EIA FULL STUDY REPORT FOR THE PROPOSED 2 (Nos). 3,000 METRIC TON LIQUEFIED PETROLEUM GAS (LPG) STORAGE TERMINAL AND SINGLE MOORING POINT (SMP)

By Taifa Gas Kenya Limited at Takaungu, Kilifi County, Kenya: LR Nos. Kilifi/Boyani/ 189,192,221,222,223,224,225,226, 228, 230, and 231 Takaungu Area, Kilifi County

EIA Principal Consultants:

1. **Irungu Maina - Lead Reg. No. 1296**
2. **Lawrence Ngeno- Reg No. 2882**
3. **Emmanuel Macharia- EHS Assistant**

August, 2018

ABBRECIATIONS/ACCRONYMS

Abbreviation/Acronym	Description
TGKL	Taifa Gas Kenya Limited
AAQM	Ambient Air Quality Monitoring
API	American Petroleum Institute
ARV	Anti-Retroviral
BOD	Biochemical Oxygen Demand
BS	British Standards
COD	Chemical Oxygen Demand
dB(A)	Decibels on A-Scale
DMP	Disaster Management Plan
EA	Environmental Audit
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
EIA	Environmental and Social Impact Assessment
ESM	Environmentally Sound Management
LPG	Liquefied Petroleum Gas
MSDS	Material Safety Data Sheet
MT	Metric Tons
NFPA	National Fire Protection Association – USA
PM	Particulate Matter
PPE	Personal Protective Equipment
TDS	Total Dissolved Solids
OMCs	Oil Marketing Companies
OSHA	Occupational Health and safety Act
DHP	Designated Health Practioners
HSEQ	Health Safety Environmental and Quality
QRA	Quantitative Risk Assessment

DECLARATION

Environmental impact assessment full study for the above mentioned project has been prepared with due diligence and care by Irungu Maina and Lawrence Cheruiyot Ngeno (C/o Tricos Solutions Limited) registered EIA/Audit Experts with the assistance of other EIA/EHS experts. The Report was prepared in accordance with the Environmental Management and Coordination Act no. 8 of 1999 and The Environmental (Impact Assessment and Audit) Regulations, 2003 and the relevant Kenya Standards (KS, 1938-Parts 1, 2, 3, 4, and 5), National Energy Policy, for submission to the National Environmental Management Authority (NEMA).

I, Irungu Maina submit this Environmental Impact Assessment Report, for the proposed 6000 Metric Ton Liquefied Petroleum Gas (LPG) Storage Terminal, and Single Mooring Point (SMP) on LR Nos. KILIFI/BOYANI/ 189,192,221,222,223,224,225,226, 228, 230, and 231 TAKAUNGU AREA, Kilifi County, For Taifa Gas Kenya Limited. To the best of my knowledge, all the information in this report is true and correct.

Signed _____ Date _____

(NEMA Registered EIA/Audit Lead Expert Reg No. 1296)

I, Lawrence Cheruiyot Ngeno submit this Environmental Impact Assessment Report, for the proposed 2nos. 3000 Metric Ton Liquefied Petroleum Gas (LPG) Storage Facility and Single Mooring Point (SMP) on LR Nos. KILIFI/BOYANI/ 189,192,221,222,223,224,225,226, 228, 230, and 231 Takaungu Area, Kilifi County, for Taifa Gas Kenya Limited. To the best of my knowledge, all the information in this report is true and correct.

Signed _____ Date _____

(NEMA Registered EIA/Audit Associate Expert Reg No. 2882)

I, ……..……submit this Environmental Impact Assessment Report, for the proposed 6000 Metric Ton Liquefied Petroleum Gas (LPG) Storage and Filling Plant, On LR Nos. KILIFI/BOYANI/ 189,192,221,222,223,224,225,226, 228, 230, AND 231 Takaungu Area, Kilifi County, for Taifa Gas Kenya Limited. To the best of my knowledge, all the information in this report is a truthful representation of all findings as relating to the proposed project.

Signed _____ Date _____

For & of Behalf of the Taifa Gas Kenya Limited

LIST OF EXPERTS

NAME	QUALIFICATIONS	DESIGNATION	EXPERIENCE (YEARS)
Irungu Maina	(PhD) Ongoing MBA, BSc PgD. Occupational Health and Safety, EIA/EA Lead ExpertLicensed OSH auditor	Team Leader	10
Lawrence Ng'eno Cheruyot	BSc, Environmental Science, EIA/EA associate expert OSHA, NEBOSH, QMS Lead Auditor, EHS expert	Team Coordinator	8
Emmanuel Macharia Muriithi	~~Bsc~~BSc, Environmental Science, EIA/EA associate expert, PGD environmental planning and management, OSHA, NEBOSH Level 1	EHS assistant and fieldworks coordinator	7
Dr. Justin Gichobi Kimani	PHD Applied Science in Geomatics, OSHA, certified Urban and Regional Planner, EIA/EA Lead expert	EIA/EA, GIS and Remote Sensing expert	10
Eng. Evans Omuony	~~Bsc~~BSc Mechanical Engineering	Site engineer	20 years
Eng. Joseph Muraya	~~Bsc~~BSc Structural And Civil Engineering	Site Engineer	25
Betty Wakio	BA Sociology	Sociologist	10
Simon Mugo Wangu	MSc, Biology of conservation	Ecologist	10

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Acknowledgement

We express our sincere thanks to management & employees **Taifa Gas Kenya Limited** for their co-operation & unstinted help without which the EIA Full Study Report for **"PROPOSED 2nos.3,000 METRIC TON LIQUEFIED PETROLEUM GAS (LPG) STORAGE TERMINAL AND SUNGLE MOORING POINT (SMP)"** could not have been possible. The courtesy extended to our team is highly appreciated.

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Non-Technical Summary

Overview

This Environmental Impact Assessment (EIA) Full Study Report has been prepared for Taifa Gas Kenya Ltd. (hereinafter referred to as the Proponent) for the proposed construction of an LPG Import and Bulk Storage Terminal and construction of a Single Mooring Point in Takaungu Vilage, Kilifi North Constituency in Kilifi County, Kenya. Taifa Gas Kenya Limited is a subsidiary of Mihamn Group, a Bulk LPG distributor and wholesaler with supporting activities across the Oil and Gas spectrum, including upstream, midstream as well as downstream LPG operations and infrastructure. The group provides term and spot LPG product distribution and supply services to commercial entities, government agencies and NGOs. The company's unrivalled reputation is based on consistently delivering large volumes safely, securely and on time, often in the most logistically challenging and complex environments of Africa and the Middle-East. This report has been prepared by Irungu Maina and Lawrence Cheruiyot Ngeno (C/o Tricos Solutions Limited) registered EIA/Audit Experts and Emmanuel Macharia Muriithi-EHS Assistant.

Project Description

Introduction

Taifa Gas Kenya Limited (TGKL) has expressed interest in developing and installing 2 nos. 3000 Metric Ton Liquefied Petroleum Gas (LPG) Storage and Filling Plant, and Single Mooring Point (SMP) at Takaungu, Kilifi county on LR NOs. Kilifi/Boyani/ 189,192,221,222,223,224,225,226, 228, 230, And 231 Takaungu Area, Kilifi County.

The land to be developed is legally owned by the company. The proposed project involves the installation of 2x 3000 metric ton LPG spherical tanks (Horton Spheres), an Ex rated LPG pump, operational office and main office, bulk tanker loading points with deluge systems, trucks parking area, fire water tank, water sprinkler system other auxiliary facilities and site features will include the saddles for the tanks, 3 chamber vapor trap and a clear site drainage. The project will also involve the construction of an offshore Single Mooring Point (SMP) to folioed the product from ships into the storage facility.

The E.I.A for the project was undertaken by a team of experts led by Irungu Maina and Lawrence Ngeno; NEMA registered team of experts). The experts were appointed by the proponent to complete the EIA study in accordance with Legal Notice (L.N.) 101: Environmental (Impact Assessment and Audit) Regulations 2003 promulgated under the Environmental Management and Coordination Act, 1999, Energy Act No. 12 of 2006 and other acceptable Kenyan standards and Regulations e.g. LPG regulations of 2009 for the LPG industry.

The proposed development activities will mainly involve civil, mechanical and electrical works associated with the installation of the LPG storage tank, pump and filling points and thereafter operations of the facilities. The main activities to be carried out in the development of the

proposed project include excavations or earth works, installation of the tank and pump and pipe works.

NEMA have to first be satisfied with the mitigation and control measures of the project's impacts put in place by the proponent. Once the authority grants approval for the EIA process and issue a license, ERC will also have to be approached for the construction permit which will then allow the project to commence.

Project Objectives

The proposed project aims to increase the availability of LPG in Mombasa and the Kenya environment in general. Use of wood as a bio-fuel is diminishing because of the decline in forest count while kerosene is unreliable in terms of availability, affordability besides being a major contributor to environmental pollution i.e. kerosene releases smoke and choking fumes.

This leaves LPG as the only clean and reliable source of energy with minimal human and environmental negative impacts as long as safety concerns on fire and spillages are adequately addressed.

EIA Process

A thorough field-based environmental and social impact assessment preceded by extensive desk study was undertaken from 16th to 22nd September, 2018. The EIA process is necessary to assess the potential environmental and social impacts (both positive and negative) of the proposed construction of the LPG bulk import and storage Terminal and construction of a Single Mooring Point (SMP); facilitate management and control of the potential environmental and social impacts associated with the construction works; assess compliance with relevant statutory and regulatory requirements and raise awareness of and commitment to environmental and social policies by project staff, the host community and other concerned parties through public meetings.

The environmental parameters assessed during this EIA full study include:

- Physiography
- Geology
- Soils
- Oceanography
- Surface and ground water resources
- Climate and air quality
- Flora, fauna and avi-fauna
- Land resources
- Noise and vibrations
- Visual aesthetics
- Liquid and Solid wastes
- Social, economic & cultural setting and health and safety issues Earthview conducted public awareness through extensive public consultation meetings. This included both formal and informal

interviews with the residents of Takaungu village and other key stakeholders. Household questionnaires were administered in households and key informant interviews conducted. The information gathered is important in that it provides details of the current environmental and socio-economic baseline situation and is critical for development of the Environmental and Social Management and Monitoring Plan (EMP). Regulations, guidelines and standards The policy and legislative framework upon which this EIA survey for the proposed project was based on and includes Kenyan and international legislation and Mihan Group Policies but was not limited to the National Energy Policy (2012); Environment and Development Policy; Land Policy; Kenya Health policy; Environmental Management & Coordination Act (EMCA) 2015; Devolved Government Legislation, International Standards and procedures including: World Bank Group Environmental, Health and Safety (EHS) Guidelines (2007) and International Finance Corporation (IFC) Sustainability Performance Standards (2012) and Guidelines (2007) and Mihan Group Policies and Procedures.

Project Technical Summary

The proposed project includes the:

- Installation of 2nos. 3000 metric tons (Horton spheres) tons LPG storage spherical tanks; with a diameter of about 22m and a thickness of 41mm.
- Filling area and shed, Ex Rated pump system
- Fitting of vent pipes to the relief valve outlets (KS1938-2006:2006)
- Operational office and main office,
- Tanker loading point with a deluge system.
- Controlled Trucks reversing parking area,
- Fire water tank with the required capacity,
- Water Sprinkler system;
- Welded steel braces that have been subjected to elastio-plastic analysis and reinforced gasset plates for holding the tank,
- Recovery sump,
- LPG vapor containment and evaporation pan,
- Clear site drainage
- Construction of a perimeter fence and gate as per the required standards.

Safety design, engineering and operation

The proposed project will be designed, constructed, and operated in conformance with applicable national and international EHS guidelines and standards.

The applicable legislation and regulations include EMCA 1999, Energy Act No. 12 of 2006, Energy (Liquefied Petroleum Gas) Regulations of 2009, KS 1938-1-5: 2006 (Revised Edition KS 1938:2012), on Handling, Storage, and Distribution of LPG in Domestic, Commercial and Industrial Installations.

Safety and health at the facility and protection of people and the environment is not optional but a core part of the process therefore the proponent will put in place all mechanisms, processes and

procedures to minimize, eliminate, mitigate or control identified risks and promotes continuous improvement. Further to this the proponent will apply HSEQ considerations in all planning, decision making, processes and practices. Various measures have also been put in place to prevent leakages which include an electronic check scale, standalone gas leak detector and shut off valve system. An emergency shutdown system will also be installed to improve the safety situation at the facility. A hazardous operability study (HAZOP) will be carried out during the design phase of the facility to incorporate health, safety and environmental considerations.

An EMP has been prepared which describes the environmental protection strategies that will be employed at the site. The EMP contains the management programmes and plans for handling the adverse environmental impacts.

Construction Phase

The 2nos. 3000 metric ton LPG Spherical Tanks (Horton Spheres) will be installed and hydrostatically tested on site before loading with LPG gas. Most raw materials and fittings required for the LPG facility will be sourced locally and where be regionally and internationally. Heavy duty machinery including cranes, bulldozers, excavators, front-end loaders and electric welding machines will be used during construction.

Construction activities are expected to generate noise levels to a limit of 85 decibels and other safety hazards. Where noise is perceived to be above the occupational permissible limits; workers will be required to put on ear defenders. Environmental noise will be mitigated through fixing of noise barriers on-site and silencers on the mobile plants.

Operational Phase

An effective and state of the art fire protection system will be provided. Loose or piled combustible material, weeds and long grass will not be permitted at least within 3.0m of the storage vessel. The county fire department will be consulted at early stage regarding the placing of storage vessels and any other guidance in respect to fire-fighting and fire protection facilities before any construction takes place.

Fire protection details will be made up fixed sprays, 3x 20mm hose reel and 2 x 9Kg Dry Chemical Powder extinguishers and a water sprinkler system (KS1938-3: Revised 2012). The sprinkler system will comprise of 1 1/2" main water line to tank and filling station, 1" and 3/4" cooling rings to storage tank complete with thermo spray sprinkler nozzles. There will be a fire water tank that will hold a 30 min water supply and incase the storage vessel is threatened it will have an application rate of 10 m^2/min over the whole surface of the storage vessel for at least 60 min non-stop.

The proponent will try his level best to provide jobs for the skilled and unskilled local resource personnel throughout the project lifecycle.

Noise levels will be kept to a minimum by designing the facility according to the requirements of Kenyan legislation - The Environmental Management and Coordination (Noise And Excessive Vibration Pollution) (Control) Regulations, 2009 legal notice 61, Factories and other places of work (Noise Prevention and Control) Rules, LN 25 of 2005 **and** ISO: 15664:2001.Noise impacts shall not exceed the standards [Threshold Limit Values (**TLV**),] adopted by International Labor Organization (ILO), World Health Organization (WHO) and American Conference of Industrial Hygienist (ACGIH) 1989-guideline document.

Skilled and unskilled opportunities will be generated through the operation of the LPG station and in other technical fields as in operations and management. Local people will be employed wherever possible.

Baseline Description of the Project Environment (Biophysical and Socio-economic)

Kilifi County, Kenya is defined by the geographic coordinate 3.2184° S, 40.1151° E, and is situated at an altitude of 3-310m (9-910 ft) above sea level. Generally, like other coastal regions in Kenya, Kilifi is characterized by a tropical and monsoon climate. The temperatures are usually high throughout the year. Maximum and minimum annual temperatures range between 26.5-34^0 C and 22.5-24.50^0 Celsius respectively (Köppen-Geiger classification). Average monthly temperatures vary by 4.3 °C (7.7°F). This indicates that the continentally type is hyper oceanic, subtype truly hyper oceanic.

The rainfall pattern is bimodal with rainfall averaging between 900-1200mm annually. The long rains come between March and July while the short one is experienced between November and December.

Pollution from waste

During construction phase, waste will be generated from construction activities, domestic waste from construction team, sewage, waste oil, treated timber, polythene and plastics packaging material and lubricants, containers of used construction materials and wastewater from hydrostatic testing.

During operation phase, waste to be generated include domestic waste generated by the operation staff, components/parts of the facility's infrastructure been removed during replacement; and redundant electronic equipment.

Whereas during decommissioning phase, the main waste generated will be demolished parts of the facility which include; concrete boulders, scrap metals, plastics and rubber among others. The contractor should develop an integrated solid waste management system for the site.

Impacts on ambient noise quality

During the construction phase the proposed project will utilize machineries such as hydraulic excavator, mobile service crane, dumpster and tipper trucks which are likely to generate noise.

The contractor at site will be expected to provide proper protective equipment and well planned programs for equipment usage.

During operation phase noise generation will be from the generator, compressor and the pumps. The amount of noise will depend on the size and the model of the pump to be used.

As will be the case with the construction phase, the sources of noise during decommissioning phase, will be mainly machinery and vehicles used in demolition of the facility and removing the materials from the site. The construction activities will be limited to daytime and the workers will be provided with personal protective equipment e.g. ear defenders.

Health and safety impacts

The potential health and safety impacts of the proposed project include the occupational health and safety risks related to the project activities; risks to the public as a result of events of major disasters such as BLEVE (Boiling Liquid Expanding Vapor Explosion), fire outbreaks and explosions.

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 LPG tanks installation; 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 (BLEVE) and fire outbreaks, severe cold burns upon contact with LPG. 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 proper safety measures are not put in place. The impact significance related to public safety is likely to be high during operational phase of the project compared to all the other phases.

Environmental Management and Impact Mitigation

This report presents an environmental management plan which covers on the measures for mitigating the adverse potential environmental impacts of the proposed project. The EMP includes programmes and plans for addressing the adverse environmental impacts. The proposed management programmes includes:

- Air quality management programme

- Noise management programme

While the plans include:

- Construction management plan;
- Construction control plan;
- Workplace health and safety plan;
- Community health and safety plan; and
- Emergency management and response plan

The proposed programs 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.

Analysis of alternatives

Several alternatives for the proposed project were evaluated. The alternatives considered include: Location, process/activity/operation, layout, input, and no-go option. On the basis of these considerations, the proposed project satisfies the overall economic, technical, environmental and safety criteria used.

Public Consultation

Public stakeholder consultation was undertaken in order to obtain the views and concerns of the neighbors and the stakeholders regarding the proposed project. The stakeholders perceived that the project will not generate adverse environmental impacts. Some of the pertinent issues which were raised have been addressed in the environmental management plan.

Conclusion and Recommendations

Conclusion

The project, including the construction and operation of the LPG spherical tanks and SMP is anticipated to provide sufficient stock of LPG to the Kenyan retail market and also lower CO_2 emissions to the atmosphere. 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 storage 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.

Recommendation

The mitigation measures proposed in this report should be included in the tender contract and tender documents so that the contractor who will be selected for the project will be bound to implement them.

CHAPTER ONE

1.0. INTRODUCTION

1.1. Project Background

Taifa Gas Limited, a privately owned company is planning to develop bulk storage and handling facility for LPG by setting up LPG Import Facility in the new LPG storage Terminal premises based on the international supply / Kenyan demand scenario of LPG & its constituents. Mounded spherical tanks for bulk LPG storage (2 Nos. x 3,000 MT) will be set up for storage purpose and dispatched through tanker trucks to various destinations by road.

Taifa Gas Kenya Limited here after referred to as the "proponent" is an established oil marketing company with offices and stations in Tanzania and East Africa region at large in general. The company has developed a fundamental understanding of the local and regional markets. Their services and products range cover a critical cross-section of the regional market.

They are at the forefront of delivering diverse, material and real solutions to meet Africa's needs for more and secure cleaner and affordable energy.

Taifa Gas Kenya Limited's activities will include:

- Storage, marketing and distribution of LPG at competitive market prices.
- Partnership with other bulk LPG importers and distributors including Mihan Gas in Tanzania for distribution of LPG products to local retailers and institutions.
- Taifa Gas Kenya Limited intends to develop one of the largest LPG facilities and distribution networks in Kenya and East Africa as a whole. The project will be Located in Takaungu, Kilifi County, the facility will receive LPG through direct imports via sea. Taifa Gas Kenya Limited will market its LPG under the brand name "Taifa Gas Kenya Limited Gas and Mihan Gas (Taifa Gas is a subsidiary of Mihan). Having successfully set up and operated bulk storage plants in Tanzania; the proponent is seeking to expand into the Kenyan market through the facility hence the need for an EIA process.

In light of bullet no.3 above the proponent would like to develop and install 2nos. of 3000MT liquefied petroleum gas (LPG) bulk storage facility and offshore single mooring point on undeveloped land adjacent to Mombasa Cement Factory LR Nos. Kilifi/Boyani/ 189,192,221,222,223,224,225,226, 228, 230, and 231 Takaungu Area, Kilifi County. Kijipwa Road separates the proposed area and the existing facility and links the proposed project entire area to the busy Mombasa-Malindi-Kilifi highway.

The Legal Notice No. 101 of 2003 (EIA/EA Regulations, 2003) requires the Proponent to prepare an EIA Study Report for approval by National Environment Management Authority (NEMA) prior to commencement of a new development. In light of this Taifa Gas Kenya Limited Energy Limited

endeavored committed themselves to undertaking environmental impact assessment for the proposed project through NEMA registered consultants.

1.2. Project Justification.

According to the GLPGP – Kenya Market Assessment Report of 2013; 87% of Kenyans use solid fuels as their primary fuel source for cooking while 5% use kerosene as a primary fuel. The heavy reliance on inefficient traditional biomass sources exacerbate forest degradation and climate change, and have not only detrimental impacts on health but also promote poverty in Kenya.

- Over 15,000 Kenyans die annually due to exposure to household air pollution from burning solid fuels
- >40% of childhood deaths are related to respiratory illness due to exposure to kerosene, wood and charcoal smoke
- Average Kenyan household of 4 family members emit 1.2 tons of CO_2 per year
- Kenya has experienced regional deforestation and degradation, with an overall 5% decline in its forest area since 1990.

There are a number of ways to reduce some or all of these negative impacts, including using improved biomass cook stoves and switching to modern fuels such as LPG. Different solutions will be appropriate for different user segments. Less than 5% of Kenyans use LPG as their primary cooking fuel, with 5% is using kerosene and less than 1% using improved biomass cook stoves. The following attributes make LPG an ideal current source of fuel.

- LPG represents a cleaner alternative to solid fuels and kerosene in the short-term, and a promising transition fuel for countries transitioning to more modern cooking technologies in the long-term1.
- LPG is particularly attractive for urban and peri-urban households given the lower availability of firewood, the purchase of cooking fuels with cash, and the ease and efficiency of LPG distribution and retail due to the greater population density.
- While kerosene is considered a modern fuel used primarily in urban areas, recent evidence highlighting its carcinogenic characteristics make it less attractive. The new campaign in the country for a "Kerosene free Kenya" should speed up the momentum to move away from kerosene.
- Opportunities in the short-term to increase LPG use in rural areas are more limited. 87% of rural households use firewood as a primary fuel, and 75% of households using firewood in Kenya are collectors, acquiring the fuel at no direct cost.

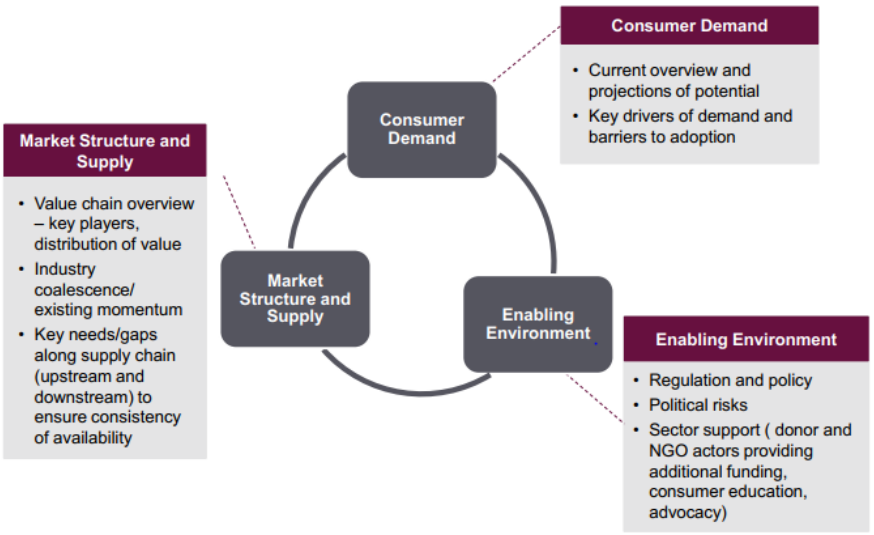


Figure 1: Kenya's LPG Market Structure and Supply, Demand, and enabling Environment

1.3. Project Objectives

The Proponent is seeking to infiltrate the LPG market and establish itself a dominant player in the dynamic and competitive LPG market in. The presence of the LPG bulk storage facility gives a major boost to the availability of bulk LPG for retailers in a market dominated by few and therefore insufficient Bulk LPG wholesalers. The proposed 2nos. of 3,000 metric ton LPG spherical tanks will therefore ensure the availability and accessibility of the gas at a wholesale scale to meet the domestic demand for this clean source of energy.

The proponent will further comply during operations with the specifications set out in the KS 06-896 for Periodic inspection, testing and maintenance of transportable gas containers.

1.4. Data Collection Methods

The team of Experts employed various approaches in collecting data and information for assessing the impacts of the proposed project. The following techniques were used:

1.4.1. Review of secondary data

A wide range of environmental and socio-economic secondary data was sought to describe the baseline conditions of the project area. These included past and published socio-economic, physical and environmental data and reports from government departments and on-line sources.

1.4.2. Study of the bio-physical and the socio-economic environment

A thorough studying into the bio-physical and the socio-economic environment of the project area; aided in understanding the viability and the feasibility of bringing the project to the area. The studies ranged but not limited to the following:

Studying the topography of land, ecology and soils, drainage patterns, Land use zoning requirements, Population distribution and settlement patterns (so that proximity of the project to the people is properly determined).

1.5. Assessing significance of Impacts

The first stage of impact assessment is identification of environmental activities, aspects and impacts. The significance of the impacts is then assessed by rating each variable numerically according to defined criteria as outlined in **Table 1**.

The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the **consequence** of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the **likelihood** of the impact occurring and can obtain a maximum value of 10.

The values for likelihood and consequence of the impact are then read off a significance rating matrix.

(Table 2), and it is determined whether mitigation is necessary using Table 3. The definitions used in the impact assessment are given below:

*An **activity*** is a distinct process or task undertaken by an organization for which a responsibility can be assigned. Activities also include facilities or components of infrastructure that are owned by an organization.

*An **environmental aspect*** is an 'element of an organization's activities, products and services which can interact with the environment. The interaction of an aspect with the environment may result in an impact.

Environmental impacts are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality.

Receptors can comprise, but are not limited to, people or human-made structures or systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as aquifers, flora and paleontology. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.

Resources include components of the biophysical environment.

Frequency of activity refers to how often the proposed activity will take place.

Frequency of impact refers to the frequency with which a stressor (aspect) will impact on the receptor.

Severity refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.

Spatial scope refers to the geographical scale of the impact.

Duration refers to the length of time over which the stressor will cause a change in the resource or receptor.

Table 1: Criteria for assessing significance of impacts

Consequences

Magnitude of Impact	**Rating**
Negligible	1
Minor	2
Marginal	3
Significant	4
Catastrophic	5
Spatial Scope/Geographic Extent of Impact	**Rating**
Activity specific	1
Site specific	2
Local area (within 5km of the project site)	3
Regional	4
National	5
Duration of Impact	**Rating**
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure/permanent	5

Likelihood

Frequency/duration of activity	**Rating**
Annually or less	1
6 monthly/temporary	2
Monthly/infrequent	3
Weekly/life of operation	4
Daily/permanent	5

Frequency of impact	**Rating**
Almost never/Impossible	1
Very seldom/highly unlikely	2
Infrequent/ unlikely seldom	3
Often/regularly/likely/possible	4
Daily/highly likely/definitely	5

Table 2: Significance Rating Matrix

Consequence (Magnitude+ Geographic extent + Duration of the impact															
Likelihood (Frequency of Activity Frequency of Impact	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 3: Positive/negative mitigation ratings and associated color codes

Significance	Value	Color	Negative Impact Management	Positive Impact Management
Very high	126-150		Propose mitigation measures	Maintain current
High	100-120		Propose mitigation measures	Maintain current
Medium high	77-105		Propose mitigation measures	Maintain current
Low medium	52-75		Maintain current management	Improve current management
Low	25-50		Maintain current management	Improve current management
Very low	4-24		Maintain current management	Improve current management

1.6. Purpose of this Report

This report addresses the requirement for preparation of EIA Study Report in accordance with EIA/EA Regulations, 2003.

The report presents an overview of the proposed project and the environmental regulatory framework from which it operates. It identifies and assesses the significance of the impacts of the project as well as mitigation measures necessary to reduce or prevent impacts.

1.7 Purpose of the EIA

The EIA is anticipated to make available for the protection, conservation and wise management of environment through planning and informed decision making. Environmental Impact Assessment (EIA) is requisite to be carried out only for those categories of projects that are covered under EIA/EA regulations (2003) and the criteria for screening have been provided in the Act. Thus, EIA is fundamentally made applicable to industrial and developmental projects, which are more likely to have significant environmental impacts.

1.8 Methodology Adopted for the EIA Full Study Process

The scope of the study would include a detailed characteristic of environment in the study area associated with the development of special Economic Zone for various environmental components. For the purpose of environmental assessment, areas within 5 km radius of the project have been studied and the following methodology will be adopted. Monitoring and analyses done as per EIA/EA regulations (2003).

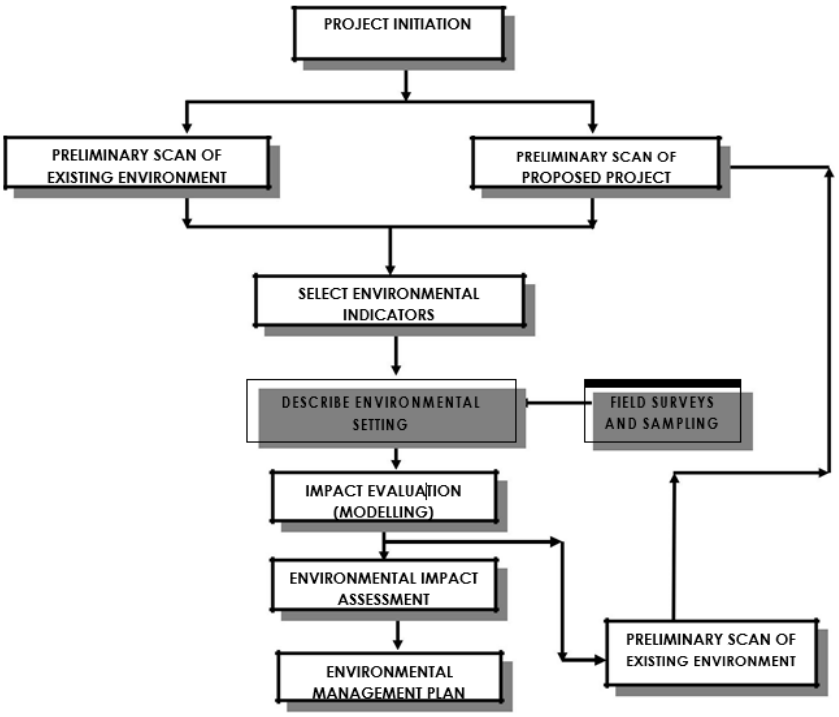


Figure 2. Flow Chart of Methodology of EIA

2.0. DESCRIPTION OF THE PROJECT

2.1. Project Location.

The proposed project will be developed on LR Nos. Kilifi/Boyani/ 189,192,221,222,223,224,225,226, 228, 230, and 231 Takaungu Area, Kilifi County , Kenya, Near Mombasa Cement Factory, Vipingo.

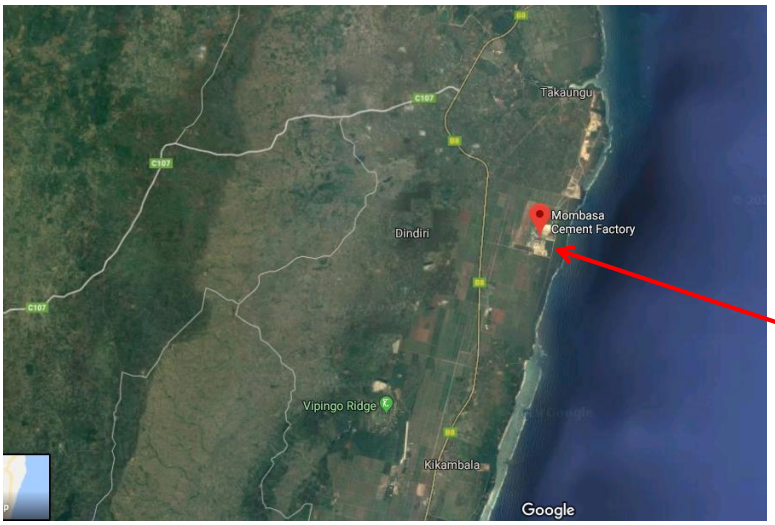


Figure 3: Satellite Image showing the location of the proposed project site

Source: **Google Earth**

The project location will be owned and operated by Taifa Gas Kenya Limited as an LPG terminal and the undeveloped part currently idle will be used for bulk LPG storage. Geographically, the site is located on approximately Latitude -3^0 74' 05.80" South and Longitude 39^0 85'15.93" Takaungu area, approximately 2kms from the main Mombasa-Kilifi-Malindi Highway. Change of user has been sought by the proponent.

(Copy of certificate of title of the land has been appended at the end of this report).

The project area can be accessed from the busy Mombasa-Kilifi-Malindi Highway using the busy Takaungu road. The surrounding area is already industrial with companies such as Mombasa Cement operating industrial activities as indicated below.

Figure 4 Part of the plot to be developed for the bulk LPG and Storage Plant

2.2. Proposed Project

The proposed project will have 2X 3000 MT Liquefied Petroleum Gas aboveground spherical tanks, a tanker filling station and perimeter wall fencing and attendant SMP works. The project will occupy a surveyed area of 2.29 ha. ERC approved trucks will be filled at the site for onward transmission to different parts of the country.

The task will involve:

The surface area beneath the 2nos 3000MT spherical storage tanks (equal to the footprint of the vessel) will be made of concrete material and will slope away from the storage vessel at a gradient of at least 1:50, to the edge of the appropriate safety distance limit. Excavation of the coastal coral rock of sandy nature up to a depth not exceeding 2m to hard rock and cart away debris, upon which paving with concrete will be done:

- Construction of the tanks foundation.
- Casting a concrete slab for LPG pumping area, installation of the Ex-rated pump.
- Designation and marking of the trucks reversing and temporary parking area during offloading and loading activities. This area will have fully fledged deluge system to back up the fire water tank especially for the mobile equipment e.g. trucks.
- 3 chamber LPG vapor containment area, (25m by 5m by 0.6m thick) for each of the spheres.
- LPG piping work and mechanical works.
- Painting work.
- Purge air from tank and pipelines and commission
- Construction of a 300 mm thick Masonry block boundary wall.

- Chain link fence around the LPG storage tanks.
- Reinforcing and raising of the existing masonry wall around the entire project area to a height of at least1.8m or more.
- Construction of the offshore single mooring point

2.3. Technology

The primary technologies used for the design, construction and operation of the LPG facility include various international codes of practice, Standards, Government Acts and Local Authority Regulations.

In Kenya there are a limited number of regulations covering the technology to be used in the design, construction and operation of LPG station.

Kenya Bureau of Standards (KEBS) through an ad hoc committee has developed standards to guide successful and safe development Liquefied Petroleum Gas (LPG) installations. In this case therefore among other standards already discussed in this report; KS 1938-1-5: 2006 (Revised edition is the KS 1938:2012 which has no major changes) on the Handling, Storage and Distribution of Liquefied Petroleum Gas in Domestic, Commercial and Industrial Installations. Subsequently the country also relies on international codes of practice, standards and guidelines for the design, construction and operation of such facilities.

In summary the proposed project will be designed and constructed in alignment with the standards quoted in table 4 below.

Table 4: Standards to be used for the Proposed LPG facility

Mechanical Works	
Kenya Standards KS 1938:2006	The handling, storage and distribution of liquefied petroleum gas in Domestic, commercial and industrial installations-code of practice. Part 1: Liquefied petroleum gas installations involving gas storage containers of individual capacity not exceeding 500L and a combined water capacity not exceeding 3000L per installation. Part 2: Transportation of LPG in bulk by road. Part 3: Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 500L.
KS 06-896	Periodic inspection, testing and maintenance of transportable gas containers.
BS 1414	Steel Wedge Gate Valves for the Petroleum, Petrochemical and Allied Industries
BS 1868	Steel Check Valves (Flanged and Butt-Welding Ends) for the Petroleum, Petrochemical and allied Industries
BS 5352	Steel Wedge Gate, Globe and Check Valves 50mm and smaller for the Petroleum, Petrochemical and Allied Industries.
ASME B 16.9	Factory Made Wrought Steel Butt Welding Fittings
1P part 2	Marketing Safety Code (for all works)
Electrical 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
BS 7430	Code of Practice for Earthing
BS 7671	Requirements for electrical Installations
IP Part 1	Electrical Safety Code
IEC 502	Specification for XLPE insulated Power Cables
Instrumentation and Control	
BS 381 C	Colors for Identification, Coding and special Purposes
BS 1363	1 3A plugs, socket-outlets and adapters
BS 4196	Sound Power Levels of Noise Sources
BS 5308	Instrument Cables
BS 6739	Code of Practice for Instrumentation in process Control Code of Practice for
BS 6739	Code of Practice for the Instrumentation of in Process Control Systems: socket outlets and couplers for industrial purposes

P Part 15	Area Classification code for Petroleum Installations
Civil and Structural Standards	
BS 8110	Structural use of concrete
BS 8004	Code of practice for foundations
BS 5328	Specification for concrete
BS 6032	Code of practice for earth works
BS 1881	Testing concrete
BS 812	Testing aggregates

2.4. LPG Storage Spherical Tank

The 2nosX 3000MT storage tanks will be sourced from certified suppliers and installed on site. Each tank has an approximate diameter of 22m and a thickness of about 41mm. The tanks will be supported welded steel braces reinforced with gusset plates. The braces will be subjected to yield and tensile strength tests though elastio-plastic analysis. The upper column of the brace should be able to withstand seismic inertia force/ pressure up to 400MPa and the lower column 235MPa.

The tank will be located 9m from the tanker filling point. During construction, the contractor will adhere to international and local standards including NFPA 58, API 25, API 2510A and KS 1938 Standards (both old and revised edition).

Details of Proposed LPG Spherical Bulk Storage Tanks

Description	No. of Tanks & Capacity of Each (MT)	Total Capacity (MT)	Temperature (°C)	Pressure (kg/cm^2g)
Existing				
Horton Spheres	2 x 3,000	6,000	5	4

2.5. Tank Truck Filling Station

The truck filling area will be reinforced with a thick concrete slab for the LPG Pump. The Ex rated pump will be installed 30m from the LPG spherical storage tank and then another 25m from the pumping area. The offices will be located in two separate plots across the main plot allocated for the tank farm; it is at this point that the muster point will also be located. The whole facility has been designed to be located at least 75m away from the storage area to the boundary wall of institutions e.g. schools, churches, hospitals and similar institutions. Fortunately, these said facilities are not anywhere near the proposed area as the area.

Tankers will be connected directly using stainless steel pipes via the pumping on to the storage tanks whenever offloading/ decanting of gas.

Before the LPG transport trucks are filled, a pre-fill inspection of the trucks will be undertaken to ensure that the trucks are safe to fill. Only transport trucks that conform to the requirements of KS 06-896- Periodic inspection, testing and maintenance of transportable gas containers will be allowed in the facility.

2.7. Boundary wall

The project will be surrounded by a 300 mm thick masonry boundary wall. Considering that the safety distances have been met; there will no need for a fire wall. The wall will have three access

gate which will also serves as emergency gates; one gate will be constructed on the same side as existing one in order to meet the Kenyan standards requirements.

2.8. Emergency Response Preparedness.

The potential health and safety impacts of the proposed project that could call for the need to have a robust **emergency response and preparedness** include the occupational health safety risks related to the project activities; risks to the public as a result of events of major disasters such as fire outbreaks and explosions. (Explosions are normally as a result of **BLEVE (Boiling Liquid Expanding Vaporization Explosion);** i.e. LPG is stored as a liquid under pressure, leakage, especially of liquid can release large volumes of highly flammable gas; a gas-air mixture containing approximately 1.5% to 10% by volume of LP gas (mostly propane components) is flammable. If a large enough volume of gas is so dispersed in the atmosphere as to reach flammable proportions throughout, ignition of the mixture will result in a rate of combustion of near-explosive force. When explosion happens this is called **BLEVE**).

The potential occupational health and safety impacts requiring emergency care on site and beyond are discussed below as per project phases:

During construction phase will include injuries through the construction activities whilst during the operational phase they will include injuries to workers from, routine monitoring and maintenance and deaths and injuries from major disasters e.g. explosions and fire outbreaks. Whereas during decommissioning; the potential H&S risks include injuries occasioned by dismantling of the facility.

The proponent has endeavored to mitigate the above potential cases of emergency as below.

2.8.1. LPG filling Plant and Its Accessories Design and Installation.

The plant has been designed in accordance with the requirements of KS 1938:2012- Code of practice 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.

Other laws and industry practices will be adhered to, as well as, as highlighted in the table below:

Legislation	Responsible Institution/Lead	Main Purpose	Relevance to the Proposed Project
KS 1938:2012	KEBS/ERC	Code of practice 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 storage vessel Filling ratio and volumes of storage vessel Storage vessel location Installation of LPG storage vessels Installation of vaporizers Periodic inspection and retesting;

Physical Planning Act of 1986; Copy of approved drawing in accordance with Local Government Act (**As Revised, 2010**), 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 KS 1938(1-5) Transport LPG by road in accordance with the Act and terms and conditions of a valid license issued by the			

2.8.2. Risk Significance during Construction & Operational Phases.

2.8.2.1. Construction phase

Impact without mitigation: Risk of large scale incident	**Significance**
Consequence	
Magnitude	5
Geographic extent	2
Duration of impact	1
Total	**8**

Likelihood	
Duration of activity	4
Frequency of impact	4
Total	**8**
Results (**Consequence * Likelihood)**	**- 64** (Low medium)
Comment/mitigation: Mitigation measures for the potential Occupational Health and Safety impacts will be covered in the construction Safety Management Plan. The implementation of the proposed project to be done in accordance to the OSHA 2007 and any other relevant H&S legislation.	
Impact with mitigation: Risk of large scale incident	
Consequence	
Magnitude	1
Geographic extent	1
Duration of impact	2
Total	**4**
Likelihood	

Duration of activity	2
Frequency of impact	1
Total	3
Results (**Consequence * Likelihood)**	**- 12 (Very low)**

2.8.2.2. Operation Phase

Impact without mitigation: Risk of large scale incident	**Significance**
Consequence	
Magnitude	5
Geographic extent	4
Duration of impact	4
Total	**13**
Likelihood	
Duration of activity	4
Frequency of impact	3
Total	**7**
Results (**Consequence * Likelihood)**	**- 91(medium high**)
Comment/mitigation:	

Mitigation measures for impacts resulting from public safety are covered in the proposed EMP.

Impact with mitigation: risks to public safety	
Consequence	
Magnitude	3
Geographic extent	2
Duration of impact	2
Total	**7**
Likelihood	
Duration of activity	4
Frequency of impact	1
Total	5
Results (**Consequence * Likelihood)**	**- 35 (low)**

*2.9.*Emergency Response Programme

The aim of this programme is to ensure that the Safety and Health of the employees' and the surrounding neighbour's quality is maintained throughout construction, as well as operational phases. The emergency response programme will include the following: undertaking Safety & Health risk assessments, Safety & Health 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, clearly marked escape routes on site, ensuring that there are Emergency contacts on site to be used in case of an emergency.

2.9.1. Preparedness & Response Site Plan (Summary)

The proponent undertakes to:

- To at all times have site response 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 Company and emergency services including police, ambulance services, and fire brigades among others.
- The following personnel will have their emergency contacts displayed on the ER site contact list in conveniently accessible location e.g. the main gate and site offices.
    - Taifa Gas Kenya Limited Telephone Contacts- **+254 736 915582**
    - Mombasa Provincial Police Headquarters **(041) 2222121**
    - Kijipwa Police Station **041-32211**
    - Kilifi County Disaster Contacts
        - **+254 700 395395**,
        - **+254 720025138,**
        - **041 - 7522426,**
    - Kilifi County Fire Brigade- +**254 712 891484 / +254 735 352434**
    - St John Ambulance **0706-777077**
    - Red Cross- **+254 700 395395**
    - AAR Ambulance +**254 734-225225**
- To regularly 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.
- There shall be at least two emergency exits one for exiting of trucks and one for public safety. Have designated trained fire marshals to assist during cases of emergencies muster point/ fire assembly point outside the plant.
- Clearly marked safety signage with the required coding will be installed on site e.g. "**NO SMOKING SIGNS**"
- All staff including the security personnel will be trained in basic firefighting skills, first aid, One Man Down stretcher bearers etc.

- No trucks will be allowed to park near the exits, fire assembly points as per the site layout drawings.
- No flammable materials e.g. lighters, torches, mobile phones, will be allowed near the filling plant except **ONLY AS** may be allowed under strict supervision in the offices and the security gates.

2.9.2. Fire Prevention and management.

2.9.2.1. Construction Phase

- Take all necessary precautions to prevent fires caused either deliberately or accidentally during construction process.
- The proponent's site build contractor shall prepare a fire prevention and fire emergency plan as a part of the Environmental Plan to be submitted to the management of Taifa Gas Kenya Limited.
- The site build contractor shall provide adequate firefighting appliances at specified localities on the worksite to meet any emergency resulting from ignition of a fire.
- The site build contractor shall ensure that hot works is prohibited under specified safety distances and 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.

2.9.2.2. Operational Phase

- All the employees working will be required to be familiar with the facility's fire and emergency procedures.
- Provision of safety induction training to all new staff, site visitors and customers will be done by the SHERQ team and the security personnel.

The facility will have a comprehensive firefighting system covering all hazardous areas and the other areas of the facility. This will ensure that any fire within the filling plant is quickly surpassed and extinguished. Technically fire protection details will be made up fixed sprays and cooling rings, 2 x 200mm hose reel and 2 x 9Kg Dry powder extinguishers and a water sprinkler system. The sprinkler system will comprise of 1 1/2" main water line to tank and filling station, 1" and 3/4" cooling rings to storage tank complete with thermo spray sprinkler nozzles. There will be a fire water tank that will hold a 2hrs water supply and in case the storage vessel is threatened by it will have an application rate of 10.5m^2/min over the whole surface of the storage vessel for at least 2 hours non-stop.

2.10. Construction Phase

2.10.1. Site preparation

Intensive site preparation work will consist of the following; site clearing, excavation followed by backfilling and compaction. The waste generated from site clearing will be transported and dumped by the waste handlers. The Contractor will be in charge of the transport of raw materials to site during

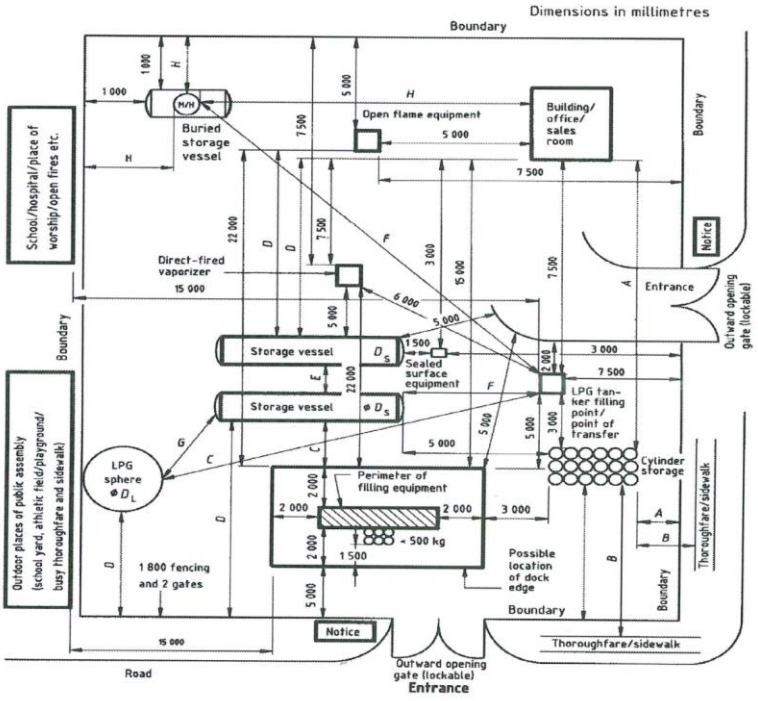
construction process. Some of the materials to be delivered to the site include aggregates, masonry stones, cement, iron sheets and other construction materials.

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. Curbs will be incorporated in parking and process areas to allow for storm water from these areas to be drained to a collection area equipped with a sump where runoff can be checked prior to release and connected to properly designed oil water separators.

2.10.2. Safety Distances

Proper safety distances will be in ensuring maximum site safety throughout the entire project lifecycle. KS 1938-3: 2012 provides specific guidelines on the safety distances to observe between different facilities in the storage plant as have been discussed as follows (only for this project).

Table 5: Recommended Safety distances extract from the KS 1938-3:2006



D_L = diameter (large)
D_S = diameter (small)
M/H = manhole

Figure 2a — Recommended safety distances for gas fuel installations

Table 2 – Safety distances

1	2	3	4	5	6	7
Water capacity of storage vessel L	Minimum (safety) distances (m)					
	From above-ground vessel to points of gas release[a]	From above-ground storage vessel to buildings and property boundaries	From buried and mounded storage vessel to buildings, property boundaries and points of gas release	From sealed surface equipment to building and property boundaries	From open flame equipment to building and property boundaries	Between above LPG storage vessels
				3.0	5.0	¼ of sum of diameters of adjacent storage vessels
9 000 <V≤ 67 5 00	9.5	9.5	7.0			
67 500 <V≤ 135 000	15.0	15.0	15.0			
135 000<V≤ 265 000	22.5	22.5	15.0			
V> 265 000	30.0	30.0	15.0			
[a]For points of transfer see clause 11 and Figure 3.						

The spacing for this project for the 2 nos. 3000 MT falls under the 135,001-265,000 size of vessel from the table above. That is 6000MT of LPG storage is equivalent to 1,200,000L of water storage. In this case therefore the land size will meet the required safety distances.

The minimum required safety distance for this type and size of tank as per the standard from the shell of the tank to the property boundary wall is 30m. The distance between the two tanks will be 10m i.e. measurements done on the actual ground noted that this requirement was achieved. Please see the appended site layout at the end of the report indicating the required safety distances for other auxiliary facilities like the pumping area, trucks parking and reversing point, point of gas release etc.

All other safety distances have been captured as per the requirements of KS 1938:2012 (extract above).

2.10.3. Materials

The exact quantities of materials required for the construction of the proposed project are not known at this stage of the project. The Proponent will utilize several materials in the construction of the project. Some of the materials will be sourced locally whereas others will be obtained from the quarrying areas Kaloleni and Bamburi Nature Trails for building sand and sandstones.

The materials to be used in the construction of the proposed project must be flame proof, fire retardant and resistant to corrosion. The said materials will be but not limited to the following.

- Sandstone

- Concrete
- Sand
- Steel rods
- PVC pipes
- Water
- Paint
- Corrugated preprinted roofing

2.10.4. Energy Diesel and electricity product

The final product after construction phase is LPG storage facility which will comprise of a 2nos.3000MT Aboveground Storage Spherical Tanks and associated Pipe work, a truck area and a single mooring point for vessels' berthing and offloading of product. The gas must be stored as liquid under pressure. Gas leakage must be prevented as this can release highly flammable gases; this will be achieved by the installation of the leak detection system.

2.10.5. By-products/ Waste

The Proposed project will generate several byproducts during both construction and operation phases.

During the construction phase of the project it is envisaged that the by-products might include:

- Metal cuttings generated from the construction activities
- Any excess construction materials brought to the project site by the contractor which can be reused later.
- Excavated material

During construction the proposed project is anticipated to generate different waste which shall include:

2.10.5.1. Domestic Waste from the Construction Area

The workers will not be supplied with any forms of foodstuffs. They are expected to buy or carry their own food. Plastic bags and containers which the workers will use to carry their food are expected to increase within the site and in the immediate vicinity.

Other forms of waste include sanitary waste and therefore the provision of sanitary facilities will need to be considered both for the site construction workers and the visiting population.

2.10.5.2. Site Construction Waste

The project will generate waste from the site construction activities which includes:

- Excavated soils and vegetation;
- Construction equipment and maintenance wastes;
- Dust and fumes;
- Scrap metals;
- Packaging materials, etc.

The wastes will be segregated in accordance with Legal Notice 121: Waste Regulation, 2006 with recyclable material collected and transported to a recycling facility. An effort will be made to minimize the amount of waste generated by application of 4-R principles (reduce (from source), reuse, recycle, recover) to the extent practical. Non-recyclable wastes should be transported offsite to a permitted landfill. A Waste Management Plan (WMP) will be developed for all phases of the Project. The objective of this plan is to minimize waste discharges and emissions and identify appropriate waste reduction and other mitigating measures.

Additionally, a Construction Environment Management Plan (CEMP), including plans for erosion and sediment control measures will be developed prior to commencement of construction activities and implemented to minimize impacts to water quality from construction activities. Other measures that will be implemented include:

- Programming site activities to minimize the disturbance of the project surface area;
- Avoid maintaining open excavations for prolonged periods and compact loose materials;
- Compacting soils as soon as excavations, filling, or leveling activities are complete;
- Implementing measures to control against sedimentation and erosion, and to ensure that construction personnel are familiar with these practices and conduct them properly; and
- Control of runoff during the construction phase.

2.10.5.3. Air Emissions

Air quality impacts associated with construction activities are generally related to the generation of dust especially during dry weather conditions and exhaust emissions from the operation of construction equipment. Control measures, such as use of dust suppression techniques, will be used in construction zones as required to minimize the impacts from fugitive dust. The air emissions from the construction equipment will be localized and temporary, lasting the duration of construction activities. Routine inspection and maintenance of construction equipment will minimize exhaust fumes.

2.10.5.4. Noise Emissions

The target noise levels during construction are set at 75dB (A) (BS 5228, 1997) during the day and 70 during the night. These levels are below the permissible limits i.e. 85dB (A) as per the Factories and other places of work (Noise Prevention) Rules of 2005.

2.10.6. Commissioning

The final stage of construction is the start-up and commissioning of the facility. During the commissioning stage, air will be purged from the tank and pipelines.

2.11. Operation Phase

Once commissioned, the tank will be filled with LPG. The gas will be brought in by ERC Licensed transporters. The product will serve an already growing LPG market in the coastal region and other regions where the demand is high.

2.11.1. Products

The primary product of the proposed project during the operational phase will be Liquid Petroleum Gas (LPG). **Liquefied petroleum gas** or **liquid petroleum gas** (**LPG** or **LP gas**), also referred to as simply propane or butane, are flammable mixtures of hydrocarbon gases used as fuel in heating appliances, cooking equipment, and vehicles.

It is increasingly used as an aerosol propellant and a refrigerant, replacing chlorofluorocarbons in an effort to reduce damage to the ozone layer. When specifically used as a vehicle fuel it is often referred to as autogas.
LPG is prepared by refining petroleum or "wet" natural gas, and is almost entirely derived from fossil fuel sources, being manufactured during the refining of petroleum (crude oil), or extracted from petroleum or natural gas streams as they emerge from the ground.

LPG is mainly used in the below activities:

2.11.1.1. Cooking

Global Overview

LPG is used for cooking in many countries for economic reasons, for convenience or because it is the preferred fuel source.

According to the 2011 census of India, 33.6 million (28.5%) Indian households used LPG as cooking fuel in 2011, which is supplied to their homes in pressurized cylinders. LPG is subsidized by the government in India. Increase in LPG prices has been a politically sensitive matter in India as it potentially affects the urban middle class voting pattern.

LPG was once a popular cooking fuel in Hong Kong; however, the continued expansion of town gas to buildings has reduced LPG usage to less than 24% of residential units.

LPG is the most common cooking fuel in Brazilian urban areas, being used in virtually all households, with the exception of the cities of Rio de Janeiro and São Paulo, which have a natural gas pipeline infrastructure. Poor families receive a government grant ("Vale Gás") used exclusively for the acquisition of LPG.

LPG is commonly used in North America for domestic cooking and outdoor grilling.

The current market for LPG in Kenya is underdeveloped, with 5-7% of households relying on LPG as a primary cooking fuel – LPG penetration is much higher in urban areas at 21%; Only 1% of rural households use LPG as a primary fuel – As it is common for some households to use multiple fuels (“fuel stacking”), total LPG penetration may be closer to 7%-10% nationally – The greater Nairobi region accounts for 60% of the market, where penetration rates for LPG are estimated to be as high as 40%. Mombasa makes up 15% of the market, with the remaining market scattered throughout other growing urban centers, especially in Western Kenya

Figure 1: Typical LPG tanker truck used in Kenya.

2.11.1.2. Rural heating

Predominantly in Europe and rural parts of many countries, LPG can provide an alternative to electricity and heating oil (kerosene). LPG is most often used in areas that do not have direct access to piped natural gas. This technology is yet to be adopted in Kenya and many African countries.

LPG can be used as a power source for combined heat and power technologies (CHP). CHP is the process of generating both electrical power and useful heat from a single fuel source. This technology has allowed LPG to be used not just as fuel for heating and cooking, but also for decentralized generation of electricity.

LPG can be stored in a variety of manners. LPG, as with other fossil fuels, can be combined with renewable power sources to provide greater reliability while still achieving some reduction in CO_2 emissions.

2.11.2. Waste

2.11.2.1. Effluent Waste

The area is connected to the Mombasa Sewer line; waste water from the sanitary facilities on the project site will be channeled to it once the proponent seeks connection to the line.

2.11.2.2. Domestic Waste

Some of the domestic waste to be generated at the facility will include office waste such as paper, empty cans among others. The principle of the 4Rs methods of minimizing waste will be deployed.

2.11.2.3. Sanitary waste

The employees of the Proponent who will be based within the project area are expected to generate sanitary waste which will be channeled to the conservancy tank.

2.11.2.4. Air Emissions

The proposed facilities will be designed to international standards. Subsequently emissions from trucks and lifting machinery etc. are expected to be low.

The only emission sources of significance for the project emission inventory during normal operations include:

- Volatile Organic Compounds (VOCs) during filling and decanting of LPG gas from the tank and tanker respectively.
- Intermittent emissions from routine testing of diesel engine driven emergency generator for backup power;
- Emissions from trucks offloading the LPG gas
- Emissions from trucks and other vehicles to be loaded with cylinders.

2.12. Decommissioning Phase

Upon decommissioning of the proposed LPG tank, rehabilitation of the project site will be carried out to restore the site to its original status or a better status than it was originally. This will include replacement of top soil and re-vegetation which will lead to improved visual quality of the area.

2.12.1. Products

During the decommissioning phase people may assume that there will be no product in the tank. However scientifically it is proven that a storage vessel that has held LPG and is deemed to be empty could be dangerous as well as. In this state the internal pressure in the vessel is approximately atmospheric and, if the valve leaks or is left open, air can diffuse into the storage vessel and form a flammable or explosive mixture. Furthermore, an empty storage vessel that does not yield gas when the valve is opened in fact might not be quite empty. In cold weather the heavier fractions of the liquid (dead stock) might not vaporize and will remain in the storage vessel. All vessels that are (or appear to be) empty should be handled with the same care as used for a full storage vessel.

The following steps will/ should be considered during the decommissioning process.

- LP Gas liquid will be decanted as much as possible through the storage vessel liquid withdrawal connection
- The remaining LP gas vapor will be removed through the venting connection (the vapor will be vented to the open air at a safe location in an approved manner.) and
- Storage vessel will be purged in accordance with appropriate requirements given in KS 1938-1 & 3: 2006.

2.12.2. By-products/ Waste

The by-products during decommissioning phase will include:

- Metal generated from the decommissioning of pipe work infrastructure, scrap, demolition wastes from the office block, dust and fumes; and

- Foundation materials which can be donated to individuals for reuse

These will be handled with extra care to avoid any form of ignition that could lead to inflammatory situations.

2.12.3. Air Emissions

The demolition activities that will occur particularly during the demolition process will generate a considerable amount of dust and other particulates that will be released into the atmosphere.

The demolition machinery, equipment and trucks brought in by the Contractor are expected to generate smoke emissions. The concentration of emissions will depend on the maintenance levels of the equipment, machinery and trucks used by the Contractor.

2.13. Health and Safety System

The potential health and safety impacts of the proposed project include the occupational health safety risks related to the project activities; risks to the public as a result of events of major disasters such as fire outbreaks and explosions.

2.13.1Basic Safety Principles (World LP Gas Association)

- While flammability is the major safety concern with LP Gas it is not the only one. Good safety practice addresses the various hazards from production to consumption.
- The term LP Gas embraces several products which while related have important physical differences which affect safety. If more than one type or grade of LP Gas is being handled each should be clearly identified and segregated. All should be within specification, especially with respect to maximum permitted vapor pressure.
- Large LP Gas installations should not be constructed close to large or sensitive populations. Populations should be restricted close to locations approved for large LP Gas installations. In planning or evaluating proposals for the location of LP Gas facilities due account should be taken of the hazards created and of the risks associated with those hazards within and beyond the facility.
- Space and separation distances are fundamental to safety at LP Gas facilities – large and small – and should be assessed for each location and observed.
- Participants in the LP Gas industry should actively promote a safety culture within their own businesses and at industry level.

- Personnel engaged in LP Gas operations should receive formal training by competent persons for their normal activities and for emergencies. LP Gas facilities should have emergency planning and response programmes appropriate to the hazards and risks which they represent. These include correct handling procedures to avoid injury.
- Fuel grade LP Gas should be adequately odourised prior to entering the distribution chain. When LP Gas is required to be odour-free adequate alternative safety measures should be employed. (See Appendix Three - References).
- Installers of appliances and equipment, and those responsible for service should be formally trained and should have reached a specified level of proficiency.
- Staff and Consumer safety awareness campaigns are an essential part of LP Gas safety principles and they should emphasize:
    - The quality/safety linkage for gas, appliances and equipment including safe practices • The risks associated with inferior installation standards and/or practices
    - The need for care and in particular for adequate ventilation • How to recognize the smell of odorized LP Gas
    - The action to take when gas is detected

The potential occupational health and safety impacts during construction phase will include injuries through the construction activities whilst during the operation phase they will include injuries to workers from, routine monitoring and maintenance and deaths and injuries from major disasters e.g. explosions and fire outbreaks. Whereas during decommissioning; the potential H&S risks include injuries occasioned by dismantling of the facility.

2.14. Employment

The proposed project is anticipated to create both direct and indirect employment in both the construction and operational phases of the project.

CHAPTER THREE

3.0. BASELINE ENVIRONMENT INFORMATION OF THE PROJECT AREA

The baseline environmental qualities of various environmental components like air, noise, water, land, flora and fauna and socio-economic form an important and integral part of any environmental study. The baseline data forms the basis for predicting/assessing the environmental impacts of the proposed project. The baseline environmental quality is assessed through field surveys within the impact zone as well as secondary data for various components of the environment, viz., air, noise, water, land and socio-economics (existing physical, biological, and social environment).

The proposed project will be developed on **LR Nos.** Kilifi/Boyani/ 189,192,221,222,223,224,225,226, 228, 230, And 231 Takaungu Area, Kilifi County, 2km off the busy Mombasa-Kilifi-Malindi Highway, Takaungu Kilifi County, Kenya.

3.1. Climatic conditions & Soils and Geology

The average annual rainfall ranges from 300mm in the hinterland to 1,300mm at the coastal belt. The coastal belt receives an average annual rainfall of about 900mm to 1,100mm with marked decrease in intensity to the hinterland. Areas with highest rainfall include Mtwapa and to the north of the coastal strip around the Arabuko Sokoke Forest. Evaporation ranges from 1800mm along the coastal strip to 2200mm in the Nyika plateau in the interior. The highest evaporation rate is experienced during the months of January to March in all parts of the county. The annual temperature ranges between 21^0 C and 30^0 C in the coastal belt and between 30^0 C and 34^0 C in the hinterland. The county experiences relatively low wind speeds ranging between 4.8 km/hr and 12 Km/hr.

Kilifi County, Kenya lies at approximately Latitude -3^0 74’ 05.80” South and Longitude 39^0 85’15.93” and 3-310 mm above sea level. Mombasa has a tropical wet and dry/ savannah climate with a pronounced dry season in the high-sun months, no cold season, wet season is in the low-sun months (Köppen-Geiger classification: As). It borders Kwale County to the south west, Taita Taveta County to the west, Tana River County to the north, Mombasa County to the south and Indian Ocean to the east. The county covers an area of 12,609.7 km^2.

Map 1: Map of Kenya Showing the Location of Kilifi County

3.2. Infrastructure Communication

The project area is accessed through the Main Mombasa-Kilifi-Malindi. The project's location is approximately 2km from the busy road and next to Mombasa Cement Vipingo Factory.

The entire road network covers about 3000Kms. Of this 1,320 km is rural classified network, about 450kms is national classified network and the rest are unclassified. Approximate 30km of rural county roads are to bitumen standards, 220Km of rural county roads are graveled and the rest are earth roads.

The county is envisioned in the Vision 2030 to be a resort city, therefore there is need to expand Malindi airport, Kilifi and Kijipwa airstrips to cater for the expected increase of visitors and residents in the county.

The county is also covered by all the major mobile telephone service providers which include; Safaricom, TeleKom and Airtel. It has mobile telephone coverage of 75 percent and 7,037 landline connections. The county has 7 post offices and 5 sub post offices. The proportion of the population that has to travel 5km or more to the nearest post office is 78 percent. There are 70 cyber cafes mostly in the urban areas and thus there is need to prioritize the establishment of digital villages and more cyber cafes.

3.3. Socio-economic Environment

Agriculture, **tourism** and **fishing** are major economic activities in Kilifi. Cash crops grown in the county include cashew nuts, sisal, coconut palms, pineapples and mangoes. Staples like banana, cassava, maize, green grams, cow peas are also cultivated. Along the coastal plains, farmers grow horticultural crops and vegetables such as tomatoes, chillis, onions, brinjals and okra.

Dairy and **beef farming** is also practised, accounting to a significant quantity of beef and milk consumed in the county and beyond. Buzeki Dairy, which produces the popular Molo Milk brand, has a milk processing plant in Kilifi Plantations. Small-scale farmers also keep sheep, goats, rabbits, pigs and bees.

Visitors to Kilifi often visit attraction sites such as Gede Ruins, Mnarani Ruins and the Vasco da Gama Pillar - which in combination attract thousands of tourists creating employment for the local communities.

Fishing is widely practiced because of the high demand for fish in Kilifi's hotel industry. Sand harvesting and extraction of gypsum, limestone, rubies and barites have been carried out over the years. The discovery of rare minerals in Kilifi, including titanium and niobium, is expected to generate a lot of revenue from the county's mining industry.

3.4. Water Supply

Currently, Kilifi Mariakani **Water** and **Sewerage Company** Limited (KIMAWASCO). The underground water pipe runs parallel to the project location alongside the sewer line.

3.5. Energy Supply and Access

The main sources of energy in the county include; wood fuel, electricity, paraffin and solar energy which are mainly used for cooking and lighting. The number of trading Centres connected with electricity stands at 50 while over 80 percent of the households use wood First Kilifi County Integrated Development Plan 2013- 2017 14 fuel. The number of trading Centres connected with electricity is expected to increase as the county continues to implement the Rural Electrification Programme which is aimed at connecting rural Centres with electricity so as to promote wealth and employment creation. The county is currently promoting the use of renewable energy and use of energy saving jikos by households

and institutions such as schools and hospitals. The county is also promoting the establishment of woodlots to ensure there is constant and sustainable supply of wood fuel.

The area is served by a 33,000KV 3- phase power distribution line that is routed along the busy Mombasa-Kilifi-Malindi Highway where the plots are located. Electricity which is already lighting several premises will be tapped easily by the proponent.

All electrical connections in the plant shall be flame proof so as to meet the required LPG standards.

3.6. Current Land Use

The project area is located in an industrial set up in Takaungu area of Kilifi County; neighboring the proposed site is the Mombasa Cement Vipingo Factory. It is estimated that 11.3 percent of the households in the county are landless according to the data available in the Lands offices. Many of these people are squatters on private land. In an effort to address the situation, the Government has put in place several schemes, although the number of people settled in these schemes is below target. This has led to an emergence of informal and unorganized settlements in Malindi, Kilifi and Mtwapa Towns. Many people in the rural parts of the county have no title deeds and they own the land communally. Absence of title deeds has discouraged long term investments on the land. The comments of the neighbours and other industrial users in the area were sough and the results appended to this report.

The mean land holding size in the county is 3.04ha per household. This indicates that majority of households have relatively large farms. The mean holding size for large scale farmers is 8.09ha.

Land tenure is a major development challenge in the county with more than 60 percent of the residents lacking title deeds. This has led to incidences of landlessness which in turn contributes to high poverty levels in the county.

3.7. Physical environment and Typographical features

Kilifi County has four major topographical features. The first one is the narrow belt, which forms the coastal plain and varies in width of 3km to 20km. The coastal plain lies below 30m above sea level with a few prominent peaks on the western boundary including hills such as Mwembetungu. Across this plain run several creeks resulting in excellent marine swamps that are endowed with mangrove forests and present potential for marine culture. This zone is composed of marine sediments, including coral, limestone, marble, clay stones and alluvial deposits that support agriculture. To the west of the coastal plain lies the foot plateau characterized by slightly undulating terrain. The plateau falls between 60m and 150m altitude and slopes towards the sea. A number of dry watercourses traverse the surface with underlying Jurassic sediments consisting of shells, sandstones and clays. In this zone, grassland and stunted vegetation prevail. The coastal range falls beyond the foot plateau and has distinct low range of sandstone hills and ranges between 150m to 450m high. These hills include Simba, Kiwava, Daka, Wacha, Gaabo, Jibana, Mazeras and Mwangea. The Nyika plateau that rises from 100m to 340m above sea level and occupies about two thirds of the county area covers the lower lying ground along the western side of the county. The plateau is less populated with a thin vegetation cover, shallow depressions and gently undulating terrain. This is an arid and semiarid zone, which is suitable for ranching. The drainage pattern for the county is formed by a permanent river (Sabaki) and seasonal rivers, which drain into Indian Ocean through the various creeks along the coastline. The seasonal rivers

are Nzovuni, Rare, Goshi and Kombeni. There are also streams which include Wimbi, Muhomkulu and Mleji.

3.8 Ecological Conditions

The county is divided into a five Agro- Ecological Zones (AEZ). They define areas that have similar characteristics such as annual mean temperatures, vegetation and humidity. These zones include the following; Coconut-Cassava Zone: This zone has the highest potential for crop production in the county spreading along the coastal uplands and low-level coastal plains. Major farming activities include tree cropping (mango, citrus, cashew nuts, and coconuts), vegetables (chilli, brinjals, okra etc.), food crops (maize, bananas, cowpeas, green grams etc.) and upland rice. Dairy farming also does well in this zone. It has an average precipitation of 1,300mm per annum and mean annual temperature of 24 0C. Cashew nut - Cassava Zone: This zone stretches northwards along the coastal plain up to Sokoke Forest. It has an average precipitation of 900mm and mean annual temperature of 240 C.

It has agricultural potential with the same crop types as in Coconut-Cassava zone, but with less production. First Kilifi County Integrated Development Plan 2013- 2017 5 Livestock-Millet Zone: The zone is of lower agriculture potential with precipitation of 700 – 900mm. The area is suitable for dry land farming especially drought tolerant crops and livestock ranching. Lowland Ranching: It varies in altitude of 90-300m with mean annual temperature of 270 C and annual precipitation of 350-700mm. Major activities within this zone include ranching and wildlife. Coconut Cashew nut-Cassava Zone: This zone is mainly found in Kilifi South and North Constituencies and is the smallest of all the zones. It varies in altitude from 30-310m above sea level with mean temperature of 270 C and annual precipitation of 900mm per annum. The area has potential for those crops grown in the coconut-cassava zones and cashew nut-cassava zones.

3.9 Administrative and Political Units

The county has seven sub counties namely, Kilifi North, Kilifi South, Ganze, Malindi, Magarini, Rabai and Kaloleni. It has 17 divisions, 54 locations, 165 sub-locations as shown in Table 6. Magarini Sub-county is the largest while Rabai is the smallest in terms of area in Km2. 1.3.1 Administrative units (Sub-County, Divisions, Location and sub locations)

Table 1: Area of the County by Sub-County

Table 1: Area of the County by Sub-County

Sub-county	Area (Km^2)	No. of divisions	No. of Locations	No. of Sub Locations
Kilifi North	530.30	1	6	22
Kilifi South	400.60	2	6	16
Ganze	2941.60	4	16	48
Malindi	627.20	2	8	18
Magarini	6979.40	2	8	28
Kaloleni	686.40	5	11	21
Rabai	205.90	3	7	12
	12,371.4	**19**	**62**	**165**

Source: KNBS Kilifi office. 2012

The county has seven constituencies‟ and thirty-five county wards which are in line with the Kenyan Constitution 2010. Table 2: County's Electoral Wards by Constituency

Constituency	Area(Km^2)	No. Of county wards
Kilifi North	530.30	7
Kilifi South	400.60	5
Ganze	2941.60	4
Malindi	627.20	5
Magarini	6979.40	6
Kaloleni	686.40	4
Rabai	205.90	4
TOTAL		**35**

Source: ***IEBC Kilifi Office, 2012***

3.10 Demographic and Population Features

The population of the county was estimated to be 1,217,892 in 2012 as projected in the Kenya Population and Housing Census 2009, composed of 587,719 males and 630,172 females. The population is projected to rise to 1,336,590 and 1,466,856 in 2015 and 2017 First Kilifi County Integrated Development Plan 2013- 2017 8 respectively at growth rate of 3.05 percent per annum. The table below shows the population projections by gender and age cohort for the county.

Age Cohort	2009 (Census)			2012 (Projections)			2015 (Projections)			2017 (Projections)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	96446	95740	192186	105845	105071	210916	116161	115311	231473	127483	126549	254032
5-9	88450	87494	175944	97070	96021	193091	106531	105379	211910	116913	115650	232564
10-14	75467	75088	150555	82822	82406	165228	90894	90437	181331	99752	99251	199004
15-19	61388	59872	121260	67370	65707	133078	73937	72111	146048	81143	79139	160282
20-24	41798	55517	97315	45871	60927	106799	50342	66865	117208	55248	73382	128630
25-29	35191	43846	79037	38620	48119	86740	42384	52809	95193	46515	57955	104471
30-34	30029	36098	66127	32955	39616	72571	36167	43477	79644	39692	47714	87407
35-39	24564	25878	50442	26958	28400	55358	29585	31168	60753	32468	34205	66674
40-44	18084	19393	37477	19846	21283	41129	21780	23357	45138	23903	25633	49537
45-49	15270	16917	32187	16758	18565	35324	18391	20375	38766	20184	22361	42545
50-54	12433	16284	28717	13644	17871	31515	14974	19612	34587	16434	21524	37958
55-59	10325	10581	20906	11331	11612	22943	12435	12743	25179	13647	13986	27633
60-64	7902	9512	17414	8672	10439	19111	9517	11456	20973	10444	12573	23017
65-69	5694	6682	12376	6248	7333	13582	6857	8047	14905	7526	8832	16358
70-74	4398	5287	9685	4826	5802	10628	5297	6367	11664	5813	6988	12801
75-79	3058	3544	6602	3356	3889	7245	3683	4268	7951	4042	4684	8726
80-84	4534	6006	10540	4975	6591	11567	5460	7233	12694	5993	7938	13931
85+	495	470	965	543	515	1059	596	566	1162	654	621	1275
TOTAL	535526	574209	1109735	587719	630172	1217892	644999	691590	1336590	707862	758993	1466856

Source: Kenya National Bureau of Statistics, Kilifi 2013

The following is an analysis of the trends in the population of the selected age groups indicated in attendant table and their implications to the development of the county. First Kilifi County Integrated Development Plan 2013- 2017 9

Under 1 Year (infants): It is projected that the population under one year in 2012 was 44,303 consisting of 22,147males and 22,156 females. This population is projected to rise to 53361 persons in 2017. The ratio of male to female infants remains almost at 1:1 indicating no major pattern change in the male: female ratio compared to the total population. The infant mortality rate is 71 per 1000 live births for the county while the national figure stands at 52 per 1000 live births. There is therefore need to improve the health sector especially the post-natal care and immunization component as well as improving maternal health to reduce the high infant mortality and maternal mortality rates in the county.

Under Five Years: The population under 5 years was estimated to be 210,916 in 2012, consisting of 105,845 males and 105,071 females, comprises of 14.6 percent of the total population. Under five mortality rate stands at 87 per 1000 live births while the national figure is 74 per 1000 live births.The county needs to strengthen projects and programmes that are aimed at controlling infant and child mortality such as immunization coverage and maternal and child health (MCH).

Pre–Primary Age (3-5 years): The population between 3-5 years was estimated to be 125,955 in 2012 consisting of 63,253 males and 62,702 females and it is expected to rise to 138,231 in 2015 and further to 151,703 in 2017.This shows that the county needs to expand, equip and staff Early Childhood Development Centres to cater for this segment of the population.

Primary School Age (6-13 years): This population was 263,016 in 2009 representing 21.7 percent of the total population. It was estimated to increase to 288,650 in 2012 before rising to 316,782 in 2015 and

347,656 in 2017. This increase is expected to put pressure on the existing 492 primary schools as well as the teaching personnel. There is therefore need for additional teachers so as to maintain a reasonable teacher/pupil ratio. It is worthy to note that the actual enrolment in primary school stands at 268,168 which shows a deficit of 20,482 school going children who are not accounted for. The county will also require increased funding for provision of teaching and learning materials.

Secondary School Age: (14-17 years): The population in the age group stood at 102,868 in 2009 representing 9.27% of the total population. The actual enrolment stands at 35,670 which is much far below the estimated secondary age population of 112,893 as at 2012. It is expected to increase to, 123,896 and 135,971 in 2015 and 2017 respectively. This poses a major challenge to the county that currently has only 120 secondary schools with 710 teachers. There is need for collaborative efforts from various stakeholders to invest in education in the county. There is also need to promote sports, drama and other extracurricular activities so that the age group discovers and develops their talents. The county will also require more investments in tertiary institutions such as universities, colleges and Youth polytechnics to absorb those that are completing secondary education.

Youth Population (15-29 years): The youth populations form a special category that is of great focus in the county. This population was 297,612 in 2009 representing approximately 27 percent of the total population and 49 percent of the labor force. It is projected to rise to 326,617 in 2012 before rising further to 358,450 and 393,385 in 2015 and 2017 respectively. First Kilifi County Integrated Development Plan 2013- 2017 10 This is a very active age group in which some are in school while others have joined the labor force. There is need to devise strategies to create job opportunities by utilizing effectively and efficiently the resources in the county. There is also need to improve the quality of the labor force by investing in tertiary institutions such as universities, colleges and youth polytechnics. This group has also unique health and social needs and there is therefore need to put more resources to youth friendly health facilities as well as expanding sports and other recreational facilities.

Female Reproductive Age (15-49 years): This population was 257,521 in 2009, which is 23.21 percent of the total population. It is projected to be 282,619 in 2012 before rising further to 310,164 in 2015 and 340,393 in 2017. This age group is the single most determining factor of the population growth. Considering low levels of contraceptive prevalence rate at 34 percent and high population growth of 3.05 percent per annum, investments in programmes and projects targeting females in the reproductive age, such as family planning and maternal healthcare, need to be scaled up. The girl child education should be emphasized so as to prevent early marriages and other cultural practices that undermine women's empowerment. There is also need for male involvement in reproductive health services.

Labor Force (15-64 years): This age group represents the population that is actively employed or seeking employment. The county had a labor force of 550,882 in 2009 and it was estimated to be 604,571 persons in 2012; further to 663,494 in 2015 and 728,159 in 2017. Female population in this category represents 53.35 percent forming the bulk of the labor force in the county. Due to the projected increase in the labor force, the county will be challenged to offer skills development opportunities and business development services so that they become more productive. The county will also need to explore more

employment opportunities for this age group. Consequently, efforts must be made to create jobs through capacity building, vocational training and initiatives that will attract investments in the county.

The dependent population: Those below 15 years and above 64 years, account for 50 percent of the total population. The challenge in the county is to ensure that the dependent population have the basic needs as enumerated in Chapter Four of the Constitution on Bill of Rights 43(1) such as highest attainable standards of health, accessible and adequate housing, reasonable standards of sanitation, free from hunger and to have adequate food of acceptable quality, clean and safe water in adequate quantities, social security and education. The county needs to strengthen social protection programmes such as the orphans and vulnerable children cash transfer and cash transfer for elderly persons. This will ensure that those burdened by the dependents can save and invest and thus break the vicious cycle of poverty.

Table 1111 Population Projection by Urban Centers

The expansion of the urban population calls for proper planning to ensure sustainable development in the urban areas. There is also need to invest in those sectors and economic activities that create jobs for the rapidly increasing urban population.

Urban Centres	2009 (Census)			2012 (Projections)			2015 (Projections)			2017 (Projections)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Malindi	41911	42239	84150	45995	46355	92351	50478	50873	101352	55398	55831	111230
Mtwapa	24134	24491	48625	26486	26877	53364	29067	29497	58565	31900	32372	64272
Watamu	5167	4863	10030	5670	5336	11007	6223	5857	12080	6829	6427	13257
Majengo	3892	3896	7788	4271	4275	8547	4687	4692	9380	5144	5149	10294
Marafa	2936	3115	6051	3222	3418	6640	3536	3751	7287	3880	4117	7998
Mazeras	3259	3627	6886	3576	3980	7557	3925	4368	8293	4307	4794	9101
Kaloleni	2779	2794	5573	3049	3066	6116	3347	3365	6712	3673	3693	7366
Marereni	2869	3080	5949	3148	3380	6528	3455	3709	7165	3792	4071	7863
Kilifi	21496	22761	44257	23591	24979	48570	25890	27413	53304	28413	30085	58499
Mariakani	12133	11922	24055	13315	13083	26399	14613	14359	28972	16037	15758	31796
Total	120576	122788	243364	132327	134755	267082	145224	147888	293113	159378	162302	321680

Source: Kenya National Bureau of Statistics, Kilifi 2013

The county‟s main urban centres are Kilifi, Malindi, Mtwapa, Kaloleni, Mazeras, Mariakani, Watamu, Marafa, Marereni, and Majengo as indicated Table 6. According to the 2009 census report, the county urban population stood at 243,364 people, which represents 36.8 per cent of the total population. The urban population is expected to increase to 267,082 in 2012, further to 293,113 in 2015 and 321,680 in 2017. This represents 21.9 percent of the total population and is expected to grow rapidly once the Kilifi resort city is completed.

3.11 Population Density and Distribution

The table below illustrates that the county population density in 2009 was 88 persons per square km2. This was projected to increase to 96 persons per km2 in 2012, further to 105 persons per km2 in 2015, and 116 persons per km2 in 2017.

Constituency	2009 (Census)		2012 (Projection)		2015 (Projection)		2017 (Projection)	
	Population	Density (Persons/ Km²)	Population	Density (Persons/ Km²)	Population	Density (Persons/ Km²)	Population	Density (Persons/ Km²)
Kilifi North	207,587	391	227818	429	250022	471	274390	517
Kilifi South	171,607	428	188332	470	206687	515	226831	566
Rabai	97,185	472	106656	517	117051	568	128459	623
Kaloleni	155,739	226	170917	249	187575	273	205857	299
Ganze	137,664	46	151081	51	165805	56	181965	61
Magarini	177,241	25	194515	27	213473	30	234278	33
Malindi	162,712	259	178570	284	195974	312	215073	342
Total	1,109,735	88	1,217,892	96	1,336,590	105	1,466,856	116

Source: Kenya National Bureau of Statistics, Kilifi office 2013

From the table, it can be seen that in 2012 Rabai constituency had the highest population density with 517 persons per Km2 while Magarini constituency has the lowest population density with 27 persons per Km2 .Rural-Urban migration to the towns is one of the reasons the First Kilifi County Integrated Development Plan 2013- 2017 notes that the population density is higher in Kilifi North, Kilifi South, Malindi and Kaloleni in comparison to Ganze and Magarini constituencies.

3.12 Education Institutions

Education ensures that a population is empowered both socio-economically and politically so that they can participate in gainful activities and make informed decisions. The county has 935 pre-schools, 492 primary schools, 120 secondary schools, 13 youth polytechnics, one college (KMTC- Kilifi) offering medical training and four universities- Pwani University, Mount Kenya University, University of Nairobi and Moi University are institutions of higher learning offering various courses. There is need to improve the physical conditions of the existing institutions and build more to ensure quality and access to education

3.13 Markets and Urban Centers

There are a total of 78 trading Centres in the county with 3,809 registered traders in retail, wholesale and manufacturer. The major ones are; Kilifi, Mtwapa, Malindi, Mariakani and Watamu among others. The wholesalers mostly deal with consumer and hardware products while retail traders, who are in both rural and urban areas, deal mainly with food products. The manufacturers mostly deal in cement such as Rhino Cement Company in Rabai, Mombasa Cement Company in Vipingo, steel products in Mazeras, salt manufacturing by Kensalt and Krystalline Salt in Gongoni and Marereni, commercial starch in Mazeras, power generation in Rabai, soft drinks by Coca Cola and Picana in Mtwapa and Export Processing Zone (EPZ) in Mazeras and Mtwapa.

3.14 Housing

Majority of the houses in the county have walls made of mud/wood 59 percent as the main walling material, followed by brick/block at 22.05 percent and mud/cement at 5.95 percent. On the floor earth 73.5 percent as the main floor materials, cement 25.05 percent, tiles 1.15 percent on roofing Makuti leads with 41.4 percent, Corrugated iron sheets 32.9 percent and grass 20.2 percent as the main roofing materials. There are informal settlements coming up in the major urban Centres in the county especially Malindi and Kilifi towns.

3.15 Environment and Climate Change

Climate change is a long-term alteration in global weather patterns, especially increases in temperature and storm activity, regarded as a potential consequence of the greenhouse effect. There has been increased appreciation of the role that climate plays in the lives of the people in recent years. This awakening has been occasioned by an increase in intensity and frequency in occurrence of extreme weather events such as severe droughts and floods in Ganze, Kaloleni and Magarini constituencies. These extreme events have had negative socioeconomic impacts on almost all sectors such as health, agriculture, environment and tourism. The Kenyan coast has been subject to shoreline changes because of its geological character. First Kilifi County Integrated Development Plan 2013- 2017 19 Also human influences have accelerated this process. A good example is the Watamu-Malindi-Ugwana bay area which is most affected at the moment.

3.15.1 Major Contributors to Environmental Degradation in the County

The county is faced with a number of environmental challenges ranging from air pollution from the quarries and cement factories, water pollution, soil degradation, deforestation, poor solid waste management in the major urban Centres and towns like Kilifi, Malindi, Mtwapa, Mariakani, and Gongoni. The county‟s arid zone is a major source of charcoal for Mombasa, Malindi, Kilifi and Mtwapa towns leading to widespread destruction of environment through uncontrolled felling of trees. The areas mostly affected by this are Ganze, Kaloleni and Magarini. Another contributor to this is sand harvesting in Marereni and quarries in Ganze.

3.15.2 Effects of Environmental Degradation

The effects of environmental degradation are being experienced at county level as a result of over exploitation of forests and unsustainable utilization of non-renewable resources. Indiscriminate felling of trees in gazetted and non-gazetted forests has led to environmental degradation leading to drought in most parts of the county. This includes areas in Ganze, Rabai, Magarini and Kaloleni.

3.15.3 Climate Change and Its Effects in the County

Climate change and variability is an emerging threat to sustainable development in the county. Although climate data from the Kenya Meteorological Department for the county is scanty, there is evidence of a changing climate evidenced by increased frequency and severity of extreme events such as the frequent

flooding in Magarini constituency. There are observed changes in the seasons whereby the rain season has changed and the onset of the rains delayed.

These changes present additional challenges to the socio-economic development of the county in a number of ways. Within the agriculture sector, which is the most vulnerable, farmers have experienced reduced yields leading to food insecurity in the county. Health sector has been affected in the sense that there have been floods experienced in the county resulting to increased water and air borne diseases like diarrhea, malaria, and respiratory diseases. Tourism Sector which is a source of income to a good number of people in the county has been affected by the effects of climate change. A number of roads have been cut-off as results of floods in the county. Beach operators some times are unable to carry on with their activities due to erratic changes in weather patterns in the county.

3.15.4 Climate Change Mitigation and Adaptation Strategies

The county has in place Environment Management Committees which are at the forefront in mobilizing stakeholders to promote environmental conservation programmes such as tree planting exercise on farm and forests, environmental conservation awareness and soil and solid waste management. The Environment Management Committees have also put measures First Kilifi County Integrated Development Plan 2013- 2017 20 in place to regulate private and public sectors development so as to minimize the negative impact on the environment. These measures include requirements such as conducting of Environmental Impact Assessment and Environmental Audits before commencement of all projects in the county. Under the ministry of Agriculture, Livestock and Fisheries farmers have been encouraged to grow drought resistant crops like cassava and millet as a coping mechanism to climate change.

CHAPTER FOUR

5.0. Anticipated Environmental Impacts and Mitigation Measures

Several environmental impacts (positive and negative) associated with the proposed project were identified through the use of experts' judgment method. 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.

5.1. 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 team of Experts utilized precautionary principles to establish the significance of impacts and their management and mitigation.

5.2. Potential impacts of the proposed project

The proposed project is anticipated to generate the following impacts; the significance of the impacts will however range from low to moderate before mitigation and will further reduce with mitigation measures:

- Soil and Geological Impacts
    - Contamination of soil
    - Soil erosion.
- Air quality Impacts
- Noise and vibration Impacts
- Impacts of waste generation
- Socio-economic impacts.
- Health and Safety Impacts.

5.2.1. Soil and geology impacts

5.2.1.1. Contamination of soil

The potential sources of soil contamination during construction phase are leaks or spills from machinery used in site preparation and demolition. 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.

During operation phase soil contamination is not anticipated because of the presence of the concrete paved surface which will prevent any potential contaminant from reaching the subsurface layer and is thus not assessed. During decommissioning phase, soil contamination could occur especially with the use of machinery in demolition of the facility.

Construction Phase

Likelihood		**Consequence**			**Rating**
Frequency	Frequency	Severity of	Spatial scope/	Duration	
5	4	1	1	1	Low
score	**9**	**3**			**27**

Mitigation Measures for soil contamination

The Contractor shall prepare a hazardous materials and waste management plan. The plan shall include, but not limited to, measures to prevent: (a) contamination of soils; (b) pollution of water; (c) and safe siting and storage.

Significance after mitigation

Likelihood		**Consequence**			**Rating**
Frequency	Frequency	Benefit/Severity	Spatial	Duration	
5	3	1	1	1	Low
score	**8**	**3**			**21**

Decommissioning Phase

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Severity of Impact	Spatial scope/Geographical extent	Duration	
5	4	1	1	1	Low
score	**9**	**3**			**27**

Mitigation Measures

The Proponent and contractor engaged in the demolition of the facility shall ensure machinery and vehicles used during demolition are adequately serviced to prevent any oil leakages.

Additionally, the Proponent shall undertake a further survey to identify any contaminated areas and remediate them accordingly.

Significance after mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/ Geographical extent	Duration	
5	3 unlikely	1 insignificant	1	1	Low negative
score	**8**	**3**			**21**

5.2.1.2. Soil erosion

During construction phase, site preparation activities such as clearance of vegetation (though so minimal), excavation and demolition will expose the soils at the construction site to agents of erosions mainly wind and rain water.

During operation phase, soil erosion is not anticipated at the project site because the concrete surface to be constructed will protect the soil from agents of erosion.

During decommissioning phase, removal of concrete surface will expose the soil to the above erosion agents.

Construction phase: Soil erosion without mitigation measures

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Benefit/Severity of	Spatial scope/Geographical	Duration	
5 Daily	5 Daily	3 marginal	1 site specific	1 One day to one month	Low negative impact
score	**10**	**5**			**50**

Mitigation Measures for potential soil erosion

The Proponent and Contractor shall implement soil conservation program described in **section 8.4.3.1.** of this report.

Significance of potential soil erosion after mitigation

Likelihood		**Consequence**			**Rating**
Frequency	Frequency	Benefit/Severity	Spatial	Duration	
5 Daily	2 Very seldom	Negligible 1	1 site specific	1 One day to one month	Low negative impact
	7	**3**			**21**

Decommissioning phase: soil erosion without mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/Geographical extent	Duration	
4 Daily	5 Daily	1 Negligible	1 site specific	1 One day to one month	Low negative impact
	10	**3**			**30**

Mitigation Measures

The Proponent shall ensure that the site is restored as much as possible to its original state. This shall be accomplished through surfacing of denuded areas and planting of vegetation.

Significance of soil erosion after mitigation

Likelihood		**Consequence**			**Rating**
Frequency	Frequency	Benefit/Severity	Spatial	Duration	
5 Daily	2 Very seldom	1 Negligible	1	1 One day to one month	Low negative impact
	7	**3**			**21**

5.2.2. Marine Life

Installation of anchors, particularly gravity anchors such as concrete blocks, will cause temporary disturbance of the seabed at and immediately around the mooring location.

Some of this disturbance will be short-lived (weeks or months) but there will be a small, permanent loss of soft sediment habitat. This loss will be slightly larger for gravity anchors than for screw anchors.

Irrespective of type, installation of an individual anchor will directly impact a relatively small area of the seabed, and the accompanying biological communities.

Even at maximum mooring densities, the anchors themselves will have a small benthic footprint. Their relatively small size, low profile, and low density, coupled with moderate water depths, also means that mooring anchors will likely have only very localized and negligible influences upon water circulation.

There will be no effluent discharge in the water body. Thus there is no impact on the aquatic biota present in vicinity of proposed project.

5.2.3. Air quality Impacts

5.2.3.1. Decreased air quality due to dust emission

During construction decommissioning phases, potential dust pollution will emanate from site preparation activities such demolition, excavation, stockpiling and preparation of mortar for construction of substructure. During operation phase, dust pollution is not anticipated as the site will be covered by the proposed project. While during decommissioning phase, dust emission would be generated from debris and soil resulting from demolition process.

Construction Phase: Significance of Impacts before Mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Severity of Impact	Spatial scope/Geographical extent	Duration	
5 Daily	5 Daily	1 insignificant	1 site specific	1 One day to one month	Low negative impact
	10	**3**			**30**

Mitigation measures for decreased air quality due to dust emission

The Proponent and Contractor shall implement dust abatement measures which shall include:

- Sprinkling stockpile with water regularly or cover with a membrane to prevent them from being blown away and keep them for the shortest time possible;
- All loads entering or leaving the site should be covered
- Securely cover waste containers and minimize drop height
- Erect solid barriers to site boundary

Significance of impact after mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Severity of Impact	Spatial scope/Geographical	Duration	
5 Daily	3 unlikely	1 insignificant	1 site specific	1 One day to one month	Low negative impact
score	**8**	**3**			**21**

Decommissioning Phase

Likelihood		**Consequence**			**Rating**
Frequency	Frequency	Severity of	Spatial	Duration	
5	5	1 insignificant	1 site specific	1	Low negative
	10	**3**			**30**

5.2.3.2. Air Pollution from Incidents

The proposed project will be designed and managed in accordance with the best industry best standards and practice. However, during operation phase unplanned or unforeseen fire or explosion incidents may occur as result of acts of vandalism or human error. Such incidents may generate emissions that have several implications on the human health and visibility of the site and its environs.

Operation phase potential air pollution incidents before mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of	Benefit/Severity of	Spatial scope/Geographical extent	Duration	
4 Life of operation	3 unlikely	4 harmful	2 site specific	4 Life of operation	Medium low
	7	**10**			**70**

Mitigation Measures for air pollution from incidents

The Proponent need to develop, implement and monitor environment, health and safety measures and procedures, including an emergency preparedness and response plan.

Significance after mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of	Benefit/Severity of	Spatial scope/Geographical extent	Duration	
4 Life of operation	3 unlikely	1 Non harmful	2 site specific	4 Life of operation	Low negative impact
	7	**7**			**49**

5.2.3.3. Exhaust emissions

During construction phase exhaust emissions from construction and demolition vehicles (used in transporting materials) are the only source of gaseous pollutants from the proposed project

During operation phase exhaust emission from trucks entering and exiting the site will be source of gaseous pollutants.

Construction and Decommissioning phases: Significance of exhaust emissions without mitigation measures

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Severity/Magnitude of Impact	Spatial scope/Geographical extent	Duration	
5 Daily	5 Daily	2 Minor	1 site specific	1 One day to one month	Low negative impact
	10	**4**			**40**

Mitigation Measures for impacts of exhaust emission

The Proponent should ensure that:

Engines and exhaust systems of construction and demolition vehicles and machinery should be regularly serviced according to manufacturer's recommendations and maintained to meet statutory limits/opacity tests; no machinery or vehicle is left idling unnecessarily.

Construction and Decommissioning phases: Significance of exhaust emissions with mitigation measures

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Severity of Impact	Spatial scope/ Geographical extent	Duration	
5 Daily	5 Daily	1 Negligible	1 site specific	1 One day to one month	Low negative impact
	10	**3**			**30**

Operation phase: Significance of exhaust emissions without mitigation measures

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Severity/Magnitude of Impact	Spatial scope/Geographical extent	Duration	
4 Life of operation	5 Daily	2 Minor	1 site specific	1 One day to one month	Low negative impact
score	**9**	**4**			**36**

Mitigation Measures for impacts of exhaust emission

The Proponent should ensure that:

Engines and exhaust systems of construction vehicles and machinery should be regularly serviced according to manufacturer's recommendations and maintained to meet statutory limits/opacity tests; no truck is left idling unnecessarily at the parking bay

5.2.4. Noise and vibration

5.2.4.1. Deterioration in ambient noise quality

The construction machinery and vehicles will generate noise of varying magnitude. The proposed project will utilize machineries such as wheel loading shovel; 30 to 40 Ton tracked Excavator, Mobile service crane, Dump Truck and Tipper lorry

From the predictions of the specialist study on ambient noise quality measurements it can be seen that all the above activities are predicted to be largely within the target noise levels, although highest levels are expected when using pneumatic drills to break hard rock for foundation when the noise levels would peak at about 68dB (A)

A summary of the predicted noise levels is presented in the table below:

Reception Point	**Preparation (dB A)**	**Excavation works (dB A)**	**General Activities**
South East Corner of proposed construction site.	50	68	58

As will be the case with the construction phase, the sources of noise during decommissioning phase, will be mainly machinery and vehicles used in demolition of the facility and removing the materials from the site.

Pre-construction and Construction Phase

Unmitigated Impact: Noise above 75 dB (A)	**Significance**
Consequence	
Magnitude	
Geographic extent	
Duration of impact	
Total	
Likelihood	
Duration of activity	
Frequency of impact	
Total	
Results (**Consequence** * **Likelihood)**	**- 8** (**Very low**)
Comment/mitigation: Follow the rules and regulations set out in the relevant codes of practice and instructions contained in the Environmental Management Plan (EMP) and construction Environmental Plan(CEP) 2. Use protective equipment	
Mitigated Impact: Noise above 75 dB (A)	
Consequence	
Magnitude	1
Geographic extent	1
Duration of impact	1

Total	**3**

Likelihood

Duration of activity 1

Frequency of impact	1
Total	2
Results (Consequence)	- 6 (Very low)

Likelihood) Comment/mitigation

1. Carryout lagging of the generator or site the power generator away from the occupied building.
2. Maintenance personnel to use ear defenders.
3. Maintain equipment and plant.

Operation phase and decommissioning

Unmitigated Impact: Noise above 85 dB(A)	**Significance**
Consequence	
Magnitude	2
Geographic extent	1
Duration of impact	1
Total	**4**
Likelihood	
Duration of activity	1
Frequency of impact	1
Total	**2**
Results (**Consequence** * **Likelihood)**	**- 8**(**very low**)
Comment/mitigation: The Proponent to ensure that the booster pumps to be used during operation phase complies with national and international noise quality standards. Noise abatement	
Impact with mitigation : Noise above 85 dB(A)	
Consequence	
Magnitude	2
Geographic extent	1
Duration of impact	1
Total	**4**
Likelihood	
Duration of activity	1
Frequency of impact	1
Total	**2**

Results (**Consequence** * **Likelihood)**	**- 8 (very low)**

Decommissioning Phase

Impact without mitigation : Deterioration in ambient noise quality	**Significance**
Consequence	
Magnitude	1
Geographic extent	1
Duration of impact	1
Total	
Likelihood	
Duration of activity	2
Frequency of impact	1
Total	**3**
Results (**Consequence** * **Likelihood)**	**- 9** (**Very low**)
Comment/mitigation: The Proponent to ensure that the machinery and vehicles used during demolition comply with Noise Quality Standards. Noise abetment measures will be included in construction management programme.	
Impact with mitigation : Deterioration in ambient noise quality	
Consequence	
Magnitude	1
Geographic extent	1
Duration of impact	1
Total	**3**
Likelihood	
Duration of activity	1
Frequency of impact	1
Total	2

Results (**Consequence** * **Likelihood) - 6 (Very low)**

5.2.5. Impacts of waste generation

Several wastes are anticipated to be generated throughout the project cycle (***Section 2.12.2*** *of this report provides a description of the waste to be generated*). During construction phase, wastes anticipated from demolition and construction activities will comprise: concrete waste, excavated soil, and metal and timber cuttings among others.

During operation phase, the expected waste from the project will include domestic and medical waste from the clinic. Medical wastes are potentially dangerous and present a high risk of infection to the general population and to the staff.

Whereas during decommissioning phase, demolition waste generated will be mainly concrete boulders, and scrap metals.

Construction phase: Significance before mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of	Benefit/Severity of	Spatial scope/Geographical extent	Duration	
4 Daily	5 Daily	4 significant	2 site specific	1 One day to one month	Low Medium
score	**9**	**7**			**63**

Mitigation Measures

The Contractor in collaboration with the Proponent will prepare and maintain site waste management plan which estimate the quantity of each type of waste expected to be produced and track their recovery and destination throughout the construction phase of the project. Waste streams could be recovered, segregated and either re-used on site (e.g. crushed concrete aggregate) or disposed offsite in line with the Proponent's ***Go Green Initiative***.

Construction phase: Significance after mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/Geographical extent	Duration	
4 Daily	5 daily	2 minor	2 site specific	1 One day to one month	Low Medium
score	**9**	**5**			**45**

Operation phase

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of	Benefit/Severity of	Spatial scope/Geographical extent	Duration	
4 Life	4 Life	2 Minor	2 site specific	4 Life of	Medium low
score	**8**	**8**			**64**

Mitigation Measures

The Proponent will manage waste in accordance with the existing procedures and relevant legislations. Waste streams could be recovered, segregated and either re-used on site (e.g. crushed concrete aggregate) or disposed offsite in line with the Proponent's Go ***Green Initiative***. Medical waste will be collected disposed offsite by NEMA approved waste handler.

Operation phase: Significance of Impacts of waste after mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of	Benefit/Severity of	Spatial scope/Geographical	Duration	
4 Life operation	4 Life operation	1 negligible	2 site specific	4 Life of operation	Medium low
score	**8**	**7**			**56**

Decommissioning phase: Significance of Impacts of waste before mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/Geographical extent	Duration	
4 Daily	5 Daily	2 minor	2 site specific	1 One day to one month	low
score	**9**	**5**			**45**

Mitigation Measures

The Contractor selected for undertake demolition work will in collaboration with the Proponent will prepare and maintain site waste management plan which estimate the quantity of each type of waste expected to be produced and track their recovery and destination throughout the decommissioning phase of the project. Waste streams could be recovered, segregated and either re-used on site (e.g. crushed concrete aggregate) or disposed offsite in line with the Proponent's ***Go Green Initiative***.

Decommissioning phase: Significance of Impacts of waste after mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/Geographical extent	Duration	
4 Daily	5 Daily	1 negligible	2 site specific	1 One day to one month	low
score	**9**	**4**			**36**

5.2.6. Health and safety

5.2.6.1. 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 silica dust
- Hazards of falling objects;
- Occupational hazards when working at height such as the roofs and walls;

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 height especially renewing coat of paint on the roofs and walls and handling of medical wastes.

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

Construction phase: **Health and Safety Risks before mitigation**

Likelihood		**Consequence**			**Rating**
Frequency o f Activity	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/Geographical extent	Duration	
5 Daily	5 Daily	4 significant	1 Activity specific	1 One day to one month	Low Medium negative impact
Score	**10**	**6**			**60**

Operation Phase: Health and Safety Risks before mitigation

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/Geographical extent	Duration	
4 Life of operation	5 likely	2 small	1 Activity specific	4 Life of operation	Medium-low negative impact
score	**9**	**7**			**63**

Decommissioning phase: **Health and Safety Risks before mitigation**

Likelihood		**Consequence**			**Rating**
Frequency of Activity	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/Geographical extent	Duration	
5 Daily	5 Daily	2 small	1 Activity specific	1 One day to one month	Low negative impact
score	**10**	**4**			**40**

Mitigation Measures

It is recommended that the Proponent enforces 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.

Construction phase: **Health and Safety Risks after mitigation**

Likelihood		**Consequence**			**Rating**
Frequency o f Activity	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/Geographical extent	Duration	
5 Daily	5 Daily	1 negligible	1 Activity specific	1 One day to one month	Low negative impact
score	**10**	**3**			**30**

Operation Phase: Health and Safety Risks after mitigation

Likelihood		**Consequence**			**Rating**
Frequency of	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/Geographical extent	Duration	
4 Life of operation	5 Likely	1 Negligible	1 Activity specific	4 Life of operation	Medium-low negative impact
score	**9**	**6**			**54**

Decommissioning phase: **Health and Safety Risks after mitigation**

Likelihood		**Consequence**			**Rating**
Frequency o f Activity	Frequency of Impact	Benefit/Severity of Impact	Spatial scope/Geographical extent	Duration	
5 Daily	5 Daily	1 negligible	1 Activity specific	1 One day to one	Low negative impact
score	**10**	**3**			**30**

5.2.6.2. Risk of Large Scale incident

The proposed project could be of great public concern especially in the event of major disaster such as major fire outbreak and explosion (BLEVE). The product to be stored is highly flammable hence incidents fire or explosions can be detrimental to the public.

The impact significance related to public safety is likely to be low during the rehabilitation and closure of the facility.

Construction phase

Impact without mitigation: Risk of large scale incident	**Significance**
Consequence	
Magnitude	5
Geographic extent	2
Duration of impact	1
Total	**8**
Likelihood	

Duration of activity	4
Frequency of impact	4
Total	**8**
Results (**Consequence** * **Likelihood)**	**- 64** (Low medium)
Comment/mitigation: Mitigation measures for the potential Occupational Health and Safety impacts will be covered in the construction Safety Management Plan. The implementation of the proposed project to be done in accordance to the OSHA 2007 and any other relevant H&S legislation	
Impact with mitigation: Risk of large scale incident	
Magnitude	1
Geographic extent	1
Duration of impact	2
Total	**4**
Duration of activity	2
Frequency of impact	1
Total	3
Results (**Consequence** * **Likelihood)**	**- 12 (Very low)**

Operation Phase

Impact without mitigation: Risk of large scale incident	**Significance**
Consequence	
Magnitude	5
Geographic extent	4
Duration of impact	4
Total	**13**
Likelihood	
Duration of activity	4
Frequency of impact	3
Total	**7**
Results (**Consequence** * **Likelihood)**	**- 91**(**medium high**)
Comment/mitigation:	

Mitigation measures for impacts resulting from public safety are covered in the emergency management and response plan presented in the EMP.

Impact with mitigation: risks to public safety	
Consequence	
Magnitude	3
Geographic extent	2
Duration of impact	2
Total	**7**
Likelihood	
Duration of activity	4
Frequency of impact	1
Total	5
Results (**Consequence** * **Likelihood)**	**- 35 (low)**

5.2.7. Socioeconomic

5.2.7.1. Compatibility with existing and proposed land uses

The proposed project site area consists is purely industrial with oil and gas being the main activity in the area. The proposed project is therefore compatible to the existing as well as future land-uses. Since the proposed project will not conflict with the existing and perhaps future developments, impacts were therefore not assessed.

5.2.7.2. Creation of employment opportunities

The proposed project will generate job opportunities (skilled and unskilled Labor) during construction and operation 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 also likely to be trickledown effect results from the employment opportunities as well as services provided by the facility.

Constructions, Operations				
Benefits without enhancement: Employment provided by the proposed project				
Magnitude	Geographic Extent	Duration of impact	Duration of activity	Frequency of impact
2	2	2	2	4
Result: LOW (+ 36)				
Benefits with enhancements				
Magnitude	Geographic Extent	Duration of impact	Duration of activity	Frequency of impact
3	3	4	4	4

Results: MEDIUM HIGH (+ 80)
Mitigation/Comments: Communication and information programs should be used to manage expectations and target local service providers including those registered through the Public Participation process. Management and enhancement measures for local employment to be included In Labor and human resources plan. Local authorities and employment hubs should be consulted. when recruiting local workers and service providers.

5.2.7.3. Improved Security

The proposed project is expected to improve the security situation in the area in that the project will have physical form of security which will range from: employing security guards installing security lights and installing alarm systems.

Apart from physical security there will also be procedural security; where visitors to the site have to log in and log out when arriving and leaving site respectively.

Construction and Operations				
Benefits without enhancement: Improved Security				
Magnitude	Geographic Extent	Duration of impact	Duration of activity	Frequency of impact
2	2	4	4	4
Results: LOW-MEDIUM(+ 64)				
Benefits with enhancements				
Magnitude	Geographic Extent	Duration of impact	Duration of activity	Frequency of impact
3	2	4	4	4
Results: LOW MEDIUM (+ 72)				
Mitigation/Comment: Installation of security facilities which includes hiring of security guards, installing an alarm system will improve the security of the area.				

5.2.7.4. General economic growth and increased land value

Due to the proposed project there will be an influx of people searching for jobs.

An increase in economic activities will increase the demand for housing, communication transport and financial services will significantly increase and thus present a likelihood of increasing the land values.

Constructions and Operations				
Benefits without enhancement: General economic growth and increased land value				
Severity	Spatial scope	Duration of impact	Duration of activity	Frequency of impact
2	3	4	4	3
Result: LOW MEDIUM (+ 63)				
Benefits with enhancements				
Severity	Spatial scope	Duration of impact	Duration of activity	Frequency of impact
2	3	4	4	4
Results: LOW-MEDIUM(+ 72)				
Mitigation/Comments: The direct project workforce will be accommodated within the nearby Takaungu, Vipingo and Kijipwa areas. Choice of the site will increase value of land in the area and promote overall development of the area.				

5.2.6.5 LPG Provision

In the operational phase, the Taifa Gas Kenya Limited Energy perceived that there will be increased LPG supply.

Operations Phase				
Benefits without enhancement: LPG Provision				
Severity	Spatial scope	Duration of impact	Duration of activity	Frequency of impact
2	5	4	4	4
Result: MEDIUM HIGH (+ 88)				
Benefits with enhancements				
Severity	Spatial scope	Duration of impact	Duration of activity	Frequency of impact
3	4	4	5	4
Results: MEDIUM- HIGH(+ 99)				
Mitigation/Comments: The proposed project will ensure that there is plenty of LPG which will meet the increasing demand for LPG in Coastal region.				

5.2.7 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 resulting from similar or diverse activities or undertakings in the area.

The concrete paving will affect permeability of storm water into the subsurface and underground water.

The soil once excavated and moved within the site loses its original physical and chemical composition, structure, arrangement of soil horizons and the transition between those horizons. These changes cumulatively alter the biological, physical and chemical properties of the soil and consequently the reaction patterns with pollutants.

5.3 Summary of Impacts

Table 6: Summary of Identified Impacts

Impact	**Significance Rating**					
	Construction Phase		**Operation phase**		**Decommissioning phase**	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Air Quality						
Dust generation	low negative impact	Very low negative impact	Not anticipated	Not anticipated	Very low negative impact	Very low negative impact
Fugitive Emission	Very low negative impact	Very low Negative impact	Low Negative impact	Low Negative impact	Very low Negative impact	Very low Negative impact
Health and Safety						
Occupational Health and Safety	Low medium negative impact	Very low negative impact	Very low negative impact	Very low negative impact	Very low negative impact	Very low negative impact
Risk of large incident fire explosion and fire outbreak	low medium negative impact	Very low negative impact	low medium negative impact	Low Negative impact	Not anticipated	Not anticipated
Noise and Vibration						
	Very low negative impact	Very low Negative impact	Low Negative impact	Low Negative impact	Very low Negative impact	Very low Negative impact

Impact	**Significance Rating**					
	Construction Phase		**Operation phase**		**Decommissioning phase**	
Socioeconomic						
Employment	low	Medium High	low	Medium High	Very low	High
LPG Provision	-	-	Medium High	Medium High	-	-
General Economic Growth and increased land value	Low	Low	Low	Low	-	-
Improved Security	Low	Medium	Low	Medium	-	-

CHAPTER SIX

6.0. ANALYSIS OF ALTERNATIVES

The following alternative aspects were considered for the proposed project: No Project Scenario, design and site alternative. Evaluation of the alternatives is governed by a "rule of reason," which requires the evaluation of alternatives "necessary to permit a reasoned choice."

6.1. No Project Scenario

The no Project Scenario is where the proposed project should not be developed. The site will remain as it is; covered by grass and shrubs and it will imply that anticipated benefits from the project would not be realized and similarly the potential adverse impacts associated with the project will not be experienced. The Project is part of the Taifa Gas Kenya Limited Energy 'Green Initiative 'which is geared towards reducing impacts of their operations on the environment. By implementing the project, the Proponent will be able to provide and promote clean energy and reduce the use of environmentally degrading source like charcoal burning, illuminating kerosene etc. These sources are prone to release pollutant gases in the form of greenhouse gas emissions (GHG). Sticking to these old sources and adopting the ''No Project Scenario'' is therefore not considered as a viable option.

6.2. Location Alternative

The Proponent has only one proposed site for the storage and distribution of Liquefied Petroleum Gas. The site is located in an area earmarked for industrial development in the Takaungu area of Kilifi County, which makes the area quite ideal for the bulk storage and filling plant setting up. Taifa Gas Kenya Limited will be the major mid-stream bulk storage facility in the area will ensure that there is continuous supply of LP gas in the facility.

6.3. Design Alternatives

6.3.1. Proposed Option

The Proponent has proposed to install 2nosx 3000MT above ground LPG spherical (Horton spheres) tanks as opposed to mounded LPG cylindrical bullets. Considering the dimensions of the site and fact that the area is stable from a seismic perspective, spherical tanks are The proponent also proposes to construct single mooring point (SMP) for LPG offloading from berthed vessels into the bulk storage tanks,

The proposed design will largely improve the safety of storage and handling of LPG at the site and will create a steady supply/stock of LPG gas to the coastal community and other areas.

Figure 6: An image of the Proposed LPG Spherical Storage Tank

6.3.2. Mounded Bullet Option

LPG can also be stored in a Mounded pressurized bullet which offer a safer option and eliminates the possibility of BLEVE. The cover of the mound protects the vessel from fire engulfment, radiation from a fire in close proximity and acts of sabotage, terrorism or vandalism. The catastrophic failure mode of a cylindrical vessel is also such that it can be directed away from any processing or occupied areas. Mounded bullet type storage is also used where visual impact is important. A typical mounded bullet is depicted in Figure 7:

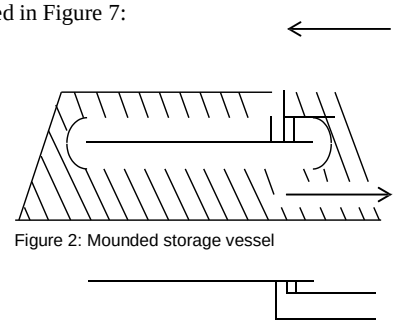


Figure 2: Mounded storage vessel

The disadvantage of mounded bullet storage over spheres is the plot space required. The proposed spherical tanks themselves have a larger footprint and the space required for mounding adds additional cost. Opting for mounded bullets storage will drastically diminish the available undeveloped space for future development including expansion of the existing operations.

6.3.3. LPG Cylindrical Tanks

LPG can also be stored in LPG cylindrical tanks, shown by figure 6 below. The cylindrical tanks can offer the maximum volume but require an extensive/maxim surface area/land space and the required thickness of a cylindrical is one-half times thicker than thickness of a sphere of the same diameter. However, they are more safe since it weight is distributed evenly on a larger area thus increasing chances of collapse as compared to LPG spheres described in the previous sections, especially in areas prone to earth quakes. The proposed site is not prone to earthquakes.

Figure 8: An image of LPG Cylindrical Tank

6.4. Input alternatives

The proposed facility will handle Liquefied Petroleum Gas. The amount of LPG stored will be dependent on the requirements of Taifa Gas Kenya Limited Energy Limited. The input alternatives are thus dictated by the market demand for gas; however, the developer will mainly be storing LPG in bulk for onward transmission to the retail market through tanker trucks via the existing road network. The design does not allow storage of other products other than Liquefied Petroleum Gas.

6.5. Conclusion

In light of these alternatives, the team of Experts can conclude that the proposed project satisfies the overall economic, technical, environmental considerations. Taifa Gas Kenya Limited Energy Ltd will have adequate stock of LPG; will not incur extra cost of land acquisition and will reduce the cost of daily transportation of LPG to the site.

As experts we are of the view that the 'No-go option' will not compete with the benefits of proceeding with the project.

CHAPTER SEVEN

7.0. PUBLIC STAKEHOLDER CONSULTATION

Public participation is an essential and legislative requirement for environmental authorization. The team of experts undertook the public stakeholder consultation (PSC) for the proposed project in accordance with the requirements for an EIA Study stipulated in the EMCA, 1999 (Amendments 2013) and EIA/EA Regulations 2003.

7.1. Interviews

Interviews were conducted during public stakeholder consultation in order to obtain the views and concerns of the interested parties in relation to the proposed project. A semi structured interview checklist/ questionnaire was used to capture the responses of the stakeholders.

The nearby industries having been consulted welcomed the project and emphasized that safety measures must be taken to ensure that the project impacts were under control and minimized.

7.2. Overall Objective of Public Stakeholder Consultation

The objectives of public participation in an EIA are to provide sufficient and accessible information to Interested and Affected Parties (I&APs) in an objective manner to assist them to identify issues of concern, and provide suggestions for enhanced benefits and alternatives.

CHAPTER SEVEN

8.0. ENVIRONMENTAL MANAGEMENT PLAN

8.1 Introduction

Environmental Management is basically resource management and environmental planning is similar to development planning. The conventional resource management and development planning look at the issues from narrow micro-economical point of view while environmental management views the issues from the broader prospective of long term sustainable development option, which ensures that the environment is not desecrated. An Environmental Management Plan is prepared for construction phase, post construction phase (commissioning and operation) and for post project phase. The environmental management plan is prepared to minimize the impact of atmospheric emissions, liquid effluents, solid wastes & noise generation on the surrounding environment.

The baseline settings of different relevant environmental components in the study area are analyzed and potential impacts on those components due to the proposed project are documented. The impacts on environment are found to be minimal during the study; however additional measures are documented for both construction and operation stages for further improvement of Environmental Quality in the form of an Environmental Management Plan (EMP).

This section presents the environmental management plan (EMP) for the proposed project. The EMP specifies the mitigation and management measures which the Proponent will undertake and shows how the Project will mobilize organizational capacity and resources to implement these measures.

The EMP covers information on the management and/or mitigation measures that will be taken into consideration to address impacts in respect of the following project phases: design, construction, operation and decommissioning.

8.2 Environment, Health and Safety (EHS)

It is of utmost concern for a company to conduct its business in a manner that will promote the protection of the occupational Health & Safety; Welfare of its employees and others involved in or affected by its business operations and address the environmental concerns regarding sustainable development.

To be a responsive and responsible corporate citizen, we shall strive to achieve an organizational culture of Safety, Health and Environmental excellence.

As an integral part of the company's business performance, the company shall declare full commitment to achieve high levels of performance in Health, Safety and Environment.

Continual improvements in Safety, Health and Environment shall be recognized as essential for the future success of the company.

8.3. Environmental Objectives

While developing an EMP within the framework of an EMS, it is imperative to have clear environmental objectives and delineate them. The key environmental management objectives for this project are to

avoid significant adverse environmental impacts and to ensure that where impacts do occur they are mitigated. In addition, the project proponent aims to meet the following specific objectives.

- To adopt construction and operational methods that will limit environmental degradation.
- To protect physical environmental components such as air, water and soil.
- To conserve terrestrial and aquatic flora and fauna.
- To protect historic and cultural sites.
- To incorporate the views and perceptions of the local inhabitants in the project.
- To generate employment opportunities wherever possible and feasible.
- To provide environmental guidelines and stipulations to the construction contractors to minimize the impact of those activities around the proposed site.
- To provide advanced sophisticated safety system to ensure safety of the public at large.
- To establish a long term program to monitor effects of the project on the environment.

8.4. Implementation

The various players responsible for execution of the EMP and associated monitoring and inspection and their designated levels of responsibilities are delineated below:

The Project Proponent will be responsible for providing all the necessary funding and administrative support to the EMP and be ultimately responsible for carrying out this project with total commitment to environmental matters.

The Management Representative (MR), working on behalf of the project proponent, will be responsible for coordinating the activities of a technical staff, responsible for monitoring and managing compliance of the EMP. The responsibilities include technical, community and administrative matters related to the EMP, including liaison with the general public in the project area, other parties and regulatory bodies on environmental issues related to the project. This person will also keep the local communities informed of the environmental compliance of the project and properly address any issues of their concern.

The EHS Representative with the help of the technical staff, will be responsible for monitoring the compliance of the EMP (for which they will be given adequate training) and must report to Management Representative (MR).

The Construction Contractor will be responsible for ensuring full compliance with environmental matters related to construction activities, as laid down in the EMP. The construction contractor will ensure that all his workers are properly briefed in environmental matters in terms of Do"s and Don"ts while they work on the project. The cost towards implementation of EMP is the part of the bidding document so that the related costs are included in the contract.

8.5 Approach to environmental impact management

The proposed EMP will be the responsibility of the proponent and his team; Table 9 presents the range of approaches that will be used to manage potential impacts of the proposed project.

Table 9: Approach used to Manage Potential Impacts

Approach	Description
Avoidance	Avoiding activities that could result in adverse impacts and/ or resources or areas considered sensitive

Prevention	Preventing the occurrence of negative environmental impacts and/ or preventing such an occurrence having negative impacts.
Minimization	Limiting or reducing the degree, extent, magnitude or duration of adverse impacts through scaling down, relocating, redesigning and or realigning elements of the project
Mitigation	Measures taken to minimize adverse impacts on the
Enhancement	Magnifying and/ or improving the positive effects or benefits of a project
Rehabilitation	Repairing affected resources
Restoration	Restoring affected resources to an earlier (possibly more stable and productive) state, typically "background or 'pristine'

The environment, health and safety management cycle has five broad components:

- Planning and design
- Project implementation (covering the construction and operation phases);
- Checking and corrective action; and
- Management review

8.5 Responsibility and Accountability

8.5.1 Environmental Management Structure

The Proponent, Taifa Gas Kenya Limited Energy Kenya Limited will utilize the existing arrangements in the implementation of the EMP during planning and design, construction, operation and decommissioning/closure. The Proponent is accountable for ensuring that resources are made available to effectively implement the EMP and necessary environmental management measures arising from the project.

8.5.2 Management of Contractors

The Contractors will be responsible for implementation of some of the EMP commitments. However, the Proponent fully recognizes that she is not absolved from those management responsibilities. Ultimate responsibility for meeting all commitments lies with the Proponent.

The Proponent will commit contractors to meeting the relevant responsibilities by means of specific conditions in the contracts of appointment. Where there is concern over the capacity of contractors to undertake specific activities according to the system stated here, the Proponent will provide additional training to improve the capacity of the contractors.

Activities of contractors will be overseen by the Project Manager and staff as appropriate.

The Proponent will put in place the following construction phase contractor arrangements to support EMP implementation:

Contractors will have certain key environmental line functions included in their job descriptions and performance criteria. Critical among these is the Construction Manager.

- The Construction Manager will be accountable for environmental (including social) management during the construction phase. Specific responsibilities for the Construction Manager will include Regular performance reviews and undertake corrective and/or remedial action where this may be required.
- Meetings will be held to review implementation of EMP requirements, highlight issues of concern, identify required interventions and prescribe corrective actions and schedule, and allocate budget and appoint responsible parties.
- A code of practice for construction teams will be prepared and implemented. This code will guide the management and behavior of construction teams. The code will include items relating to health safety and community relations.
- Information on the implications of construction will be disseminated before construction starts
- Contracts will be key tools in managing many potential negative impacts such as transport related incidents. They will specify required environmental and social practices.

8.5.3 Training, Awareness and Capacity Building

The Proponent will ensure that all contractors' staff is inducted on health and safety, environmental and emergency response procedures. The Proponent will use written (newsletter/posters/toolbox talks) and verbal (as part of routine briefings) communication methods to raise awareness on a range of health, safety and environmental issues. This will be done in both Kiswahili and English languages (as appropriate) to ensure that all members of the workforce are made aware.

8.5.4 Monitoring and Compliance Assessment

During the construction phase, the Proponent will monitor and inspect contractors' written records to demonstrate compliance with the EMP. This compliance monitoring will verify that the responsible parties are implementing the specifications contained in the EMP. Compliance will mean that the contractor is fulfilling contractual obligations.

To determine the effectiveness of the EMP, the Proponent will use a series of internal and external inspections and audits:

Minor non-conformances will be discussed during the inspection and recorded as a finding in the inspection report. Major non-conformances will be formally reported as an incident and will be subject to the requirements of the authorities.

8.5.5 Incident handling and Reporting

All incidents and accidents arising from the project will be handled and reported respectively as per section 98 and 117 of the Energy Act No. 12 of 2006.

An incident can arise from the following:

- Significant non-conformance with the EMP identified during an internal inspection
- Any non-conformance identified by either the authorities or an external audit
- Accidents or spills resulting in potential or actual environmental harm
- Accidents or near misses that did or could result in injury to staff, visitors to site or the surrounding communities
- Significant complaints received from any source.

Note: All incidents will also be formally recorded and noted in the General Register in accordance with requirements of OSHA 2007.

8.5.6 Checking and corrective action

Checking and if necessary implementing corrective action, to ensure that required EMP management activities are being implemented and desired outcomes are achieved. As such this component includes four key activities namely:

- Monitoring selected environmental quality variables as defined in the objectives and targets.
- Ongoing inspections of the operational controls and general state of the operations.
- Internal audits to assess the robustness of the EMP or to focus on a particular performance issue.
- External audits to provide independent verification of the efficacy of the EMP.

8.5.7 Corrective Action

There are several mechanisms for implementing corrective action, both during the construction and operational phases. The main mechanisms to address transgressions include verbal instructions (in the event of minor transgressions from established procedure, usually following a site inspection); written instruction (identifying source(s) of problems, usually following an audit) and contract notice (following possible breach of contract).

8.5.8 Reporting

The findings of all of the above will be structured into instructive reporting that provides information to all required parties on EHS performance, together with clearly defined corrective action where this is seen to be required. Both the monitoring and inspections are to be reported continuously.

8.5.9 Liaison

Throughout the project cycle, the Proponent will liaise with authorities especially NEMA Kenya to ensure ongoing feedback on the environment performance of the project.

Table 11: Mitigation and Management measures for the identified Impacts

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
Air Quality	Degradation of Air Quality	Relevant legislative and Kenya Standard design requirements will be adhered to where appropriate. Vehicles and machinery will be regularly maintained. Maintenance activities requiring purging of gas will be minimized and conducted under favorable Meteorological conditions (to facilitate rapid atmospheric dispersion). Install standard leak	To achieve air quality objectives of the Draft Air quality Regulations 2008 during construction and operation. To minimize the potential for construction, operation and decommissioning activities to adversely affect sensitive receptors. To maintain	No receipt of air quality-related complaints from neighboring sensitive receptors. Documentation of regular servicing/maintenance of all vehicles and plant components.	Non-compliance and incident reporting will be closed out to ensure prompt rectification and change management as required. Neighbors' complaints will be recorded and closed out. Regular reporting and audits will be undertaken by the Production Manager in accordance with the	Throughout project cycle	No significant material additional cost	Proponent, Contractor and User (Taifa Gas Kenya Limited Energy)

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
		Detectors for hazardous area installations. Any detected leaks will be repaired as a high priority. Best practice measures are implemented to minimize the potential for dust to be generated and escape off-site.	Acceptable limits of vehicular and machinery operating emissions. To minimize gaseous and dust emissions.		Requirements of the LPG (Safety) The results of leaks detection and estimates of the volume of any gas vented, and recommendations and corrective actions shall be implemented. Audit of vehicle servicing records. Audit of the plant maintenance records for leaks detection and repair.			
Noise Quality	Noise Pollution from Incidents	Construction activities	To minimize the	No noise related	Landholder	Construction, Operation and	60,000 monitoring	Proponent and User

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
		near sensitive places shall be restricted to normal working hours (typically 7.00 am to 6:30 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. Equipment will be fitted with noise control devices where possible	potential for noise to adversely affect sensitive receptors during project cycle. To achieve relevant environmental acoustic quality objectives of the Legal Notice No. 61 of 2009, during project cycle.	complaints received from residents and landholders. □ Documentation of repair and replacement of faulty equipment as soon as possible. □ Documentation of consultation and planning for atypically noisy events. No noise related complaints received from residents and landholders.	complaints relating to noise will be recorded and closed out. Regular audits and will be undertaken, and recommendations and corrective actions shall be implemented. Noise survey(s) will be undertaken as appropriate and upon request from the administering authority. Noise surveys at relevant nearest local residences will	Decommissioning phases	cost per schedule	

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
		and appropriate.		Documentation of repair and replacement of faulty equipment as soon as possible. Documentation of consultation and planning for atypically noisy events.	be undertaken a s appropriate.			
Waste	Pollution from waste generation	Develop strategies (waste management plan) for management of specific waste streams prior to construction phase. Stockpile and salvage reusable and recyclable wastes, such as timber	To minimize any negative impacts associated with waste generation through adoption of the waste	No evidence of Uncontrolled waste (i.e., not in appropriate containers) at above ground facilities during inspections. Record of	Housekeeping checks to ensure waste is being stored correctly and no litter is occurring. Regular audits and reviews will be undertaken, and	Construction, operation and Decommissioning phases	No material additional costs are anticipated above general budgets for responsibilities of EHS Manager for the implementation of the plan.	Proponent, Contractor and User

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
		Braces, fiber /nylon rope spacers, pallets, drums and scrap metals. Store hazardous wastes 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.	Management hierarchy. No spills of hazardous waste fluids (e.g., oil). Safe and proper disposal of waste.	regulated waste disposal. Number of Waste Spill Reports.	Recommendations and corrective actions shall be implemented. Waste will be tracked and appropriately recorded. Report hazardous waste spills. Review of operations waste management procedures, and quantity of regulated wastes generated.			

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
		Where practical, wastes (e.g., scrap metal) will be segregated and reused/recycled. All litter and general waste disposal will be at a local municipal landfill utilizing 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						

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
		hazardous spill incidents will be provided and maintained.						
Soil Quality	Degradation of soil	Minimizing the areas to be excavated Re-vegetating disturbed areas once construction and demolition works are completed; during construction and decommissioning phases respectively; Ensuring that vehicles/equipment used during construction and decommissioning phases are serviced regularly.	To avoid or minimize soil disturbance/contamination.	Documentation of regular servicing/maintenance of all vehicles and plant components. The extent of excavated area	Non-compliance and incident reporting will be closed out by senior management to ensure prompt rectification and change management as required. Neighbors' complaints will be recorded and closed out. Regular reporting and inspections will	Construction phase	No material additional costs are anticipated above general budgets for responsibilities of EHS Manager for the implementation of the plan.	Proponent and Contractor

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
					be undertaken Audit of vehicle servicing records.			
Water Quality	Degradation of water quality	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.	To minimize any negative impacts on water resources during construction, operation and decommissioning g phases.	No evidence of uncontrolled waste (i.e., not in appropriate containers) at above ground facilities during inspections. Record of regulated waste disposal. Number of Waste Spill Reports.	Housekeeping checks to ensure waste is being stored correctly and no litter is occurring. Regular audits and reviews will be undertaken, and recommendations and corrective actions shall be implemented. Waste will be tracked and appropriately	Construction, operation and decommissioning	No material additional costs are anticipated above general budgets for responsibilities of EHS Manager for the implementation of the plan.	Proponent, Contractor and User

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
		Leaving vegetation *in-situ wherever* possible, and re-vegetation of bare soil before the next rainy season. Exposed ground and stockpiles will be minimized to reduce silty runoff, and if necessary measures such as geotextiles will be used to shield spoil mounds. Preventing wet concrete and cement from entering watercourse; Stockpiles to be kept away from watercourses			Recorded. Report hazardous waste spills. Review of operations waste Management procedures and quantity of regulated wastes generated.			

Health and Safety	Occupational health and safety impacts	Development and Implementation of occupational health and safety plan. The Plan will	To minimize impacts on health and safety during construction,	Occupational Injury and illness incidents.	Workplace inspection to ensure	Construction, operation and decommissioning phases	No material additional costs are anticipated	Proponent and Contractor

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
		cover on the following: Formulation of EHS Management system Development of health and safety programmer Risk assessment and health monitoring for workers Contractor selection criteria in relation to health and safety Job description to include health and safety requirements	Operation and decommissioning phases.	Workforce health Process safety	operations/activities are being undertaken in accordance with the safe operating procedures, standards and regulations Regular audits and reviews will be undertaken, and recommendations and corrective actions shall be implemented. Personnel will be trained on health and safety.		General budgets for responsibilities of EHS manager for the implementation of the plan. Additionally, the health and safety audit of the facility will not be carried out in isolation, instead it will be audited together will other facilities onsite during annual statutory audit of the entire plant hence no additional cost is anticipated	
Socio-economic	Creation of employment	During construction	Maximize impacts on local economy	Kenya Labor Laws	Compliance with	Construction, operation and	No additional cost is	Proponent, and Contractor

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility

	and supply of goods and services opportunities	will be encouraged t o source where possible labor from the local community; During operation phase, the Proponent will utilize their existing human resource policy in hiring personnel required to operate the plant. The Proponent will ensure that hiring of personnel follows the Kenya Labor Laws and that there will be no discrimination on the grounds of race, ethnicity, religion, gender, and political affiliation. The	and employment during project phases		Kenyan Laws	decommissioning phases	anticipated	

Aspect	Impact	Mitigation Measure/Enhancement measures	Objective	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost Estimate	Responsibility
		contractors will similarly Be required to apply the same policy. The Proponent will utilize their existing procurement policy and ensure that where possible goods and services are sourced from the local area.						

CHAPTER 8

8.1 Introduction

Growth in the industrial sector creates new opportunities for employment and can also help diversify the economy. This is especially important given the high level of urbanization and growing levels of unemployment and poverty in many cities. Unemployment is particularly high and an important factor in continued levels of low human well- being and slows growth. Synergistic growth in the industries could have positive spin-offs for the socio-economic development. This chapter describes about benefits of the project on improvements in the physical infrastructure, social infrastructure, Employment potential in the region.

8.2. Improvement in the Social Infrastructure

From the very initial stage of the inception of the project, infrastructure development in and around the project site has kept in consideration, infrastructure development will be done based on actual requirement socio-economic development of the region. The infrastructure development will be rolled out as part of company's CSR activity.

8.3. CSR Activities

Taifa Gas Kenya Limited has assessed the infrastructural demand of the study area; based on the detailed plan of action as part of proposed CSR activities transform itself into personal social responsibility for the personnel manning the factory.

- Infrastructural facilities for local people like Educational facilities, Medical facilities, Transportation facilities etc.
- Special health awareness camp and medical camps for primary checkup will be arranged at least once in a year in nearby villages from health check-ups.
- Facilitate schools with toilets, drinking water tanks etc.
- Save daughter campaigns
- Roads passing nearby the proposed plant will be maintained.
- Funds will be provided to arrange extracurricular activities for nearby schools.
- Tree plantation in rural areas.
- Provision of sanitation (toilets) facility at nearby villages.

8.4. Economic Development

This project will increase the economic activities around the area, creating avenues for indirect employment during operation phase of the project. There would be a wider economic impact in terms of generating opportunities for other business like workshops, marketing, repair and maintenance tasks etc.

The continuous inflow of people will require local transport system like autos, taxis etc which would help economic boost.

8.5. Employment Potential

During construction phase of the project, this project will provide temporary indirect employment to many unskilled and semi-skilled labors in nearby villages.

The project will create indirect employment opportunities within the surrounding region. The unit will use good faith efforts to employ local people from the nearby villages depending upon the availability of skilled & un-skilled man-power surrounding the project site. In operation phase, the proposed project would require significant labor force. Migration of highly education and skilled experience will result in increase of literacy in the surrounding villages.

8.6 Improved Security

The proposed project is expected to improve the security situation in the area in that the project will have physical form of security which will range from: employing security guards installing security lights and installing alarm systems.

Apart from physical security there will also be procedural security; where visitors to the site have to log in and log out when arriving and leaving site respectively

CHAPTER 9

CONCLUSION AND RECOMMENDATIONS

The project by Taifa Gas Kenya Limited seems to be safety conscious and aware about the impacts of the industrial projects and is environment friendly.

We may conclude as under:

- The project proponent will follow all the statutory norms and guidelines as per EMCA, 1999 (Amendments 2013) to safeguard environment.
- Wastewater generated from the proposed project will be treated in sedimentation traps & reused. Sewage will be treated in existing STP.
- Ambient Air Quality of the project site are concerned viz. SPM (PM10 & PM2.5), SO2 and NOx, their concentrations in the ambient air at the proposed site were observed to be well within the prescribed limits
- The operational phase noise shall be within industrial premises which will not exceed 75 dB (A).
- The project will generate temporary indirect employment opportunities during construction stage and also at operational stage. The standard of living of local people due to above employment is likely to be better, so we may say that it is positive socio-economic impact. The region will get economic boost.
- Overall the project will have positive impact for socio-economic and cultural development.

REFERENCE

The following list of references was referred to in preparing this EIA Report:

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21. *Control) Rules 2005*
22. **British Standard (BS) 8233:1999**: *Sound Insulation and Noise Reduction for*
23. *Buildings*.
24. **British Standard (BS) 5228 Part 1, 1997***: Noise and Vibration Control on Construction and Open Sites*
25. **British Standard (BS) 5228 Part 4, 1997***: Noise Control on Construction and Open Sites: Code of Practice for Noise and Vibration Control applicable to piling operations*

26. **Wikipedia**- *Liquefied Petroleum Gas (LPG)*

27. **GLPGP** – Kenya Market Assessment Report-, 2013.

Annexures

Sketch Map

Land Ownership/Lease Agreements

KRA Pin Certificate

Company Certificate of Incorporation

Sample of Questionnaires

Annex 1: Sketch Map

Taifa Gas Kenya Ltd undeveloped plot to be used for the LPG storage and filling plant/