	Operation phase personnel; contractors hired to undertake maintenance
Decommissioning phase	• Demolition activities, operation of demolition equipment and tools	negative	Local water resources

Table 25: Significance of Impacts on Health and Safety

Nature	Some activities during construction, operation and decommissioning phases would result in health and safety impacts.
Impact Magnitude – Low	**Extent:** The impacts will affecting the personnel involved in the respective phases of the project **Duration:** The duration would be short-term for construction and decommissioning phases and long term during operational phase. **Intensity:** the intensity can be considered low.
Likelihood	There is a definite likelihood of impact on health and safety.
Impact significance	Low

Mitigation Measures

In order to mitigate health and safety impacts associated with the project, the Proponent will develop and implement occupational health and safety plan. Mitigation measures shall include the following:

- Appropriate lighting shall be deployed at night marking the boundaries of the construction area to avoid accidents;
- The contractor and proponent will comply with the Occupational Safety and Health Act No. 15 of 2007 i.e. by insuring the construction workforce and providing training and PPE;
- The pipeline ROW being a wetland, the proponent will have to comply with the provisions of Legal Notice No.19 of 2009 (Rev. 2017) and other legislative measures imposed by relevant lead agencies such as Department of Fisheries and the Kenya Maritime Authority; and
- First aid services and an emergency vehicle to be readily available at site;

The Proponent is recommended to enforce the existing H&S operation procedures for minimizing potential health and safety impacts. During construction phase, the Proponent is recommended to ensure that tool box talks are done every day. Toolbox talks address actual and anticipated safety concerns for scheduled project work. The talks provide an opportunity to relate specific safety concerns with the jobs to be performed.

Compliance to IFC Performance standard 4: Community Health, safety and security
This performance standard has been triggered by the nature of the proposed project that pauses great public concern especially in the event of a major disaster such as explosions and fire outbreaks. Liquefied Petroleum Gas is a highly flammable product and can be detrimental to the public safety if measures are not put in place. The Proponent in conjunction with the Contractor and the community shall implement a health and safety plan that shall include:

- Adherence to OSHA 2007 Act and its subsidiary legislations to ensure that health and safety of immediate neighbours and the public is not threatened;
- The Contractor to ensure that construction work is undertaken in manner not likely to pose risks to community health and safety;
- The Proponent to undertake an independent quantitative risk assessment prior to operation of the facility. The findings of this assessment will inform the development of an emergency safety plan;
- The Proponent to create awareness among the neighbours on the community safety and security procedures; and
- The Proponent will also assist and collaborate with the neighbouring Communities, County government and the neighbouring facilities in their preparations to respond effectively to emergency situations.

7.2.8 Socioeconomic Impacts

Positive
The proposed project will generate job opportunities (skilled and unskilled Labour) during construction, operation and decommissioning phases. It is anticipated that proposed project will provide opportunities for local employment and service provision, such as the use of local transport companies and sourcing of some construction materials locally. There is also likely to be trickledown effect results from the employment opportunities as well as services provided by the facility. The positive socio-economic impacts of the project are identified in the Table 26 below:

Table 26: Positive Socio-Economic Impacts

Project Phase	Project Aspect/activity	Impact type	Stakeholder /Receptor Affected
Construction phase	• Creation of employment • Creation of business opportunities	Direct, indirect induced positive impacts	Construction personnel and Local and internal suppliers
Operation phase	• Reduction in Deforestation • Reduced cost of LPG gas • Catalyst for development	Direct, indirect induced positive impacts	Operation personnel Local suppliers
Decommissioning phase	• employment	Direct, indirect induced positive impact	Demolition personnel

Negative

It is anticipated that proposed project will result in behavioral change among the construction crew and the residents as they socialize. The result may be upsurge in prostitution, family break ups, and sexually transmitted diseases including HIV/AIDS. Employment of "outsiders" rather than local residents, may create tensions causing disruptions thereby affecting project implementation. The negative socio-economic impacts of the project are identified in the Table 27 below:

Table 27: Negative Socio-Economic Impacts

Project Phase	Project Aspect/activity	Impact type	Stakeholder /Receptor Affected
Construction phase	• Prostitution, family break ups, and sexually transmitted diseases including HIV/AIDS • Employment of "outsiders"	Indirect induced negative impacts	Construction personnel Local host community
Operation phase	• Employment of "outsiders" in skilled areas	Indirect induced negative impacts	Operation personnel Local host community
Decommissioning phase	• Employment of "outsiders" in skilled areas	Indirect induced negative impacts	Demolition personnel Local host community

Mitigation Measures

In order to mitigate socio-economic impacts associated with the project and to avoid negative impacts and to comply with Bank policy, the Proponent will develop and implement socio-economic plan including the following mitigation measures:

- Carrying out sensitization on health issues facilitation of preventive measures to site workers and truck drivers for protection against diseases that can be transmitted through sexual contacts;
- Maximise local employment. Local residents are looking forward to employment opportunities, especially women and youth; and

- Ensure meetings to discuss and address emerging issues are held regularly (every week and at the beginning then monthly when the project has picked up.

Compliance to IFC Performance standard 5: Land acquisition and involuntary resettlement:

No land acquisition and involuntary resettlement shall be carried out prior to this project since the project site is currently an active site with similar development. Hence this Performance standard will not be triggered.

Compliance to IFC Performance standard 2: Labour and working conditions

The Proponent undertakes to observe International Labour Organization (ILO) and the United Nations (UN) labour laws in addition to compliance which has been domesticated under the Employment Act, 2007. The Proponent shall seek:

- To promote the fair treatment, non-discrimination, and equal opportunity of workers;
- To establish, maintain, and improve the worker-management relationship;
- To promote compliance with national employment and labour laws such as non-engagement of child labour;
- 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;
- To avoid the use of forced labour; and
- During construction phase, the Contractor will be encouraged to source where possible labour from the local community.

7.2.9 Cumulative impacts

Cumulative impacts are impacts of an activity that in themselves may not become significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area. The proposed construction of the Proposed Project facility will attract people to the project area. The area going to experience improved economic activity. This will include gradual increase of project area population seeking opportunities. The potential cumulative impacts will include:

- Progressive increase in demand for water for operations;
- Progressive congestion and constraints to the few available health facilities in the Project area;
- Potential Progressive increase in impacts from trucks collecting LPG from the facility;
- Progressive increase in persons visiting the facility;
- Progressive increase in the quantity of generated waste; and
- Potential increase in water and air pollution.

Mitigation Measures

In order to mitigate cumulative impacts associated with the project and to avoid negative impacts, the Proponent will develop and implement Corporate Social Responsibility plan in consultation with the relevant authorities and institutions operating in the area including the following:

- There is need to facilitate the putting up of a health facility in the project area so as to assist the workers and the community;
- The largest contribution to respiratory disease occurrence is the use of wood, charcoal or kerosene as a source of cooking energy and kerosene lamp as source of lighting energy due to the amount of smoke produced and the presence of excessive dust in the project area. The local community need to be sensitized on the dangers of using fire wood a source of cooking energy and kerosene lamp for lighting. The benefits of using clean energy for lighting like solar energy for lighting and LPG for cooking need to be highlighted; and
- The community need to be encouraged to promote regular tree planting to enhance project area biodiversity.

8 Environment Management Plan

The Environment Management Plan is an important process of ensuring project sustainability and environmental and social protection. Whereas efforts are usually made to develop mitigation measures for a proposed project, it is during the operation lifespan of the project that actual impacts are noted or experienced.

It is therefore important to integrate in the environmental and social impact assessment process, an environment monitoring and management plan that includes the monitoring of the progress of mitigation measures being implemented while also monitoring the project for any new negative impacts that were not earlier considered or anticipated.

The proponent shall ensure that the Contractor understands and implements all specified mitigation measures during the construction period. The proponent's Supervising Engineer is responsible for assessing the Contractor's Environmental and Social Management Plan and internally implements the Management Plan to ensure that the Environmental and Social Impacts are monitored and managed in an environmentally and socially acceptable manner.

Monitoring systems should be set up by the Proponent during the operational phase, so that potential environmental problem areas can be detected well in advance and the appropriate remedial action carried out. The Proponent shall have a checklist of items that need to be monitored as a matter of routine or periodically over agreed intervals, depending on the nature of the aspect to be monitored. The types of parameters that can be monitored may include proposed mitigation measures or design features, or actual impacts. Depending on the nature of impact or aspect to be monitored, monitoring can be done as part of routine or periodic maintenance. However, socio-economic and ecological parameters can be effectively assessed over a longer time span.

8.1 Environmental and Social Management Plan

Environmental monitoring is an integral part of the environmental management process.

It rationally completes the process that begins with establishing the environmental baseline condition followed by carrying out the Environmental and Social Impact Assessment then Implementation of Mitigation Measures and Monitoring the success of those measures.

The Environmental and Social Management Plan (ESMP) is provided in Table 28.

Table 28: Environmental and Social Management Plan (ESMP)

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
Design Phase						
1.	Proposed Project	Landscape visual impact	– Design of infrastructure that conforms with the project site features (topography and aesthetics)	• AGOL • Design Consultant	• Site infrastructure design blending with host environment	Approx. 500,000/=
2.	Proposed Project Sanitation Facilities	Soil and water contamination	– Design appropriate containments for oils/other construction chemicals and sanitary waste from the contractor's camp.	• AGOL • Design Consultant	• Availability of sanitary facility and paved containments in the design	Approx. 500,000/=
3.	Proposed Project Mangrove Vegetation Cover	Removal of existing Vegetation	– Design of appropriate construction that provides for incorporation of existing mangrove vegetation	• AGOL • Design Consultant	• Site infrastructure incorporating mangrove vegetation	Approx. 200,000/=
Pre-Construction Phase						
1.	AGOL Project Facts	Potential lack of support from project area community	– Timely dissemination of project facts to community and stakeholders – Convening of meetings with Community and Stakeholders to carry out sensitization and disseminate project facts	• AGOL • PR Firm	• Feedback information and forms from project area community	Approx. 500,000/=
2.	Clearing of Proposed Project site vegetation	Vegetation damage, and invasion by exotic species	– Maintain native mangrove cover by selective removal of trees which cannot be incorporated in the project design by use of manual clearing technics; *This is in line with:*	• AGOL • Contractor	• Existing mangroves incorporated in the Constructed Site area	Approx. 600,000/=

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			♦ *Environmental Management and Coordination Act (EMCA), 1999 Amended 2015* ♦ *OP 4.01 Environmental Assessment*			
3.	Clearing of Proposed Project site vegetation	Generation of Solid Waste	– Contractor to provide strategically located solid waste collection container (skip); – Collect together all generated waste from site clearing; – Transport and dispose all waste away from site; – Liaise with the County government on suitable dumping site for spoils; *This is in line with:* ♦ *Environmental Management and Coordination Act (EMCA), 1999 Amended 2015,* ♦ *Water Act 2012 and Public Health Act, Cap 242* ♦ *OP 4.01 Environmental Assessment*	• AGOL • Contractor	• Presence of waste collection bins • Contract with NEMA Registered Waste Disposal Firm	Approx. 100,000/= for waste collection bins 10,000/= per month for Waste Disposal
4.	Clearing of Proposed Project site vegetation	Noise pollution (excess noise and vibration)	– Use of noise reduction/ hearing protection devices when working with noisy equipment; – Use of serviceable chain saws (low noise emission); – Instruct machinery operators to avoid raving of engines; – Carry out site preparation activities during the day; *This is in line with*	• AGOL • Contractor	• Records of machine and vehicle maintenance • Availability and use of Ear Muffs	Approx. 200,000/= for provision of noise pollution

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			♦ *Environmental Management and Coordination Act (EMCA), 1999 Amended 2015;* ♦ *Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009* ♦ *OSHA Act, 2007.* ♦ *OP 4.01 Environmental Assessment*			
5.	Clearing of Proposed Project site vegetation	Sanitary and other Domestic Waste	– Provide site clearing workers with solid waste bins for their use; – Ensure site has toilet facilities; – Sensitize workers on site cleanliness and hygiene *This is in line with:* ♦ *Environmental Management and Coordination Act 1999 Amended 2015* ♦ *Water Act 2012* ♦ *OP 4.01 Environmental Assessment* ♦ *Public Health Act, Cap 242*	• AGOL • Contractor	• Presence of waste bins and Toilets for use by workers	Approx. 400,000/= for provision of Sanitary and waste collection facilities.
Construction Phase						
1	Soil Excavation at Proposed Project site	Soil Erosion	– Excavated soil is to be used for backfilling excavated areas while excess soil is disposed of off-site; – Soils are not to be left exposed to wind/water; – Soil erosion is to be reduced and river valley protection enhanced. *This is in line with:* ♦ *Environmental Management and Coordination Act 1999 Amended 2015*	• AGOL • Contractor	• Ground cover in constructed areas • Quality of surface water at the site and in the neighboring rivers,	Part of Construction Obligation

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			♦ *Water Act 2012* ♦ *OP 4.01 Environmental Assessment*			
2.	Construction of the Proposed Project site	Air Pollution (dust, fuel and smoke emissions)	– Control speed of vehicles and Prohibit idling; – Spray water during construction; – Maintenance vehicles & equipment regularly; – Provision of dust masks for use in dusty conditions; – Use serviceable vehicles/machinery to reduce smoke; *This is in line with:* ♦ *Environmental Management and Coordination Act 1999 Amended 2015* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment;* ♦ *Public Health Act, Cap 242*	• AGOL • Contractor	• Records of machine and vehicle maintenance • Availability and use of Noise Masks • Low dust generation during construction	Approx. 500,000/= for air pollution prevention
3.	Construction of the Proposed Project site	Excess noise and vibration	– Use noise hearing protection devices when working with noisy equipment or noisy environment; – Use serviceable equipment with low noise emission; – Instruct truck/machinery operators to avoid raving engines; *This is in line with:* ♦ *Environmental Management and Coordination Act 1999 Amended 2015* ♦ *Noise and Excessive Vibration Pollution) (Control) Regulations, 2009*	• AGOL • Contractor	• Records of machine and vehicle maintenance • Availability and use of Ear Muffs	Approx. 300,000/= for provision of noise pollution

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment*			
4.	Construction of the Proposed Project site	Generation of Solid Waste	– Provide communal solid waste collection containers (skip) for the collection and storage prior to appropriate disposal; – County Government/NEMA to provide waste dumping site; – Engage a NEMA Registered Waste Collection Firm; – Excavation activities to be done during the dry season to avoid soil erosion and siltation of streams; – Site soil to be used to backfill excavated sites; *This is in line with:* ♦ *Environmental Management and Coordination Act 1999 Amended 2015,* ♦ *Waste Management Regulations, 2006* ♦ *Water Act 2012* ♦ *Public Health Act, Cap 242* ♦ *OP 4.01 Environmental Assessment*	• AGOL • Contractor • NEMA Registered Waste Collection and Disposal Firm	• Clean, Organized, Neat Site • Presence of waste collection receptacles • Contract with NEMA Registered Waste Disposal Firm	Approx. 200,000/= for waste containers 10,000/= per month for waste collection and disposal
5.	Construction of the Proposed Project site	Generation of Liquid Waste – used oil and other Chemicals (Hazardous Waste)	– Construct a paved containment for storage of oils and other liquid chemicals being used in the construction site; – Provide containers for storage of used oils from vehicles /machines/equipment being used at the construction site; – Engage a NEMA Registered Firm for the collection, transportation and appropriate disposal of used oil;	• AGOL • Contractor • NEMA Registered Used Oil Collection and Disposal Firm	• Presence of a paved area for storage of oils and other chemicals • Presence of used oil containers.	Approx. 400,000/= for paved containment & used oil containers. 10,000/= per month for collection and

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			This is in line with: ♦ *Environmental Management and Coordination Act 1999 Amended 2015,* ♦ *Waste Management Regulations, 2006* ♦ *Water Act 2012* ♦ *Public Health Act, Cap 242* ♦ *OP 4.01 Environmental Assessment*			disposal of used oil.
6.	Construction of the Proposed Project site	Risk of fire	– Provide firefighting equipment at the construction site area; – Contractor staff to be sensitized on firefighting equipment use; – No burning of materials is to be permitted at the site. *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *Public Health Act, Cap 242* ♦ *OP 4.01 Environmental Assessment*	• AGOL • Contractor	• Performance records • Presence of Fire Extinguishers at construction site	Approx. 300,000/= for fire extinguishers
7.	Construction of the Proposed Project site	Potential Pollution of Surface and Groundwater	– No disposal of domestic waste at the project site; – Provision of used oil containers at a central point; – Use of waste bins/proper waste management; – Pave parking area for trucks and direct drainage to containment; – Analysis of water at the site area 2 times a year *This is in line with:*	• AGOL • Contractor	• Water Quality Reports • Presence of Waste Bins	Approx. 50,000/= for communal waste containers 200,000/= per year

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			♦ *Environment Management and Coordination Act (EMCA), 1999 Amended 2015,* ♦ *Water Act 2012* ♦ *Public Health Act Cap 242* ♦ *OP 4.01 Environmental Assessment*			
8.	Construction of the Proposed Project site	Safety of Workers and other visitors to construction site	• Use of construction site barrier tapes to isolate the site(working) area to bar intruders from accessing the area in case of a dropping object; • Appropriate head, hand and foot protection (PPE) during the manual clearing of vegetation and construction activities; • Adopting ergonomic work flow designs that fit physical tasks to employees and not vice versa. Maintain work productivity; • Construction site visitors require appropriate safety Gear. *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *Environment Management and Coordination Act (EMCA), 1999 Amended 2015* ♦ *OP 4.01 Environmental Assessment* ♦ *Public Health Act Cap 242*	• AGOL • Contractor	• Workers have Safety Gear • Medical records • Emergency contacts for Hospital and Police available	Approx. 300,000/= for safety gear
9.	Construction of the Proposed Project site	Working at heights	• Testing of structures for integrity prior to undertaking work; • Implementation of fall protection including induction on climbing techniques and use of fall protection measures,	• AGOL • Contractor	• Medical Records and Training records • Availability and use of proper PPE	Approx. 500,000/= for special safety equipment

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			• Provision of harnesses and scaffolds for working at heights; • Inspection, maintenance, and replacement of fall protection equipment ; • Use of helmets and other protective devices that are going to mitigate against scratches, bruises; lacerations and head injuries due to dropping objects[• Provide first aid facilities at the site; *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment* ♦ *Public Health Act Cap 242*		• Availability of Fall Protection Equipment at the Construction Site	
10.	Construction of the Proposed Project site	Health issues of construction workers and Community	– Sensitize workers and community on sexually transmitted diseases especially STIs and HIV/AIDS which is spread through socialization and unprotected sex; – Sensitize workers on use of protection facilities like mosquito nets appropriate gear when working in waterlogged areas to avoid Bilharzia; – Provide workers and community with condoms. – Facilitate the development of a Health facility at the project area together with Ministry of Health and interested Donor Agencies. *This is in line with:* ♦ *Public Health Act Cap 242*	• AGOL • Contractor • Ministry of Health • NGOs and Donor Agencies • Local Administration	• Pamphlets on Health Matters • Records of disease incidences /prevalence	500,000/= for sensitization and provision Of condoms. Health facility cost to be determined

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment*			
11.	Construction of the Proposed Project site	Community misconceptions	• Awareness creation amongst the Community on project facts; • Community issues to be responded to promptly; • Project progress reports and monitoring reports to be prepared and recommendations implemented;	• AGOL • Local administration • Local Leaders	• Records of Meetings with Community • Records of community issues recorded and responses.	Approx. 100,000/= for convening meetings
12.	Construction of the Proposed Project site	Increase in social vices/ Security Concerns	• Conduct Information Education and Communication; (IEC) amongst the community and the project staff; • Hold meetings between Contractor Staff and Community; • Have regular police patrols at the beginning of project development; • Collect information on persons coming into the project area to settle during project implementation.	• AGOL/Ministry of Education • Local Police • Local Administration • Local Leaders	• Meeting reports • Police records on project area security	Approx. 300,000/= for convening meetings
13.	Construction of the Proposed Project site	Surface run off and sedimentation from construction activities	– Construction of effective drainages and culverts; – Plant soil binding grasses and other native plants *This is in line with:* ♦ *Environmental Management and Coordination Act 1999 Amended 2015*	• AGOL • Contractor	• Surface runoff water impact protection facilities in the project area	Construction Obligation

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			♦ *Water Act 2012* ♦ *OP 4.01 Environmental Assessment*			
14.	Construction of the Proposed Project site	Sanitary facilities for construction workers	• Installation of appropriate sanitary facilities; • Having a monitoring programme for the septic tanks to ensure no overflow takes place *This is in line with:* ♦ *Environment Management & Coordination Act (EMCA), 1999 Amended 2015,* ♦ *Waste Management Regulations, 2006* ♦ *Public Health Act Cap 242* ♦ *OP 4.01 Environmental Assessment*	• AGOL • Contractor	• Presence of Toilet Facilities for Workers and Visitors to the Construction Site.	Construction Obligation
15.	Construction of the Proposed Project site	Dangers of having Child Labour issues arising	• Contractor to be strictly advised not to engage any underage persons(under 18 years of age) to perform any form of work at the site during construction • Contractor will be required to comply with the Employment Act, 2007 *This is in line with* ♦ *Employment Act, 2007*	• AGOL • Contractor	• List of workers that does not contain underage persons	Construction Obligation
Operational Phase						
1.	Operation of Proposed Project Facility	Maintenance of facilities Working at heights	• Use of barrier tapes to isolate the maintenance areas; • Provide harnesses/scaffolds for working at heights; • Inspect and maintain fall protection equipment;	• AGOL • AGOL Site Manager	• Use of Proper PPE and Equipment • Handouts on safety	Approx. 200,000/=

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			• Use of protective devices to mitigate against injury; • Provide first aid facilities at the site; *This is in line with* *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment*			
2.	Operation of Proposed Project Facility	Risk of Fire	– Sensitization of Workers on Fire Safety Risks; – No burning of any materials near or in the site *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *Environmental Management and Coordination Act 1999 Amended 2015* ♦ *OP 4.01 Environmental Assessment*	• AGOL Site Manager • County government	• Handouts on Fire Hazards and Safety	Routine Site Operation Activity
3.	Operation of Proposed Project Facility	Pollution of surface water and Waste management	– Ensure solid waste is collected and appropriately disposed of; – Ensure that used oil from trucks are not released to the ground; – Used oil is to be put into containers and appropriately disposed of by a NEMA approved agent; – Provision of used oil containers for use by truck drivers; *This is in line with:* ♦ *Environment Management and Coordination Act (EMCA), 1999 Amended 2015,* ♦ *Water Act 2012* ♦ *Public Health Act Cap 242* ♦ *OP 4.01 Environmental Assessment*	• AGOL Site Manager	• Presence of solid waste containers • Containers for storage of used oil recovered from trucks	Approx. 20,000/= for provision of used oil containers

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
4.	Operation of Proposed Project Facility	AGOL Site Solid Waste Management during Operation	• Provision of communal solid waste containers (skip); • Provision of secured solid waste collection containment where waste container (skip) is to be placed; • Regular disposal waste depending rate fill up. *This is In line with:* ♦ *Environment Management and Coordination Act (EMCA), 1999 Amended 2015,* ♦ *Waste Management Regulations, 2006* ♦ *Water Act 2012* ♦ *Public Health Act Cap 242.*	• AGOL Site Manager	• Waste Collection and Disposal Reports • Presence of Waste Bins	Approx. 20,000/= for Waste Containers 10,000/= per month for waste disposal by NEMA Approved Firm
5.	Operation of Proposed Project Facility	Health issues of Facility Workers, Truck Drivers and Community	– Sensitize workers and community on sexually transmitted diseases especially STIs and HIV/AIDS which is spread through socialization and unprotected sex; – Provide workers and community with condoms. – Encourage Workers, Truck Drivers and Community to go for HIV Testing and Counselling in order to live a productive life; *This is in line with:* ♦ *Public Health Act Cap 242* ♦ *Occupational Safety and Health Act (OSHA) 2007*	• AGOL • Ministry of Health • Local Administration	• Presence of a HIV Programme at the Facility • Records of disease incidences /prevalence (URTI, HIV/AIDS, Water Borne Diseases etc.	100,000/= for sensitization and provision Of condoms.

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
6.	Operation of Proposed Project Facility	Monitoring and Evaluation of the effectiveness of project Mitigations	Implementation of monitoring of facility operations and success of proposed mitigations – Health Trends (URTI, Malaria, STIs and HIV/AIDS); – Livelihood and socio-economic status of project area community; – Community perception on the AGOL Facility – Any new emerging issues, threats and benefits of the LPG Storage Facility	• AGOL Site Manager • Local Administration	• Quarterly Reports on Facility performance	Routine Operation of the Facility
Decommissioning Phase						
1.	Decommissioning of Proposed Project Facility	Air Pollution (dust, smoke, fuel emissions)	– Control of demolition vehicle speeds; – Prohibition of idling of vehicles; – Water is to be sprayed on building undergoing demolition during decommissioning o reduce dust emission; – Regular maintenance of vehicles and equipment; – Provision of dust masks for use in dusty conditions. – Use of serviceable vehicles and machinery to avoid excessive smoke emission *These is in line with:* ♦ *Environmental Management and Coordination Act 1999 Amended 2015* ♦ *Occupational Safety and Health Act (OSHA) 2007*	• AGOL • Decommissioning Contractor	• Decommissioning Records	Approx. 200,000/= for nose protection equipment (dust masks)

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
2.	Decommissioning of Proposed Project Facility	Noise pollution	– Noise reduction/ hearing protection devices when working with noisy equipment; – Use of serviceable equipment with low noise level; – Instruction to truck/machinery operators to avoid raving engines; – Use of noise protection (ear muff) during demolition; *This is in line with:* ♦ *Environmental Management and Coordination Act 1999 Amended 2015.* ♦ *Occupational Safety and Health Act (OSHA) 2007.*	• AGOL • Decommissioning Contractor	• Decommissioning Records	Approx. 200,000/= for noise pollution mitigation
3.	Decommissioning of Proposed Project Facility	Potential Injury to Workers	• Use of appropriate head, hand and feet protection (PPE) during demolition of structures • Adopting ergonomic work flow designs that fit physical tasks to employees and not vice versa while maintaining a balance with productivity; *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007*	• AGOL • Decommissioning Contractor	• Availability of appropriate gear/Records • Use of Proper PPE	Approx. 200,000/= for PPE and other safety equipment
4.	Decommissioning of Proposed Project Facility	Working at heights	• Use construction site barrier tape to isolate the site to guard site visitors from accidents and injuries; • Implement a fall protection program that includes training in climbing techniques and use of fall protection measures, Provide Harnesses;	• AGOL • Decommissioning Contractor	• Availability of appropriate Safety Gear/Records • Proper use of PPE	Approx. 100,000/= for PPE and other safety equipment

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KShs)
			• Use of helmets and other protective devices i to mitigate against injury, • Provide first aid facilities at the site *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007*			
5	Decommissioning of Proposed Project Facility	Site area rehabilitation and restoration	• Remove all demolished waste material; • Repair and restore project area site • Evaluate site contamination • Plant trees and other appropriate vegetation *These is in line with:* ♦ *Environmental Management and Coordination Act 1999 Amended 2015* ♦ *Occupational Safety and Health Act (OSHA) 2007*	• AGOL • Site Restoration Contractor	• Site Pollution Report • Well restored site	1,000,000/= for site Pollution assessment

8.2 Management Programmes

This section presents the programmes for managing the identified impacts. It is worth noting that the use of management programmes to manage the impacts is necessitated by the fact that most of the mitigation measures cannot be implemented as discrete, isolated actions because there are spatial, temporal and casual interactions among impacts. The programmes recommended for managing the potential impacts of the proposed project include:

- Air quality management programme
- Noise management programme
- Occupational Health and Safety

The implementation of the EMP is also linked to a series of comprehensive management plans. Management and mitigation measures should be in compliance with legislative requirements. Where no legal guidance is provided, industry and/or international good practices should be applied as far as is practicable.

8.2.1 Air quality management programme

The aim of this programme is to ensure that air quality is maintained through construction, as well as operation phases. The air quality management programme includes the following:

Dust management

- Dust abatement measures shall be implemented to control dust generated from construction activities. Refer to the construction control plan and construction management plan for dust abatement measures;
- A complaints register and protocol will be drawn up as a means for surrounding establishments, workers and neighbouring community to voice their issues and concerns, particularly those relating to the nuisance effects of dust and noise The register will be set up prior to the commencement of construction activities. These public complaints should be responded to as a matter of urgency and where possible, measures taken to minimize the cause of dust and noise.

Emissions

- The Contractor shall ensure that the construction machinery and equipment are appropriate and fit to prevent fugitive emissions, as per national standards or international practices. The Proponent shall ensure the regular maintenance of this equipment.
- A maintenance plan for the construction machinery and vehicles shall be implemented to prevent excessive emissions during the construction phase of the project.

8.2.2 Noise management programme

- This programme aims to ensure that noise generated by construction and operation activities is kept to a minimum and adheres to relevant noise standards. The noise management programme includes the following:
- The Contractor shall ensure that construction activities are limited to working hours (i.e. between 06h 00 and me 18h 00 daily) from Monday to Saturday, or as required in terms of legislation and/or negotiated with the neighbouring community;
- Noise generating equipment will be designed to control and dampen noise emissions, and will be located at a distance far enough from the nearest noise sensitive development, to ensure that the increase in ambient noise level will comply with ISO standards; and
- The surrounding establishments, workers and neighbouring community shall be able to register their complaints and concerns about noise through complaints register set up prior to the commencement of construction activities. These public complaints should be responded to as a matter of urgency and where possible measures must be taken to minimize the noise.

8.2.3 Occupational Health and Safety Programme

The aim of this programme is to ensure that the Safety and Health of the employees' quality is maintained through construction, as well as operation phases. The OHS management programme includes the following: Undertaking S&H risk assessments, S&H audits, Provision of adequate and appropriate firefighting equipment, Provision of Personal Protective Equipment to the workers and Issuing of work permit systems for hot jobs at the site.

8.3 Management Plan

8.3.1 Overview

The following management plans will be implemented during construction, operation, and decommissioning phase of the proposed project:

- Construction management plan
- Construction control plan
- Labour and human resources plan
- Workplace health and safety plan
- Community safety plan
- Emergency management and response plan
- Rehabilitation and closure management plan

8.3.2 Construction Management Plan

The construction management plan for the proposed project shall include the following:

Management of fuels and other hazardous materials

- The Contractor shall comply with all applicable laws, regulations, permit and approval conditions and requirements relevant to the storage, use, and proper disposal of hazardous materials;

- The Contractor shall manage all hazardous materials and waste in a safe and responsible manner, and shall prevent contamination of soils, pollution of water and/ or harm to people or animals as a result of the use of these materials;
- The Contractor shall prepare a hazardous materials and waste management plan for inclusion in the site specific environmental plan to be submitted to the Proponent prior to establishment on site. The plan shall include, but not limited to, measures to prevent safe siting and storage;
- The contractor shall place on-site tools and equipment, such as generators, compressors on bunded impermeable sheeting to prevent oil spills/leaks from causing subsurface contamination;
- The contractor shall ensure oil spills/leaks are prevented or minimized. This can be achieved through: instructing employees not to overfill diesel bowsers and equipment tanks; regular auditing to verify that no leaking or defective equipment is brought/used onsite; any oils or lubricants discharged during servicing of the machinery or vehicles are contained in dry trays or other appropriate containment measures;
- The Contractor shall ensure that fuelling and repairs are carried out by trained personnel familiar with spill containment and clean-up procedures; and
- The Contractor shall ensure that all the employees working onsite are trained on good housekeeping practices.

Management of the construction site

- The contractor shall prevent littering and the random discard of any solid waste on or around the construction site;
- The contractor shall manage hazardous waste; and
- The Contractor to determine safe traveling speeds for the construction site and ensure that restrictions are enforced.

Emergency Preparedness

- The Contractor shall develop an emergency plan that will enable rapid and effective response to all types of environmental emergencies in accordance with recognized national and international standards. The emergency plan shall include establishment of a network of communication between the Contractor and emergency services including police, ambulance services, and fire brigades among others; and
- The Contractor shall test emergency preparedness with drill operations and shall review drills, conduct mock emergencies and remedy shortcomings to ensure a high level of emergency readiness to deal with environmental and third party incidents.

Fire Prevention and management

- The Contractor shall take all necessary precautions to prevent fires caused either deliberately or accidentally during construction process;
- The Contractor shall prepare a fire prevention and fire emergency plan as a part of the;
- Environmental Plan to be submitted to AGOL;
- The Contractor shall provide adequate firefighting appliances at specified localities on the worksite to meet any emergency resulting from ignition of a fire; and

- The Contractor shall ensure that hot work is prohibited under specified meteorological conditions with high fire risks and that appropriate and adequate firefighting equipment would be required to be on standby at all times where hot work is being carried out.

Management of air quality

- The Contractor shall institute appropriate measures to minimize or avoid air quality impacts. This can be achieved through formulation of air quality management plan;
- The Contractor to minimize/control emission of dust due to traffic movement and wind erosion of stockpile material and exposed soil;
- The Contractor to mitigate emissions of gases vapours and odours by conducting initial risk assessment and the installation of procedures to control the risk; and
- The Contractor to ensure that all equipment used and all facilities erected on site are designed and operated to control the emission of smoke, dust, fumes and any other air impurity into the atmosphere.

Noise Management Programme

The noise management programme is geared towards minimizing the amount of noise generated by the construction and operation activities as well ensure adherence to the relevant noise standards. The noise management programme includes the following:

- The Contractor shall comply with the legal requirements for the management of noise impact specified in the noise quality regulations; and
- The Contractor shall formulate noise management plan for minimizing the generation of noise and vibration from construction activities occurring on site and its impact on surrounding residents, businesses and workers.

Complaints register

The Contractor shall establish and maintain a register for periodic review by the Proponent that logs all the complaints raised by the neighbours or the general public about construction activities. The register shall be regularly updated and records maintained including the name of the complainant, his/her domicile and contact details, the nature of the complaint and any action taken to rectify the problem.

Health management

- The Contractor shall comply with all relevant legislative requirements governing worker health and safety (e.g. OSHA 2007 and its subsidiary legislations); and
- The Contractor shall prepare and implement a programme to minimize diseases likely to be contracted by the construction workers as a result of the proposed project such as HIV Aids.

8.3.3 Construction Control Plan (CCP)

The CCP for the proposed project shall cover on the following:

Control of access

The contractor shall ensure that the construction is not accessed by authorized persons.

Control of top soil and subsoil

- The contractor shall store topsoil excavated from the site in a wind row or stockpile which shall be discernibly separate from wind rows or stockpiles of any other excavated materials;
- Top soil shall be protected from any contaminant that might impact on vegetation;
- The Contractor shall temporarily stockpile topsoil in a location that will minimize any loss due to erosion or mixing with other material; and
- The Contractor shall ensure that topsoil is stockpiled in a manner and for a period of time that does not result in deterioration in its plant support capacity.

Control of material supply and burrow areas

- The Contractor shall, as far as possible, source all material needed to construct the proposed project from the licensed mines;
- In instances where materials are to be obtained from a new borrow area the Contractor shall comply with relevant legislations; and
- The Contractor shall prepare a method statement including plans, detailing the expected quantity of excavation, temporary and permanent drainage control, the final contouring of the borrow pit and the proposed method of rehabilitation.

Rehabilitation

- After completion of construction activities, the Contractor shall clear the site of construction materials and dispose wastes in appropriate disposal sites; and
- The Contractor shall remove all temporary works on the construction site and grow grass on the sloppy areas where retaining wall will not be constructed to control soil erosion.

8.3.4 Labor and Human Resources Plan

In designing the Labour and human resources plan Contractor shall:

- Comply with the provisions of Employment Act, 2007; and
- Wherever possible, give priority to qualified local people when hiring employees.

8.3.5 Workplace Health and Safety Plan

The workplace health and safety plan to be implemented by Synergetic Energy Partners, AGOL and Contractor shall include the following key measures:

- All relevant national legislation, including the OSHA 2007 and related regulations, shall be adhered to ensure that health and safety of proximate communities and the public at large are not threatened during construction and operational phases of the Project;
- The Proponent shall ensure workplace health and safety during the operational phase of the facility; and
- Health and safety performance will be continuously monitored and procedures reviewed with the aim of eliminating risk as far as reasonably practicable.

8.3.6 Community health and safety plan

The community health and safety plan to be implemented by the Contractor, Synergetic Energy Partners and AGOL shall include:

- Adherence to OSHA 2007 Act and its subsidiary legislations to ensure that health and safety of immediate neighbours and the public is not threatened;
- The Contractor to ensure that construction work is undertaken in manner not likely to pose risks to community health and safety;
- The Proponent to undertake an independent quantitative risk assessment prior to operation of the facility. The findings of this assessment will inform the development of an emergency safety plan; and
- Synergetic Energy Partners and AGOL to create awareness among the neighbours on the community safety procedures.

8.3.7 Emergency Management and Response Plan

The Proponent shall rollout and implement their documented emergency response plan at the completed footprint. The EMRP shall include:

Emergency management planning

The components of the Emergency management planning shall include:

- Structure and operation of the emergency management team;
- Establishment of an emergency management centre;
- Information retained by the emergency management team;
- Incidents requiring activation of the plan;
- Incident severity classification; and
- Process to be followed in the event of an emergency.

Information pertaining to emergency management shall be reported through the HSE reporting process. A quantitative risk assessment report will be compiled by an independent company prior to commissioning of the facility.

Emergency Response Plan

The Proponent shall implement a community health and safety plan which shall include the following measures:

AGOL will compile a comprehensive safety emergency management plan (SEMP) for the facility. The SEMP will cover the following aspects:

- Kenya's Safety regulations;
- Scope of the SEMP;
- Notification of local authorities;
- Details of the facility's system;
- Aim of the SEMP;
- Objectives of SEMP;
- Roles and responsibilities in the event of an emergency;
- Information requirements in the event of an emergency;
- Evacuation of people;
- The role of local communities;
- Regular testing of the SEMP;
- Planning for the eventuality of failure on the facility;
- Causes of the facility's failure;
- Probability of facility's failure;
- Size and duration of the facility;

- Hazards and effects of facility's failure;
- Hazard range and emergency planning distances; and
- Anticipation of worst credible incidents.

8.3.8 Rehabilitation and decommission management plan

The rehabilitation and decommissioning management plan include the following:

Planning for closure

- The Proponent shall develop rehabilitation and decommissioning plan in conjunction with relevant stakeholders at least one year before the end of facility's operations;
- The Proponent shall investigate practical options for closure of the facility at least one year before decommissioning and submit a report to relevant authorities NEMA included; and
- The Proponent to explore options of re-use and recycling of the facility's components/structures.

Decommissioning

- The Proponent shall take into consideration the health and safety of personnel, contractors, neighbors and the public during the planning and implementation of the demolition process; and
- The Proponent shall undertake a further survey to identify any contaminated areas remediate them accordingly.

Post Closure

The Proponent shall ensure that the facility's site is free of impacts associated with the abandonment/closure. The Proponent shall develop, rollout and implement a monitoring plan that includes:

- Monitoring of the rehabilitated site to confirm whether progress is satisfactory; and
- Outline of how land improvement and future land use will be affected by the past operation and decommissioning of the Proposed Project.

8.4 Monitoring

The proposed programmes and plans will be subjected to monitoring. Monitoring will have two elements: routine monitoring against standards or performance criteria; and periodic review or evaluation. Monitoring will often focus on the effectiveness and impact of the programme or plan as a whole. During construction phase, the Proponent shall monitor the Contractor's activities in order to verify that the management measures/procedures/specifications are implemented as contained in the EMP.

Compliance will mean that the Contractor is fulfilling their contractual obligation.

During operation phase, the Proponent will monitor facility's operations to ensure compliance with management measures in the EMP and operation procedures. As part of this monitoring, the Proponent will undertake statutory initial environmental audit as required by the EIA/EA Regulations, 2003 Amended 2019 and subsequent annual self environmental audits.

8.4.1 Programme Monitoring

The Proponent shall regularly monitor programme implementation. The process will include the regular monitoring of:

- Erosion of soil resulting in the immediate surroundings of the facility caused by the presence of facility or impacting on structures associated with the facility;
- Air quality and ambient emissions, including dust generated by construction activities; and
- Noise generation during construction and operation phases.

8.4.2 Plan Monitoring

All of the management plans make provision for monitoring and evaluation. Special attention should be given to the monitoring arrangements relating to biophysical impacts, occupational health and safety, facility operational and emergency response.

During the construction phase of the project, the Contractor's HSE Officer shall report all environmental impacts as well as accidents and incidents to the Proponent's HSE Officer. The reported impacts and incidents will be captured on a database to ascertain trends and track progress in the implementation of preventive and corrective actions, and benchmarking against other, similar operations.

Depending on the level of severity, accidents and incidents will be investigated by the Contractor's HSE division, with key input from the line management to ensure accountability.

During operation, the Proponent's HSE department will monitor the health and safety of personnel and contractors, in compliance with legislative requirements. Emergency incidents should be reported to the relevant authorities. The reported impacts and incidents will be captured on a database to identify weakness in the emergency response plan and track progress in the implementation of preventative and corrective and benchmarking against other similar operations.

The above information is vital for the smooth running of the facility and therefore AGOL is encouraged to ensure that the contractor and monitoring staff are able to monitor all activities and keep records for review by AGOL and other Authorities.

A monitoring Plan is provided in Table 29.

Table 29: Proposed Project Facility Monitoring Plan

#	Environmental Component	Activity	Standard/ Reference	Location	Frequency	Implementation	Supervision
Pre-Construction Phase							
1.	Project Design	Provision of Solid and Liquid Waste	NEMA Guidelines	Proposed Project Facility	Quarterly until Design is ready	• AGOL • Design Consultant	• AGOL • Supervision Consultant
2.	Vegetation cover	Monitor clearing to ensure consistent with ESMP	ESMP	Proposed Project Facility	As required during site preparation	Contractor	Supervision Consultant
Construction Phase							
1.	Noise levels	Noise levels on dB (A) scale from excavation and construction areas not to exceed the Maximum Noise Level Permitted (Leq) in dB(A)	NEMA guidelines	Noise level meter kept at a distance of 30m from source	When noisy construction activities are in progress. Or as directed by	Contractor	Supervision Consultant
2.	Air Pollution	Dust and Smoke Emission	NEMA guidelines	Construction area of Proposed Project Facility	As required by the Supervision	Contractor	Supervision Consultant
3.	Soil Erosion	Turbidity in ocean	NEMA Guidelines ESMP	Construction area of Proposed Project Facility	During and after the rainy seasons	Contractor	Supervision Consultant
4.	Accidents	Accident reports, community consultations	ESMP	Construction area of Proposed Project Facility	Monthly	Contractor	• AGOL • Supervision Consultant
5.	Health	URTI, HIV/AIDS, Malaria and Water borne disease prevalence	ESMP	Construction area of Proposed Project Facility	Monthly	• Contractor • Local Public Health Centre	• AGOL • Supervision Consultant

#	Environmental Component	Activity	Standard/ Reference	Location	Frequency	Implementation	Supervision
6.	Construction waste	• Quantity and Type of solid waste generated by construction activities. • Waste Segregation	NEMA guidelines	Construction area of Proposed Project Facility	Monthly	Contractor	AGOL
7.	Sanitary waste	Contractor toilet facilities operation/performance	NEMA guidelines	Construction area of Proposed Project Facility	Monthly	Contractor	Supervision Consultant
8.	Project Area Population	Change in Community Population next to facility	ESMP	Construction area of Proposed Project Facility	Quarterly	• AGOL • County	Supervision Consultant
Operation Phase							
1.	Solid Waste	• Quantity and Type of solid waste generated during operation • Segregation	NEMA guidelines	Designated Waste Collection points at the site	Monthly	Waste Collection Firm Registered with NEMA	AGOL Officer
2.	Health	• Changes in health trends • Presence of Mosquitoes etc • Records of Malaria and Water borne disease occurrence • HIV/AIDS	ESMP	Proposed Project Facility	Monthly	• Local Public Health Facility • New Health Centre Set up for Project area Community	• AGOL Officer • Ministry of Health
3.	Sanitary waste	Site toilet facilities operation and performance	NEMA guidelines	Proposed Project Facility	Monthly	AGOL	Appointed AGOL Officer
4.	Performance of Proposed Project Facility	• No of LPG Tankers Loaded every month • Recorded safety incidences	ESMP	Proposed Project Facility	Monthly	AGOL	Appointed AGOL Officer

#	Environmental Component	Activity	Standard/ Reference	Location	Frequency	Implementation	Supervision
5	Fire Fighting Equipment and Emergency Response Warning Facilities	• Regular checking as required by Safety Data Sheets	OSHA 2007	Proposed Project Facility	As recommended	• AGOL • Appointed Agent	Appointed AGOL Officer
6.	Socio-economic status of Project Area Community	• Records of Community income generation/livelihood	ESMP	Proposed Project Facility	Quarterly	AGOL	Appointed AGOL Officer

Source: *ESIA Field Survey Activity –Proposed Project Faciity - AGOL*

9 Incident Prevention and Hazard Communication Action Plan

The construction and operation activities of the proposed project might generate incidents and hazards to the health and safety of the employees. It is therefore imperative that the project is constructed and operated in a safe and incident free manner particularly in compliance with Kenyan legislation on safety (e.g. Legal Notice No. 40 titled "Building Operations and Works of Engineering Construction Rules", 1984) and the Proponent's HSE management system requirements. This section recommends the incident prevention and hazard communication actions that the Proponent should undertake in the construction and operations phase of the project.

9.1 Incident Prevention – Construction Phase

Contractor health and safety is an essential component of incident prevention during the construction phase of the project. It is recommended that contractor health and safety rules be implemented for the project containing the elements described below.

9.1.1 Responsibilities with regard to safety

The responsibilities with regard to safety must be documented by the Proponent for all contractors to follow while working at the project site. The Proponent's responsibility is to issue procedures, safety rules and safety induction training for all contractors working on site. It is the responsibility of all contractors to strictly adhere to the Proponent's HSE standards and to ensure that every person in the contractors' employment observes the requirements of the Proponent's regulations.

The contractor will be required to nominate a contractor supervisor for the project. This person will be responsible for all HSE compliance requirements of subordinates and will issue instructions regarding safety and health which have to be carried out by all contract employees.

9.1.2 Designation of First Aiders

In accordance with the Legal Notice 160 of 1977 (First Aid Rules), the contractor shall ensure that an adequate number of certified first aiders are available at the project site with properly equipped first aid boxes. At least one first aider for every 50 employees is recommended.

9.1.3 Contractor Employee Responsibility with regard to Safety

Any contractor employee who observes or is involved in an accident will immediately report such incident to the contractor supervisor who will record the details in a General Register as stipulated under the Occupational Safety and Health Act, 2007. The Contractor's Supervisor on site shall fill out an Accident Report Form and submit it to the nearest provincial DOHSS office within 24-hours of the accident.

9.1.4 Personal Conduct

It will be the responsibility of the contractor to ensure that their employees do not engage in any of the following practices during the construction phase of the project:

- Smoking;
- Personal business; and
- Misconduct.

9.1.5 Personal Protective Equipment (PPE)

Each contractor working at the project site shall ensure that all their employees are provided with appropriate and adequate PPE. The contractor will be required to maintain a register indicating the issuance, control and use of PPE which includes the following:

- Safety shoes;
- Safety helmets (hard hats);
- Hand protection (gloves);
- Eye and face protection (safety glasses);
- Hearing protection (ear plugs, ear defenders); and
- Clothing (overalls).

9.1.6 Safety Procedures

The contractor will be required to issue the Proponent with a comprehensive Safety Method Statement for carrying out each phase of the construction works. The contractor will further be required to comply with the safety procedures of the Proponent EHS Management System.

9.1.7 Fire and Emergency Procedures

The contractor and all the employees working for them shall be required to be familiar with the Proponent's fire and emergency procedures. The safety induction training to be provided by the Proponent's Consultant for all contractors working at the project site will include the Proponent's emergency and evacuation procedures.

9.1.8 Security Procedures

The contractor will be required to familiarize themselves with the Proponent's security procedures and shall ensure that all employees comply with those security procedures.

9.1.9 Working Tools and Equipment

The contractor will ensure that no unsafe tools are used at the project site. The contractor will further ensure that all scaffolding and ladders, cranes, welding machines, compressors, etc. are in good serviceable condition at all times during the construction phase of the project and have been certified by DOHSS approved persons.

9.2 Incident Prevention – Operational Phase

9.2.1 Proponent's HSE Management System

The Proponent will develop, rollout and implement a detailed HSE management system for their project. It is expected that relevant parts of such an HSE management system will be rolled out and implemented at the project site during the operational phase of the project.

9.2.2 Emergency Response Plan

In the event of an emergency at the project site the Proponent's Emergency Response Plan will be activated in accordance with the procedures laid out in it. It will therefore be necessary for the Proponent to develop, rollout and implement their documented emergency response plan prior to the construction phase. The emergency response plan should as a minimum include the headings given below.

- Introduction;
- Purpose;
- Scope;
- Abbreviations;
- Definitions;
- Emergency response organization;
- Emergency notification system;
- Evacuation procedures;
- Emergency response plan activation;
- Contingency plans;
- Emergency management resources and logistics;
- Crisis control center;
- Deactivation and recovery plan;
- Training;
- Emergency response plan maintenance; and
- Emergency response plan distribution.

10 Conclusions and Recommendations

10.1 Conclusions

The project, including the construction and operation of the Proposed Project is anticipated to provide efficient and seamless transfer of LPG from the receiving jetty to the storage terminal in addition to the provision of sufficient stock of LPG to augment AGOL's current LPG storage capacity thereby increasing the supply capacity of LPG to industrial, commercial and residential customers throughout Kenya and East Africa. This will also reduce the deficit and meet the increasing demand of LPG and therefore promote LPG as environment friendly fuel source.

The potential adverse impacts associated with the proposed project are possible to mitigate successfully. The impacts before implementation of mitigation measures are assessed as very low to medium low and the ratings are expected to improve further with the implementation of the proposed mitigation measures. In particular, the LPG facility will be designed, constructed and operated according to the latest industry norms and standards. Programs and plans developed and implemented through the EMP will be monitored and audited to ensure compliance with current regulations and cleaner production practices.

10.2 Recommendation

The Consultant recommends that the proposed development should be allowed to proceed taking into account the implementation of the proposed Mitigation Measures and Environment Management Plan (EMP). An environmental audit is recommended upon the completion of construction works to corroborate the implementation of the proposed mitigation measures. Any unforeseen project impacts shall be identified and addressed through annual environmental audits.

11 ESIA Team Members

The Environmental and Social Impact Assessment was undertaken by a team of consultants from Gomake Consultancy Company Limited that included the following:

- Kennedy Kijana McAbon'go – Environmental Lead Expert;
- Dr. Joseph Wandera – Sociologist;
- Fredrick Maseno – Health & Safety Expert;
- Stephen K. Kiarie – Project Engineer;
- Brian Asutsa – Engineer;
- Felix Lagoswa – Socio-economist; and
- Judy Okoth – Enumerator.

As required under Regulation 14 of the Environmental (Impact Assessment and Audit) Regulations 2003, Gomake Consultancy Company Limited is registered by the National Environment Management Authority (NEMA) as a Firm of Experts. The Lead Environmental Expert is also registered and licensed by NEMA as Environmental Impact Assessment and Audit Lead Expert. Registration certificates for the Firm of Experts and Lead Expert are attached in Annex 9 of this Report.

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ANNEXES

Annex 1: Approved Terms of Reference

Annex 2: Proponent's Ownership Documents

Annex 3: County Government Approval and Project Layout Plans

Annex 4: Minutes and Attendance Register of Public Consultation Meetings

Annex 5: Stakeholder Consultations Response

Annex 6: Baseline Noise Level Measurement Report

Annex 7: Baseline Air Quality Report

Annex 8: IFC performance standards

Annex 9: Practicing Licenses for the ESIA Experts and Firm of Experts