ENVIRONMENTAL IMPACT ASSESSMENT FULL STUDY REPORT

FOR THE PROPOSED CONSTRUCTION OF

AN OIL AND GAS STORAGE DEPOT ON PLOT L.R No. 149107, AT

VIWANDANI LOCATION, MAKADARA SUB COUNTY,

NAIROBI COUNTY.

EIA/EA LEAD EXPERT

BILL OKEMWA

P.O BOX 1728-00100

NAIROBI

PROPONENT

MAKADARA OIL TERMINAL LIMITED,

P.O BOX 45675 GPO,

NAIROBI.

APRIL, 2022

CERTIFICATION

This EIA Full Study Report was prepared in accordance with the Environmental Management and Coordination Act (EMCA), 1999 (Amended, 2015) and the Environmental (Impact Assessment and Audit) Regulations, 2003 for submission to the National Environment Management Authority (NEMA). The report has been prepared by Bill O. Okemwa; NEMA registered and licensed EIA/EA Lead Expert.

To the best of our knowledge we certify that all the information contained in this report is correct and righteous.

EIA/EA LEAD EXPERT:

Name: BILL O. OKEMWA

Signature: ……....

Date: ……

PROPONENT:

Company: MAKADARA OIL TERMINAL LIMITED (MOTL)

Signature: ……....

Date: ……

ABBREVIATIONS

ALARP	As low as reasonably practicable
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BS	British Standard
CO_x	Carbon Oxides
EEZ	Exclusive Ecological Zone
EHS	Environmental Health and Safety
EHS	World Bank General Environmental Health and Safety Guidelines
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
EPRA	Energy and Petroleum Regulatory Authority
EPRP	Emergency Preparedness and Response Plans
EPT	Energy and Petroleum Tribunal
ERC	Energy Regulatory Commission
ESD	Emergency Shut Down
FEED	Front End Engineering Design
GIIP	Good international Industry Practice
GRS	Grievance Redress System
HAZID	Hazard Identification
HAZOP	Hazard and Operability
HRM	Human Resource Management
HSE	Health & Safety
HSEMP	Health & Safety Environmental Management Plan
IFC	International Finance Corporation Performance Standards
KEBS	Kenya Bureau of Standards
KPLC	Kenya Power and Lighting Company
LEL	Lower Explosive Limits
LPG	Liquid Petroleum Gas

MSDS	Material Safety Data Sheet
NEMA	National Environment Management Authority
NO_x	Nitrogen Oxides
NPEA	Nuclear Power and Energy Agency
OHS	Occupational Health and Safety
OSH	Occupational Health & Safety
OSHA	Occupational Safety and Health Act
PDCA	Plan-Do-Check-Act
PFP	Passive Fire Protection
PM	Particulate Matter
PSV	Pressure Safety Valve
QSR	Quick Service Restaurants
RERAC	Renewable Energy Resource Advisory Committee
REREC	Rural Electrification and Renewable Energy Corporation
SO_x	Sulphur Oxides
STOP	Safety Training Observation Programme
TOR	Terms of Reference
TPH	Total Petroleum Hydro-carbons
UEL	Upper Explosive Limits
UNESCO	United Nations Educational, Scientific and Cultural Organization
USTs	Underground Storage Tanks
VCE	Vapour Cloud Explosion
WHO	World Health Organization

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EXECUTIVE SUMMARY

The proposed project for which this EIA full study report has been prepared is the proposed construction of an Oil and Gas Storage Depot infrastructure and its associated facilities and amenities for Makadara Oil Terminal Storage Depot at Viwandani Location, Makadara Sub County, in Nairobi County. The project had previously been submitted as Project Report in December 2021.

In compliance with the requirements and provisions of the Environmental Management and Coordination Act No. 8 of 1999 and Regulation 10 of the Environmental (Impact Assessment and Audit) Regulations, 2003 Legal Notice No. 101 and Legal Notice 15 of the Environmental (Impact Assessment and Audit) Regulations, 2016, the Authority required the proponent to initiate an Environmental Impact Assessment full study to facilitate wider public consultation, in-depth evaluation of the potential impacts associated with the proposed project and materialize harmony with stakeholders.

Pursuant to the directive by the Authority, in Feb., 2022, Terms of Reference (TOR) initiating an Environmental Impact Assessment Full Study were prepared and submitted to NEMA **(NEMA/TOR/5/2/401)** and approved.

The development comprises the construction of an Oil and Gas Storage Depot infrastructure and its associated facilities and amenities located on co-ordinates 1˚ 18' 3.175" S 36˚ 52' 19.081" E on Plot L.R No: 149107, along Jogoo road, at Viwandani Location, Makadara Sub County, in Nairobi County. This construction project shares impacts similar to most construction activities ditto urban development projects, and are thus manageable through the proposed EMP that shall be developed commensurate to the assessment of its potential environmental and social impact in this study report.

This Environmental Impact Assessment full study has been undertaken under requirements of Environmental Management Coordination Act (EMCA), 1999 (Amended 2015), schedule II that lists the projects supposed to undergo EIA studies in accordance with section 58 (1-4) of the Act. This is as stipulated by National Environment Management Authority that requires all development projects to do so in order to elucidate the potential adverse impacts of a project and thereby devising appropriate mitigation measures.

The overall objective of the study was to construct an Oil and Gas Storage Depot infrastructure and its associated facilities and amenities for receiving, handling, storage, and delivery of petroleum products. On the other hand, the major objective of the EIA full study was to evaluate the effects/impacts of proposed development in relation to the general environmental aspects i.e. physical, biological, and social-economic environments. It aims at influencing the protection and co-existence of the development with the surroundings as well as the compatibility of the proposed development to the area; to ensure and enhance sustainable environmental management during implementation and operational phases.

The scope of EIA study was to identify impacts likely to be caused to the environment, public health, socio-economic wellbeing, carrying out of environmental investigations in line with current legislations. The methodologies for EIA full study were environmental screening, environmental scoping, desktop studies, site visits, public and stakeholder participation and finally study report writing.

The study covered the physical extent of the project site and its immediate environs, implementation works of the proposed development and installation of key utilities and other facilities required for the project to function optimally. The baseline survey included physical, biological and the socio–economic environment.

This Environmental Impact Assessment full study examined the potential positive and negative environmental and social impacts of the project on the immediate surroundings with due regard to all the phases of construction, operation and eventual decommissioning of the depot. It encompassed all aspects about the physical, ecological, socio-cultural, health and safety conditions at the site and its environs during and after construction.

The EIA full study has revealed that there are both positive and negative impacts. The main positive impacts of the project include but not limited to: storage, handling and provision of petroleum products, providing oil reserves that will avert petroleum products crisis in the country, easy movement of people, goods and services, boost growth of local and regional economy, employment opportunities and generation of income and improve livelihoods, create business opportunities for various service suppliers and contractors, improvement of infrastructure, income

to the proponent, optimal land utilization, revenue to the government, and decongest existing oil depots/terminals among others.

The significant negative impacts include: pressure on existing water resources, pollution (soil, air, noise, and water), solid and liquid waste generation, increased power demand, soil erosion and sedimentation, potential incidences of petroleum product leaks from storage tanks and supply lines, potential fire risk because of the highly combustible petroleum products handled, public utilities disruption, occupational health and safety hazards, impacts on material sourcing, and increased traffic in to the/along jogoo road serving the oil depot.

To avoid, reduce, and/or minimize for potential significant, negative environmental and social impacts, mitigation measures were proposed and environmental and social management plan (ESMP) formulated. Recommendations were proposed to carry out annual environmental audits and follow ups once the project is in operation. However, a monitoring program was also developed to not only track down occurrence of impacts, but also to check on compliance requirements. Outlined below is a summary of impacts and mitigation measures;

Impact	**Proposed Mitigation Measure**
Objective: To Minimize Impacts of various Depot Fires	
LPG, Fuel Oil, Gasoline & Gas Oil Fires	• Strategic location of Fire Fighting equipment at the depot • Provision of functional firefighting equipment at the depot Compliance to Nairobi County requirements on firefighting including: ✓ Use of periodic maintenance firefighting appliances, ✓ Conducting an annual fire safety audit, and ✓ Display of a fire clearance certificate at site. • Conducting regular emergency drills to include but not limited to fire fighting and response. • Maintaining an Electrical maintenance Plan • Marking and checking to ensure all fire escape routes are available and clear at all times. • Having a marked Fire Assembly Pint at the depot **Fighting procedures for various depot fires** **Small fires:** • Any extinguisher suitable for Class B fires, dry chemical, CO_2, water spray, fire- fighting foam or Halon. **Large fires:**

- Water spray, fog or fire-fighting foam.
- Water may be ineffective for fire-fighting, but may be used to cool fire-exposed containers.
- Fire-fighting foam is suitable for polar solvents with > 10% oxygenate concentration

Isolate area around a container involved in fire.

- Cool tanks, shells and containers exposed to fire and excessive heat with water.
- ***For huge fires*** the use of unmanned hose or monitor nozzles may be advantageous to minimize personnel exposure.
- ***Major fires*** may require withdrawal, allowing the tank to burn.
- ***Large storage tank fires*** require specially trained personnel and equipment to extinguish the fire with the need for properly applied fire-fighting foam

Objective: To Minimize Occupational Health and Safety Risks

Occupational Health and Safety Risks

- Provide all workers with the necessary protective gears
- Ensure all workers are in protective gears all the time when on site
- Place fire extinguishers in strategic areas within the station
- Designate and mark smoking areas
- Workers to be trained as fire marshals
- Fire escape routes to be shown clearly
- Provide enough first aid kits within the project site
- Train workers in administering first aid
- Label all potential hazards such as movable machine parts
- Raise awareness and educating workers on risks from equipment and training them on the use of the equipment.
- Placing visible and readable signs around where there are risks.
- Ensuring security in and around the site to control the movement of people.
- Providing safe and secure storage for equipment and materials in the site.
- Placing visible and readable signs to control the movement of vehicles and notify motorists and pedestrians around the, and workers in the site.

Objective: To Minimize Solid Waste Generation Ensuring Efficient Solid Waste Management

Increased Solid Waste Generation

Following EMCA regulations on Waste Management, Legal Notice 121 including:

- Use of an integrated solid waste management system like: Source reduction; Recycling; Reuse; and Land filling/Backfilling.
- Using waste minimization techniques like buying required quantities in bulk.

- Identifying all sources of wastes, and ensuring wastes are handled by licensed personnel
- Making available suitable facilities for the collection, segregation and safe disposal of the wastes.
- All construction materials left over at the end of construction should be used in other projects or sold
- Ensure proper handling and storage of construction materials to reduce damage

Objective: To Minimize Impacts on Soil Geology, Degradation And Soil Erosion

Soil Geology, Degradation and Soil Erosion

- Use properly maintained hoses and fittings
- Make the cement screeds in all the chambers using water proof material.
- Install a monitoring well next to the tanks to check on leaks
- Use water finding dipstick and/ or a hydrometer to check on density/ specific gravity
- Ensure there is no oil spills, leaks during refilling and when offloading the fuel
- Excavated materials should be removed promptly from the site to avoid erosion
- Avoid unnecessary movement of soil materials from the site
- Control activities especially during rainy any windy conditions
- Regular sprinkling of water to reduce dust
- Landscaping after completion of the depot with appropriate local vegetation.
- Apply soil erosion control measures including:
  - ✓ Control speed and operation of construction vehicles.
  - ✓ Sprinkle water on excavated areas.
  - ✓ Maintenance of construction equipment.
  - ✓ All bare areas should be landscaped after
  - ✓ Provide workers with dust masks if working on sensitive areas.

Objective: To Minimize Impacts on Hydrology, Drainage and Storm Water

Hydrology, Drainage and Storm- water

- A well-drained area should be identified for parking, servicing and maintenance of the vehicles and equipment.
- Observe appropriate disposal procedures for oils and lubricants
- Provide drainage channels should during construction to minimize any possible water logging.
- Provide a segregated drainage system where water contaminated with oils drains to instead of draining into the open storm drains.
- Water contaminated should be directed into the oil-water separator from where it should be treated before it is released to the rest of the drainage system.

- An interceptor tank made up of reinforced concrete walls and floor shall be constructed and its inner walls shall be plastered with water proof cement. (Each chamber shall have a manhole with a reinforced concrete cover).
- The used oil tank will have a concrete wall which will be able to contain the net products of used oil. Its plinth shall be sloped towards the Oil-Water separator for treatment.
- The drainage system should ensure that surface flow is drained suitably into the public drains provided to control flooding within the site.
- The channels should be covered with gratings or other suitable and approved materials to prevent occurrence of accidents and entry dirt that would compromise flow of run-off.
- The drainage channels should ensure the safe final disposal of run-off /surface water and should be self-cleaning which means it should have a suitable gradient.
- Implementation of roof water harvesting

Objective: To Minimize Impacts of Workers Falling from High Heights

Working at Heights

- Use construction site barrier tape to isolate the site to guard site visitors from accidents and injuries.
- Implement a fall protection program that includes training in climbing techniques and use of fall protection measures.
- Provide Harnesses.
- Use of helmets and other protective devices to mitigate against injury, Provide first aid facilities at the site.

Objective: To Minimize Impacts of Air, Dust Pollution And Exhaust Emissions

Air/Dust Pollution and Exhaust Emission

- Avoid excavation works in extremely dry weathers.
- Personal protective equipment to be worn.
- Post signs that limit vehicles speed onto unpaved roads and over disturbed soils.
- Cover stockpiles of sand, soil and similar materials or surround them with wind breaks.
- Ensure strict enforcement of on-site speed limit regulations.
- Sprinkle water on access routes when necessary to reduce dust generation by construction vehicles.
- Ensure strict enforcement of on-site speed limit regulations
- Sprinkle water on graded access routes whenever necessary to reduce dust generation by construction vehicles
- Enclosing the structures under construction with dust proof nets.
- Using efficient machines with low emission technologies for the ones that burn fossil fuels.
- Regular maintenance and services of machines and engines.
- Use of clean fuels e.g. unleaded and de-sulphurized fuels.

- Educate and raise awareness of construction workers on emission reduction techniques.

Objective: To Minimize Impacts of Noise and Vibration

Noise and Vibrations	Complying with the EMCA noise regulation Legal Notice 61 including: • Prescribe noise reduction measures if appropriate e.g. restricted working hours, transport hours and noise buffering • Consult with the surrounding community on the permissible noise levels and best working hours. • Use best available technology • Sensitize construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used. • Ensure that construction machinery is serviced and kept in good condition to reduce noise generation. • Observe normal working hours during noisy construction works (00800 to 1700) hours • Ensure that all generators and heavy duty equipment are insulated or placed in enclosures • Construction workers to wear ear muffs if working in noisy section.

Objective: To Minimize Impacts of Increased Traffic

Increased Traffic	• Placing signs around the site notifying other vehicles about the heavy traffic and to set the speed limit around the site. • Ensuring all drivers for the project comply to speed regulations. • Making sure the construction doesn't occupy the road reserves and complying with traffic and land demarcation obligations. • Ensuring all vehicles used for the project are in good working condition both legally and commensurate to their intended use.

Objective: To Minimize Impacts of Above-ground Fuel Storage, Handling And Potential Leaking

Above-ground Fuel Storage, and Handling	• Use properly maintained hoses and fittings • Make the cement screeds in all the chambers using water proof material. • Install a monitoring well next to the tanks to check on leaks • Use water finding dipstick and/or a hydrometer to check on density/specific gravity • Ensuring no spills during refilling and /or when offloading the fuel

Objective: To Minimize Water Consumption and Ensure Efficient Water Use

Increased Water Demand	• Drill a borehole • Ensure that water is sourced from a sustainable source and from licensed water vendors. • Recycling waste water and using it for other purposes • Provide information signs on means and needs to conserve water • Promote re-cycling and re-use of water as much as possible

	• Sensitize the occupants to conserve water by avoiding unnecessary wastage. • Detect and repair broken pipes promptly • Install roof gutters and installing water storage tanks to collect and harvest rain water • Avoid unnecessary toilet flushing
Objective: To Minimize Incidences and Accidents	
Increased Incidences and Accidents	• Registration of all workplaces by the Director, Directorate of Occupational Health and Safety (DOHSS) • Provision of appropriate Personal Protective Equipment (PPE) for staff • Erect warning signs • Allocate a fire assembly point • Comply with all standards and legally required health and safety regulations as set out by the Occupational Safety and Health Act (Part XI: Section 96) as pertains to construction activities; • Provide fully functional standard First Aid Kit on site. Recommendations for Employees exceeding fifty (50) [as per the • Demarcate all works which may pose a employees and other site workers • For fire and safety the Contractor, should ensure the following: • For fire and safety the Contractor, should ensure the following: • Place portable fire extinguishers at suitable locations • Training all staff on fire safety policy and procedures • Clearly mark all fire exits within the site
Objective: To Minimize Impacts of Insecurity	
Insecurity	• Maintaining a perimeter wall and have a manned barrier • Installation of CCTV cameras • Maintaining security alarms • Partnership with the neighbors and police in community policing. • Control of secondary businesses. • Round the clock security for the facility. • Adequate lighting and an alarm system installed at strategic points.
Objective: To Minimize of Impacts on Community	
Community Impacts	• Initiate good public relation between the proponent, contractor and the community • Erect and maintain relevant information boards including approvals and consultants of the proposed depot facility • Keep a "Complaints Register" on Site • Continuous community and stakeholder engagement • The proponent to develop a Grievance Redress System accessible to all stakeholders

In conclusion, results from EIA study show that the proposed project will have numerous positive socio-economic impacts as outlined earlier. However, the negative environmental impacts resulting from establishment of the facility are mitigate-able. Therefore, implementation of the Environmental Management Plan will assist in dealing with environmental issues during the project cycle. There are also guidelines for addressing environmental health and safety.

This project is recommendable for approval by the National Environment Management Authority (NEMA) for the issuance of an EIA license subject to periodic monitoring and evaluation from the day of commencing construction operations and decommissioning phases, as long as the set standards, measures and regulations are thoroughly upheld and adhered to. This will be in compliance with the Environmental Management and Coordination Act of 1999 (Amended 2015) and the Environmental Impact Assessment and Audit regulations, 2003.

CHAPTER ONE: INTRODUCTION

1.1 Introduction and Background Information

This Environmental Impact Assessment (EIA) full study report has been prepared for the purpose of seeking licensing for construction an Oil and Gas Storage Depot infrastructure, its associated facilities and amenities for Makadara Oil Terminal Limited along Jogoo Road, at Viwandani Location, Makadara Sub County, in Nairobi County resulting from the Authority requiring the proponent to initiate an Environmental Impact Assessment full study to facilitate wider public consultation, in-depth evaluation of the potential impacts associated with the proposed project and materialize harmony with stakeholders.

The project had previously been submitted as Project Report in December 2022. Following the project review by the Authority, it was upgraded to a Full Study Report through a Terms of Reference (TOR) that was prepared, submitted to NEMA and approved **(NEMA/TOR/5/2/401)** in Feb., 2022.

This Environmental Impact Assessment full study report seeks to examine both the positive and negative effects that the proposed Shell Depot development project is likely to have on both the physical and socio-economic environment in order for sound decision making to promote human activities that align synergistically with the natural world within a sustainable development framework.

A comprehensive environmental policy was therefore needed to take care of the environment in a holistic way. This was achieved through enactment of the Environmental Management and Coordination Act (EMCA), 1999 (Amended, 2015), schedule II that lists the projects supposed to undergo EIA studies in accordance with section 58 (1-4) of the Act. The Act stipulate that Environmental Impact Assessment be carried out on all development projects to do so in order to elucidate the potential adverse impacts of a project and thereby devising appropriate mitigation measures. It is in response to this provision that this project report has been prepared.

1.2 Justification of the Proposed Project.

The project once implemented, will be in accordance with the Energy and Petroleum Regulatory Authority (EPRA) under the Energy Act, 2019 that is responsible for the economic and technical regulation of the petroleum sub sectors. Therefore, the proposed construction of An Oil and Gas

Storage Depot will serve one of the Authority's key mandate as provided by the Energy Act 2019 which is to; Co-ordinate the development of upstream petroleum infrastructure and promote capacity building in upstream petroleum operations.

Currently and in the recent past, the demand for petroleum products in Kenya and East Africa in general have incredibly increased in all the four main marketing fronts consisting of retail, commercial, aviation, marine and resellers. Similarly, there is a remarkable growth of the growth in clients requiring requiring the use of petroleum products across all the economies and sectors in Kenya and regionally. Owing to this, there is need for construction of new oil storage depot to create room to receive, handle, store and deliver petroleum products. This will in-turn increase the county's current storage capacity ensuring for efficient supply of petroleum products.

Once implemented, the oil depot facility's main positive impacts include but not limited to: storage, handling and provision of petroleum products, providing oil reserves that will avert petroleum products crisis in the country, facilitate easy movement of people, goods and services, boost growth of local and regional economy, employment opportunities and generation of income and improve livelihoods, create business opportunities for various service suppliers and contractors, improvement of infrastructure, income to the proponent, revenue to the government, and decongest existing oil depots/terminals among others.

1.3 Objectives of the Project

The overall objective of the study was to construct an Oil and Gas Storage Depot infrastructure, its associated facilities and amenities for receiving, handling, storage, and delivery of petroleum products.

1.3 Specific Objectives of the Project

This project seeks to achieve the following objectives:

1. Construct an Oil Storage Depot infrastructure, its associated facilities and amenities
2. Maximize returns on investment for the proponent while taking due consideration of policy, legal and administrative procedures governing the operations of a facility of this nature.
3. To ensure that the concerns of the neighboring community in this environment are captured and addressed in all stages of the project's cycle.

4. Ensure that implementation of the project does not in any way interfere with the environmental sustainability of the area in question giving due consideration to:
    - Neighboring population and land uses.
    - Facilities and infrastructure within the project area
5. Put in place mitigation measures that will ensure that any potential negative impacts resulting from project activities are taken care of at the earliest opportunity to alleviate any harmful effect to the neighboring populations and the environment.

1.4 Objectives of the EIA

The overall objective of the study is to assess the potential significant adverse impacts of the proposed development and articulate appropriate mitigation measures.

The specific objectives of this study include the following:

1. To identify and evaluate the significant environmental impacts of the proposed project.
2. To assess the environmental costs and benefits of the proposed project to the local and national economy.
3. To determine the compatibility of the proposed facility with the local environmental setting.
4. To evaluate and select the best project alternative from the various options.
5. To propose mitigation measures for the negative environmental impacts
6. To incorporate Environmental Management Plans and monitoring mechanisms during implementation, operation and decommissioning phases of the project.

1.5 Scope of the Study and ESIA Study Activities

The study has been conducted to evaluate the potential and foreseeable negative impacts of the proposed development. The physical scope is limited to the proposed site and the immediate environment as may be affected by or may affect the proposed project. Any potential impacts, are also evaluated as guided by EMCA 1999 and the Environmental (Impact Assessment and Audit) Regulations 2003. This report includes an assessment of impacts of the proposed site and its environs with reference to the following:

1. A review of policy, legal and institutional framework.
2. Description of the proposed project.

3. Review of baseline information.
4. Assessment of the potential negative environmental impacts of the proposed project.
5. Analysis of alternatives.
6. Development of mitigation measures and future monitoring plans.
7. Occupational and Environmental health and safety management.

1.6 Methodology

1.6.1 Environmental Screening.

The environmental screening was carried out to determine whether an EIA study is necessary for this project and at what level of evaluation.

1.6.2 Environmental Scoping.

In environmental scoping, the focus was on environmental impacts of great concern. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects. Impacts were also classified as immediate and long-term impacts.

1.6.3 Desktop Study and Review.

The desktop study and review provided a detailed description of the project with respect to the intended revisions i.e. spatial coverage, preliminary design layout, magnitude, implementation schedules, costs and human resources. Relevant documents were reviewed to obtain information on the baseline information in general but specifically at the proposed project site.

Proposed project documentary review provided further understanding the project design (site plan and architectural drawings), land use, local micro-environmental conditions, data on demographic trends, land use practices, development strategies and plans (local and national) as well as the policy and legal documents among others. Others included area maps, current and past survey documents, Development Plans of the Nairobi City, relevant policy, legal and institutional frameworks, regulations, guidelines and standards were also relied upon.

1.6.4 Field Site Visits

Physical evaluation of the project area was carried out with specific focus on landform trends, land use patterns, biodiversity, natural resources, hydrology and climatic variations. This was also an evaluation of the current environmental status with respect to physical, biological and socio-cultural perspectives. It was a systematic field inspection backed with available documentation and direct interviews.

In addition to identifying the potential positive and negative impacts, field assessments contributed understanding the additional proposed works to be undertaken. The field survey adopted various techniques of baseline data collection on the existing environmental conditions, namely:

- Field observations and recordings including photography the project site and its vicinity.
- Use of checklists for determining potential environmental impacts of the proposed project.
- Consultations and public participation within the neighborhood of the project site.

1.6.5 Field Observations

Detailed field observation assessment was undertaken to enable existing determination of the exact socio-economic activities within the proximity of the project site. Among the broad focal areas for which observation was done included; current settlement patterns and land use, commerce, and trade industry among others. Checklists were used along with observations to check on additional/ possible environmental impacts of the project would have on the environment during both construction and operational phases. In this assessment, checklists were utilized to:

- Facilitate identification of potential additional environmental impacts;
- Provide a means of comparing the predicted environmental impacts;
- Indicate the magnitude of the additional developments environmental impacts both positive and negative;
- Indicate possible adverse environmental impacts that are potentially significant but about which sufficient information can be obtained to make a reliable prediction on the additional developments; and
- Indicate negative potential environmental impacts in the project area, which merit mitigation measures and monitoring during project implementation based the additional developments.

1.6.6 Public Participation and Stakeholders Engagement

Structured stakeholder engagement was undertaken in the Makadara neighborhood to capture the views and concerns of interested and affected parties. Photos of the project site and the immediate neighboring developments were taken from the initiated field visits and physical inspections for inclusion in this full study report. The engagement process entailed face to face meetings and interviews.

The study also sought public opinion/views of neighbors, interested or affected parties of the proposed project if any through Consultation and Public Participation (CPP) exercise. Clip board questionnaires were administered to the public and interviews held with neighbors. The local county administration and relevant lead government agencies were engaged in the organization and participation of this meetings with key stakeholders. The questionnaires have been included in this report.

1.7 Impact Assessment Methodology

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

1.7.1 Steps in Impact Assessment/Analysis

Socio-Environmental Impact Assessment and Analysis was conducted as below:

a. Baseline characterization: Involves examination of the current baseline and existing conditions before the project is undertaken and any potential impacts generated;
b. Impact Identification: Involves identification of sources of potential impacts and the project phase where the potential impacts are generated;
c. Impact Mitigation: Having identified the potential impacts and their sources, here monitoring and mitigation measures are recommended and costed to the impact;

1.7.2 Potential Impact Rating

Potential Socio-Environmental Impact are rated to:

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

1.7.3 Impact Rating Criteria

An impact rating is the product of two elements: (a) the severity of the potential impact and (b) the likelihood of the event occurring.

1.7.4 Severity Criteria

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

Table 1: Impact Rating Criteria

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

			but only with a degree of support			
	Long-term/ Irreversible > 6 years Constant frequency	Large part of the community	Those affected will not be able to adapt to changes and continue to maintain pre-impact livelihood	Widespread and diverse Primary and secondary impacts likely to be impossible to reverse or compensate for.	Catastrophic event Resulting in loss of life, severe injuries or chronic illness requiring hospitalization.	Affects environmental conditions, species and habitats for the long term (i.e., over the life of the Project) may substantially alter the local and regional ecosystem and natural resources, and may affect sustainability. Regeneration to its former state would not occur without intervention. Affects environmental conditions or media over the long term, has local and regional affects and/or is irreversible

1.7.5 Impact Likelihood Criteria

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

a. Low likelihood Rare (e.g., few or no occurrences in related projects);
b. Medium likelihood Uncommon (e.g., documented occurrences in related projects); and
c. High likelihood Common (e.g., occurs within the Petroleum industry projects).

1.7.6 Determining Rating of Impacts

The overall rating of the impacts will be determined by using the following matrix

It should be noted that these matrices act as a guide and there may be situations where their rigid application is inappropriate and where stakeholder perceptions and feedback have a significant role to play. For specific impacts where this is the case, the rating is clearly explained in the evaluation of the impact.

Table 2: Overall rating of Impacts

Severity	**Likelihood**		
	Low	**Medium**	**High**
High Level	Moderate	Major	Major
Medium Level	Minor	Moderate	Major
Low Level	Insignificant	Minor	Moderate
Low severity	Insignificant	Minor	Moderate
Medium sevierity	Minor	Moderate	Major
High severity	Moderate	Major	Major

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

- Status of compliance with relevant Kenyan legislation, policies and plans and any relevant Kenyan or industry policies, standards or guidelines;
- The magnitude (including nature, scale and duration) of the change to the natural or socio-economic environment (e.g. An increase in noise, an increase in employment opportunities), expressed, wherever practicable, in quantitative terms. The magnitude of all impacts is viewed from the perspective of those affected by taking into account the likely perceived importance as understood through stakeholder engagement;

- The nature of the impact receptor (physical, biological, or human). Where the receptor is physical (e.g. the air shed) its quality, sensitivity to change and importance are considered. For a human receptor, the sensitivity of the household, community or wider societal group is considered along with their ability to adapt to and manage the effects of the impact; and
- The likely that the identified impact will occur.

1.8 Impact Mitigation Measures

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

a. ***Avoid at Source; Reduce at Source:*** avoiding or reducing at source through the design of the Project (e.g. avoiding by sitting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity);
b. ***Abate on Site:*** Add something to the design to abate the impact (e.g. pollution control equipment); Abate at Receptor: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g. traffic measures);
c. ***Repair or Remedy:*** Some impacts involve unavoidable damage to a resource (e.g. material storage areas) and these impacts require repair, restoration and reinstatement measures.
    - ✓ Compensate in Kind; Compensate through other means where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g. financial compensation for degrading agricultural land and impacting crop yields).
    - ✓ It is emphasized that compensation to individuals with residual impacts to livelihood or quality of life will generally be non-financial and will have a focus on restoring livelihoods.
d. ***Control:*** This aims to prevent an incident happening or reduce the risk of it happening to as low as reasonably practicable (ALARP) through reducing the likelihood of the event (e.g. preventative maintenance regimes, traffic calming and speed limits, community road safety awareness training);
e. ***Reducing the consequence*** (e.g. Bunds to contain hazardous substance spills); and a combination of both of these;

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

1.8 Reporting.

In the entire exercise, the proponent and EIA experts contacted each other on the progress of the study and signing of various documents. Ten copies of this report alongside a soft copy will be submitted to the National Environment Management Authority for review and issuance of an EIA license. All the materials and workmanship used in the execution of the work shall be of the best quality and description.

CHAPTER TWO: PROJECT DESCRITION

2.1 Nature of the Project

The overall objective of the study was to construct an Oil and Gas Storage Depot infrastructure and its associated facilities and amenities for receiving, handling, storage, and delivery of petroleum products.

2.2 Site Ownership

The land where the proposed construction works of Makadara Oil Terminal Storage Depot shall take place is owned by the proponent as appended to this report.

2.3 Justification of the Proposed Project

The project once implemented, will be in accordance with the Energy and Petroleum Regulatory Authority (EPRA) under the Energy Act, 2019 that is responsible for the economic and technical regulation of the petroleum sub sectors. Therefore, the proposed construction of An Oil and Gas Storage Depot will serve one of the Authority's key mandate as provided by the Energy Act 2019 which is to; Co-ordinate the development of upstream petroleum infrastructure and promote capacity building in upstream petroleum operations.

Currently and in the recent past, the demand for petroleum products in Kenya and East Africa in general have incredibly increased in all the four main marketing fronts consisting of retail, commercial, aviation, marine and resellers. Similarly, there is a remarkable growth of the growth in clients requiring the use of petroleum products across all the economies and sectors in Kenya and regionally. Owing to this, there is need for construction of new oil storage depot to create room to receive, handle, store and deliver petroleum products. This will in-turn increase the county's current storage capacity ensuring for efficient supply of petroleum products.

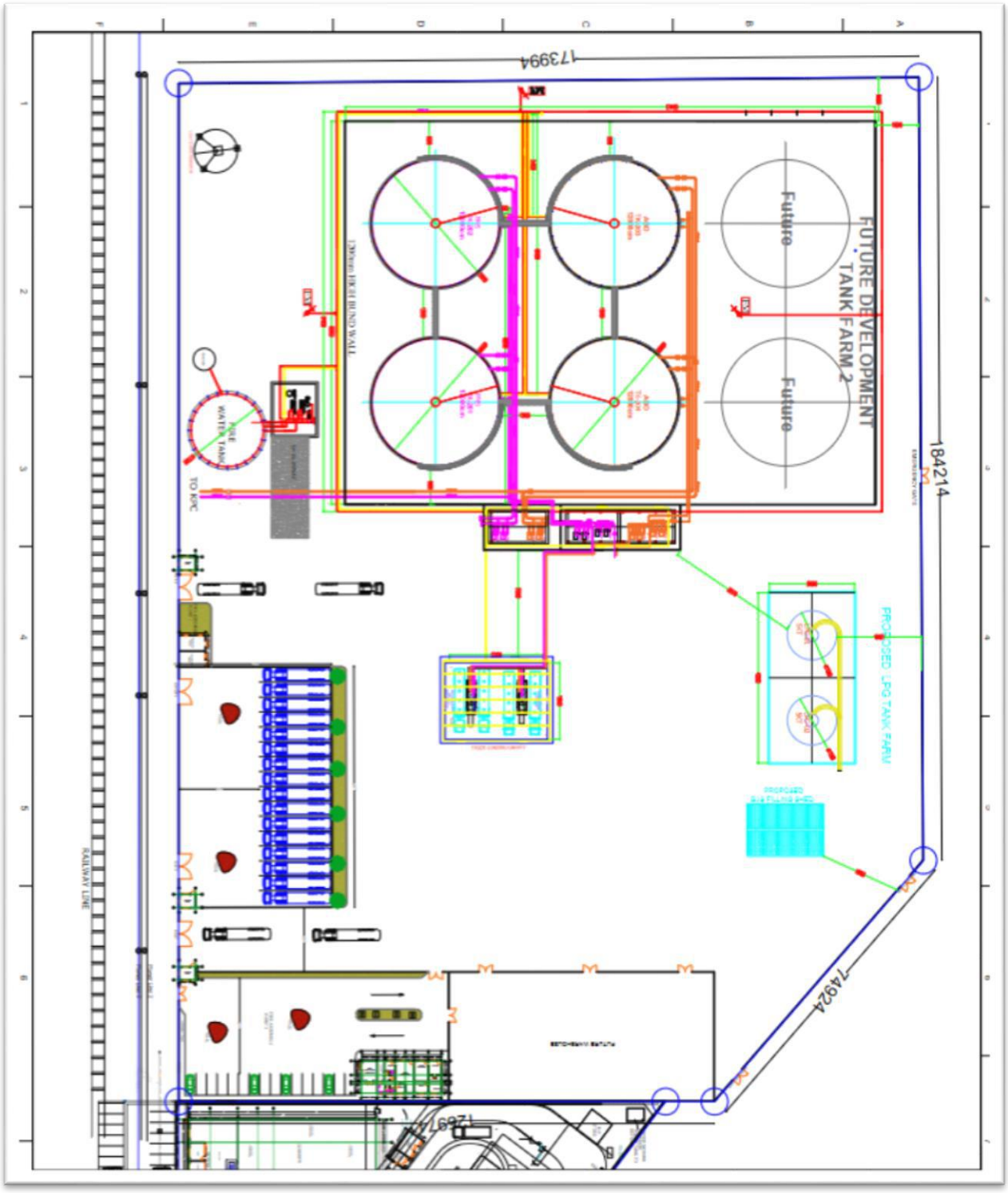
Once implemented, the oil depot facility's main positive impacts include but not limited to: storage, handling and provision of petroleum products, providing oil reserves that will avert petroleum products crisis in the country, facilitate easy movement of people, goods and services, boost growth of local and regional economy, employment opportunities and generation of income and improve livelihoods, create business opportunities for various service suppliers and contractors, improvement of infrastructure, income to the proponent, revenue to the government, and decongest existing oil depots/terminals among others.

2.4 Makadara Oil Terminal Storage Depot Description and Layout Plan

This section of the EIA study report will provide in-depth and detailed information of the proposed Makadara Oil Terminal Storage Depot and all the Oil Storage Depot's operations, technology, facilities and infrastructure so as to serve public motorists and other clients who shall be seeking their services. The Oil Storage Depot's infrastructural facilities include;

a. 6 No. of aboveground tanks @ with a storage capacity of 12000 M^3 totaling to 72,000 M^3
b. 4 No. of LPG bullets of each capacity of 70 metric tonnes totaling 280 Metric Tonnes
c. Product loading and offloading gantries
d. Depot Warehousing facility,
e. Pumps and pumping areas
f. Administration and service buildings
g. Fire-fighting infrastructure and services
h. Ablution blocks
i. Server rooms and other telecommunication infrastructure
j. Weighbridge
k. Truck parking yard
l. Lubes warehouses
m. Rail siding

2.4.1 Proposed Makadara Oil Terminal Storage Depot Map Layout Plan



Layout 1: Proposed Makadara Oil Terminal Storage Depot typical site layout plan

The building plans were designed and drawn by KENT AFRICA LIMITED, Nairobi. All the necessary Physical Planning regulations such as plot ratio and plot coverage's were taken into account by the consultant during the design of the proposed development project.

2.5 Oil Storage Depot's Process and General Description

2.5.1 Depot's LPG Facility

The proposed LPG storage and handling facility envisages design and construction of the following project components:

a. LPG storage tanks of capacity of at least 10,000MT(10KT) in the medium term and 25,000KT in the long term
b. Product transfer line from the truck/rail offloading area to the storage area
c. Road tanker loading arms, pumps, and compressors within a steel framed structure and vehicle-loading gantries including provision for future expansion.
d. Rail siding, loading arms and pumps and compressors.
e. Product delivery piping and recovery/return systems.
f. Cylinder filling facilities.
g. Firefighting system and potable water supply.
h. Power supply and lighting systems.
i. Instrumentation and Control, tanks gauging and communication systems.
j. Weighbridge for rail/road loading.
k. Truck packing facilities. (Shared)
l. Control/Office building, a gatehouse and shippers building (shared)
m. Site facilities such as security fencing, internal roads and vehicle parking areas, paths, surface and foul water drainage systems

2.5.2 Depot's White Oil Storage Facility

The proposed white oil storage and handling facility envisages design and construction of the following project components

a. Six 12,000-M^3 capacity each tanks in total 72000 M^3 – three PMS and three AGO.
b. Dedicated 6-inch issuing pipelines for product issuing from the tanks to gantry

c. Pump raft with four transfer/back loading pumps to issue product directly into Lines 2 and 4 and four loading pumps to load product into trucks and two offloading pumps in cases of receiving products by trucks.
d. Two truck loading bays each capable of loading two trucks simultaneously with both MSP and AGO. Each loading bay with four loading arms each, two for each product.
e. Firefighting systems
f. Tie-ins at the existing Line 5 receipt area, Line 2 pump manifold area, and Line 4 pump manifold area to aid back-loading to Western Kenya via line 2 and 4,and receipt into storage directly from line5 of the two product grades and back-loading to existing KPC tanks
g. Dedicated 16-inch receipt pipelines for product receipt into the respective MSP and AGO tanks
h. Other auxiliary facilities such as firefighting ,power supply, parking spaces, office space etc. will be share with the LPG plant above (**2.5.1**)

2.5.3 Depot's Codes, Standards and Regulations

This depot and all its constituent facilities will be designed in accordance with the relevant international standards and codes, as well as any national standards and local regulations.

Table 1: Design & Installation Codes

Pressure Vessels	ASME VIII Div. 2
Process Piping	ASME B31.3
Relief Devices	API 520, 521, 526 and 2000 as applicable
Fire Detection and Protection	NFPA 11, 15 and NFPA 58
Design and Installation Codes	API 650,KS EAS 976:2020,API RP2003

Table 2: Electrical, Control and Instrumentation Systems codes and standards:

Instrument Air Quality	ASME VIII Div. 2
Electrical	ASME B31.3
Process Measurement Instrumentation	API RP 551 and 554

Table 3: ISO – International Organization for Standardization

ISO 10970	Measurement of fluid flow in closed conduits – Guidance to the selection, installation and use of Coriolis flow-meters (mass flow, density and volume flow measurements

Table 4: BS – British Standards

BS EN 50288-7	Multi element metallic cables used in analogue & digital communication and control – part 7: Sectional specification for Instrumentation control cables
BS EN 50262	Cable glands for Electrical Installations
BS 6121-1	Mechanical Cable Glands – Specification for Metallic Glands
BS 6739	Code of Practice For Instrumentation In Process Control Systems- Installation Design & Practice
BSEN837-1,2&3	Pressure gauge
DIN 43760	Temperature Vs Resistance curves for RTDs

Table 5: API – American Petroleum Institute

API 2510	Design and Construction of oil Installations
API STD 520 P1 & API RP 520 P2	Sizing, Selection and Installation of Pressure-relieving Devices in Refineries
API STD 521	Pressure-relieving and De-pressuring systems
API STD 526	Flanged Steel Pressure Relief Valves
API STD 527	Seat Tightness of Pressure Relief Valves
API RP 551	Process Measurement Instrumentation
API RP 554 - All parts	Process Instrumentation and Control
API STD 670	Machinery Protection System
API STD 607	Fire Test for Quarter - Turn Valves and valves equipped with non- metallic seats
API STD 618	Reciprocating Compressors for Petroleum, Chemical, and Gas Industry Services
API MPMS	Manual of Petroleum Measurement Standards
API Spec 6D	Specification for Pipeline Valves (Gate, Ball and Check Valves)

Table 6: IEC – International Electro-technical Commission

IEC 60079	Electrical apparatus for explosive gas atmospheres (all parts
IEC 60331	Test for Electric Cables under fire conditions-circuit integrity
IEC 60332	Test on Electric and Optical fiber cables under Fire Condition

IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60654 - All parts	Operating conditions for industrial process measurement and control equipment
IEC 60584 Parts 1 & 2	Thermocouples
IEC 60751	Industrial Platinum Resistance Thermometer Sensors
IEC 60751	Electromagnetic Compatibility
IEEE-C62.36-2000	Standard Test Methods for Surge Protectors Used in Low - Voltage Data, Communications, and Signaling Circuits
IEC 60801	Electromagnetic Compatibility for Industrial process Measurement and Control Equipment

Table 7: KS Standard

KS 1938	Part 3 - Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 9000 L

Table 8: NFPA Standards

NFPA 10 (2018)	Standard for Portable Fire Extinguishers
NFPA 15 (2017)	Standard for Water Spray Fixed Systems for Fire Protection
NFPA 24 (2019)	Standard for the Installation of Private Fire Service Mains and their Appurtenances
NFPA 58 (2017)	Liquefied Petroleum Gas Code
NFPA 70 (2017)	National Electrical Code
NFPA 72 (2016)	National Fire Alarm and Signaling Code
NFPA 110 (2016)	Standard for Emergency and Standby Power Systems

Table 9: ASME Standards

ASME B1.20.1	Pipe Threads General Purpose
ASME B16.5	Pipe flanges and flanged fittings.
ASME B16.9	Wrought Butt welding Fittings
ASME B16.11	Forged Fittings, Socket-Welding and Threaded
ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASME PTC 19.3	Temperature Measurements
ASME MFC-18M	Measurement of fluid flow using Variable Area Meters

2.5.4 White oils Pipeline Route

The optimal pipeline route to MOTL depot shall be determined based on the following criteria:

- Shortest route that avoids all major constraints
- Sufficient clearance from buildings and other structures
- Proximity to existing services
- Minimization of road and service crossings
- Ground conditions
- Constructability

2.5.5 Process Fluid

The white oils that shall be stored and delivered through the depot are MSP and AGO. The general properties are shown in Table 10 below:

Product	Density (kg/m3)	Viscosity (cS @ 21oC)
Automotive Gas Oil	840	5.95
Premium Motor Spirit	720	0.8

2.5.6 Flow Rates

The design flow rates for the existing pipelines at PS 10 are as shown in Table 11 below.

Pipeline	Maximum Flow Rate
Line 5	1,400 m^3/hr
Line 4	400 m^3/hr
Line 2	150 m^3/hr

2.5.7 Process Flow

Spare flanges have been provided at the KPC Line 5 receipt area manifold for tie-in. These flanges shall represent the battery limits for this study on the receipt size. Two pipelines, dedicated to MSP and AGO respectively, shall run along the proposed pipeline route from the process area at PS 10 to the tanks at the OMC Depot. These pipelines will be unidirectional and shall be used for back-loading back into the PS 10 tanks.

2.6 Pipeline

2.6.1 General

The pipeline will be of a welded steel construction designed in accordance with ASME B31.4 and all other standards and specifications as applicable.

2.6.2 Pressure and Temperature

All equipment shall be designed to a pressure and temperature rating that matches the existing rating at the proposed tie-in area at the KPC depot, i.e., ANSI Class 600, and temperature range of 0-50 °C.

2.6.3 Pipe Material

The pipe material is selected in accordance with the applicable codes and standards for onshore process piping, ASME B31.3 and will be manufactured in accordance with API Spec 5L and PSL2. The line pipe material, wall thickness, and grade are determined based on the internal pressure, external loads, corrosion allowance and areas where increased safety is required, such as crossings. The following parameters will be considered:

- The wall thickness/grade combination in accordance with ASME B31.4.
- Design Pressure/Maximum Working Pressure and Test pressure.
- Pipe manufacturing process.
- Materials selection
- Field Welding
- Corrosion allowance.
- External coating and corrosion protection

The line pipe material will initially be assumed to be carbon steel (CS), which is the industry standard for this type of facility.

2.6.4 Line Sizing Criteria

The pipeline velocity shall be within the limits shown in the table below. Velocities above the theoretical maximum shall accepted should the hydraulic analysis predict acceptable pressure profiles within the pipeline. These values are indicative and in line with good engineering practice, but not an absolute requirement in Table 12 below.

	Minimum	Target	Maximum
Velocity (m/s)	1	1.5	2

2.6.5 Pipe Wall Thickness

The pipe wall thickness shall be determined by following ASME B31.4. Preliminary calculations performed. The tolerance for wall thickness should meet criteria provided under Table 9 of API specification 5L. Corrosion allowance shall be factored in.

2.6.6 Pipeline Cover

It is envisaged that most the pipeline will be above ground. However, should the pipeline need to be buried, the depth of cover will be in accordance with ASME B31.4 (Minimum cover of 1.1m) and depend on the encountered soil characteristic. The depth of cover shall be increased at road and service crossings as required to ensure the minimum clearances in accordance with the design code(s) and third-party requirements if any.

In areas where there is an increased risk of damage or interference by third parties, additional protective measures shall be considered including increased wall thickness, concrete protection and pipeline marker tiles or tape.

2.6.7 Crossings

Road crossings to be constructed by open cut methods where practicable and permitted, and where necessary trenchless techniques shall be used. The most appropriate construction technique will be determined during later stages of engineering with consultation with the appropriate authorities.

2.6.8 Corrosion Protection

ASME B31.3 does not stipulate a corrosion allowance for any particular application. The design engineer shall establish the corrosion allowances based on sound engineering opinion and industry best practice.

This provision will be in lieu of any secondary corrosion control measures, such as Cathodic protection systems, and should serve towards safe operation of the system, within the design parameters, for the duration of its design life.

2.6.9 Stress Analysis

The pipe stresses that will need to be considered during later stages of engineering are:

- Hoop stress - caused by pressure being exerted on the pipe internally, is primarily dependent on pipe size and diameter, and must not exceed the Specified Maximum Yield Stress of the pipe material.

- Axial Stresses - caused by restrained axial growth of the pipe due to thermal and pressure expansion and applied forces. This is typically minimal for steel pipe but may be considerable under certain conditions.
- Bending Stresses – caused by forces applied to the piping body due to pipe weight, concentrated masses (valves and equipment), seismic and wind etc.
- Torsional Stresses – caused by rotation moments around the pipe axis, which is minimal compared to bending stresses and is commonly ignored
- Fatigue Stresses – caused by continuous cycling of stresses in the piping.
- Robust stress analyses and simulations will be carried out during FEED and detailed design.

2.6.10 Surge Analysis

A comprehensive surge analysis shall be performed during later stages of engineering definition.

2.7 Tank Sizing and Design

2.7.1 Tank Sizing

The tanks will sized in accordance with industry standard regarding nominal capacity, diameter and height and will be subject to optimization during further stages of engineering definition

2.7.2 Tank Design

The white tanks shall be designed strictly according to API 650 with regard to the material, design, fabrication, erection and inspection for the MOTL tanks, which will be of adequate safety, and reasonable economy for use in the storage of refined petroleum products.

The LPG sphere tanks shall be designed strictly according to ASME sec V111 with regard to the material, design, fabrication, erection and inspection for the MOTL tanks, which will be of adequate safety, and reasonable economy for use in the storage of LPG

The table 13 below gives a summary of the tank design and capacities.

Product	Roof Type	Base Type	No of Tanks	Tank Capacity(m^3)	Design Capacity(m^3)
AGO	Cone roof	Cone up, circumferential water collection sump	3	12.000	36,000
MSP	Cone roof, internal floating roof	Cone up, circumferential water collection sump	3	12,000	36,000
LPG	Spherical tank	spherical	2	5000	10000

2.8 Truck Loading System

The truck loading system shall be of the bottom loading design, which is the industry standard for its relative speed, efficiency, ease of use and safety compared to the more common top-loading system which are in use throughout Kenya.

The trucks will be loading by way of bottom loading arms mounted on skids, which will be provided complete with all the required components, i.e. meters, filters and safety equipment. Each skid will be able to load two trucks simultaneously (one of each side), with both AGO and MSP and are located strategically to allow for efficient access for the truck on either side of each skid as shown in the below.

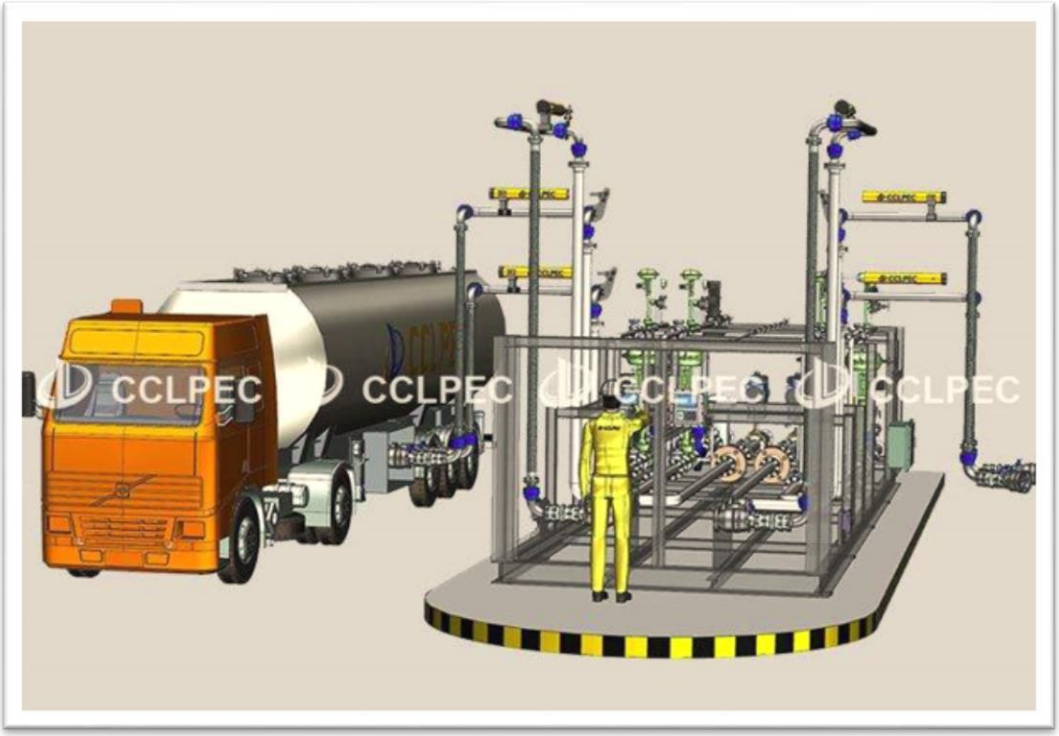


Figure 2: LPG truck loading/unloading via a skid by way of bottom loading hoses connected to corked LPG compressors.

2.9 Pumping Requirements

The MOTL depot will require pumps to enable product transfer for three key processes: truck loading, back-loading into KPC tanks and transfer to the mainline at Lines 2 and 4. These pumps shall be installed within a pump raft and are designed and sized accordingly to match their duty and flow requirements.

2.9.1 Truck Loading Pumps

The truck loading pumps are sized to enable loading to occur at peak loading periods assuming maximum truck and product availability. Based on the typical industry standard 4-inch loading arm flow rate of approx. 136 m^3/hr, the following pump configuration has been proposed for the loading bay arrangement described in figure 2 above and Table 14 below.

Product	Flow Rate	Configuration	Total Number
AGO	136	1 duty, 1 standby	2
MSP	136	1 duty, 1 standby	2

LPG tankers shall be loaded and unloaded via a set of vertical compressors rated at 200m3/h as Table 15 below.

Product	Flow Rate	Configuration	Total Number
LPG compressors	200M3/h	1 duty, 1 standby	2
LPG filling pumps	35m3/h	1 duty ,1 standby	2

2.9.2 Transfer Pumps

The following transfer pumps will to transfer product back to the KPC Depot and direct to the mainline booster pumps at the Line 2 and Line 4 proposed Table 16 below:

Duty	Product	Max. Flow Rate	Configuration	Total No.	Remark
Back-loading	AGO	1,400	1 duty, 1 standby	2	To match Line 5
Back-loading	MSP	1,400	1 duty 1 standby	2	To match Line 5
Transfer to Lines 2&4	AGO	400	1 duty 1 standby	2	To match Line 4
Transfer to Lines 2&4	MSP	400	1 duty, 1 standby	2	To match Line 4

Note: All pump prime movers will be Variable Frequency Drives to allow for automatic control of the flow rates depending on the flow requirements.

2.10 Electrical System

2.10.1 Classification of Hazardous Areas

The nature of operations of the proposed depot means that there will be ignition hazards due to the presence of flammable gasses or vapors arising from product fumes. The depot facility layout shall be classified into zones in accordance with IEC 60079-10 Standard, Part 1 for classification of hazardous areas for explosive gas atmospheres, or equivalent Standard. Accordingly, the layout and facilities shall be classified into Zone 0, Zone 1, and Zone 2.

The depot is expected to be of standard layout & design hence direct examples to IECEx shall be used to determine radii of the hazardous area zones, though point source and risk based approaches shall be applied where found to be necessary. Hazardous area classification drawings and documentation shall be produced as part of detailed designs. The classification documentation shall include such information as standards and codes used flammable material characteristics, dispersion calculations, ventilation calculations, gas group and temperature class, extent of zone and sources of release, and any other special considerations.

2.10.2 Electrical Equipment Selection and Installation

The selection criteria for electrical equipment for hazardous area shall be guided by the area classification (Zone) in accordance with IEC60079-14 Part 5 or equivalent. Other considerations to be applied shall be temperature classification (T Class), apparatus grouping (Group II, IIA, IIB, or IIC), ambient temperature and any other external influences. All equipment for used in hazardous areas shall have Ex Marking in accordance with IECEx marking scheme or equivalent.

Installation and commissioning of electrical equipment in hazardous areas shall be done according to requirements of IEC 60079-14: Electrical installations in hazardous areas (other than mines), or equivalent.

2.10.3 Load Sizing

Preliminary estimate of total electricity demand for the proposed project is 813 kVA. These are preliminary load sizing only; the actual individual loads and the total load shall be determined after detailed designs for the project.

2.10.4 Power Supply and Distribution

Nominal characteristics of electrical power supply and distribution will be 66kV or 33kV, three (3) phase incoming supply from Kenya Power (to be defined at detailed design). This will then be stepped down to Low Voltage 415V three (3) phase four (4) wire with solidly grounded neutral, earthing arrangement (TNS), and a frequency of 50Hz.

A new substation will be provided either in a ground mounted Transformer room (indoor) or a ground mounted fenced Transformer yard (outdoor). The main components will be as follows:

- Transformer sized at 800kVA, which considers a diversity factor of 0.6 on the estimated ‘current loads’ of the depot and a 30% spare capacity for future loads (rail-siding and LPG Loading pumps).
- Main LV Distribution Board (MLVDB) located inside the electrical Switch room supplied by the Transformer.
- Load Distribution Boards (LDBs) and Motor Local Control Panels (MLCPs) supplied from the Main LV Distribution Board (MLVDB) to supply the load terminal panels and junction boxes in the field (plant areas).

2.10.5 Back-Up Power Supply

In addition to the normal power supplied by the utility provider through the Transformer, a standby generator set located near the electrical room in an outdoor enclosure will be provided to supply the MLVDB in case of utility power failure. The initial estimate for the Standby Generator Size is 500kVA (to be confirmed at detailed design, actual size shall depend on the operation philosophy).

2.10.6 Switchgear

The MLVDB shall be composed of the following:

- Incoming section for the utility supply,
- Non-essential bus bar side comprising of power factor correction system, and feeders for the electrical fire pump and the booster pumps
- Essential bus bar side comprising of all other loads in the depot expect those listed for non-essential section
- Bus-tie section connecting the non-essential and essential bus bar sides during normal operation on utility supply
- Incoming section for the generator supply connected to the essential bus bar side only

The Standby Generator shall supply power to the essential side of the MLVDB through an incoming generator supply circuit breaker operating in an automatic transfer switch arrangement with the bus-tie circuit breaker and the utility incoming circuit breaker. The utility incoming breaker, generator supply circuit breaker, and the bus-tie circuit breakers for the MLVDB shall be draw out types. The load and feeder circuit breakers shall be fixed types. The MLVDB bus circuit breakers shall be rated for short-circuit fault levels as required by the incoming Kenya Power service. The circuit breaker types shall be selected in accordance with the following criteria:

- Above 800 Amps - Air Circuit Breakers (ACBs)
- Between 60 Amps and 800 Amps - Moulded Case Circuit Breakers (MCCBs)
- Less than 60 Amps – Miniature Circuit Breakers (MCBs).

All overcurrent protection shall be made by the circuit breakers.

2.10.7 Uninterruptible Power Supply

Uninterruptible Power Supply (UPS) Systems shall be provided for control and instrumentation equipment as shown in the preliminary load schedule, subject to the final detailed designs. The

I&C Panel Load AC UPS will be sized to provide enough power (rated for 415/240V, 1 Phase + Neutral + Earth) for instrumentation and automation equipment of the facility during periods of power failures and startup of the standby generator and vice versa.

The critical equipment at the oil depot to be supplied by the UPS shall include depot control and monitoring, and safety systems. A further AC UPS shall be provided for office equipment. Both AC UPSs shall be online static inverted types. Other UPS systems shall be provided if required by the instrumentation and control, and electrical systems. These may include 24VDC UPS and 110VDC or 48VDC UPS.

2.10.8 Control Equipment

Three options shall be selected for motor starting in this project. These shall either be star-delta, autotransformer, and Variable Frequency Drives. In case of the first two methods, Motor Control Centers (MCCs), Cubicles, or Panels shall include start/stop push buttons, local/remote selector switches, running/stopped/tripped (fault) indications, relays, and control circuits.

A local control station with start/stop push buttons and, running/stopped/tripped (fault) indications shall be mounted beside each motor. They shall have suitable IP rating and mounted on galvanized steel channel frames. In case Variable Frequency Drives are used (these are preferred for energy saving), functions provided by start/stop push buttons and local/remote selector switches shall be contained within the VFD.

2.10.9 Low Voltage Network

The LV distribution network shall allow for 30% spare capacity/space for future expansion, including panel boards and cables. The terminal lighting and power panels shall have a minimum spare capacity of 30%.

LV Power Cables shall be color coded in accordance with IEC Standards. Multi-core electrical control and instrumentation cables shall have individual cores numbered. A minimum of 20% spare cores shall be included in multi-core control and instrumentation cables.

Power cables shall have a minimum conductor size of 2.5mm^2; lighting cables shall have minimum conductor size of 2.5mm^2, while control circuits shall have a minimum conductor size of 1.5mm^2.

2.10.10 Cabling and Accessories

All cables are to be copper conductor cross-linked polyethylene (XLPE), 600/1000V. Cables to be laid in galvanized steel cable trays or in cable trenches. The cable routing between the different areas (substation, buildings, pump stations, plant areas, and tank farm) shall consist of combination of cable trays, underground trenches, and conduits.

The cable trays and cable trenches covered with checker plates shall be used inside buildings, conduits shall be used for cable risers in hazardous areas and under services crossings (e.g., roads), and direct buried cable trenches shall be used between facilities in non-paved areas.

Flexible metallic conduits shall be used for terminating all connections to motors and vibrating equipment. For all types of cable routing, the different cable categories shall be mutually separated with a minimum distance of 300mm. Cable conduits, cable trays and cable ducts shall be sized to provide 30% spare space when filled to 50%.

2.10.11 Earthing and Protection

To ensure safe operation, equipotential bonding shall be provided in all installations for all electrical equipment. The earthing configuration shall be TN-S type. Transformer neutrals shall be connected to the main earth source. All equipment and facilities shall be earthed and equipotential bonded appropriately to IEC or equivalent standards.

Several equipotential earth bars shall be installed in main electrical, low current, mechanical rooms, loading station and in the pumping station to ensure easy access for connection and earthing of all electrical conducting equipment. Each equipotential bar shall be connected in loop configuration via buried bare copper conductor. The cable used in buried grounding network shall be minimum $50mm^2$.The equipotential wire shall be $25mm^2$ minimum. Each Storage tank earthing boss shall be bonded to earth network with minimum $50mm^2$ stranded copper cables or copper tapes.

A lighting protection system shall be installed to cover all above ground installations and systems such as the pumping *station* and the tank area. The system shall have impedance of less than 10 ohms. Notwithstanding this, recommendations of API RP 2003 for protection against ignitions arising out of static, lightning, and stray currents shall be followed.

2.10.12 Lighting

Proper external lighting within and around the facility shall be provided. External lighting for roadway, parking, and technical areas and the facility perimeter shall be designed in accordance with by appropriate standards. The outdoor lighting fixtures shall be LED type. Except for areas not classified as hazardous area, lighting equipment shall comply with ATEX Ex II 2 G electrical classification. The external lighting shall be controlled by suitable sensors or timing circuits with manual bypass/overrides.

2.10.13 Cathodic Protection

Cathodic protection shall be provided for all the buried piping and storage tanks by means of suitable methods in accordance with API RP 651 (Cathodic Protection of Aboveground Petroleum Storage Tanks) or NACE equivalent, and API RP 1632 (Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems) or NACE equivalent, latest editions.

2.10.14 Instrumentation and Control System

All field instrumentation systems shall be suitable for use in hazardous environment. The main components of the Instrumentation and Control System shall comprise of the following:

2.10.15 Control System

The control systems shall consist of a SCADA / DCS server/PLC system that shall be the backbone of the MOTL operations; it shall handle all process controls and SCADA communications within the system and hold the terminal wide process control database for third party communications. It shall provide real time monitoring and control environment serving key functions:

- Interfacing to system controllers, OPC servers, and ATG communications interface units
- Serving the operator Graphic User Interface
- Providing alarms and events handling and annunciation
- Providing history and trending
- Automatic archiving of Alarms & Events, and History, with rapid archive data restore where and when required
- Handling Sequence of Events (SOE) logging and data representation where required.
- Hosting operational reports; alarm settings, process history, tank storage inventory snapshots and throughputs, metering throughputs meter totals, etc

- Holds the engineering repository database
- Providing an interface to external process data historians

The control system will come with third party interfaces to connect to KPC control systems as may be required.

2.10.16 Proposed Communication system between KPC and MOTL

A 12-core single mode fibre cable shall be laid during pipeline construction to link OMC and KPC for data exchange and other communication requirements. The fibre will connect to KPC control systems and telecoms transparently as shall be agreed. A Firewall between KPC and MOTL shall be installed and configured for secure connectivity between the two entities.

Through this communication link, voice and data shall be possible between MOTL and KPC. ATG data, metering information, ESD system and valves status and necessary controls will be exchanged between MOTL and KPC.

All necessary ICT equipment shall for purpose of MOTL connection and operation shall form part of the communication systems. This will include Ethernet switches, Firewall, IP phones and Routers.

2.10.17 Automatic Tank Gauging System

Radar type Automatic Tank Gauging system consisting of product level gauge, temperature probe and pressure transmitters installed on the tanks for product level measurements. The Automatic Tank Gauging system shall be configured and tanks data availed in SCADA/DCS/PLC and displayed in detail at operator screens and in a database for ERP and connectivity to other systems. The following data shall be displayed:

- Gross Observed Volume (GOV)
- Gross Standard Volume (GSV)
- Net Standard Volume (NSV)
- Product Level
- Total Calculated Volume (TCV)
- Total Observed Volume (TOV)
- Relative Density
- Product Pressure

- Ullage
- Innage
- Product Temperature
- Alarms and event logs

The tanks high level alarms, which will he hardwired switches, will be installed and signals shared with KPC for Emergency Shutdown controls.

2.10.18 Metering

Considering the flow rate ranges expected into and out of MOTL Depot, unidirectional multiproduct 8-inch ultrasonic meter has been proposed to be installed at inlet and outlet (1No each) pipelines connecting to KPC system. The meters shall meet OIML requirements and shall meet Kenyan statutory requirements i.e., Weights and Measures authority. Meters installation shall at least have uninterrupted 10Diameters as a minimum at upstream and downstream. The meter pressure and temperature shall be installed at least 3Diameters downstream as per industry standards.

The proposed Ultrasonic Flow meter shall have the following features:

- Comply with API MPMS with compliance with International Organization of Legal Metrology (OIML) Recommendation R117-1 Class 0.3.
- Be Eight Path chordal design for optimal linearity and repeatability.
- Meter to have advanced sigma processing with real-time diagnostic analysis.
- Meter to have continuous logging capability for diagnosis and history.
- Have ±0.1% linearity over nominal flow range
- Be insensitive to swirl
- Have provisions f

The meters shall be calibrated and certified for the purpose at accredited facility. During calibration, MOTL, KPC and Weights and Measures personnel shall jointly witness the calibration process. The metering measurement data shall be directly and transparently be accessed from the metering system by both KPC and MOTL,

The meters measurement data to be shared between KPC and MOTL SCADA/DCS/PLC systems include (among any other required):

- Batch volumes
- Meter Gross Observed Volume (GOV)
- Meter Gross Standard Volume (GSV)
- Net Standard Volume (NSV)
- Total Calculated Volume (TCV)
- Total Observed Volume (TOV)
- Product Density
- Product Metering Pressure
- Product Metering Temperature

The meters shall be installed under supervision of KPC and Weights and Measures and KPC. Upon successfully completion of installations, meters shall be sealed to ensure are tamperproof.

LPG shall be received and dispatched by a calibrated weighbridge and weighing scales for cylinders

2.10.19 CCTV and Access control

The facility will be equipped with CCTV and Access control system to monitor and control access at MOTL site. The CCTV systems shall comprise of the central equipment, access control units, cameras and monitors. The central equipment shall process and digitally record the video signals, as well as manage the system control. The power supply for CCTV and access control shall be 220VAC.

2.10.20 Truck Loading Instrumentation System

There shall be a truck loading management system for inventory and product accounting system during dispensing of product via bottom loading facilities at MOTL. The system shall include Batch controllers, Positive Displacement meters (PDM), Truck and Drivers identification systems and terminal loading management application.

Batch controllers to be used shall be microprocessor based and shall be provided in each loading bay. They shall be certified for installation and use in Zone 1 Group IIA Class T3 hazardous area and shall be of explosion proof type. The system shall be equipped with Dual communication port for interface with host computer supporting RS232, RS422 and RS485 serial standards as well as TCPIP. Host computer to be able to communicate with the batch controller on any of the two ports.

There shall be truck loading management software will have features including product processing, records/reports, customers ID, delivered volumes among others. The system shall be equipped with RFID readers for identification for vehicles, drivers and other authorized users of the facility.

2.10.21 Boundary Valves

There shall be boundary and others motorized valves installed for operation of depot. All boundary valves will be controlled by KPC and status shared between MOTL and KPC. For on-going operations, OMC shall issue a permissive to KPC to open the valves.

The boundary valves shall have interlocks that govern its operation. For instance, the valves shall not open if that MOTL tank will have High-level alarm. Other alarms that will form part of interlocks include:

- Valves leak
- Emergency shutdown alarm at MOTL
- Emergency shutdown at KPC
- Low level alarm from issuing tank at MOTL
- Fire alarm signal from KPC
- Fire alarm signal at MOTL depot
- Tanks inlet an outlet interlocks

2.10.22 Fire Detection and Alarming System

MOTL facility be equipped with Fire alarming system within ITS premises and tank areas. The system shall be furnished with a complete 24 VDC, electrically supervised, analog addressable fire alarm system with emergency communication. The system shall include but not be limited to all fire control panels, audio amplifiers, power supplies, initiating devices, audible and visual notification appliances, alarm devices, and all accessories required to provide a complete operating fire alarm system.

2.10.23 Cabling

The instrument cables shall be Multi pair, SWA/SWB/STA, PE insulated Flame Retardant Low Smoke Zero Halogen (LSZH) sheath with individually and collectively screened pairs. The conductor sizes for instrument cables shall be 1.5 mm^2 of voltage grade 250Volts. All instrument

cables shall conform to the latest editions of the relevant International Electro technical Commission (IEC) Recommendations Codes of Practices.

2.10.24 Emergency Shutdown System

The ESDS system will be used for all critical and shutdown control, separate from the control performed by the DCS/PLC. The ESD will consist of fail-safe logic controllers and will be totally and physically separated and functionally independent of any other systems with respect to tripping actions. Interfaces between ESD and other peripherals will be such that the ESD functionality cannot be impaired or defeated.

2.11 Firefighting System Description

Firefighting and protection facilities are provided in design, as appropriate, in accordance with the requirements of the National Fire Protection Association (NFPA) Codes. Consideration shall also be given to the requirements of other relevant HSE standards where applicable.

A risk assessment shall be carried out as part of the detailed design process in order to identify all credible risk scenarios. The results of this assessment will form the basis for the detailed development of the fire protection system.

2.11.1 General

The major areas requiring protection against fire related hazards are the main storage tanks, the pump shelters, and road loading/offloading facilities and all areas within the terminal. Firefighting and protection shall be provided to address all foreseeable hazards arising from fire in these areas.

2.11.2 Main tanks

In the event of a fire in one or more of the main storage tanks, it will be necessary to protect these tanks, plus all adjacent tanks exposed to the effects of radiant heat, from structural damage and the possible resulting spread of the fire. The exposed tank walls and roofs shall be cooled by water by means of a water spray system connected to the fire hydrant main.

This spray system will be supplemented by fixed water monitors located outside the tank bunded area, also supplied from the hydrant main, which can provide additional protection to the tanks and to other facilities if required.

Each tank shall be provided with fixed bottom foam injection facilities that will be supplied with foam solution from mobile foam generation units connected via manifolds outside the bund wall. Foam application rates will be accordance with NFPA standards and/or local standards and requirements.

In addition to the application of foam to tanks by bottom injection, it shall be possible to apply further foam externally by means of the fixed water monitors, which shall be capable of throwing expanded foam (supplied from a mobile foam generation unit) over the tank roofs.

2.11.3 Hydrant System

A hydrant main shall be provided around the site. This will constitute the primary fire water supply for fire protection purposes and will incorporate standard hydrant connection points at key locations around the site in accordance with the requirements of the relevant codes and standards. The hydrant system will supply water to the following:

- Tank cooling water system
- Water monitors
- Hand-held hose streams connected at hydrant points as required
- Foam facilities (including the mobile foam units)
- Other areas of the site as described below

The hydrant main will be installed in a ring configuration, with section isolating valves to ensure that if any part of the system is unavailable due to breakdown or maintenance, water can still be supplied via the remainder of the ring

The system will be maintained under pressure by means of a series of jockey pumps complemented by the main fire pumps (1 operating + 1 spare) set for automatic start-up on low pressure.

The maximum design flow-rate for the hydrant system will be determined by the water demand rate for the worst-case fire scenario.

2.11.4 Water Supply

The normal source for water in the hydrant main will be the firefighting storage tank which will be supplied from a borehole and the nearest city water main. The water storage tank will be adequately size to provide a minimum of 4 hours of operation at the maximum design flowrate.

A borehole as a back-up will be dug to provide water in case of an interruption in city water supply, feasibility subject to a hydro-geological survey that may be conducted during latter stages of project implementation.

Sufficiency of the local water main to service the depot firefighting requirements shall be determined during detailed design, and the need for alternative sources assessed.

2.11.5 Fire-fighting Foam

Firefighting foam concentrate will be stored on site in readiness for use. To this end, a central foam store will be provided. Further mobile storage units may if necessary be distributed at key locations around the site, to be determined by the risk assessment.

2.11.6 Fire Protection for other Facilities

The main fire hydrant system (see above) will be suitably routed to provide water availability for protection and fire fighting in the areas of the main building, workshop, stores and other buildings as appropriate. Hydrant connection points will also be provided as necessary in these areas.

2.11.7 Portable Extinguishers

In addition to the main fixed fire protection and fire-fighting equipment, suitable portable and hand-held extinguishing equipment, including mobile foam apparatus and fire extinguisher units, shall be provided for use against minor fires. These units shall be located at key positions around the site and within buildings as appropriate.

2.11.8 Fire Detection and Alarm System (DO to Enhance)

An automatic fire detection and alarm system will be provided, with detectors installed as a minimum in all buildings, loading bays and shelters, and around tank bund areas. Manual alarm call points will be provided as necessary at key positions in site operational areas and in buildings. A central fire control panel located in the control building will monitor all detection and alarm signals. Visual and audible alarms shall be automatically actuated on a local zoned basis or across the entire site as appropriate.

2.11.9 Containment Philosophy

The tanks will be located in pairs within secondary containment bunds. Each bund area has been sized to contain the following:

- The contents of the largest full tank within that bund
- An allowance for firefighting water
- An allowance for rainwater
- An allowance for foam
- A reasonable freeboard on top of all the above

2.12 Civil Works

All civil designs will be carried out using the applicable codes and standards. The Civil design for the project will comprise primarily of:

- Main terminal layouts with respect to storage tanks, bund areas, roads, buildings, vehicle movements and parking, tanker load, fence lines & gates.
- Tank foundations and bund area design.
- Site earthworks and earth retaining structures.
- Pump and pipe support foundations or sleepers.
- Buildings required at the terminals
- Structural steelwork and reinforcement

2.12.1 Buildings

They will include but not limited to control and switch room building, offices, gatehouse and drivers' waiting area.

2.12.2 Shelters

They will include but not limited to Staff Parking shelters, truck loading area shelter and fire pump shelter.

2.12.3 Others

Other significant civil designs include:

- Firewalls
- Tank farm hard-standing
- Pipe and cable routes plus markings
- Drainage and sewerage
- Lighting and surveillance camera towers
- OWS and dump tank

- Borehole for firefighting water

2.13 Depot's Operation Activities

The facility is to be designed for the following operational activities:

2.13.1 Storage of Petroleum Products (White Oils: AGO/PMS and LPG)

i) Storage Information white products

a. *Type of Storage Tanks / Installation*: Vertical Cylindrical steel tanks
b. *Nominal Storage Capacity*: (Diesel) 3 X 12,000 M^3& (Petrol) 3 X 120000 M^3– Total 72,000 M^3
c. *Product to be stored*: Petrol (50%) and Diesel (50%)
d. *Product Storage Capacity*: 30m diameter x 17m height. – Total 72,000 M^3
e. *Number of Storage tanks*: 3+3 = 6
f. *Max. Design Pressure*: 17.24 barg @ 55 Deg. C
g. *Design Temperature*: -27 to 55 Deg.C

ii) Product Receipt Information:

a. *Product to be received*: oil Max. Operating Pressure: 7 barg @ 45 Deg. C
b. *Size of M^3 of oil parcel that will be imported*: 30000M^3
c. *Size of maximum parcel that will be offloaded at one time*: 30000 M^3 based on current inventory levels
d. *Number of mobile trucks to be offloaded every month*: max 10 trucks per month
e. *Truck Unloading Pumping rates*: 250 to 300 M^3 per hour
f. *Time taken to offload this parcel in Hrs*: 34 hours for 10,000 M^3
g. *Jetty to Tank Farm Pipeline Sizing*: NPS 12" / DN 300

2.13.2 Bulk Transfer/Loading of Petroleum Products (White Oils: AGO/PMS and LPG)

i) Bulk Transfer and Loading Facilities (Tanker-Truck Loading Gantry):

a. *No. of Bay*: 2Bays in one loading Gantry
b. *Capacity of Road Tankers to be loaded*: 30,000 M^3 each
c. *Pumping Rate*: 7 Pumps of 200M^3 /hour capacity (6 Working + 1 Standby)
d. *Truck Loading capacity*: Approx 12000 M^3 in 12-hours(Sunrise to sunset)
e. *Discharge Pressure while loading Tankers*: 4 – 6 barg at Ambient Temperature

f. *Unloading from Tanker*: YES

g. *Truck loading methodology*: Weigh Bridge on each gantry (Six)

ii) Receiving LPG by mobile trucks

The facility will receive gas imported by mobile trucks in parcels of 20,000 tonnes each and 100-200 such trucks will form the monthly turn over. The trucks will be offloaded using Pumps in the yard capable of pumping at 250 to 300 M^3 per hour and the gas will be conveyed through pipeline installed from the offloading gantry to the Storage Terminal (Length of pipeline to be decided later).. The gas will be received into the tanks duly measured and inventoried with the help of weighbridge weights before and after offloading.

2.13.3 Storage Information LPG

a. *Type of Storage Tanks / Installation*: Vertical Spherical steel tanks

b. *Nominal Storage Capacity*: 5KT per tank two tanks

c. *Product to be stored*: LPG

d. *Number of Storage tanks*: 2

e. *Max. Design Pressure*: 17.24 barg @ 55 Deg. C

f. *Design Temperature*: -27 to 55 Deg.C

2.14 Depot De-commissioning Activities

2.14.1 Decommissioning Phase

Decommissioning in this project will occur for the storage space and parking yard. During these activities, all equipment and fixtures that were required during the construction and operational phase will be dismantled and removed from the site. It is mandatory that the proponent ensure safe dismantling of all the facilities and equipment's.

2.14.2 Removal of Waste

Waste from the facility during construction and usage will be carted away and disposed of by a licensed NEMA waste handler. Waste generated during this phase may include:

a. Sludge from decommissioned tanks

b. Masonry works/building works, (cement bags, broken building blocks, etc.

c. Roofing (iron sheets, timber/ metal pieces, etc.)

d. Plumbing (pipe fittings and off cuts, etc.)

e. Electrical works (residual cables and connectors, damaged electrical fittings, etc.)

f. Wastes generated from dismantling of tanks fixtures and equipment.
g. Wastes generated from wrappers and packaging material

2.14.3 Site Restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, the open earth sites will be restored through replenishment of the topsoil and re-vegetation where appropriate.

2.15 Total Project Costs and Duration

The total project cost **KShs 400, 000, 000.00** (Four Hundred Million shillings). This cost includes construction cost, cost of labor, professional fees and **VAT**.

CHAPTER THREE: BASELINE INFORMATION OF THE STUDY AREA

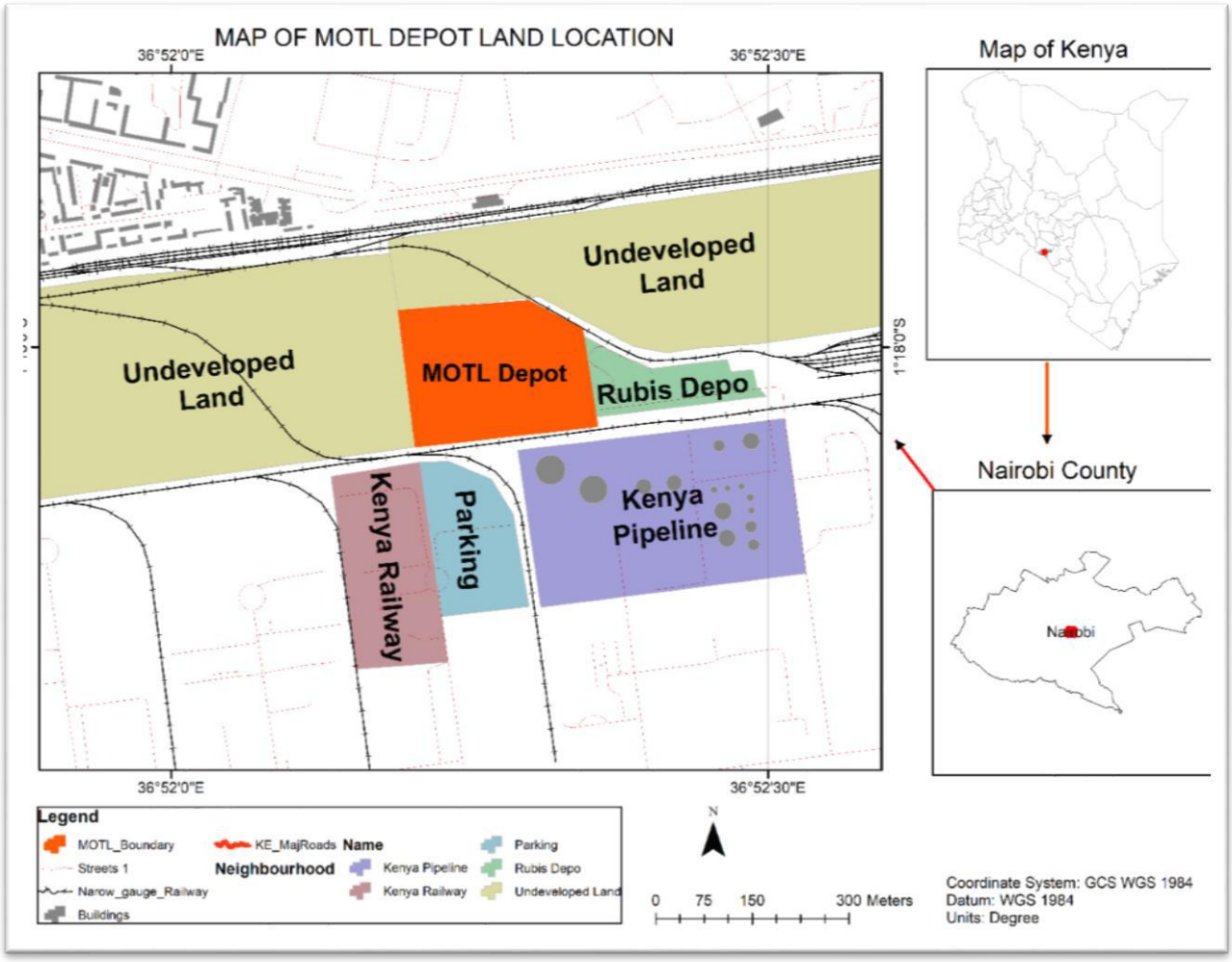
3.1 Introduction

Baseline information (background information on the biophysical, social and economic settings) is important reference point for conducting EIA. Baseline data is essential for the assessment of the potential impacts of the project. The conditions of the natural environment forms a basis for the selection by planners of the area to be developed for various land uses for the sustainability of the proposed project and therefore evaluation of the baseline information is important in understanding the existing environmental set up. The main objective of baseline information is to provide adequate and accurate environmental baseline information and this can be broken down as follows:

- To provide a description of the status and trends of environmental factors, against which predicted changes can be compared and evaluated in terms of importance
- To provide a means of detecting actual change by monitoring once the project is implemented.

3.2 Location of the Project

The proposed Oil Storage Depot development project shall be constructed on 14 Acres piece of land on **Plot L.R No: 149107**, along Jogoo road, at Viwandani Location, Makadara Sub County, in Nairobi County. The GPS coordinates of the proposed project site are 1˚ 18' 3.175" S and 36˚ 52' 19.081" E as shown in Photo 1 below: (The current project site)



Map 1: The current project site

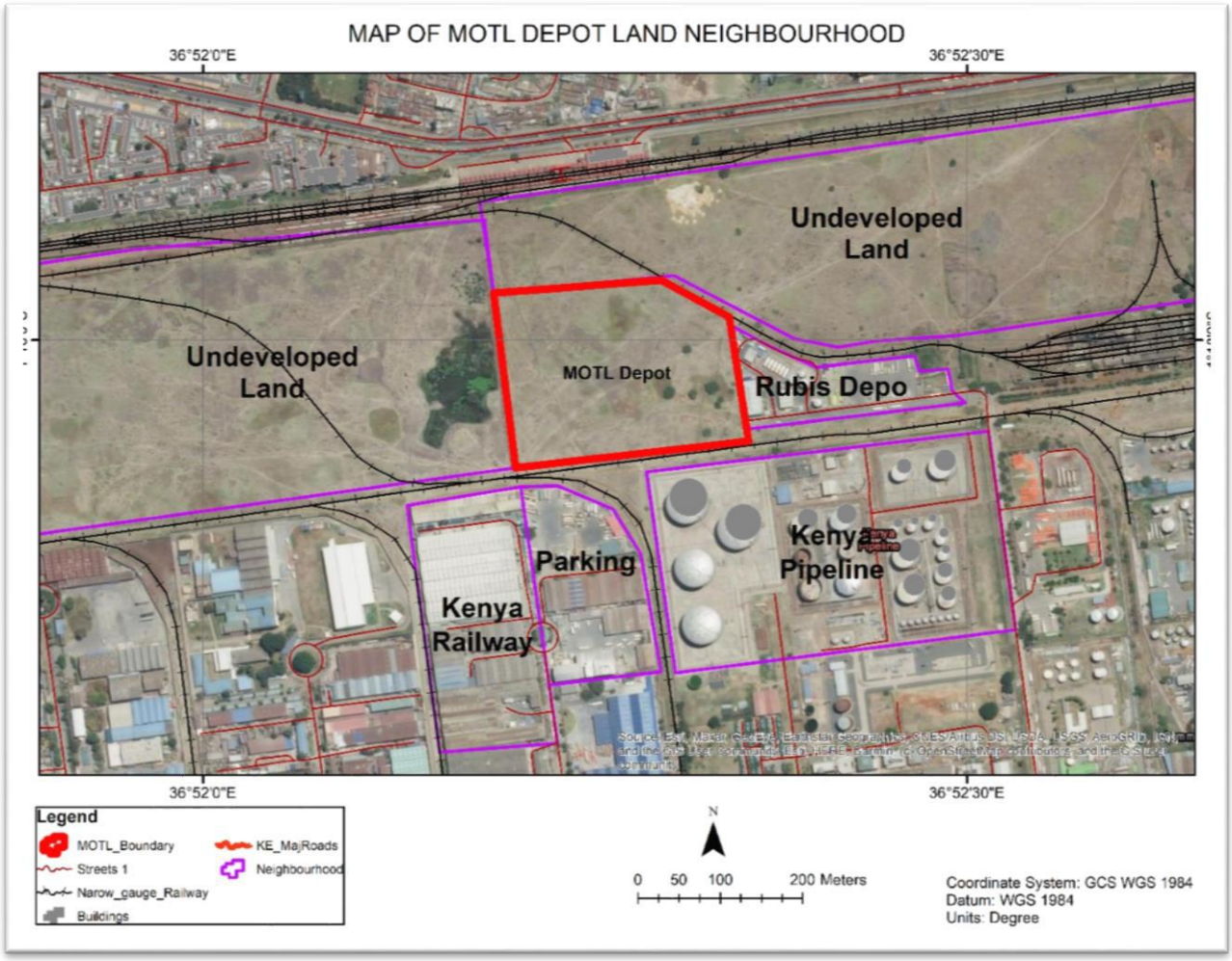
3.2 Site Status, Land Use and Suitability

The proposed oil storage depot site is the larger Nairobi Industrial area, an area which is specifically set aside for various industrial purposes (both light and heavy industrial works). The site is in an idle open field that borders the main Jogoo road and the intersection between Jogoo road and Rabai road.

Under special issue of the Kenya Gazette Supplement Issue no. 8, of 4th Feb., 2011, the entire area is falls under the Protected Areas Order of 2011, referred to as Depots (as appended herein). The proposed depot is therefore compatible with the zoning laws and regulations as well as the neighboring similar facilities and land uses.

On the front and back of the project site is the Old Metre Gauge railway line. On the right side of the project site are the Rubis Energy Kenya Limited depot and the Kenya Pipeline Company depot. Within this area are similar Fuel Terminals/Oil Depots for Total Energy Kenya Limited, MAKADARA OIL TERMINAL LIMITED and National Oil depots among others.

The terrain of the proposed project site is generally flat. The site has no human settlement in the neighborhood. The project site is not located close to any environmental sensitive areas whatsoever. The proposed project site is in a mixed development urban zone.



Map 2: Site Map indicating the depots similar facilities and land uses.

Photo 2: The Kenya Pipeline Company depot

Photo 3: Rubis Energy Kenya Limited depot

Photo 4: SGR station

3.3 Topography

Nairobi County lies within the latitudes 1°9'N and 1°28'S, and longitudes 36°4'W and 37°10'E. It is located 30 km to the east of the Great Rift Valley and occupies an area of about 696km^2. Altitude varies between 1600 and 1850 meters above sea level. There is however an eastward slope of land with maximum altitude of 2300m in the northwest and 2000m in the southwest. The western part of Nairobi is on high ground of the Kikuyu highlands that rise from an altitude of between 1600-1800 meters with rugged topography. The eastern side is generally low, approximately 1600 meters, and flat.

The physiography of Nairobi is consequent upon the volcanic rocks found and the tectonic movements which have affected them. It is part of the lava plains that are bordered to the north-west and west by the Kikuyu highlands, an extension of the high ground of the eastern flank of the Rift Valley; and to the south-west by the Ngong hills. The Kikuyu highlands are characterized by a steep downward slope in an easterly direction. The northern boundary between the two physiographic units of the Kikuyu highlands and the plains is roughly along the east-west line

across the Nairobi city center. The plains are made up of two parts, i.e. the Athi plains and the northern section of the Kapiti plains, both of which extend further southwards and eastwards.

3.4 Climate and Meteorology

The project lies in Makadara, Nairobi County which has a temperate tropical climate with two rainy seasons. The highest rainfall is received between March and April and the short rainy season is between November and December. The average annual rainfall in Nairobi is about 900m, but the actual amount in any one year may vary from less than 500 mm to more than 1900 mm and the seasons of rainfall coincide approximately with the time of changeover of the monsoon currents which affect Eastern Africa, the South-West Monsoon becoming established in April, and north-east monsoon in November.

The average daily temperatures in Nairobi varies only from about 17°C during July and August to 20°C in March, the daily range of temperature is quite large, averaging about 10°C in May and 15°C in February. These leads to Nairobi having an annual average temperature maximum of 24.9°C and an average minimum of 13.3°C and average mean relative humidity value is 78.3% in the morning and 50.5% in the afternoons.

3.4.1 Winds

The wind near the ground is very predominantly easterly throughout the year, generally between north-east and east from October to April, and between east and south-east from May to September. The strongest winds occur during the dry season just prior to the "Long Rains" when speeds of 20 to 25 mph are common from mid-morning to early afternoon; at other times of the year winds speeds are usually 10 to 15 mph. During the night the wind is usually light. In the squalls sometimes associated with thunderstorms, short-lived of up to 70 mph. have been known to occur.

3.4.2 Precipitation

Nairobi has a bimodal rainfall pattern, in which the maxima occur in March-April (long rains) and November-December (short rains). This simple rainfall regime is complicated by the uncertainty of rainfall from year to year. Thunderstorms may occur, nearly always during the afternoon or evening, during most months of the year but they are rare during the period

June/August. Hail is comparatively rare in Nairobi, being reported on average less than once a year unlike other areas such as the western part of Kenya.

3.4.3 Sunshine and Solar Radiation

Nairobi experiences a total of about 2,500 hours of bright sunshine per annum, which is equivalent to an annual mean of approximately 6.8 hours of sunshine per day. July and August are characterized by cloudiness and during these months the average daily sunshine in Nairobi is 4 hours. Often there are several days in succession when the sun fails to penetrate the thick stratocumulus cover, although on other days the cloud cover does break for a short period. There is about 30% more sunshine in the afternoon than in the morning, and it follows that westerly exposures receive more insulation than easterly ones.

3.4.4 Ambience and Air Quality

The project area lies in Nairobi, an urban area, where the major sources of air pollution are as a result of industrial, construction, increased development activities and their related amenities (majorly cars). However the project area falls out of the central business and industrial districts thus enjoys better air quality and this forms part of the reason as to why the area is majorly residential.

3.5 Geology

The project and its surrounding area lie in Nairobi which is covered mainly by Tertiary volcanic material overlying folded Precambrian Basement System rocks of the Mozambique Belt. The youngest Tertiary rocks are the Limuru Trachytes, which are subsequently underlain by Kerichwa Valley Tuffs, Nairobi Trachytes, the Athi Series and the Kapiti Phonolites. In Nairobi lava sheets from subsequent lava flows are superimposed on top of each other and on outcrop they form extensive and remarkably flat volcanic terraces, such as the Embakasi Plains (Nairobi Phonolites), Athi Plains (Mbagathi Phonolitic Trachytes), the Karen-Langata and Kilimani-Lavington Areas (Nairobi Trachytes) and Kapiti Plains (Kapiti Phonolites).

Weathering from this Tertiary period resulted in Old Land Surfaces which have the characteristic reddish-brown color inherent of the soil in the project area. Aquifers were formed when the lava flows produced voids in permeable and semi-permeable lava series due to joints and fractures. The geological history of Nairobi has been dominated by volcanic activity since Miocene times. These areas are currently underlain by a series of volcanic rocks as a result of successive lava flows that

originated from centers and fissures on the high eastern flank of the Rift region to the west. The main rocks exposed in the area and its surroundings are:

- Basement system (Precambrian metamorphic rocks of the Mozambique Belt),
- Tertiary volcanic and sediments,
- Pleistocene sediments, and
- Recent deposits

3.6 Soil Types

The soils of the Nairobi region consist of red soils that increase in their depth westwards and north-westwards from about 4 m at the City center to over 10 m in the vicinity of the Rift Valley. Other soils include alluvium, clays and swamp soils occupying former river valleys or swamps. The main types of soil in the project area region are silty clays of moderate to high plasticity. Other soils are sandy-clayey silt with thixotrophic characteristics.

3.6.1 Soil Laboratory Analysis

To establish the baseline status of the soils at the site, soil samples were collected for TPH analysis. The analysis result shows that the sample has got low levels of organic carbon, Nitrogen, Pentanes and Benzene. These are within the permissible limits indicating that this site has not been impacted by petroleum products as shown in the Appendices. Further, there are monitoring wells at the existing depot and so far there is no leakage from the underground storage tanks. Micronutrients are sufficiently supplied in the soil samples. There is no limitation to the establishment of the proposed depot hence highly recommended.

3.7 Drainage and Hydrology

The main drainage in Makadara as that of Nairobi, is consequent upon the regional topography and prevailing slope of the volcanic rocks. Nairobi is characterized by two main drainage basins. The Nairobi River and its tributary valleys (Kirichwa Kubwa, Kirichwa Ndogo, Gitathuru and Mathare) dissect and drain the northern and north-western parts; while the tributaries of Athi River (Sosian, Makoyeti, Ormanya, Donga and Mbagathi valleys) drain the southern and south-western parts.

River Rui Ruaka also drains the northwest and is joined by the Karura stream before it enters Nairobi River at a point about 2.5 km off Dandora railway station. The Nairobi sub-basin drains

eastwards, while the flow in the Athi river basin is mainly to the south and south-east. A smaller sub-basin occurs mid-way across Nairobi and consists of the Ngong River and its tributary of Motoine valley both of which flow eastwards. The uplifting and deposition of volcanic materials have given rise to streams that are characterized by young valleys with steep gradients and narrow and/or sharp V-shapes in the north-western and western parts.

The rapid down-cutting, together with the relatively soft character of the younger volcanic rocks have resulted in the streams flowing in generally parallel courses, with limited instances of river capture. The streams are most active during the period of heavy rains and head-ward erosion of gullies and tributaries is common. The transported load is mainly a result of erosion of the thick soil cover which gives rise to flowing streams of red mud.

3.7.1 Water Laboratory Analysis

To establish the baseline status of the water at the site, water samples were collected for TPH analysis. The analysis result shows that the sample has got low levels of organic carbon, Nitrogen, Pentanes and Benzene. These are within the permissible limits indicating that this site has not been impacted by petroleum products as shown in the Appendices. Further, there are monitoring wells at the existing depot and so far there is no leakage from the underground storage tanks.

3.8 Demographic Features

Nairobi County's population projections in 2009, 2018, 2020 and 2022 based on the 2009 Kenya Population and Housing Census by age cohort and gender with an inter-censual growth rate of 3.8 per cent. In 2009, the County population was projected to be 3,138,369 and is expected to rise to 4,941708 in 2018, 5,433,002 in 2020 and 5,958,338 in 2022 respectively.

3.9 Infrastructure Development

3.9.1 Road, Railway Network and Airports

The current road network in the County is inadequate in terms of coverage to meet current and future demands as envisaged in the Vision 2030. There is heavy congestion on most of the City's roads especially during the morning and evening peak hours. The total road network covers 3,602 Km out of which 1,735 Km are tarmac while 1867 Km are earth roads.

Nairobi County hosts three airports; Jomo Kenyatta International Airport, Wilson Airport and Eastleigh Airport. Jomo Kenyatta International Airport (JKIA) is the biggest airport in East and Central Africa, and is the focal point for major aviation activities in the region.

The County has a railway network of 75 Km and a total of 10 functional railway stations which are: Embakasi, Makadara, and Nairobi main terminal, Dandora, Githurai, Kahawa, Kibra, Dagoretti, JKIA and Syokimau. The established Makadara and Imara Daima railway stations and expansion of Nairobi platform has improved public transportation in Nairobi and with it socio-economic development.

Photo 5 & 6: A section of the old railway lines serving the project site on both ends

Photo 7: A section of the new railway lines serving the project site on South end

3.9.2 Information and Communication and Technologies

Posts and telecommunication sub-sector has experienced mixed growth in the recent past. While the County has 38 post office branches, the growth of postal services has been declining due to increase in penetration of mobile telephony and internet. Mobile telephony has the highest coverage in Nairobi compared to other parts of the country with over 95 per cent of the inhabitants having access to mobile communication.

The players engaged in mobile telecommunication include: Safari-com, Airtel, Telkom, and Orange while those in mailing services include Kenya Postal Corporation, Group 4 Securities (G4S), DHL and Wells Fargo among others.

3.9.3 Waste Water and Sewer Line System

Completion of the construction activities will be followed by use of the depot by Makadara and Nairobi County residents and motorists. Both solid and liquid wastes will be produced during this phase of the project. To manage solid wastes, the proponent will avail litterbins/receptacles within the depot premises for temporary storage awaiting sound disposal.

There is an existing 900mm diameter trunk NCWSC sewer line which runs along the line of Jogoo Road adjacent to the depot where effluent from toilets and washrooms will be discharged into. Storm water will be conveyed to the NCWSC's storm water drainage system.

A segregated drainage system shall be provided by the proponent where water contaminated with oils drains to instead of draining into the open storm drains. The contaminated water will be directed into an oil-water separator from where it should be treated before it is released to the rest of the drainage system. For this purpose, an interceptor tank made up of reinforced concrete walls and floor shall be constructed and its inner walls shall be plastered with water proof cement. (Each chamber shall have a manhole with a reinforced concrete cover).

3.10 Energy Access

The main sources of energy in Nairobi County are electricity, solar, liquefied petroleum gas (LPG), biogas, paraffin, charcoal and firewood. Lack of access to clean sources of energy is a major impediment to development due to health related complications such as increased respiratory infections and air pollution.

For instance, 63.2 % of the population use paraffin as cooking fuel. Other sources of energy for cooking include LPG (20.2 %), charcoal (10.5 %) and firewood (1.8 %). About 68.2 % of households use electricity as a means of lighting 28.8 % use paraffin while 2.9 % and 1.7 % use grass and dry cells respectively.

There is adequate power infrastructure within the vicinity of the proposed site that can be reinforced by KPLC for the provision of the power requirements of the proposed project. Two diverse incoming 11kV overhead lines to a new 11kV Switch room will be erected for the proposed depot development.

Photo 8: Electricity supply right at the proposed depot site

3.11 Housing Types

Materials used in the construction of dwelling units are an indicator of housing conditions and the extent to which they protect occupants from the elements and other environmental hazards. Availability of materials, cost, weather and cultural conditions have a major influence on the type of materials used in different localities. The housing type by wall materials in Nairobi County is mainly characterized by stone, brick/block, mud/wood and corrugated iron sheet. The stone and block walled houses are 65.9 % while wood and corrugated iron sheet are 31.1 %. The classification by floor type indicates that 75.8 % of household have cement floor, 14.2 % earthen

floor, 7.5 % tiles and 2.2 % for those with wooden floor. Most of the households in Nairobi have corrugated iron sheet roofed houses which accounts for 56.6 %. Tiles and concrete roofs account for 12.4 % and 27.9 % respectively.

3.12 Vegetation

The proposed site Makadara Oil Terminal Storage Depot an already developed neighborhood comprising of mainly petroleum product depots and depot infrastructural facilities and amenities. There are no trees to be cut down.

3.13 Tourism and Wildlife

Nairobi County is a major center of tourism in the region. Its relative proximity to many tourist attractions areas both in Kenya and East Africa makes it an asset of great importance in the tourism sector. As the capital city and commercial center, it attracts many business and leisure tourists. This is partly because the Jomo Kenyatta International Airport (JKIA), the main point of entry to Kenya by air, is located in the County.

3.13.1 Main Tourist Attractions, National Parks and Reserves

Nairobi County has major parks and museums which serve as the main tourist attraction and activities centers. The main national parks are Nairobi National Park, Nairobi Safari Walk and Nairobi Mini Orphanage. The Nairobi Safari Walk is a major attraction to tourists as it offers a rare foot experience for wildlife viewing.

The County boasts of the Nairobi National Museum which houses a large collection of artifacts portraying Kenya’s rich heritage through history, nature, culture and contemporary art. Other important museums include Nairobi Gallery and the Nairobi Snake Park.

CHAPTER FOUR: POLICY, LEGISLATIVE AND INSTITUTIONAL FRAMEWORKS

4.1 International and National Policy and Legislative Framework Context

4.1.1 Sustainability

The principle of sustainability requires that natural resources should be utilized in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations. It strives for equity in the allocation of the benefits of development and decries short-term resource exploitation which does not consider the long-term costs of such exploitation.

4.1.2 Principle of Intergenerational Equity

The principle of sustainability should be examined together with that of intergenerational equity, which focuses on future generations as a rightful beneficiary of environmental protection. Essentially, the principle of intergenerational equity advocates fairness, so that resent generations do not leave future generations worse off by the choices they make today regarding development. Its implementation requires the utilization of natural resources in a sustainable manner while avoiding irreversible environmental damage.

4.1.3 Principle of Prevention

The principle of prevention states that protection of the environment is best achieved by preventing environmental harm in the first place rather than relying on remedies or compensation for such harm after it has occurred. The reasoning behind this principle is that prevention is less costly than allowing environmental damage to occur and then taking mitigation measures.

4.1.4 Precautionary Principle

The precautionary principle recognizes the limitations of science, as it is not always able to accurately predict the likely environmental impacts of resource utilization. It calls for precaution in the making of environmental decisions where there is scientific uncertainty.

4.2 General Overview

Kenya has a policy, legal and administrative framework for environmental management. Under the framework, the National Environment Management Authority (NEMA) is responsible for ensuring that environmental impact assessments (EIAs) are carried out for new projects and

environmental audits on existing facilities as per the Environmental Management and Coordination Act 1999. EIAs are carried out in order to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts and developing mitigation measures for the negative ones.

The government has established regulations to facilitate the process on EIAs and environmental audits. This in accordance with the requirements and provisions of the Constitution of Kenya under Part VI, Section 58 of the Environmental Management and Coordination Act No. 8 of 1999 and Regulation 10 of the Environmental (Impact Assessment and Audit) Regulations, 2003 Legal Notice No. 101 and Legal Notice 15 of the Environmental (Impact Assessment and Audit) Regulations, 2016. In the past, the government has established a number of National policies and legal statutes to enhance environmental conservation and sustainable development.

The proponent will need to observe the provisions of the various statutes that are aimed at maintaining a clean, healthy and sustainable environment. Some of the policy, legal and institutional provisions are explained in the following sub sections

4.3 Policy Framework

The Kenya Government policy on all new projects, plans, programs or activities requires that an Environmental Impact Assessment is carried out at the planning stages of the proposed development. This is to ensure that significant potential impacts on the environment and health are taken into consideration during the design, construction, operation, and decommissioning of the facility. The EIA report will include but not limited to the following information:

- Human Environment: socio-economic, socio-cultural and socio-legal aspects.
- Built Environment: material assets.
- Natural Environment: flora, fauna, soil, water, air, climate, landscape, historical landmarks, archeological and ecological aspects.

Environmental policies cut across all sectors and government departments. As such policy formulation should be consultative steered by interdisciplinary committees.

4.3.1 National Environmental Action Plan (NEAP)

National Environmental Action Plan was a deliberate policy effort to integrate environmental concerns into the country's development initiatives/plans. This assumed a consultative and multi-

sectoral approach. Such an approach ensured that environmental management and the conservation becomes integral in various decision making platforms.

As a result of its adoption and implementation, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been and/or are in the process of development. Under the NEAP process, Environmental Impact Assessments were introduced targeting the industrialists, business community and local authorities.

4.3.2 National Shelter Strategy to the Year 2000

Kenya adopted this strategy following the International Year of Shelter for the Homeless in 1987. This advocates for the involvement of various actors to come in and assist the government in providing housing. This took cognizance of the governments' inability to provide sufficient shelter for all its citizens. The government was to simply facilitate other actors such as developers to invest in shelter.

4.3.3 National Policy on Water Resources Management and Development

While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water facilities in all sectors for promotion of the country's socio-economic progress, it also recognizes the by-products of this process as wastewater. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution.

In addition, the policy provides for charging levies on waste water on the basis of quantity and quality. The "polluter-pays-principle" applies in which case parties contaminating water are required to meet the appropriate cost of remediation. Consequently, to ensure water quality, the policy provides for establishment of standards to protect water bodies receiving wastewater, a process that is ongoing. The standards and measures to prevent pollution to water resources are provided for in the Environmental Management and Coordination (Water Quality) Regulations, 2006 which is a supplementary legislation to EMCA, 1999.

4.3.4 Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999)

The key objectives of the Policy include: -

- To ensure that from the onset, all development policies, programs and projects take environmental considerations into account,

- To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation,
- To come up with effluent treatment standards that will conform to acceptable health guidelines.

Under this paper, broad categories of development issues have been covered that require a "sustainable development" approach. These issues relate to waste management and human settlement. The policy recommends the need for enhanced re-use/recycling of residues including wastewater, use of low or non-waste technologies, increased public awareness and appreciation of a clean environment. It also encourages participation of stakeholders in the management of wastes within their localities. Regarding human settlement, the paper encourages better planning in both rural and urban areas and provision of basic needs such as water, drainage and waste disposal facilities among others.

4.4 Environmental Legal Framework

4.4.1 The Constitution of Kenya

The Constitution of Kenya bestows the right to a clean and healthy environment, which includes the right:

a. To have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and
b. To have obligations relating to the environment fulfilled under Article 70.

69. (1) The State shall:

a. Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
b. Encourage public participation in the management, protection and conservation of the environment;
c. Protect genetic resources and biological diversity;
d. Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
e. Eliminate processes and activities that are likely to endanger the environment; and
f. Utilize the environment and natural resources for the benefit of the people of Kenya.

(2) Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

70. (1) If a person alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter.

(2) On application under clause (1), the court may make any order, or give any directions, it considers appropriate:

a. To prevent, stop or discontinue any act or omission that is harmful to the environment;
b. To compel any public officer to take measures to prevent or discontinue any act or omission that is harmful to the environment; or
c. To provide compensation for any victim of a violation of the right to a clean and healthy environment.

(3) For the purposes of this Article, an applicant does not have to demonstrate that any person has incurred loss or suffered injury.

48. The State shall ensure access to justice for all persons and, if any fee is required, it shall be reasonable and shall not impede access to justice.

The project shall be implemented in consultation with both the national government and the county government including the relevant authorities.

4.4.2 Environmental Management and Co-ordination Act No. 8 of 1999. Cap 387

This EIA project report has been undertaken in accordance with the provisions of Section 58 of Environment Management and Coordination Act, 1999 and subsequent EMCA (Environmental Impact Assessment /Environmental Audit regulations, 2003). Part II of EMCA, 1999 states that every person is entitled to a clean and healthy environment and had the duty to safeguard the same. In this regard, development proposals should not compromise the quality of the environment. Section 58 of EMCA No.8 of 1999 and EIA/EA regulations, 2003 underscore the need for environmental impact assessments for development activities such as this new commercial development.

The Environment Management and Coordination Act (EMCA), 1999 provides for the establishment of an umbrella legal and institutional framework under which the environment in general is to be managed. EMCA is implemented by the guiding principle that every person has a right to a clean and healthy environment and can seek redress through the High court if this right has been, is likely to be or is being contravened. Entitlement to a clean and healthy environment in:

1. Every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment.
2. The entitlement to a clean and healthy environment under subsection (1) includes the access by any person in Kenya to the various public elements or segments of the environment for recreational, educational, health, spiritual and cultural purposes.
3. If a person alleges that the entitlement conferred under subsection (1) has been, is being or is likely to be contravened in relation to him, then without prejudice to any other action with respect to the same matter which is lawfully available, that person may apply to the High Court for redress and the High Court may make such orders, issue such writs or give such directions as it may deem appropriate to—
    a. Prevent, stop or discontinue any act or omission deleterious to the environment;
    b. Compel any public officer to take measures to prevent or discontinue any act or omission deleterious to the environment;
    c. Require that any on-going activity be subjected to an environment audit in accordance with the provisions of this Act;
    d. Compel the persons responsible for the environmental degradation to restore the degraded environment as far as practicable to its immediate condition prior to the damage; and
    e. Provide compensation for any victim of pollution and the cost of beneficial uses lost as a result of an act of pollution and other losses that are connected with or incidental to the foregoing.
4. A person proceeding under subsection (3) of this section shall have the capacity to bring an action notwithstanding that such a person cannot show that the defendant's act or omission has caused or is likely to cause him any personal loss or injury provided that such action—

a. Is not frivolous or vexatious; or
b. Is not an abuse of the court process

5. In exercising the jurisdiction conferred upon it under subsection (3), the High Court shall be guided by the following principles of sustainable development—
    a. The principle of public participation in the development of policies, plans and processes for the management of the environment;
    b. The cultural and social principles traditionally applied by any community in Kenya for the management of the environment or natural resources in so far as the same are relevant and are not repugnant to justice and morality or inconsistent with any written law;
    c. The principle of international co-operation in the management of environmental resources shared by two or more states;
    d. The principles of intergenerational and intra-generational equity;
    e. The polluter-pays principle; and
    f. The pre-cautionary principle

The proponent has initiated this EIA Project Report and submitted it NEMA and other lead government agencies for review and licensing in compliance with EMCA regulations

4.3.2.1 The EMCA (Water Quality) Regulations, 2006

These Regulations were published in the Kenya Gazette Supplement No. 68, Legislative Supplement No. 36, and Legal Notice No. 120 of 29th September, 2006. The Regulations provides for sustainable management of water resources including prevention of water pollution and protection of water sources (lakes, rivers, streams, springs, wells and other water sources).

Regulation No. 14 (1) requires every licensed person generating and discharging effluent into the environment to carry out daily effluent discharge quality and quantity monitoring and to submit quarterly records of such monitoring to the Authority or its designated representatives.

The proponent will have to ensure that appropriate measures to prevent pollution of underground and surface water are implemented throughout the project cycle.

4.4.2.2 The EMCA (Waste Management) Regulations, 2006

These Regulations were published in the Kenya Gazette Supplement No. 69, Legislative Supplement No. 37, and Legal Notice No. 121 of 29th September, 2006. The regulations provide details on management (handling, storage, transportation, treatment and disposal) of various waste streams including:

- Domestic waste,
- Industrial waste,
- Hazardous and toxic waste,
- Pesticides and toxic substances,
- Biomedical wastes, and
- Radioactive waste.

Regulation No. 4 (1) makes it an offence for any person to dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.

The proponent shall ensure that the main contractor adopts and implements all possible cleaner production methods during the construction phase of the project.

Regulation 6 requires waste generators to segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal.

Regulation 14 (1) requires every trade or industrial undertaking to install at its premises anti-pollution equipment for the treatment of waste emanating from such trade or industrial undertaking.

Regulation 15 prohibits any industry from discharging or disposing of any untreated waste in any state into the environment.

Regulation 17 (1) makes it an offence for any person to engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by NEMA.

Regulation 18 requires all generators of hazardous waste to ensure that every container or package for storing such waste is fixed with a label containing the following information:

- The identity of the hazardous waste
- The name and address of the generator of waste

- The net contents
- The normal storage stability and methods of storage
- The name and percentage of weight of active ingredients and names and percentages of weights of other ingredients or half-life of radioactive material
- Warning or caution statements which may include any of the following as appropriate- The words "WARNING" or "CAUTION"

Regulation 19 (1) requires every person who generates toxic or hazardous waste to treat or cause to be treated such hazardous waste.

The proponent shall ensure that the main contractor implements the above mentioned measures as necessary to enhance sound environmental Management of waste.

4.4.2.3 The Occupational Safety and Health Act, 2007

This is an act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. The Act was published in the Kenya Gazette Supplement No. 111 (Acts No.15). It received presidential assent on 22nd October, 2007 and became operational on 26th October, 2007.

The key areas addressed by the Act include:

a) General duties including duties of occupiers, self-employed persons and employees
b) Enforcement of the act including powers of an occupational safety and health officer
c) Registration of workplaces.
d) Health General Provisions including cleanliness, ventilation, lighting and sanitary conveniences
e) Machinery safety including safe handling of transmission machinery, hand held and portable power tools, self-acting machines, hoists and lifts, chains, ropes & lifting tackle, cranes and other lifting machines, steam boilers, air receivers, refrigeration plants and compressed air receiver
f) Safety General Provisions including safe storage of dangerous liquids, fire safety, evacuation procedures, precautions with respect to explosives or inflammable dust or gas

g) Chemical safety including the use of material safety data sheets, control of air pollution, noise and vibration, the handling, transportation and disposal of chemicals and other hazardous substances materials
h) Welfare general provisions including supply of drinking water, washing facilities, and first aid
i) Offences, penalties and legal proceedings

Under section 6 of this act, every occupier is obliged to ensure safety, health and welfare of all persons working in his workplace.

The proponent will be required to ensure that the main contractor includes in the contract document, adequate measures to promote safety and health of workers.

4.4.2.4 Noise and Vibration Pollution (Control) Regulations, 2009

These regulations were published as legal Notice No. 61 being a subsidiary legislation to the Environmental Management and Co-ordination Act, 1999. The regulations provide information on the following:

a) Prohibition of excessive noise and vibration
b) Provisions relating to noise from certain sources
c) Provisions relating to licensing procedures for certain activities with a potential of emitting excessive noise and/or vibrations and
d) Noise and excessive vibrations mapping.

Regulation 5 further makes it an offence for any person to make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property.

Regulation 12 (1) makes it an offence for any person to operate a motor vehicle which- *(a)* produces any loud and unusual sound; and *(b)* exceeds 84 dB(A) when accelerating. According to sub regulation 2 of this regulation, No person shall at any time sound the horn or other warning device of a vehicle except when necessary to prevent an accident or an incident.

Regulation 16 (1) stipulates that where a sound source is planned, installed or intended to be installed or modified by any person in such a manner that such source shall create or is likely to emit noise or excessive vibrations, or otherwise fail to comply with the provisions of these

Regulations, such person shall apply for a license to the Authority. According to regulation 18 (6), the license shall be valid for a period not exceeding seven (7) days.

The project proponent will be required to comply with the above mentioned regulations in order to promote a healthy and safe working environment.

4.4.3 Public Health Act Cap 242

Part IX section 115 of the Act states that no person or institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires that local Authorities take all lawful necessary and reasonable practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to injuries or dangerous to human health. As such, proponents and contractors of housing projects should ensure that health and safety concerns of workers, neighboring communities and occupants of the building are taken into consideration.

The Proponent ensure that there is waste segregation at source, all construction waste is collected and disposed off by a licensed NEMA waste handler and that waste covers are provided at the waste yard.

4.4.4 Physical Planning Act, 1999

Physical Planning Act, 1999 gives the local authority power to prohibit or control development activities in their jurisdictions. Section 30 states that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local Authority.

Finally, section 36 states that if development with a development action, local authority is of the opinion that the proposed development activity will have injurious impacts on the environment, the applicant will be required to submit together with the application the EIA report.

The proponent shall strictly adhere to the Zoning Laws and Regulation as stipulated

4.4.5 Building Code 2000

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local Authority for permit to connect to the sewer line and all the wastewater must be discharged into sewers. The code prohibits construction of structures/building on sewer lines.

4.4.6 The Kenya Water Act, 2016

The Kenya Water Act of 2016 was enacted to ensure equitable and sustainable use of water resources in the country. It establishes the Water Resource Management Authority to manage water resources in the country that are vested in the state.

The Cabinet Secretary also formulates, and publishes in the Gazette, the national water resources management strategy in accordance with which the water resources of Kenya are being managed, protected, used, developed, conserved and controlled, the Water Resources Management Authority (WRMA) in turn formulate a catchment management strategy through which water catchment areas are managed.

WRMA may also with approval from the Cabinet Secretary declare an area to be a protected area where it is satisfied that special measures are necessary for the protection of a catchment area or part thereof and the Authority may impose such requirements, and regulate or prohibit such conduct or activities, in or in relation to a protected area as the Authority may think necessary to impose, regulate or prohibit for the protection of the area and its water resources.

Schemes are categorized hierarchically with state schemes taking precedence over community schemes and by notice in the Kenya gazette land may be acquired for purposes of a state scheme under means prescribed in the law as to how land may be acquired. Community water resources projects are only allowed if the proposed project is approved by the persons owning or occupying at least two-thirds of the particular area concerned in the project; and provision is made by the project for an adequate alternative supply of water to be supplied to permit holders likely to be adversely affected and unable to benefit from the scheme.

In term of water work permits will be required for the following purposes except in state schemes; any use of water from a water resource (except as provided in section 26); drainage of any swamp or other land; the discharge of a pollutant into any water resource; any purpose, to be carried out in or in relation to a water resource, which is prescribed by rules made under the Act to be a purpose for which a permit is required. Further exceptions for permit requirement are for;

i. The abstraction or use of water, without the employment of works, from or in any water resource for domestic purposes by any person having lawful access thereto;
ii. Any development of ground water, where none of the works necessary for the development are situated within one hundred meters of any body of surface water (other than in-closed spring water); or within a ground water conservation area; or
iii. The storage of water in, or the abstraction of water from, a dam constructed in any channel or depression which the Authority has declared, by notice published in the Gazette, not to constitute a watercourse for the purposes of the Act.

Permits may be applied for from WRMA and in may be subject to EIA in accordance with the requirements of the EMCA of 1999, payment of a prescribed fee and completion of an application form. The WRMA determines an application for a permit as soon as practicable after its lodgment but where an application duly made in accordance with the procedure is not determined by the Authority within six months after lodgment, any fee paid by the applicant will be refunded to the applicant. Every permit will be subject to subsequent variation by the Authority after hydro graphic survey of the relevant body of water has been made, and after reasonable notice has been given to all parties affected.

Thus the Kenya Water Act of 2016 will also provide guidelines and framework for the project's activities and through compliance the project will align its objectives with those of this act.
The main contractor will be required to implement necessary measures to ensure water conservation and also to prevent potential for water contamination during the construction phase to comply with this the developer will use a channel to direct water to the main channel just like the houses in the surrounding neighborhood.

4.4.7 The County Governments Act, 2012

An Act of Parliament giving effect to Chapter Eleven of the Constitution; to provide for county governments' powers, functions and responsibilities to deliver services and for connected purposes Section 102 of the Act: The principles of planning and development facilitation empowers the County to

a) Integrate national values in all processes and concepts;
b) Protect and develop natural resources in a manner that aligns national and county government's policies;

Section 103 of the Act: The objectives of county planning shall be to—

a) Ensure harmony between national, county and sub-county spatial planning requirements;
b) Facilitate the development of a well-balanced system of settlements and ensure productive use of scarce land, water and other resources for economic, social, ecological and other functions across a county;
c) Maintain a viable system of green and open spaces for a functioning eco-system;
d) Protect the historical and cultural heritage, artefacts and sites within the county;
e) Make reservations for public security and other critical national infrastructure and other utilities and services;
f) Work towards the achievement and maintenance of a tree cover of at least ten per cent of the land area of Kenya as provided in Article 69 of the Constitution.

Section 104 of the Act: Obligation to planning by the county.

a) The county planning framework shall integrate economic, physical, social, environmental and spatial planning.
b) The county government shall designate county departments, cities and urban areas, sub-counties and Wards as planning authorities of the county.
c) To promote public participation, non-state actors shall be incorporated in the planning processes by all authorities.
d) County plans shall be binding on all sub-county units for developmental activities within a County.

4.4.8 The Penal Code (Cap. 63)

Section 191 of the Penal Code makes it an offence for any person or institution that voluntarily corrupts, or foils water for public springs or reservoirs rendering it less fit for its ordinary use. Similarly, section 192 of the same act prohibits making or vitiating the atmosphere in any place to make it noxious to health of persons/institution in dwellings or business premises in the neighborhood or those passing along a public way.

The proponent will be required to ensure strict adherence to the Environmental Management Plan throughout the project cycle in order to mitigate against any possible negative impact.

4.4.9 Petroleum Act, Cap. 116

The legislation has noted several challenges that face the sector which include proliferation of substandard Petroleum Products dispensing and storage sites which pose environment health and safety risks; diversion of petroleum products destined for export into the local market by unscrupulous business people to evade tax and a dominance of the market by a few companies among others.

The Government noted these challenges in its energy policy contained in Session Paper No. 4 of 2004 on Energy and recommended review of the Petroleum Act Cap 116 and other energy sector statutes and the introduction of a new energy sector legislation to cover petroleum, electricity and renewable energy. It also recommended the formation of a single energy sector regulator to regulate electricity, downstream petroleum, renewable energy and other forms of energy.

The act makes provisions for restricting and regulation for the importation, transport and storage of petroleum. A license to store petroleum in an installation shall authorize the keeping of the quantity and description of the petroleum product specified therein within the confines of the installation whether in tanks, storage sheds or otherwise in accordance with the specifications and plans attached to the license.

The Act provides for specifications in the granting of a license of the premises to be licensed giving particulars of the materials and construction of each building. The position of the premises in relation to adjoining property and distances from neighboring buildings should be specified. The position and capacity of each tank, the position of all buildings, structures or other works within the installation, all lighting arrangements including position of electric cables, switches and fuse boxes, drainage systems, water connections, fire hydrants and fire-fighting appliances should also be specified.

4.4.10 The Energy Act, 2019

In March 2019, the Energy Act of 2019 was enacted. This led to the transformation of the then Energy Regulatory Commission (ERC) to the Energy and Petroleum Regulatory Authority (EPRA), The Energy Tribunal transformed to The Energy and Petroleum Tribunal (EPT), The Rural Electrification Authority transformed to Rural Electrification and Renewable Energy Corporation (REREC)/ Renewable Energy Resource Advisory Committee (RERAC) and the

Kenya Nuclear Electricity Board transformed to Nuclear Power and Energy Agency (NPEA) to regulate petroleum and renewable energy sectors in addition to electricity.

The Act is to consolidate the laws relating to energy, to provide for National and County Government functions in relation to energy, to provide for the establishment, powers and functions of the energy sector entities; promotion of renewable energy; exploration, recovery and commercial utilization of geothermal energy; regulation of midstream and downstream petroleum and coal activities; regulation, production, supply and use of electricity and other energy forms; and for connected purposes.

Construction Permits are also to be issued by ERC (now, EPRA), for all petroleum related facilities in order to check proliferation of substandard sites. All petroleum operators are required to comply with provisions for Environment Health and Safety. Petroleum products should also meet the relevant Kenya Standards.

The Cabinet Secretary may on the recommendation of the Commission make regulations

i. Defining the kind of petroleum to which the regulations shall apply, and dividing the petroleum into classes or categories and making different provisions with regard to such classes or categories;
ii. Governing the design, construction and operation of pipelines, refineries, bulk liquefied petroleum gas facilities, retail dispensing sites, storage depots and providing for the protection of property and the environment and the safety of the public in the construction and operation thereof

The proponent shall obtain a Petroleum Business License which will be issued the Energy and Petroleum Regulatory Authority (EPRA)

4.4.11 Institutional Framework

At present there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), National Environmental Management Authority (NEMA), the Forestry Department, Kenya Wildlife Services (KWS) and others. There are also local and international NGOs involved in environmental activities that impact on the environment in one way or the other in the country.

Table 17: Institutions and Departments which deal with Environmental issues in Kenya.

Institution	Mandate/EIA Relevance
NEMA	The National Environment Management Authority (NEMA) is established under the Environmental Management and Coordination Act (EMCA) No. 8 of 1999, as the principal instrument of government in the implementation of all policies relating to the environment. (*Source: GoK. (2012). National Environmental Management Authority. www.nema.go.ke*).
Nairobi County Government	The onset of the 2010 constitution of Kenya ushered in the County Government of Nairobi. The county took over from the defunct County Council of Nairobi that was created by then Local Government Act, Cap 265 of the Laws of Kenya. Its mandate is to provide services to residents of the Nairobi city. Among other functions, the County government is responsible for the provision of essential services like water, sewer and public safety (Functions of County Governments Part 2 (Fourth Schedule, Article 185 (2), 186 (1) and 187 (2)). Some of the county departments whose functions are pertinent to the project include the following: • Planning Department • Public Health Department • Social Services and Housing Department • Housing Development Department • Inspectorate Department • Engineer's Department • Department of Environment
Nairobi City Water and Sewerage Company (NCWSC)	The Nairobi Water Company is a water service provider charged with the provision of the water and sewerage services in Nairobi. Those services were previously offered by the Water and Sewage Department of the County Government of Nairobi .Nairobi Water Company's formation arose from the enactment of the Water Act 2002 and amendment in 2016, which created new institution to manage water resources in the country. Under the new Act, water service providers will be licensed by water service boards to retail water in their jurisdictions. Nairobi Water Company is one such water service provider, which has been appointed by the Athi Water Service Board to provide water and sewerage services to the residents of Nairobi and its environs.
Ministry of Energy-KPC	The Ministry of Energy derives its mandate from Cap.112 and 435 of the Laws of Kenya. In addition, a Sessional Paper (No.4 of 2004) provides the policy framework and direction on Energy Development in Kenya for the next 20 years. The Cabinet Secretary of Energy

	oversees policy formulation while the Permanent Secretary oversees efficiency and effectiveness in the implementation of formulated policies. The Ministry has three technical departments namely; Geo-Exploration, Electric Power and Renewable Energy. The Ministry of Energy's mission is to facilitate provision of clean, sustainable, affordable, reliable and secure energy sources for national development while protecting the environment, (*Source: GoK, MoE, www.energy.go.ke).*
Ministry of Labor	This ministry's mandate is to: enforce labour laws, maintain industrial peace, industrial training and promote safety and health of employees. We also develop and coordinate implementation of policies and strategies for human resource development, micro and small enterprise sector and productivity improvement. Our mandate is derived from Presidential Circular No 1/2006 of March 2006 and also from the following Acts of Parliament and other policy documents: • Employment Act, Cap. 226; • The Regulation of Wages and Conditions of Employment Act, Cap. 229; • The Trade Disputes Act, Cap. 234; • The Workmen's Compensation Act, Cap. 236; • The Trade Unions Act, Cap. 233; • The Industrial Training Act Cap 237; • The Factories and Other Places of Work Act, Cap. 514; • National Social Security Fund (NSSF) Act, Cap 258; • ILO Conventions and Recommendations; • The Industrial Relations Charter of 1984; • Economic Recovery Strategy for Wealth and Employment Creation; • The 9th National Development Plan; • Session Paper No.2/2005 on MSE development; and • The Legal Notice 7354 of September 2002 on the establishment of the • Productivity Centre of Kenya (PCK). (Source: GoK, Ministry of Labour,) *www.labour.go.ke*)
Ministry of Finance Planning, National Development	The Ministry of Finance, Planning and National Development is mandated to facilitate and coordinate the national development planning process and to provide leadership in national economic policy management. Its core functions include:

	• The coordination of government economic policies, including regional and international cooperation policies; • The coordination and preparation of the planning components of the Medium Term Expenditure Framework (MTEF); the Fiscal Strategy Paper and the requisite budget documents; • The provision of leadership and coordination in the preparation of the main National Development Plan documents, including the integration of County Integrated Development Plans (CIDP); National Development Plans, and specific socio-economic programmes and plans; • The coordination and management of population, economic and national statistical services within government; and • The Coordination and provision of leadership in the national Monitoring and Evaluation (M&E) framework. (*Source: GoK. MoFPND and Vision 2030. www.planning.go.ke*)
Ministry of Health	This ministry is charged with the functions of: • Public health and sanitation policy • Preventive and promote health services • Community health services • Health education • Reproductive health • Food quality and hygiene • Health inspection and other public health services • Quarantine administration • Oversight of all sanitation services • Preventive health program including vector control • National public health laboratories • Government chemist • Dispensaries and health centers (i.e., levels 2 & 3) • Kenya Medical Research Institute (KEMRI) • Radiation Protection Board • Member of KEMSA Board • Member of Kenya Medical Training College (KMTC) Board (*Source: GoK, (2013) Ministry of Public Health and Sanitation, www.publichealth.go.ke*)
Ministry of Transport and Infrastructure	The development of integrated Nairobi metropolitan areas growth and development strategy covering among other things: • Integrated roads, bus and rail infrastructure for metropolitan area • Efficient mass transport system for Nairobi metropolitan area

	• Replacement of slums with affordable low cost/rental housing provision of adequate housing • Development and enforcement of planning and zoning regulations • Preparation of spatial planning for metropolitan area • Efficient water supply and waste management infrastructure • Promotion, development and investment in sufficient public utilities, public services and world class infrastructure for transforming Nairobi into a global competitive city for investment and tourism • Identification and implementation of strategic projects and programmes requiring support by government • Promotion of Nairobi metropolitan area as a regional and global services centre for financial, information and communication technology, health, education, business, tourism and other services • The development of a sustainable funding framework for the development of identified urban and metropolitan areas (*Source: GoK. (Ministry of Transport and Infrastructure Development, Mandate.*)
Kenya Urban Roads Authority	The mandate of KURA as defined in the Kenya Roads Act, 2007 is the Management, Development, Rehabilitation and Maintenance of all public roads in the cities and municipalities in Kenya except where those roads are national roads. KURA's core functions include: • Constructing, upgrading, rehabilitating and maintaining roads under its control. • Controlling urban road reserves and access to roadside developments. • Implementing roads policies in relation to urban roads. • Ensuring adherence by motorists to the rules and guidelines on axle load control prescribed under the Traffic Act and under any regulations under this Act. • Ensuring that the quality of road networks is in accordance with such standards as may be defined by the Cabinet Secretary. • In collaboration with the Ministry responsible for transport and the police department, overseeing the management of traffic and road safety on urban roads. • Monitoring and evaluating the use of urban roads. • Planning the development and maintenance of urban roads. • Collecting and collating all such data related to the use of urban roads as may be necessary for efficient forward planning under the Roads Act.

	• Preparing the road works programs for all urban roads. • Liaising and coordinating with other road authorities in planning and on operations in respect of roads. • Advising the Cabinet Secretary on all issues relating to urban roads. • Performing such other functions related to the implementation of the Roads Act as may be directed by the Cabinet Secretary (*Source: GoK (2012) Kenya Urban Roads Authority. Retrieved July 4, 2012 from www.kura.go.ke*)
County Environment Committees.	According to EMCA, 1999 and amended 2015, the Governor by notice in the gazette appoints County Environment Committees of the Authority in respect of every county respectively. The Environment Committees are responsible for the proper management of the environment within the county in respect of which they are appointed to. They are also to develop a county strategic environmental action plan every five years and perform such additional functions as are prescribed by the Act or as may, from time to time be assigned by the Governor by gazette notice. The decisions of these committees are legal and it is an offence not to implement them.
National Environmental Complaints Committee.	The Committee is charged with the following functions: Investigating allegations/ complaints against any person or against the Authority (NEMA) in relation to the condition of the environment and its management, Prepare and submit to the Council periodic reports of its activities which shall form part of the annual report on the state of the environment, and to perform such other functions and excise such powers as may be assigned to it by the Council.
National Environment Action Plan Committee.	This Committee is responsible for the development of a 5-year Environment Action plan among other things. The National Environment Action Plan shall contain: Analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time, and Analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity among other duties as the EMCA specifies.
National Environmental Tribunal.	This tribunal guides the handling of cases related to environmental offences in the Republic of Kenya. The Tribunal hears appeals against the decisions of the Authority. Any person who feels aggrieved may challenge the tribunal in the High Court.

CHAPTER FIVE: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Description of the Anticipated Impacts

5.1.1 Anticipated Impacts

An impact assessment was undertaken following full characterization of the environmental and social baseline, and identification of all project aspects. The anticipated impacts of the proposed project on the environmental elements are both positive and negative. The magnitude of each impact is described in terms of being significant, minor or permanent, short-term or long term, specific (localized) or widespread, reversible or irreversible.

The scope of the assessment will cover the proposed project site, and will be undertaken in accordance with, the National Environmental legal requirements, and guidelines triggered for the project. All the relevant environmental, social and economic aspects will be identified for the proposed activities, the activities will be considered in terms of their potential to interact with the (physical, biological, socio-economic) environment. The EIA project report shall distinguish the impacts through the following phases

- Construction phase
- Operational phase
- Decommissioning phase

Most of the impacts have been addressed in the proactive design of the project and other mitigation measures can only be guaranteed through active and responsible management committed to the propositions of the environmental management plan.

5.2 Positive Impacts

5.2.1 Provision of Petroleum Product Storage Depot

The Depot will provide a facility for storage, handling and provision of petroleum products, providing oil reserves that will avert petroleum products crisis in the country. This will in turn supply fuel, lubricants and LPG to various service station facilities in Nairobi County, the Country and region at large.

5.2.2 Stimulate Local Economy

Energy plays a key role in economic growth and development. Therefore, the construction of An Oil and Gas Storage Depot will serve to improve the accessibility of petroleum products all through the day and night to residents and motorists thus boosting the local economy in Nairobi County and the Country in general.

This project will contribute to the country's economic development. In particular, the proposed project will help in the achievement of strategies specified in the Kenya's energy policy commitment of ensuring provision of reliable and adequate supply and distribution of petroleum products in all parts of Kenya at least cost.

5.2.3 Ensuring Availability and Accessibility of Petroleum Products

The proposed construction of Makadara Oil Terminal Storage Depot will ensure the reliable availability and accessibility of fuel, diesel and gas within at affordable and least cost for the local community in Nairobi County and the country in general. Further, this will ensure competition and cushion the local community and Kenyans from exploitative rising fuel prices from scrupulous middle men in the petroleum industry.

5.2.4 Creation of Employment and Income Opportunities

The proposed construction of Makadara Oil Terminal Storage Depot will create employment to some skilled and semi-skilled Kenyan citizens. A number of employment opportunities will be created for various personnel construction and operation phases of the depot thus generating income and improve livelihoods of Kenyan citizens.

This will be a significant impact since unemployment is currently quite high in Nairobi County and Kenya at large. Besides direct employment, other forms of employment are likely to result from the multiplier effects, such as increased urbanization, industrialization and local markets for providing goods and services during both the implementation and operational phases.

5.2.5 Creation of Business Opportunities

The proposed depot development project will require various in its planning, construction and operation phases. This will in turn create business opportunities between the proponent and various service suppliers and contractors.

5.2.6 Improved Infrastructural Development

The proponent is intending to construct the depot to the required and set international. This will involve sound development of the proposed depot as per the approved layout design drawings in constructing and developing the depot. Thus, at the end of the construction, it will be an improvement of whole depot facilities site, as well as the neighboring infrastructural facilities and amenities.

5.2.7 Generation of Income

At operational stage, the depot shall be an economic investment hence more income to the proponent and a source of livelihood to various employees who will be working at the depot.

5.2.9 Optimal Land use

The project will lead to the optimal utilization of the land that is currently not utilized and not developed.

5.2.10 Generation of Revenue

Economic returns will be realized in terms of revenue collection to both National government and County Government of Nairobi.

5.2.11 Provision of Market for Building Materials

The proposed project will require supply of building materials most, of which will be sourced locally in Nairobi and the surrounding areas. This provides ready market for building material suppliers such as quarrying companies, hardware shops and individuals with such materials.

5.2.13 Decongestion Existing Depot

The construction of the new depot will create more petroleum product storage and handling space and provision of petroleum products, providing oil reserves that will avert petroleum products crisis in the country. This will in turn reduce the amount of time wasted queuing for petroleum products in other existing depots. Hence increases efficiency in serving clients.

5.2.13 Training on OHS

During the operation of the depot, the employees shall be trained on work place occupational health and safety measures on handling of flammable petroleum products, how to respond to work place

accidents, hazards and other conditions. These will be effectively mitigated on through the use of appropriate PPEs at all times and proper handling of the petroleum products.

Table 18: Socio-economic impact during Construction

Nature	The benefit to the local economy will be positive direct through employment and procurement of services and indirect through spending in the local economy due to increase in wages.
Impact Magnitude-Medium	**Extent** The project will create employment and procurement to the local, suppliers. **Duration** Employment created will only last to the end of construction phase and thus is short-term. **Intensity** The intensity will be low as a few jobs will be created locally with substantial amount of the total investment being spent on goods and services obtained from the local area during the construction phase.
Likelihood	There is likelihood that the impact will occur.
Impact significance	Medium

Table 19: Socio-economic Impact during Operation Phase

Nature	The benefit to the local economy will be positive direct through employment and procurement of services.
Impact Magnitude-Medium	**Extent** The project will create employment and procurement to the local and regional suppliers. **Duration** Employment created will last life time of the project and thus is mid-term. **Intensity** The intensity will be medium as a few jobs will be created locally.
Likelihood	There is high likelihood that the impact will occur.
Impact significance	Medium

5.3 Potential Negative Environmental Impacts

The impacts that are seen as likely to negatively affect the environment and local population include the following:

5.3.1 Occupational Health and Safety (OHS)

During construction works and operation of the depot, occupation hazards, incidences and accidents may occur which might result in injuries of construction workers, depot employees, pedestrians, motorists, private properties and infrastructure.

Table 20: Characteristics of Impact on Health and Safety

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

Table 21: Significance of Impacts on Health and Safety

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

5.3.2 Increased Water Demand

Water is a major concern especially in many construction sites. The proposed development may cause some strain to the existing water source since construction activities are known to be heavy

water consumers. Operation of the depot will bring about an increase in water consumption. The proponent will apply for connection with water supply from existing NCWSC or sink their own borehole. In case of water shortage, there will be reserves at the storage tanks which will be constructed to harvest and store rain water.

Table 22: Characteristics of Impact on Water Resources

Project Phase	Project Aspect/activity	Impact type	Stakeholder /Receptor Affected
Construction phase	Water usage drinking, concrete batching and dust suppression Water contamination	Negative	Ground water resources
Operation phase	Water usage firefighting, drainage system, cooling machines, drinking, cleaning, etc	Negative	Ground water resources
Decommissioning phase	Contamination of water by demolition waste	Negative	Ground water resources

Table 23: Significance of Impacts on Water Resources

Nature	Some activities during construction and decommissioning phases would result in contamination of water resource
Impact Magnitude-Low	**Extent:** The extent of the impact is site specific. **Duration:** The duration would be short-term for construction and decommissioning phases waste as the impacts will not persist after construction and decommissioning phases respectively. **Intensity:** The intensity can be considered low
Likelihood	There is a likelihood that the impact will occur.
Impact significance	Low

5.3.3 Increased Power Demand

There will be increase in power consumption especially during construction and operation phase of the depot. The depot shall connect to the existing power main for their and construction activities like welding, lighting, and operation activities like charging other electrical gadgets used for running the station, pumping fuel among other daily station services and this might strain the power resources.

5.3.4 Pollution

The construction activities on the site will result to increased dust and gas emissions. Such dust and gases have direct negative impact to the quality of air and hence animal/human health.

Hooting idling of the vehicles delivering construction materials and workers will generate noise and vibrations which may have negative effects to the Makadara neighborhood. Petroleum oils, and grease, used in vehicles and construction machinery and paints used in the construction works may spill or leak on/into the ground further contaminating the soil and potentially ground water.

5.3.5 Air Quality

The construction activities on the site may result to increased dust and gaseous emissions. Some construction machinery and trucks, including small vehicles may generate hazardous exhaust fumes such as Carbon Oxides (CO_x), Sulphur Oxides (SO_x) and Nitrogen Oxides (NO_x). Dust particles as caused by wind and vehicles suspended in the air mostly during dry and windy seasons. Such dust and gases have direct negative impact to the quality of air hence affects human and animal health and livelihoods.

Table 24: Significance of Air Quality Impacts

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

5.3.6 Noise and Vibrations

Construction activities will be generating noise and hence affecting other daily operations in the Makadara neighborhood. Such noise will mainly emanate from the construction machinery and equipment which include trucks and other vehicles accessing the site. There might also be noise from the workers on site workers carrying on the construction works. Unwanted and undesirable noise may has negative psychological effects impacting on job performance, safety, and health.

Table 25: Noise Impacts during construction phase

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

5.3.7 Flora and Fauna

Currently, there no natural vegetation on the existing depot. However, there is a little planted vegetation on the edges of the depot and at the moment none of them shall be cleared to pave way for the construction of the station. However, noise/dust pollution from construction activities might disturb such fauna like small that might be flying around the depot.

5.3.8 Soil Geology and Degradation

Some small leaks from underground tanks and supply lines might lead to extensive contamination of soil, soil organisms and ground water overtime. This would require a lot of resources and time to clean up the pollution and its general effects on the environment and people. Soil degradation may occur during excavations for foundation laying. The excavated materials can be carried by water or blown by wind causing erosion.

Table 26: Impact on soil quality

Project Phase	Impact type	Significance
Construction phase	Soil contamination and Soil erosion	Negative
Operation phase	Soil contamination	Minor
Decommissioning phase	Soil contamination and Soil erosion	Minor

Table 27: Soil Impact Significance

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

5.3.9 Hydrology and Water quality

Water may get contaminated by oil/fuel leaks from the underground storage tanks. The leaks may be from overfilled tanks, and accidental leaks that may contaminate the soil, soil micro and macro organisms and waster aquifers.

Table 28: Impact on **Hydrology and Water quality**

Project Phase	Impact type	Significance
Construction phase	Ground Water contamination	Minor
Operation phase	Ground Water contamination	Minor
Decommissioning phase	Ground Water contamination	Minor

Table 29: Hydrology and Water quality Impact Significance

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

5.3.10 Waste water and Sewage Effluents

Effluent/sewage resulting from sanitary facilities and wastewater from the proposed developments is of significant concern with respect to the environment. It should always drain effectively into the available sewerage treatment system via well designed drainage system networks.

If possible, a pollution solution system which is a compact oil separator which separates oil from wash down water collected from the under canopy area of a depot in two different tanks, and allows the wastewater to be discharged to sewer, while separating the solid material and contaminants in a separate tank for collection and sound disposal can be installed.

5.3.11 Solid Waste

This will be as a result of construction activities. Such waste materials include stones, wood, broken glasses and tiles, containers, metal rods, pieces of iron sheets/ tiles and sharp objects such as nails. During operation of the depot, solid wastes shall be generated from daily depot activities, motorists, clients and employees.

Table 30: Waste Impact Characteristics

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

Table 31: Waste generation impacts

Nature	Waste generated during construction, operation and decommissioning of the proposed development would result in a negative direct impacts if not managed properly.
Impact Magnitude-Low	**Extent:** The extent of the impact is site specific. **Duration:** The duration would be short-term for construction and decommissioning phases waste as the impacts will not persist after construction and decommissioning phases respectively. However,

	impact of waste generated during operation will be long term- lasting the life of the project. **Intensity:** The intensity can be considered low as the work will be temporary. Similarly intensity of impact of waste generated during operation is low as they are not anticipated to occur on a daily basis or frequently
Likelihood	There is a likelihood of waste generation throughout project cycle.
Impact significance	Low to medium

5.3.12 Depot Warehouse

There could be spills from the depot warehouse and storage that will be storing, handling and supplying the petroleum products. This might lead to potential water, soil and vegetation contamination.

5.3.13 Disaster Preparedness

During and construction works, there might be cases of injuries, accidents or occupation hazards which might result in injuries of construction workers, depot employees, pedestrians, motorists, private properties and infrastructure.

5.3.14 Fire Risks

Depots have a greater fire risk than most establishments because of the highly combustible products handled. A lot of care must be taken while offloading, refueling and while undertaking day to day activities.

5.3.15 Increased Traffic

A depot comes with increased traffic to the depot especially for collection of petroleum products by tankers, trucks and railway containers for supply to various petroleum service providers locally and regionally. Therefore, there might be incidences of high traffic inflow especially during peak hours at the entry and exit of the depot, along Jogoo Road. If not properly controlled, it might lead to traffic snarl ups, time wasting and potential accidents.

5.4 Mitigation Measures for Potential Negative Impacts

5.4.1 Potential Mitigation Measures for Occupational Health and Safety

During construction of the depot, the contractor will be required to prepare a waste management plan for the work sites at the start of the project. The site is to be kept clean, neat and tidy at all times. The contractor shall implement measures to minimize occupational health and safety risks:

- Workmen and visitors shall be provided with suitable protective gear (such as dust masks, ear muffs, helmets, overalls, industrial boots etc.) particularly during construction. There must be fully equipped first aid kits on site and a safety officer who has a first aid training and knowledge of safety procedures. In addition, the contractor must have insurance for the workmen.
- Carrying out annual environmental and safety audits for the depots.
- Safety kits and emergency facilities should be provided in case of any accidents and incidents common to projects of such nature. These should be placed in strategic locations on site.
- Delivery and storage of materials at appropriate locations.
- The contractor will be required to adhere to Factories and Other Places of Work Act, especially the building operations and works of engineering construction rules and its subsidiary and supplementary regulations on safety and public health in the construction activities. Standards and legal requirements should be adhered to. These include:
    - ✓ Building codes,
    - ✓ Occupational Safety & Health Act,
    - ✓ The Public Health Act,
    - ✓ As well as other recognized best practices and procedures.
- The project proponent and contractor should take appropriate insurance cover for the various project activities and personnel.
- The workforce should be further trained on safety measures.

5.4.2 Potential Mitigation Measures for Water Use and Management

The contractor and proponent shall implement the following water use and management to maximum utilization:

- Provision of notices and information signs within the project site to notify on means and need to conserve water resource.
- Installation of water conserving taps that turn-off automatically when water is not in use will be done
- Encouragement of water re-use/recycling during both construction and operation phases of the project.

- Avoid wasting the water supplied to the site.
- Roof catchments should be provided with rainwater harvesting systems to enhance collection and storage of rain water. Such water can be used to water flower gardens and all kind of cleaning required on site.
- Install water meters for the offices to ensure accountability and responsibility.
- Provide water storage tanks to handle water shortages.

5.4.3 Potential Mitigation Measures for increase Power Demand

- All electrical appliances should be switched off when not in use.
- Put off all lights when not in use.
- Use a design that is environmentally sound to avoid use of electricity for air conditioning
- Use energy conserving electric lamps for general lighting.
- Utilize natural light inside buildings to avoid using electricity for lighting during the day.

5.4.4 Potential Mitigation Measures for Pollution

- Regular and prompt maintenance of construction machinery and equipment. This will minimize generation of hazardous gases and other suspended particulate matter.
- Areas generating dust particles should be regularly sprinkled with water to reduce dust blowing out over the area and should be enclosed where possible to mitigate the effects of wind on them.
- Maintenance should be carried out in a well-designed, paved and protected area and where oil/grease is completely restrained from reaching the ground.
- All oils/grease and materials should be stored in a site's store.
- Sound pollution control measures should be adopted

5.4.5 Potential Mitigation Measure for Air Quality

- Provide personal protective equipment to workers during works
- Ensure regular and prompt maintenance of construction machinery and equipment to minimize generation of hazardous gases and other suspended particulate matter.
- Control over areas generating dust particles and regularly cleaning and sprinkling water to reduce and keep down dust.
- Use environmentally friendly fuels such as unleaded gasoline.

5.4.6 Potential Mitigation Measures for Noise and Vibrations

- Construction works should be carried out **strictly** during normal working hours i.e. 0800 to 1700 hrs.
- Machineries should be maintained regularly to reduce noise resulting from friction.
- There should not be unnecessary horning of the involved machinery
- Provision of appropriate signage at the construction site notifying of the construction activity and timings

5.4.7 Potential Mitigation Measures for Flora and Fauna

- Additional secondary and local vegetation will be panted at the end of the construction activities improve the aesthetic value of the depot and manage soil erosion.
- Landscaping should be done within the site to make the service environmentally friendly

5.4.8 Potential Mitigation Measure for Soil Geology and Degradation

- Use properly maintained hoses and fittings
- Make the cement screeds in all the chambers using water proof material.
- Install a monitoring well next to the tanks to check on leaks
- Use water finding dipstick and/ or a hydrometer to check on density/ specific gravity
- Ensure there is no oil spills, leaks during refilling and when offloading the fuel
- Excavated materials should be removed promptly from the site to avoid erosion
- Avoid unnecessary movement of soil materials from the site
- Control activities especially during rainy any windy conditions
- Regular sprinkling of water to reduce dust
- Landscaping after completion of the depot with appropriate local vegetation.

5.4.9 Potential Mitigation Measures for Hydrology, Drainage and Water quality

- A well-drained area should be identified for parking, servicing and maintenance of the construction plant and equipment.
- Appropriate disposal procedures for oils and lubricants should be observed
- Drainage channels should be provided during construction to minimize any possible water logging.
- A segregated drainage system should be provided where the water that is contaminated with oils is not allowed to drain in to the open storm drains.

- Water contaminated should be directed into the oil-water separator from where it should be treated before it is released to the rest of the drainage system.
- An interceptor tank made up of reinforced concrete walls and floor shall be constructed and its inner walls shall be plastered with water proof cement. (Each chamber shall have a manhole with a reinforced concrete cover).
- The used oil tank will have a concrete wall which will be able to contain the net products of used oil. Its plinth shall be sloped towards the Oil-Water separator for treatment.

5.4.10 Potential Mitigation Measures for Wastewater and Sewage Effluents

- Ensure no undue interference with the laid drainage system.
- All drain pipes passing under the building, driveway or parking should be of heavy duty PVC pipe tube encased in 150mm concrete all round.
- All manholes on drive ways and parking areas should have heavy duty covers set and sealed airtight as approved by specialists.
- All waste pipes should have cleaning roding eyes accessible from outside and free to every part of the system for inspection, cleaning and repair.
- Sanitary facilities should be kept clean always through regular cleaning.
- Ensuring the sewerage treatment plant is not overloaded to minimize incidences of untreated sewer spills to the environment
- If possible, install a “pollution solution” system, which separates oil from wash down water and allows the wastewater to be discharged to sewer, while separating the solid material and contaminants in a separate tank for collection
- The channels shall be designed with regard to peak volumes.
- Paving of the sidewalks, parking and other open areas shall be done using pervious materials

5.4.11 Potential Mitigation Measures for Solid Wastes

The contractor shall implement measures to minimize waste and develop a waste management plan to include the following:

- Express condition shall be put in the contract that before the contractor is issued with a completion certificate; he will clear the site of all debris and restore it to a state acceptable to the supervising architect and environmental consultant.

- Bins/receptacles shall be placed at strategic locations within the site as collection centres to facilitate separation and sorting of the various types of wastes. These bins shall be placed with clear markings e.g. plastics, paper and others, to receive different solid waste materials.
- The contractor and proponent shall work hand in hand with private refuse handlers that are already on the ground and local council to facilitate sound waste management.
- The wastes shall be properly segregated and separated to encourage recycling of some useful waste materials.
- Use of an integrated solid waste management system through a hierarchy options i.e. source reduction, recycling, composting and reuse shall be encouraged. This will facilitate proper handling of solid waste during operation stage.
- Recycle construction materials where possible.
- Designating one central collection point to ensure the depot is tidy.

5.4.12 Potential Mitigation Measures for Lubricant Shop

- The floor of the shop will be constructed using water proof concrete, thereby making it impervious to oils and greases
- Provide one 9 Kg dry powder fire extinguisher
- Train staff on how to handle the lubricants and respond immediately to accidental leaks

5.4.13 Potential Mitigation Measures for Oil Interceptor

- Oil skimming should be done frequently to prevent carryover of contaminants to the open storm drains
- Analysis of discharge from the interceptor to be conducted one every 6 months
- Heavy duty manhole covers provided and in place at all times unless skimming is in progress to prevent fall of persons

5.4.14 Potential Mitigation Measures for Disaster Preparedness

- Provide accessible and clearly marked EXIT routes that in the event of an accident
- Install enough fire-fighting equipment at strategic locations and within reach.
- Train workers and office caretakers on fire fighting and first Aid and personal safety
- Carry out fire and emergency drills to assess disaster preparedness
- Provide personal protection equipment during construction

5.4.15 Potential Mitigation Measures for Fire Risks

- The underground storage tanks shall be fabricated out of 6mm thick mild steel plates in accordance with KS 200 (BS 2594) which is the standard design for Flammable and Combustible Liquids.
- The installation of underground storage tanks shall be supervised by an engineer who specializes in Underground Petrol Storage Systems and shall be done in accordance with the API 1615: Installation of Underground Petroleum Storage Systems.
- A fire extinguisher shall be placed at the service bay and in the office building.
- A bucket full of dry sand shall be placed at each pump.
- Water hydrants should be installed.
- All the electrical connections shall be designed by a registered engineer and connected to one central emergency stop switch.
- Installation of an automatic fire alarm system for the entire facility
- All fire control and fighting facilities shall be installed following local council fire master's requirements and approval e.g.
    - Provision of 2. No. 9kg carbon dioxide (CO_2) fire extinguisher stationed at each pumping/dispensing area.
    - Provision of fire blanket
    - Provision of long fire hose reel

5.4.16 Potential Mitigation Measures for Traffic Implication

- The contractor shall be required to erect clear road signs showing speed limits and warning other motorists of turning vehicles
- Provision of parking spaces
- Clearly demarcated pedestrian walkways to be provided
- Liaising with traffic police to control movement of vehicles and pedestrians within the depot

5.4.17 Potential Mitigation Measures for Site Security

- The management shall strategically install lighting as well as security alarms and backup systems including surveillance of the area on a 24 hours basis.
- Security guards shall protect the property in a 24-hour basis and document any suspect movement within the facility and its environs.

CHAPTER SIX: QUANTITATIVE RISK ASSESSMENT IN THE OIL STORAGE DEPOT

6.1 Introduction

The Oil & Gas industry and it's infrastructural development projects presents such a prime source of revenue for many countries and governments globally. However, it also involved risks of major accidents. The accidents may cause death, suffering, environmental pollution and disruption of business. To ensure all risks identified and controlled, risk management approaches need to be strategically implemented.

Quantitative Risk Assessment is therefore the process of identification of hazards and evaluation of the extent of risk a raising therefrom the proposed Oil Storage Depot, the frequency and magnitude of hazardous events with an aim of mitigating them to achieve safety.

6.2 Risk Analysis and Risk Management Strategies

Quantitative Risk Assessment (QRA) as a tool will assist the MOTL's safety management system which can be effectively applied for Planning, Front End Engineering Design (FEED), Detailed Design, Construction, and Commissioning, Decommissioning and Disposal or modifications in the oil storage depot's process system.

If the depot's potential risks and hazards are properly identified mainly through Hazard identification process, and potential accidents postulated as well as all the depot's potential risks well controlled in a satisfactory manner including the As Low As Reasonable Practicable (ALARP) criteria, then the MOTL management we optimize the negative outcome of potential hazards and risks.

6.3 Hazard Identification in the Depot

Hazard identification involves a qualitative review of accidents that might occur with the object of gaining an appreciation of possible hazards and suggesting appropriate prevention. Identification of all major hazards exposed during platform operation is the most important because of its significant effects to QRA results.

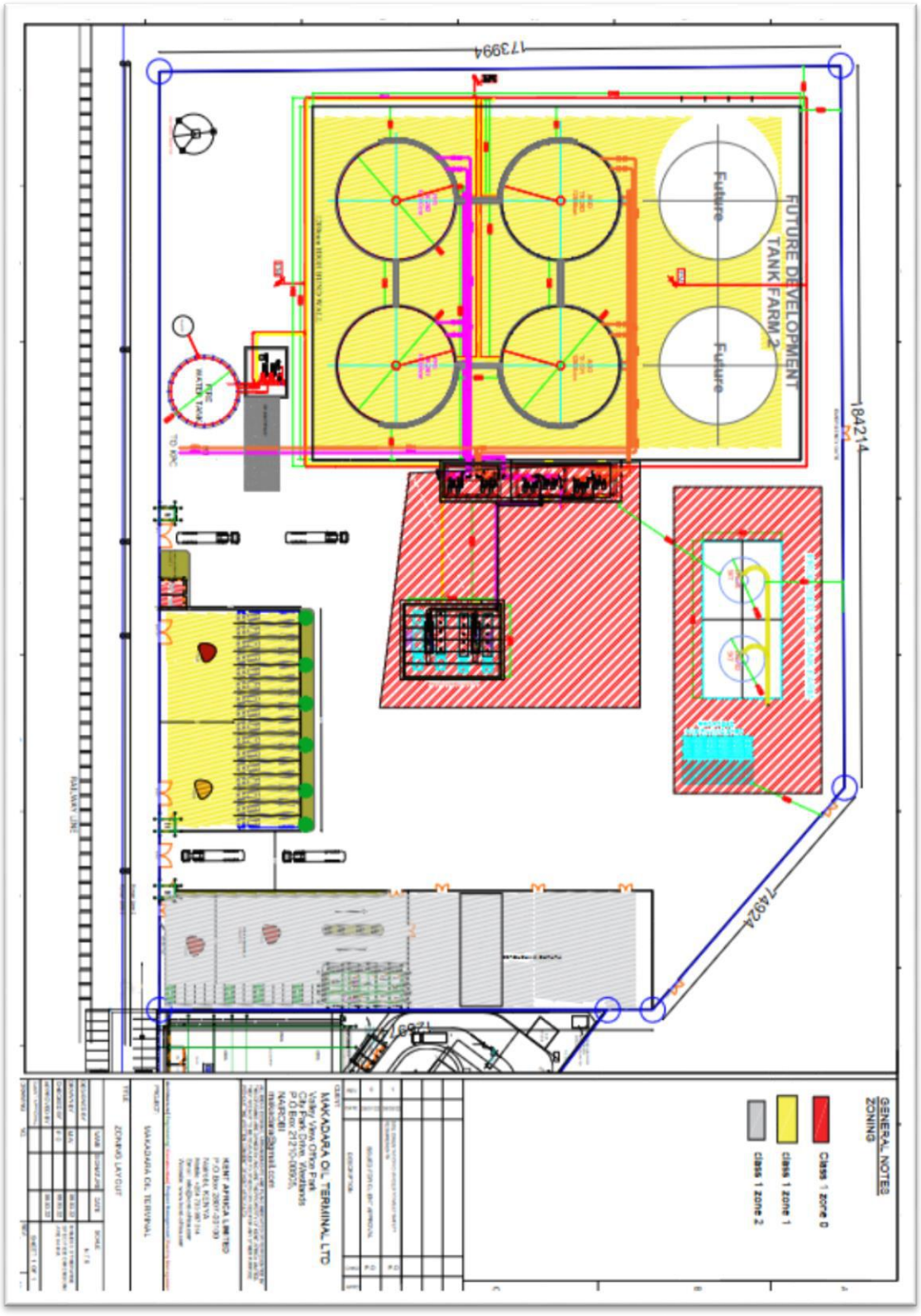
The potential causes and consequences of releases of the petroleum products which will be handled during the depots operation activities shall be clearly identified and documented on to the hazard register. For each ignited release scenario, which can involve LPG, White Product and Black

Product, a coarse qualitative risk ranking shall be given and the firefighting equipment required to tackle each of these fires shall be documented accordingly.

Depending on the product being handled, a range of fire types are possible ranging from pool fires, depot fires, flash fires and possible explosions. This hazard register serves to link the firefighting equipment to the identified ignited releases, which will provide the hazard based context to the firefighting training plan.

6.4 Potential Location of Ignited Release in the Depot

Based on the proposed design depot Layout Design and Drawings, the following are likely to be release locations identified as a potential cause of fire hazards (**Layout 2 below**):



Layout 2: Proposed Makadara Oil Terminal Storage Depot Zoning layout plan

Class I, Zone O: A Class I, Zone O Location is a location (1) in which ignitible concentrations of flammable gases or vapors are present continuously; or (2) in which ignitible concentrations of flammable gases or vapors are present for long periods. In the map above the areas are represented in a red shading and are namely

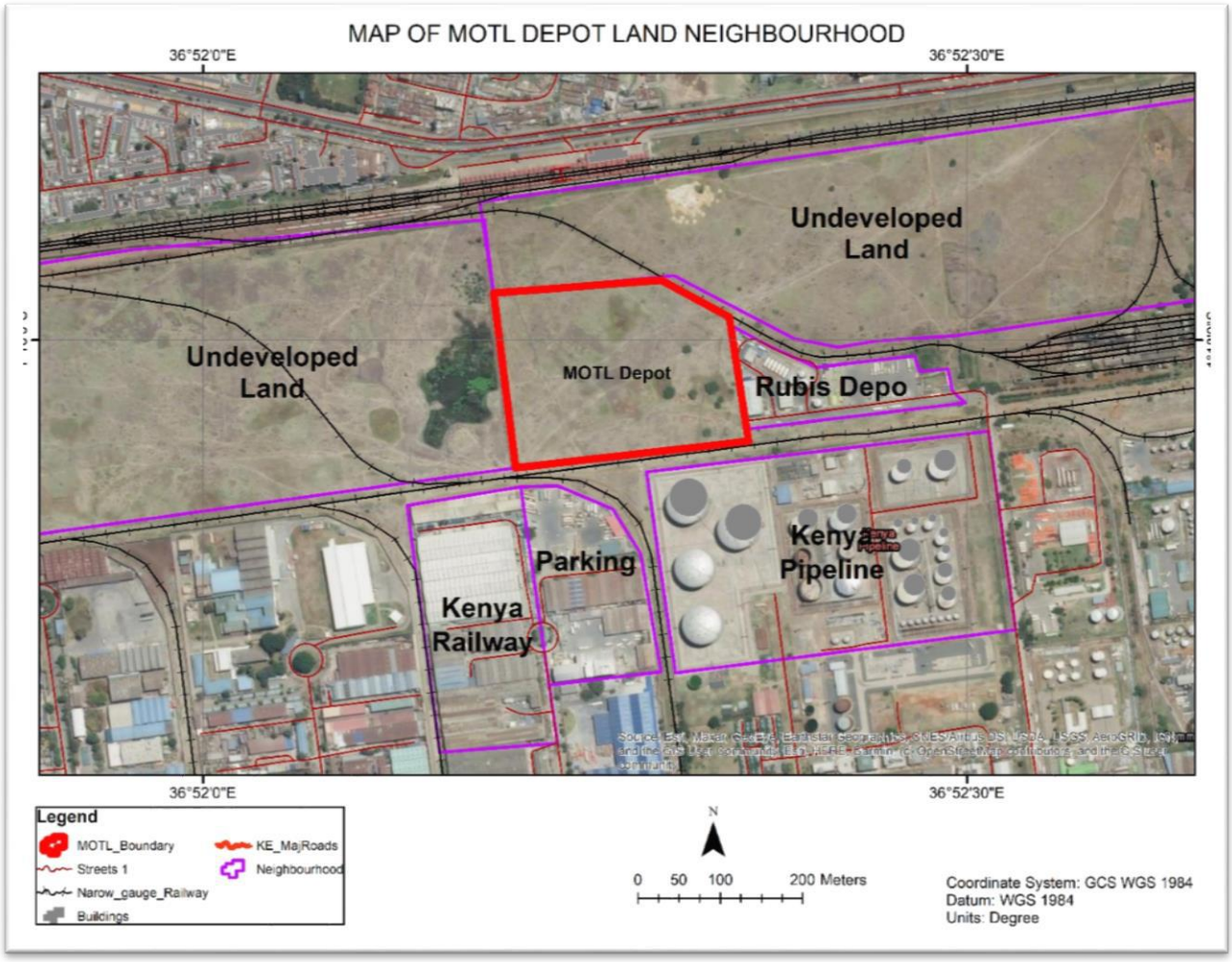
- The LPG tank farm
- Gantry and pumping houses

Class I, Zone 1: A Class I, Zone 1 Location is a location (1) in which ignitable concentrations of flammable gases or vapors are likely to exist under normal operating conditions; or (2) in which ignitible concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations or because of leakage. Or (3) in which equipment is operated or processes are carried on, of such a nature that equipment breakdown or faulty operations could result in the release of ignitable concentrations of flammable gases or vapors and also cause simultaneous failure of electrical equipment in a mode to cause the electrical equipment to become a source of ignition; or (4) that is adjacent to a Class I, Zone O location from which ignitible concentrations of vapors could be communicated. In the map above the areas are represented in a yellow shading and are namely

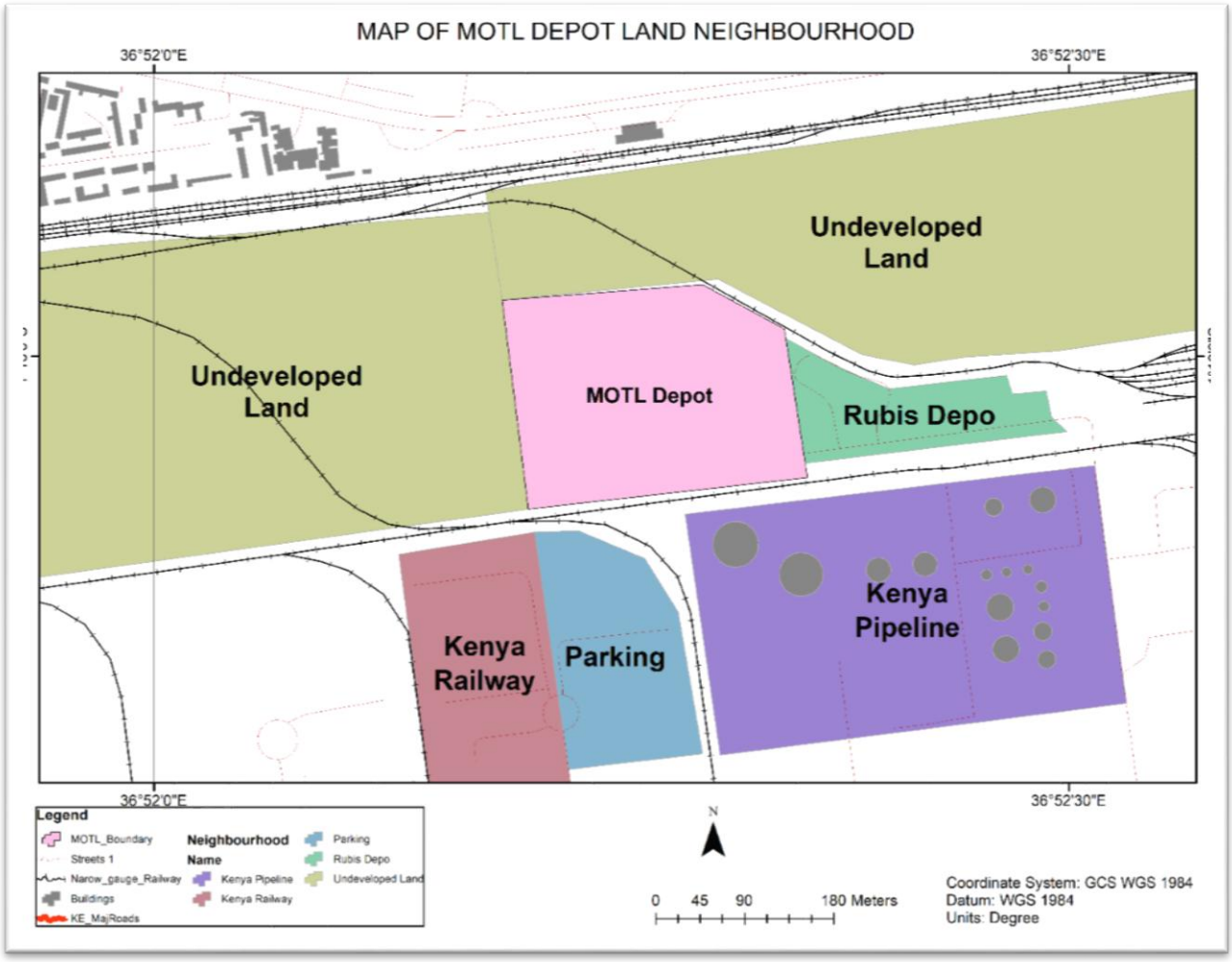
- Truck parking area
- White products tank farm
- Electrical switchgear room/ operator hut facilities.

Class I, Zone 2: A Class I, Zone 2 Location is a location (1) in which ignitible concentrations of flammable gases or vapors are not likely to occur in normal operation and if they do occur will exist only for a short period; In the map above the areas are represented in a yellow shading and are namely

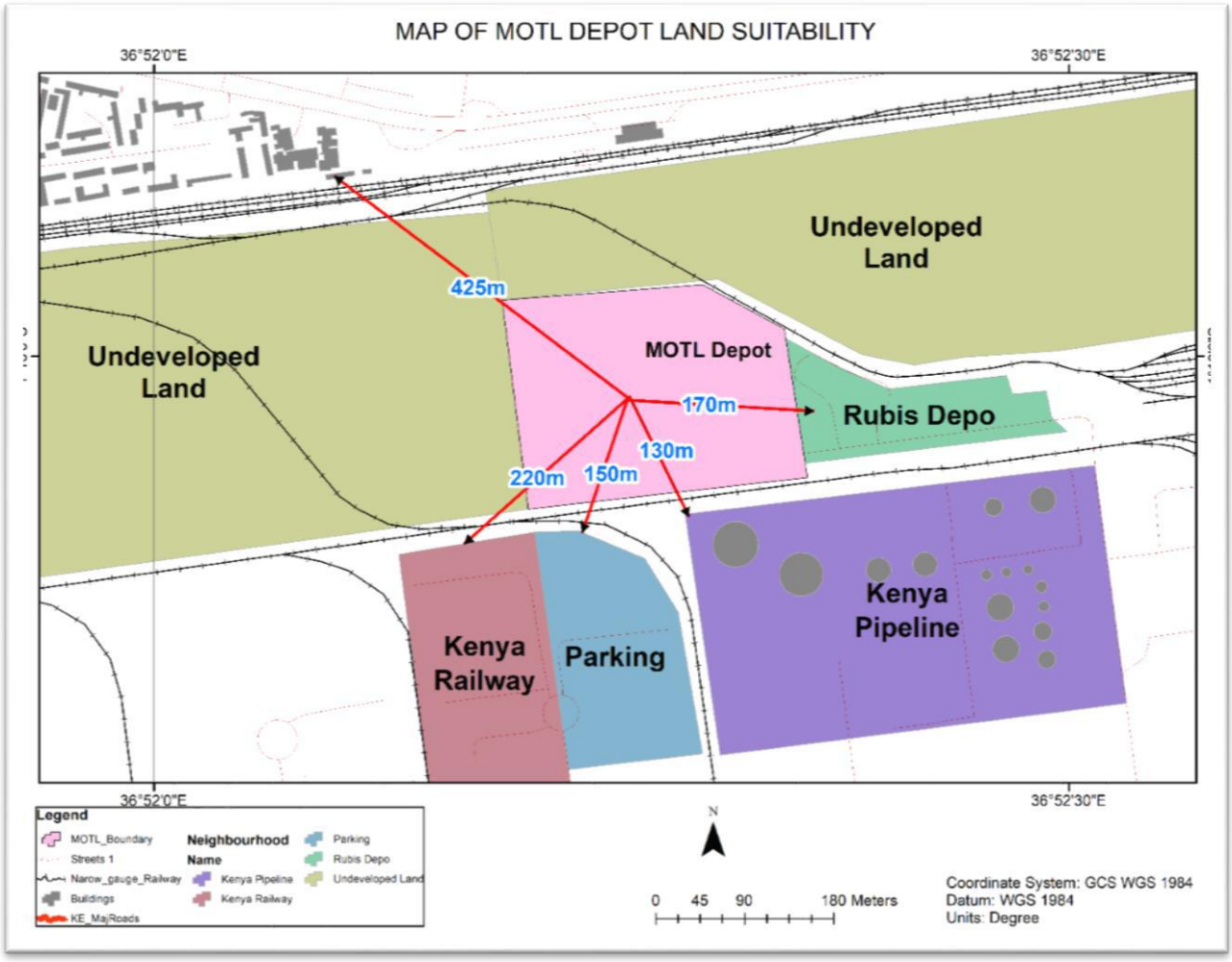
- Office block
- Service building



Map 3: Proposed MOTL Depot and similar neighboring facilities



Map 4: Proposed MOTL Depot and distances to the surrounding establishments & facilities



Map 5: Proposed MOTL Depot and distances to the surrounding establishments & facilities

a. Depot Safety Standards and Distances

Table 31: Depot Safety Standards as per the KEBS and API International Standards

Tank capacity/type	Any type of tank
Minimum distance from tank shell to property boundary	Not less than 7.5m
Minimum distance from tank shell to nearest important building	Not less than 7.5m
Minimum distance to from the tank shell to nearest road	Not less than half diameter of biggest tank
Minimum distance from bulk truck loading to important building	Not less than 15m
Minimum distance from tank shell to building with heat source i.e workshop or rail siding	Not less than 15m
Minimum distance from filling shed to property boundary with solid wall	Not less than 6m

[Refer to KS EAS 976:2020]

NOTE:

b. On Depot Safety Standards

From the Depot Safety Standards as per the local Kenyan; KEBS standards and International Standards: API described in (Table 31) and Maps 3, 4, and 5, all the required safety standards to optimize on the negative outcome of the frequency and magnitude hazards and risks and mitigating them to achieve human, property and environmental safety

From (Table 31): The minimum safety distances between Depot infrastructural facilities averages between 6 m to 15 m. This has been well achieved from the depot Architectural Drawing and Design Layout.

Similarly, from site Maps 3, 4, and 5, the distance between the MOTL Depot to Rubis Depot (**170m**), Kenya Pipeline Co. (**130m**) Kenya Railways Parking (**150m**), Kenya Railways Facility

(**220m**), Makadara SGR Station (**425m**). The average distance between MOTL Depot and the surrounding similar establishments is **219m**, clearly indicating that the depot facility falls within the required and recommended safety desistance with the surrounding development infrastructural facilities.

Beside the safe distances, the proposed depot is buffered, cushioned and protected large tracks of undeveloped land as well Jogoo road which well insulate the depot from potential hazards.

6.5 Safeguards to Minimize Spill Sizes in the Depot

The minimization of release volumes will be achieved by the provision of the recovery tank underneath the loading arms in the depot's loading. The use of Quick Connect Disconnect Couplers and integral isolation valves on the end of the loading arms will reduce the amount of the spillage caused during the separation of the two mating flanges. Fire Alarms, Gas detection and Fireproof Communications systems will be provided in the depot as the first step to dealing with release, both ignited and unignited.

6.6 Proposed Fighting Fires at the Depot

Detailed in tables below are the proposed firefighting means for both small and large fires that can/might occur at the depot.

Table 32: Proposed firefighting means for small fires at the depot

No.	Fire Type	Mitigation Measure		
Small Fire Type (At all Depot Locations)		**Preventive Measures**	**Detection System**	**Portable Extinguishers**
1	LPG (residual) spill	a. Good house keeping b. Clean spills quickly c. Maintain hazard areas	a. Fire and gas detection b. Fire alarms	a. Dry chemical b. Foam
		Fixed Systems	**Response Measure**	**Skills and PPE**
		a. Fire hydrants	b. Shut off gas supply c. Leave to burn in controlled fashion	a. Fire marshal always required b. Additional fire team PPE
2	Gasoline spill	**Preventive Measures**	**Detection System**	**Portable Extinguishers**
		a. Good house keeping b. Clean spills quickly c. Maintain hazard areas	a. Fire and gas detection b. Fire alarms	a. Dry chemical b. Carbon dioxide c. Foam
		Fixed Systems	**Response Measure**	**Skills and PPE**
		a. Fire hydrants b. Water supply	a. Skin cooling b. Shut off fuel supply c. Leave to burn in controlled fashion	a. Fire marshal always required b. Additional fire team PPE
3	Gas oil spill	**Preventive Measures**	**Detection System**	**Portable Extinguishers**
		a. Good house keeping b. Clean spills quickly c. Maintain hazard areas	a. Fire and gas detection b. Fire alarms	a. Dry chemical b. Carbon dioxide c. Foam
		Fixed Systems	**Response Measure**	**Skills and PPE**
		a. Fire hydrants	a. Shut off gas supply b. Leave to burn in controlled fashion	a. Fire marshal always required b. Additional fire team PPE

Table 33: Proposed firefighting means for large fires at the depot

No.	Fire Type	Mitigation Measure		
Large Fire Type		**Preventive Measures**	**Detection System**	**Fire Suppression & Control Measures**
1	LPG	a. Good house keeping b. Clean spills quickly c. Maintain hazard areas d. Crash barriers	a. Fire and smoke detection b. Gas detection c. Real time drivers & management communication d. Fire alarms e. Gas alarms f. Leak detection device	a. Automatic shutdown of unloading b. Fire Hydrants and fire hose cabinets c. Depot mire monitor towers d. Depot Fire pumps
		Fixed Systems	**Response Measure**	**Skills and PPE**
		a. Fire hydrants	a. Shut off gas supply b. Leave it to burn in controlled fashion	a. Fire marshal always required b. Additional fire team PPE
2	Gasoline	**Preventive Measures**	**Detection System**	**Portable Extinguishers**
		a. Good house keeping b. Clean spills quickly c. Maintain hazard areas d. Crash barriers	a. Fire and smoke detection b. Gas detection c. Real time drivers & management communication d. Fire alarms e. Gas alarms f. Leak detection device	a. Automatic shutdown of unloading b. Fire Hydrants and fire hose cabinets c. Depot mire monitor towers d. Depot Fire pumps
		Fixed Systems	**Response Measure**	**Skills and PPE**
		a. Fire hydrants	a. Shut off fuel supply b. Leave it to burn in controlled fashion	a. Fire marshal always required b. Additional fire team PPE

3	Gas oil	**Preventive Measures**	**Detection System**	**Portable Extinguishers**
		a. Good house keeping b. Clean spills quickly c. Maintain hazard areas d. Crash barriers	a. Fire and smoke detection b. Gas detection c. Real time drivers & management communication d. Fire alarms e. Gas alarms f. Leak detection device	a. Automatic shutdown of unloading b. Fire Hydrants and fire hose cabinets c. Depot mire monitor towers d. Depot Fire pumps
		Fixed Systems	**Response Measure**	**Skills and PPE**
		a. Fire hydrants	a. Shut off gas supply b. Leave to burn in controlled fashion	a. Fire marshal always required b. Additional fire team PPE

6.7 Proposed Depot Firefighting Training Plan

6.7.1 Proposed Depot Staff Training Requirements

All personnel assigned to new depot operations should receive a basic grounding in the HS&E aspects of their daily activities and operation. Such basic induction should include workshops for staff and should deal with such occupational, health, safety and environmental themes including:

- Products handled and physical properties;
- Basic first aid;
- Basic firefighting using hand held extinguishers;
- Incident reporting and STOP programs;
- Permit to Work System and safe systems of work;
- Task Risk Assessments and Hazard Identification;
- Environmental impact.

A register should be kept of all personnel who attended the course, and bi-annual refresher sessions should be scheduled for staff.

6.7.2 Proposed Depot Fire Safety Staff Training Requirements

This training segment will commence with the basic HS&E induction segments given above in Section 6.7.1. It will also include the participation in:

- Process and Electrical HAZOPs;
- HAZIDs.

The purpose of this will be to provide a grounding in HAZOP and HAZID techniques as well as maintain live hazard registers as a first step in developing risk assessment skills and attaining a COMAH type culture at the depot.

The depot fire safety staff should be continuously trained as well as attend emerging new fire safety courses/trainings (if possible) so as to become effective and efficient in:

- Choice and use of appropriate extinguishing mediums;
- Fire and combustion theory;
- Use of hydrants and monitors with and without foam.
- Use of hose reels;
- Isolating fuel sources (including electrical);
- Use of fire team skills
- Rescue skills and first aid skills/expertise
- Team work and working in pairs

Once proficiency has been attained in these basic grounding courses, staff will move on to fire location training at the depot, which will have both practical and written elements. This should be backed up by regular fire drills and exercises, for night shift staff as well as day shift fire safety staff.

6.8 Proposed Depot Training Plan for Fighting Small Fires

6.8.1 Depot Fires and Residual LPG Fires

Depot and residual LPG fires that might occur within the depot may be tackled directly using a handheld portable foam extinguisher or a dry chemical powder extinguisher. It is important that only a residual LPG fire should be tackled in this way. A small LPG jet or spray fire should not be extinguished as this will release unignited product to the atmosphere, which if allowed to accumulate in a confined area and could ignite causing a flash fire.

Thus a small jet fire should be allowed to burn itself out under controlled conditions, so as to avoid explosive re-ignition. This will include ensuring that the jet fire is not directed towards a product line, an escape route, a building (including the depot pump house), pollution control equipment or other firefighting equipment. Every effort should be made to shut-off the fuel to the fire.

Deflector shields should be used to redirect a small jet fires and water spray cooling should be deployed on an impinged product line, either with a fixed water spray system or with a hose reel attached to a fire hydrant with a spray nozzle affixed. Small jet fires should not be tackled by personnel not trained specifically to tackle such fires.

The firefighting training programme for members of the fire response team should include a segment in tackling small jet fires. It is important to keep LPG from flowing into drains and to ensure all depot systems are correctly bonded to earth so as to avoid electrostatic discharges and fire.

Fire team members should not expose themselves to any smoke from a small jet fire, and should ensure they are wearing fire retardant coveralls, gloves and helmet. Goggles should be worn. It should not be necessary to don full firefighting PPE, but this remains the decision of the on scene commander. It is important that an unignited release of LPG is detected quickly and unloading operations stopped quickly and the wind direction established via reference to the windsock.

6.8.2 Gasoline Fires

Gasoline fires may occur within the depot and should be tackled directly using:

- A handheld portable foam extinguisher,
- A dry chemical powder extinguisher,
- A Carbon dioxide fire extinguisher or a water spray (from a hydrant and hose with a spray nozzle or from fixed water spray equipment) or using the mobile foam extinguisher.

An unignited spill of gasoline will result in the liberation of flammable vapour, which if allowed to accumulate in a confined area and could ignite causing a flash fire. Every effort should be made to shut-off the fuel to the fire and the area around a container involved in a fire should be isolated.

It is important to keep gasoline from flowing into drains and to ensure all depot systems are correctly bonded to earth so as to avoid electrostatic discharges and fire. Fire team members should not expose themselves to any smoke from a small fire, and should ensure they are wearing fire

retardant coveralls, gloves and helmet. Goggles should be worn. It should not be necessary to don full firefighting PPE, but this remains the decision of the on scene commander.

6.8.3 Gas Oil Fires

Gas Oil fires can occur within the new within the depot and should be tackled directly using:

- A handheld portable foam extinguisher,
- A dry chemical powder extinguisher,
- A Carbon dioxide fire extinguisher or,
- Using the mobile foam extinguisher.

An unignited spill of gas oil can result in the liberation of flammable vapour, which if allowed to accumulate in a confined area and could ignite causing a flash fire. Every effort should be made to shut-off the fuel to the fire. It is important to keep Gas Oil from flowing into drains and to ensure all the depot systems are correctly bonded to earth so as to avoid electrostatic discharges and fire.

Fire team members should not expose themselves to any smoke from a small fire, and should ensure they are wearing fire retardant coveralls, respiratory equipment, gloves and helmet. Goggles should be worn. It may be necessary to don full firefighting PPE, but this remains the decision of the on scene commander. Only trained personnel are to tackle gas oil fires.

6.8.4 Fuel Oil Fires

Fuel Oil fires can occur within the depot and should be tackled directly using:

- A handheld portable foam extinguisher,
- A dry chemical powder extinguisher,
- A Carbon dioxide fire extinguisher or a water spray (from a hydrant and hose with a spray nozzle or from fixed water spray equipment) or using the mobile foam extinguisher.

An unignited spill of Fuel Oil can result in the liberation of flammable vapour, which if allowed to accumulate in a confined area and could ignite causing a flash fire. Every effort should be made to shut-off the fuel to the fire. It is important to keep Fuel Oil from flowing into drains and to ensure all the depot systems are correctly bonded to earth so as to avoid electrostatic discharges and fire.

Fire team members should not expose themselves to any smoke from a small fire, and should ensure they are wearing fire retardant coveralls, respiratory equipment, gloves and helmet. Goggles

should be worn. It may be necessary to don full firefighting PPE, but this remains the decision of the on scene commander.

All the tanker trucks brought in to the depot will be suitable for operation in the hazardous areas established for the depot, have their cigarette lighters removed and be equipped with a Carbon dioxide extinguisher and water fire extinguisher.

6.8.5 Electrical Fires

Small electrical fires are to be tackled with portable Carbon dioxide extinguishers by the fire response team and are to be tackled with the advice of the Responsible Person Electrical so as to ensure that the power supply has been correctly and positively isolated.

Additional PPE may be required to protect fire team members from the hazards of electrical shock and the RPE should be consulted.

6.8.6 Cellulosic Fires

Small cellulosic fires are to be tackled using;

- Portable water extinguishers,
- Fire buckets and
- Hose reels connected to the fire hydrants.

These types of fires should not occur in the depot, as all matches, cigarette lighters and other sources of ignition will not be permitted in the depot, which will also be a non-smoking area. All electrical equipment and hot surfaces will be suitable for the hazardous zones established for the depot.

6.9 Proposed Depot Training Plan for Fighting Large Fires

6.9.1 Depot Fires and Residual LPG Fires

At the first instance large LPG releases must be prevented through:

- Cleaning up the spill quickly using rapid dilution if necessary;
- Maintaining the integrity of pipework and fittings;
- Flange management;
- Careful driving of tanker trucks and strict adherence of the speed limit at the depot;

- Maintenance of crash barriers to protect piping and the firewater pump house.

Secondly, the leak must be detected through:

- Alert depot operations personnel raising the alarm and acting;
- The possible use of coupling position indicating alarms;
- The detection of LPG vapours.

Thirdly, should a leak occur it must be controlled immediately through:

- Shutting down the pumped import of product;
- Providing quick and effective segmentation and isolation of the source of the leak.

Then the leak must be mitigated by:

- Attempting to contain it;
- Diluting it with firewater;
- Good natural ventilation.

In order to prevent ignition, the following measures must be in place:

- The strict control of the hazardous area classification on the depot, through carefully controlled modifications to design that might occur on the depot;
- The strict control of permitted work on the depot, allowing no work to occur without the correct permit;
- Strict controls on the suitability of mobile plant, vehicles, hand tools and power tools on the depot in relation to the hazardous areas;
- Ensuring that ship shutdown and depot shutdown systems and communications are connected;
- Ensuring that good bonding and earthing is applied
- A strictly observed no smoking policy;
- The condition of personnel's PPE should be in good order and of the appropriate type, particularly boots.

LPG vapour may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to ignition source, flammable vapours can burn in the open or explode in confined spaces. Vapours may travel long distance to an ignition source and flash back.

It is prudent to initiate water spray equipment, particularly on personnel escape routes along the depot on detection of gas or release of LPG, provided the equipment is well bonded to earth, as it is becoming established practice that release of water spray will mitigate against the creation of a flammable atmosphere.

Residual LPG fires can occur within the depot and should be tackled directly as per gasoline fires or small residual LPG fires. It is important that only a residual LPG fire should be tackled in this way. A large LPG jet fire should not be extinguished as this will release unignited product to the atmosphere, which if allowed to accumulate in a confined area and could ignite causing a flash fire.

Thus a large jet fire should be allowed to burn itself out under controlled conditions, so as to avoid explosive re-ignition. This will include ensuring that the jet fire is not directed towards a product line, an escape route, a building (including the firewater pump house), pollution control equipment or other firefighting equipment.

Every effort should be made to shut-off the fuel to the fire. Deflector shields should be used to redirect a jet fire and water spray cooling should be deployed on an impinged product line, either with a fixed water spray system or with a hose reel attached to a fire hydrant with a spray nozzle affixed.

Jet fires should not be tackled by personnel not trained specifically to tackle such fires. The firefighting training programme for members of the fire response team should include a segment in tackling jet fires.

It is important to keep LPG from flowing into drains and to ensure all depot systems are correctly bonded to earth so as to avoid electrostatic discharges and fire. Fire team members should not expose themselves to any smoke from a small fire, and should ensure they are wearing fire retardant coveralls, gloves and helmet. Goggles should be worn. It is important that an unignited release of LPG is detected quickly and unloading operations stopped quickly and the wind direction established via reference to the windsock.

It is recommended that a windsock is installed in a prominent location at the depot.

6.9.1 Depot Gasoline Fires

Large depot gasoline fires can occur within the depot and should be tackled with the utmost caution and only by qualified and trained members of the fire team using the appropriate equipment and PPE. At the first instance large gasoline releases must be prevented through:

- Cleaning up the spill quickly using rapid dilution if necessary;
- Maintaining the integrity of pipework and fittings;
- Flange management;
- Careful driving of tanker trucks and strict adherence of the speed limit;
- Maintenance of crash barriers to protect piping and firewater pump house.

Secondly, the leak must be detected through:

- Alert depot operations personnel raising the alarm and acting;
- The possible use of coupling position indicating alarms;
- The detection of gasoline vapours.

Thirdly, should a leak occur it must be controlled immediately through:

- Shutting down the pumped import of product;
- Effecting quick and effective segmentation and isolation of the source of the leak.

Then the leak must be mitigated by:

- Attempting to contain it;
- Diluting it with firewater.

In order to prevent ignition, the following measures must be in place:

- The strict control of the hazardous area classification on the depot, through carefully controlled modifications to design that might occur on the depot;
- The strict control of permitted work on the depot, allowing no work to occur without the correct permit;
- Strict controls on the suitability of mobile plant, vehicles, hand tools and power tools on the depot in relation to the hazardous areas;
- Ensuring that ship shutdown and depot shutdown systems and communications are connected;
- Ensuring that good bonding and earthing is applied;

- A strictly observed no smoking policy;
- The condition of personnel's PPE is in good order and of the appropriate type, particularly boots.

The effect of a fire is mitigated by ensuring redundancy and fire proofing of communication and fire and gas cables. Gasoline vapour may be ignited rapidly when exposed to heat, spark, open flame or other source of ignitions. When mixed with air and exposed to ignition source, flammable vapours can burn in the open or explode in confined spaces. Vapours may travel long distance to an ignition source and flash back.

For a Major Gasoline fire at the Depot, the following equipment should be started automatically and should be checked as being operational by trained personnel:

- Firewater pumps and salt water fire main and fire main distribution system;
- Foam generation tank and header.

As a result, the following firefighting equipment will be available for use:

- Fire water foam monitor towers;
- Fire hydrants and fire hose cabinets;
- Water spray and water fog spray.

Fire team personnel should don:

- Full firefighting personal protective equipment including respiratory equipment; and should ensure:
    - ✓ Their escape route is secure through the deployment of water sprays at the fire monitor tower and back along the depot;
    - ✓ They are not working alone;
    - ✓ The alarm has in fact been raised and product transfer has in fact stopped.

Support should arrive in the form of:

- The fire trailer with monitor;
- Portable foam monitor;
- The deployment of depot firefighting systems.

An incident team must be set up, allowing for relief of fire team members and provision of medical attention as required and when necessary.

If the major gasoline fire occurs within the Depot, and the depot fire monitor towers will not be available, and the fire should be tackled with:

- The fire trailer with monitor;
- Portable foam monitor;
- Fire hydrants and fire hose cabinets;

Bearing in mind that water may not be effective against gasoline fires, personnel should also ensure that:

- The water spray is being successfully applied to the pipe-way to effect skin cooling;
- A possible spray fire or jet fire is not directed across the road;
- A possible spray fire or jet fire does not impinge directly on neighboring pipework;
- A possible spray fire or jet fire does not impinge directly on the wall of the electrical switchgear room, the firewater pump house or the operator huts.

Proposed Recommendations to Fight Gasoline Fires:

The following additional measures should be considered in fighting gasoline fires at the depot:

- The possibility of inducing foam at the fire hydrants;
- Strategic location of firefighting foam drums along the depot;
- Spare firefighting PPE at the depot;
- Passive fire protection of the firewater pump house walls and roof;
- Passive fire protection of emergency shut-off valves at the depot.

6.9.2 Gas Oil Fires

Large gas oil fires can occur within the depot and should be tackled with the utmost caution and only by qualified and trained members of the fire team using the appropriate equipment and PPE. At the first instance large gas oil releases must be prevented through:

- Cleaning up the spill quickly using rapid dilution if necessary;
- Maintaining the integrity of pipework and fittings;
- Flange management;

- Careful driving of tanker trucks and strict adherence of the speed limit;
- Maintenance of crash barriers to protect piping and firewater pump house.

Secondly, the leak must be detected through:

- Alert depot operations personnel raising the alarm and acting;
- The possible use of coupling position indicating alarms;
- The detection of gas oil vapours.

Thirdly, should a leak occur it must be controlled immediately through:

- Shutting down the pumped import of product;
- Effecting quick and effective segmentation and isolation of the source of the leak.

Then the leak must be mitigated by:

- Attempting to contain it;
- Diluting it with firewater.

In order to prevent ignition, the following measures must be in place:

- The strict control of the hazardous area classification on the depot, through carefully controlled modifications to design that might occur on the depot;
- The strict control of permitted work on the depot, allowing no work to occur without the correct permit;
- Strict controls on the suitability of mobile plant, vehicles, hand tools and power tools on the depot in relation to the hazardous areas;
- Ensuring that ship shutdown and depot shutdown systems and communications are connected;
- Ensuring that good bonding and earthing is applied
- A strictly observed no smoking policy;
- The condition of personnel's PPE is in good order and of the appropriate type, particularly boots.

The effect of a fire is mitigated by ensuring redundancy and fire proofing of communication and fire and gas cables. Gas oil vapour may be ignited rapidly when exposed to heat, spark, open flame or other source of ignitions. When mixed with air and exposed to ignition source, flammable

vapours can burn in the open or explode in confined spaces. Vapours may travel long distance to an ignition source and flash back.

For a major gas oil fire at the depot, the following equipment should be started automatically and should be checked as being operational by trained personnel:

- Firewater pumps and salt water fire main and fire main distribution system;
- Foam generation tank and header.

As a result, the following fire-fighting equipment will be available for use:

- Fire water foam monitor towers;
- Fire hydrants and fire hose cabinets;
- Water spray and water fog spray.

Fire team personnel should don:

- Full firefighting personal protective equipment including respiratory equipment; and should ensure:
    - ✓ Their escape route is secure through the deployment of water sprays at the fire monitor tower and back along the depot;
    - ✓ And they are not working alone;
    - ✓ The alarm has in fact been raised and product transfer has in fact stopped.

Support should arrive in the form of:

- The fire trailer with monitor;
- Portable foam monitor;
- The deployment of depot firefighting systems.

An incident team must be set up, allowing for relief of fire team members and provision of medical attention as required.

If the major gas oil fire occurs within the depot, then the fire water monitor towers will not be available, and the fire should be tackled with:

- The fire trailer with monitor;
- Portable foam monitor;

- Fire hydrants and fire hose cabinets;

Bearing in mind that water may not be effective against gas oil fires, personnel should also ensure that:

- The water spray is being successfully applied to the pipe-way to effect skin cooling;
- A possible spray fire or jet fire is not directed across road;
- A possible spray fire or jet fire does not impinge directly on neighboring pipework;
- A possible spray fire or jet fire does not impinge directly on the wall of the electrical switchgear room, the firewater pump house or the operator huts.

Proposed Recommendations to Fight Gas Oil Fires

The following additional measures should be considered in fighting gas oil fires at the depot:
The possibility of inducing foam at the fire hydrants;

- Strategic location of firefighting foam drums along the depot;
- Spare firefighting PPE at the depot;
- Passive fire protection of the firewater pump house walls and roof;
- Passive fire protection of emergency shut-off valves at the depot.

6.9.3 Fuel Oil Fires

Large fuel oil fires can occur within the depot and should be tackled with the utmost caution and only by qualified and trained members of the fire team using the appropriate equipment and PPE. At the first instance large fuel oil releases must be prevented through:

- Cleaning up the spill quickly using rapid dilution if necessary;
- Maintaining the integrity of pipework and fittings;
- Flange management;
- Careful driving of tanker trucks and strict adherence of the speed limit;
- Maintenance of crash barriers to protect piping and firewater pump house.

Secondly, the leak must be detected through:

- Alert depot operations personnel raising the alarm and acting;
- The possible use of coupling position indicating alarms;
- The detection of fuel oil vapours.

Thirdly, should a leak occur it must be controlled immediately through:

- Shutting down the pumped import of product;
- Effecting quick and effective segmentation and isolation of the source of the leak.

Then the leak must be mitigated by:

- Attempting to contain it;
- Diluting it with firewater.

In order to prevent ignition, the following measures must be in place:

- The strict control of the hazardous area classification on the depot, through carefully controlled modifications to design that might occur on the depot;
- The strict control of permitted work on the depot, allowing no work to occur without the correct permit;
- Strict controls on the suitability of mobile plant, vehicles, hand tools and power tools on the depot in relation to the hazardous areas;
- Ensuring that ship shutdown and depot shutdown systems and communications are connected;
- Ensuring that good bonding and earthing is applied to a discharging ship.
- A strictly observed no smoking policy;
- The condition of personnel's PPE is in good order and of the appropriate type, particularly boots.

The effect of a fire is mitigated by ensuring redundancy and fire proofing of communication and fire and gas cables. Fuel oil vapour may be ignited rapidly when exposed to heat, spark, open flame or other source of ignitions. When mixed with air and exposed to ignition source, flammable vapours can burn in the open or explode in confined spaces. Vapours may travel long distance to an ignition source and flash back.

For a major fuel oil fire at the depot head, the following equipment should be started automatically and should be checked as being operational by trained personnel:

- Firewater pumps and salt water fire main and fire main distribution system;
- Foam generation tank and header.

As a result, the following firefighting equipment will be available for use:

- Fire water foam monitor towers;
- Fire hydrants and fire hose cabinets;
- Water spray and water fog spray.

Fire team personnel should don:

- Full firefighting personal protective equipment including respiratory equipment; and should ensure:
    - ✓ Their escape route is secure through the deployment of water sprays at the fire monitor tower and back along the depot;
    - ✓ And they are not working alone;
    - ✓ The alarm has in fact been raised and product transfer has in fact stopped.

Support should arrive in the form of:

- The fire trailer with monitor;
- Portable foam monitor;
- The deployment of depot firefighting systems.

An incident team must be set up, allowing for relief of fire team members and provision of medical attention as required.

If the major fuel oil fire occurs at the depot, then the fire depot monitor towers will not be available, and the fire should be tackled with:

- The fire trailer with monitor;
- Portable foam monitor;
- Fire hydrants and fire hose cabinets;

Bearing in mind that water may not be effective against fuel oil fires, personnel should also ensure that:

- The water spray is being successfully applied to the pipe-way to effect skin cooling;
- A possible spray fire or jet fire is not directed across road;
- A possible spray fire or jet fire does not impinge directly on neighboring pipework;
- A possible spray fire or jet fire does not impinge directly on the wall of the electrical switchgear room, the firewater pump house or the operator huts.

Proposed Recommendations to Fight Fuel Oil Fires

The following additional measures should be considered in fighting fuel oil fires at the depot: The possibility of inducing foam at the fire hydrants;

- Strategic location of firefighting foam drums along the depot;
- Spare firefighting PPE at the depot;
- Passive fire protection of the firewater pump house walls and roof;
- Passive fire protection of emergency shut-off valves at the depot.

6.9.4 Large Electrical Fires

It is not expected that large electrical fires can take hold at the depot. Electrical switchgear rooms are fitted with fixed CO_2 systems, with manual release at the outside of the entrance. More recently, Innogen or equivalent systems have been used, due to the concentrations and harmful effect of a CO_2 release on personnel. A fixed Innogen or equivalent system should be considered for the electrical switchgear room

6.9.5 Large Cellulosic Fires

Large cellulosic fires are to be tackled using hose reels connected to the fire hydrants. These types of fires should not occur on the depot, as all matches, cigarette lighters and other sources of ignition will not be permitted on the depot, which will also be a non-smoking area.

Table 33: Flammable Properties Fire Fighting Procedure for Various Depot Products

Oil Type	Flash Point [ºC]	Auto Ignition Point [ºC]	LEL [%]	UEL [%]	Fighting Procedure
Fuel Oil	38	210	0.7	5	**Small fires:** • Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire- fighting foam or Halon. **Large fires:** • Water spray, fog or fire-fighting foam. • Water may be ineffective for fire-fighting, but may be used to cool fire-exposed containers. • Fire-fighting foam is suitable for polar solvents with > 10% oxygenate concentration **Isolate area around a container involved in fire**. • Cool tanks, shells and containers exposed to fire and excessive heat with water. • ***For huge fires*** the use of unmanned hose or monitor nozzles may be advantageous to minimize personnel exposure. • ***Major fires*** may require withdrawal, allowing the tank to burn. • ***Large storage tank fires*** require specially trained personnel and equipment to extinguish the fire with the need for properly applied fire-fighting foam.
Gas Oil	56	250	0.5	5	**Small fires:** • Foam, dry chemical powder and carbon dioxide. **Large fires:** • Water fog or spray to cool fire exposed surfaces (e.g. containers) and to protect personnel. • Only use personnel trained for fire-fighting and cut off fuel supply if it is possible to do so. • Respiratory and eye protection equipment are required for fire-fighting personnel exposed to fumes or smoke

Oil Type	**Flash Point [°C]**	**Auto Ignition Point [°C]**	**LEL [%]**	**UEL [%]**	**Fighting Procedure**
LPG	-60 to 250	450-468	1.9 to 2.2	8.5 to 9.5	**Risk of fire or explosion by mechanical impact, friction, sparks, flames or others sources of ignition.** • Fire should not be extinguished until the source is shut off. • Vapours settle to ground level and may reach ignition sources remote from the point of escape via drains and other underground passages. **To avoid uncontrolled explosive re-ignition,** • Avoid Static discharge; material can accumulate static charges which may cause an incendiary electric discharge. • Do not extinguish flame at leak. • Cut off fuel if safe to do so • Allow fire to burn out under controlled conditions. • Extinguish small residual fires with foam or dry chemical powder. • Respiratory and eye protection required for fire-fighting personnel exposed to fumes or smoke. • Water spray should be used to cool equipment
Gasoline	-43	>280	1.4	7.6	**Small fires:** • Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire- fighting foam or Halon. **Large fires:** • Water spray, fog or fire-fighting foam. • Water may be ineffective for fire-fighting, but may be used to cool fire-exposed containers. • Fire-fighting foam is suitable for polar solvents with > 10% oxygenate concentration **Isolate area around a container involved in fire**. • Cool tanks, shells and containers exposed to fire and excessive heat with water.

					• ***For huge fires*** the use of unmanned hose or monitor nozzles may be advantageous to minimize personnel exposure. • ***Major fires*** may require withdrawal, allowing the tank to burn. • ***Large storage tank fires*** require specially trained personnel and equipment to extinguish the fire with the need for properly applied fire-fighting foam.

CHAPTER SEVEN: PROJECT ALTERNATIVES

7.1 Introduction

This section examines alternatives of the proposed project in terms of the site, products, materials, technology and waste management options. It also compares impacts of each alternative *vis-a-vis* those of the proposed project. This becomes an aid to decision making process.

7.2 Construction Alternatives

The proposed Depot facility construction works including but not limited to; fabrication, welding, tank/pipes/equipment and machinery installation, will be in accordance with the requirement and standers (local and international) specification as proposed by the Engineer and approved by the National and County relevant authorities in line with International Standards and requirements

7.2.1 Tank Sizing

The tanks will sized in accordance with industry standard regarding nominal capacity, diameter and height and will be subject to optimization during further stages of engineering definition

7.2.2 Tank Design

The white tanks shall be designed strictly according to API 650 with regard to the material, design, fabrication, erection and inspection for the MOTL tanks, which will be of adequate safety, and reasonable economy for use in the storage of refined petroleum products.

The LPG sphere tanks shall be designed strictly according to ASME sec V111 with regard to the material, design, fabrication, erection and inspection for the MOTL tanks, which will be of adequate safety, and reasonable economy for use in the storage of LPG

7.2.3 Pipe Material

The pipe material is selected in accordance with the applicable codes and standards for onshore process piping, ASME B31.3 and will be manufactured in accordance with API Spec 5L and PSL2. The line pipe material, wall thickness, and grade are determined based on the internal pressure, external loads, corrosion allowance and areas where increased safety is required, such as crossings. The following parameters will be considered:

- The wall thickness/grade combination in accordance with ASME B31.4.
- Design Pressure/Maximum Working Pressure and Test pressure.

- Pipe manufacturing process.
- Materials selection
- Field Welding
- Corrosion allowance.
- External coating and corrosion protection

The line pipe material will initially be assumed to be carbon steel (CS), which is the industry standard for this type of facility.

7.2.4 Pipe Wall Thickness

The pipe wall thickness shall be determined by following ASME B31.4. Preliminary calculations performed. The tolerance for wall thickness should meet criteria provided under Table 9 of API specification 5L. Corrosion allowance shall be factored in.

7.2.5 Pipeline Cover

It is envisaged that most the pipeline will be above ground. However, should the pipeline need to be buried, the depth of cover will be in accordance with ASME B31.4 (Minimum cover of 1.1m) and depend on the encountered soil characteristic. The depth of cover shall be increased at road and service crossings as required to ensure the minimum clearances in accordance with the design code(s) and third-party requirements if any.

In areas where there is an increased risk of damage or interference by third parties, additional protective measures shall be considered including increased wall thickness, concrete protection and pipeline marker tiles or tape.

7.3 Alternative to Site

Currently, the proposed site houses a single dwelling residential unit and it is un-utilized. The site is right next to the busy Jogoo road which currently is currently used by a lot of motorists. According the feasibility studies by the proponent, a Depot is well suited in comparison to other land uses. The proponent has acquired the site and starting to look for an alternative land may take quite some of which there is no guarantee that it will be acquired.

The proposed oil storage depot site is the larger Nairobi Industrial area, an area that is currently un-utilized and specifically zoned industrial purposes. According the feasibility studies by the proponent, a Depot is well suited in comparison to other land uses. The proponent has acquired the site and starting to look for an alternative land may take quite some of which there is no guarantee that it will be acquired.

The terrain of the proposed project site is generally flat. The site has no human settlement in the neighborhood. The project site is not located close to any environmental sensitive areas whatsoever. The proposed project site is in a mixed development urban zone.

7.4 Alternative Land Use Activities

Under special issue of the Kenya Gazette Supplement Issue no. 8, of 4th Feb., 2011, the entire area is falls under the Protected Areas Order of 2011, referred to as Depots (as appended herein). The proposed depot is therefore compatible with the zoning laws and regulations as well as the neighboring similar facilities and land uses.

On the front and back of the project site is the Old Metre Gauge railway line. On the right side of the project site are the Rubis Energy Kenya Limited depot and the Kenya Pipeline Company depot. Within this area are similar Fuel Terminals/Oil Depots for Total Energy Kenya Limited, MAKADARA OIL TERMINAL LIMITED and National Oil depots among others. For uniformity and conformity, the proponent is interested in the construction of the proposed Depot.

7.5 Solid Waste Management Alternatives

Throughout construction works, the project will produce wastes such as soil, concrete, wood chips, metal scraps and paper wrappings among others. The proponent will observe the EMCA (Waste Management Regulations, 2006). Receptors/litterbins will be placed at strategic positions in the Depot for temporary storage of general solid wastes before collection for sound disposal.

7.6 Waste Water Management Alternatives

Waste water from the premises will come from the toilets and surface runoffs. Viable alternatives to handle these wastes is to connection to the existing sewer system running next to the facility along Jogoo road.

7.6.1 Use of Oil Interceptor

The proponent has designed the Depot's drainage system as guided by the topographical survey so that all surface run-off mixed with oil and grease shall easily drain in to the oil interceptor which will trap sediments and grease/ oils in the Depot premises while clean and non-contaminated run off shall drain into the open drain within the facility.

7.7 Zero or No Project Alternative

The No Project Option is the least preferred from the socio-economic and partly environmental perspective since if the project is not done:

- The economic benefits especially during construction, i.e. provision of jobs for skilled and non-skilled workers will not be realized.
- There will be no generation of income by the developer/proponent to the County and National Government.
- The social-economic status of Kenyans and local Makadara community would remain unchanged.
- The local skills would remain under-utilized.
- No employment opportunities will be created for Kenyans who will work in the service station.
- Discouragement for investors to produce this level of standard and affordable developments.

If the project is stopped then the trickle-down effect of financial resources will not be felt in this area. In this respect, the "No project alternative" is not deemed appropriate.

CHAPTER EIGHT: STAKEHOLDER CONSULTATION AND PUBLIC PARTICIPATION

8.1 Introduction

Public participation and community consultation has been taken up as an integral part of social and environmental assessment process. Public participation has been viewed as a continuous two-way process, involving promotion of public understanding of the processes and mechanisms through which developmental problems and needs are investigated and solved. Consultation was used as a tool to inform and educate stakeholders about the proposed action both before and after the development decisions were made. It assisted in identification of the problems associated with the project as well as the needs of the population likely to be impacted.

The Consultation and Public Participation Process is a policy requirement by the Government of Kenya and a mandatory procedure as stipulated by EMCA 1999 section 58, on ESIA for the purpose of achieving the fundamental principles of sustainable development. Public consultation was carried out in this Project with the objectives of minimizing probable adverse impacts, and to achieve speedy implementation of the project by creating awareness amongst the community on the benefits of the project.

The purpose of the public consultation includes the following:

- To ascertain the public views on various environmental issues related to the proposed development.
- To encourage and provide for people's participation in project development.
- To obtain new insight and site specific information, and to appropriating possible mitigation measures based on local knowledge of the communities
- To facilitate and open and inclusive approach to consultation that provided timely and transparent information to the stakeholders;
- To provide an opportunity for stakeholders to provide feedback on the project raise their concerns;
- To aid project planning and development of mitigation measures and monitoring plans to address issues raised.

8.2 Stakeholder Engagement Plan

8.2.1 Objectives of the Stakeholder Engagement Plan (SEP)

The SEP seeks to define an environmentally, technically and culturally appropriate approach to stakeholder consultation and public participation process. The goal of this SEP is to improve and facilitate decision making and create a platform for communication that actively involves, and fosters in a timely manner, a common understanding between all project stakeholders and project affected persons/neighbors.

The SEP ensures that all groups of affected persons are provided sufficient opportunities to voice their opinions and concerns in regard to the proposed project, which will importantly help the Authority with decision making on the sound development of the proposed project. The key objectives of the SEP can be summarized as follows:

a. Understand the stakeholder engagement requirements,
b. Identify key stakeholders that are affected by the development project,
c. Identify the most effective methods and structures through which to disseminate project information (potential environmental impacts and proposed mitigation measures) to ensure regular, accessible, transparent and appropriate consultations and public participation,
d. Develop a stakeholders' engagement and public participation process that provides stakeholders with an opportunity to positively influence project planning and design,
e. Establish formal grievance/resolution mechanisms,
f. Define roles and responsibilities for the implementation of the SEP, and
g. Define reporting and monitoring measures to ensure the effectiveness of the SEP and periodical reviews of the SEP based on ESIA study findings:

Key elements for a successful stakeholder engagement and consultations include the following:

- Proponent to ensure adequate engagement with affected communities throughout the project cycles by disseminating and disclosing relevant environmental and social information,
- Take account of the outcome of the engagement process with affected communities in the identification of risks and impact associated with the project,
- Provide affected communities with access to relevant information on:
    - ✓ The purpose, nature, and scale of the proposed project,

- ✓ The duration of the proposed project activities,
- ✓ Any risks to and potential impacts on such communities and relevant mitigation measures,
- ✓ The envisaged stakeholder engagement process, and
- ✓ The grievance mechanism.

- Undertake a process of consultation in a way that provides the affected communities with opportunities to express their views on project risks, impacts and mitigation measures, and allows the client to consider and respond to them, and
- Particular attention is to be paid to vulnerable individuals and communities in designing and implementing consultations.

8.3 Stakeholder Analysis and Identification

Stakeholder analysis determines the likely relationship between stakeholders and the proposed project and helps to identify the appropriate consultation methods for each stakeholder group during the various project phases. To this purpose, a process for identifying the environmental and social risks and impact of the proposed project will be established, along with identification of affected persons and the proposed mitigation measures.

The stakeholder analysis will be carried out to identify:

- Who will be adversely affected by the impacts of the proposed project
- Who are the most vulnerable among the potentially impacted persons and where special engagement efforts are necessary,
- At which stage of the Proposed Project development will stakeholders be most affected (e.g. planning, construction, operations, decommissioning or both?),
- Which stakeholders might help to enhance the proposed project design,
- Which stakeholders can best assist with the early scoping of issues and impacts,
- Who strongly supports or opposes the changes that the project will bring and why, and
- Who is critical to engage with first, and why?

Table 34: Stakeholders Analysis and Categorization

No.	Community Category	Actual Community
1	Landowners whose property is impacted by the proposed project	Immediate neighbors/facilities & businesses within project site including; Kenya Railway Station, Rubis Energy Kenya Ltd, Kenya Pipeline Co., Total Energies Kenya Ltd, Vivo Energy Kenya Ltd depots
2	Local Media	They include; • 2 Local Nation-wide Newspaper/ Dailies • One Local Nation-wide Radio station • The Kenya Gazette Important for carrying the media adverts informing the public of the proposed development project
3	National & County Government Administrative Authorities	National Gov't: Interior Ministry ✓ County Comm., Nairobi Office (Deputy County Comm./Asst. County Comm.) ✓ Local Administration ▪ Area Chief, ▪ Makadara Police Station County Government of Nairobi Ministries • National Environment Management Authority (NEMA) • Ministry of Environment • Kenya Forest Service (KFS) • Water Resource Authority (WRMA)
4	Infrastructural Sector Government Agencies	They include • Kenya Urban Roads Authority (KURA) • Energy & Petroleum Regulatory Authority (EPRA) • National Construction Authority (NCA)
5	Local Political Class	Area Member of Parliament & County Assembly (MP/MCA)
6	Community Based Organizations (CBOs)	Churches, mosques
7	Business Groups	Trucks, Matatus, Boda-boda Associations around the project area
8	Residence Associations	This an industrial area with limited residential facilities. Unlikely to have resident association

8.4 Stakeholder and Public Consultation Process

This process consists of a voluntary process of prior engagement with immediate locals, neighbors and relevant National and County Government and the general public/citizens of local communities directly affected by the proposed development project works. This process involves the open sharing of the proposed development with the said stakeholder to get their opinions and the search for a shared solution of potential impacts/mitigation measures regarding the new development.

In the context of the Proposed Project, stakeholder and public consultation is an important step that will be completed and improved throughout the Proposed Project cycle, in particular during the preparation of the ESIA report and any other potential mitigation measures and instruments. The main objective of the consultation process is to inform stakeholders about the Proposed Project and its impacts (positive and negative) and to enable them to articulate their different points of views, concerns and values. This process will ensure greater transparency and accountability that will greatly help the licensing authority in decision making.

In that regard, the proponent through EIA/EA Lead Expert shall organize for (3) three public consultation and participation meetings to gather the views of the various stakeholders and the general public in a way that is technically, socially and economically feasible. In attendance are the above listed stakeholders and neighbors (**Table 3**).

The CPP meetings shall be organized by the proponent, and chaired by the County Commissioner (or a representative appointed by the County Commissioner) in conjunction with National Environment Management Authority (NEMA) officials.

Table 35: Consultations throughout Project Cycle

Project Cycle	Method of Consultations	Expected Outcomes
Project preparation	Public consultations meeting One on One interviews Small group meetings	• Awareness about project objectives raised among stakeholders. • Project affected persons (PAPs) informed about project adverse impacts, mitigation measures and their entitlements. • Awareness about project impacts raised among stakeholders, and consensus reached, about project benefits. • Public awareness raised, and project benefits understood. • Stakeholder/neighbors informed, and support the project • Grievance redress mechanism prepared in consensus, and timely. • Safeguards instruments (Environmental and Social Impact Assessment [ESIA]) study report prepared & submitted to NEMA for licensing
Project Implementation	Public consultations Small group meetings	• Safeguards instruments implemented in consensus. • Grievances resolved amicably • Social risks reduced
Project Completion	Inauguration ceremony	• Clients from the private sector, the public sector informed about the benefits of the project. • Proponent paying its bills timely. • Safeguards instruments implemented successfully.

CHAPTER NINE: ENVIRONMENTAL MONITORING AND MANAGEMENT PLAN (EMMP)

9.1 Significance of Environmental Management Plan of Key Issues

The EMP involves the protection, conservation and sustainable use of the various elements or components of the environment. The EMP for the proposed project provides all the details of project activities, impacts, mitigation measures, time schedules, costs, responsibilities and commitments proposed to minimize environmental impacts. The main activities include monitoring and evaluation and environmental audits during implementation and decommissioning phases of the project.

9.2 Introduction to EMP & Key Issues

Some of the potential impacts of the proposed Oil Storage Depot development project include but not limited to;

- Air, Soil/Water and Noise pollution,
- Pressure on social amenities; water, electricity, drainage,
- Chances of incidences and accidents may occur which might result in injuries of the public, construction workers, Depot employees, and motorists,
- Generation of construction waste,
- A greater fire risk because of the highly combustible products handled, and
- Traffic impacts.

Table 36: Proposed EMMP for Construction and Operation Phases

CONSTRUCTION PHASE				
Impact	**Mitigation Measure**	**Responsibility**	**Indicator**	**Cost**
Noise Pollution	• Complying with the EMCA noise regulation Legal Notice 61 including: ✓ Observe normal working hours during noisy construction works (00800 to 1700) hours ✓ Ensure that all machines are switched off when not in use ✓ Workers to wear ear muffs if working in noisy section.	Contractor; Management	Amount of noise generated (dB)	Within Project Cost
Construction Waste	• Following EMCA regulations on Waste Management, Legal Notice 121 including: ✓ Using waste minimization techniques such as buying required quantities in bulk. ✓ Making available suitable facilities for the collection, segregation and safe disposal of the wastes. ✓ Excavated waste should be re-used or backfilled.	Contractor; Management	Amount of waste on site	Within Project Cost
Air/Dust Pollution	• Ensure strict enforcement of on-site speed limit regulations • Sprinkle water on graded access routes whenever necessary to reduce dust generation by construction vehicles • Enclosing the structures under construction with dust proof nets.	Contractor; Management	Amount of gaseous emissions Amount of particulate emission	Within Project Cost
Drainage and Storm water	• The drainage system should ensure that surface flow is drained suitably into the public drains provided to control flooding within the site. • Drainage channels should be installed in all areas that generate or receive surface water such as car parking, driveways and along the building block-edges of the roofs. • The channels should be covered with gratings or other suitable and approved materials to prevent occurrence of	Throughout project period	Presence of drainage channels Percentage of paved area	Within Project Cost

	accidents and entry dirt that would compromise flow of run-off. • The drainage channels should ensure the safe final disposal of run-off /surface water and should be self-cleaning which means it should have a suitable gradient. • Provide water storage tanks to collect storm water for cleaning uses. • Implementation of roof water harvesting			
Increased Traffic	• Develop a Traffic Management Plan and strictly adhere to the its recommendations • Placing signs around the site notifying indicating construction works • Ensuring all drivers for the project comply to speed regulations. • Making sure the construction doesn't occupy the road reserves and complying with traffic and land demarcation obligations.	Contractor; Management	Availability of signage Number complaints recorded per month Number of incidences and accidents recorded per month	Within Project Cost
Insecurity	• Ensure the general safety and security at all times by providing day and night security guards • Adequately lighting within and around the at night premises.	Proponent Contractor	Availability of security personnel Theft cases reported	Within Project Cost
Occupational Health and Safety Risks	• Provide all workers with the necessary protective gears • Ensure all workers are in protective gears all the time when on site • Place fire extinguishers in strategic areas within the deport • Designate and mark smoking areas • Fire escape routes to be shown clearly • Provide enough first aid kits within the project site • Train workers in administering first aid • Placing visible and readable signs to control the movement of vehicles and notify motorists and pedestrians around the, and workers in the site.	Proponent Contractor NEMA County Government of Nairobi County Public Health Officer	Number of incidents/ accidents per monthly Availability of PPEs Number of fire drills conducted Visibility and clarity of signage and alerts	Within Project Cost

Increased Pressure on Utilities	• Employing water conservation techniques to prevent wastage. • Employing power saving techniques such as switching off equipment when not in use, using natural light whenever possible. • Using machines with power saving technologies. • Providing proper sanitary facilities for construction workers. • Inspecting the drainage facilities regularly to ensure they are free of debris	Proponent Contractor County Government of Nairobi KPLC	Amount of water consumed per day Amount of electricity consumed per day Amount of fuel consumed per day Number of drainage blockages per month	Within Project Cost
Vegetation loss	• Designate access pedestrian routes and parking zones that are cabro paved • Provide signs marked do not Walk/Park on grass • Landscape the depot after construction activities	Proponent; Contractor	Warning signs on site Landscaped lawns	Within Project Cost
OPERATION PHASE				
Risk of Fire outbreak and Explosion	• Strategic and Isolated location of LPG cages at the depot • All LPG cylinders undergo a rigorous safety and verification check before distribution to the stations. LPG Cylinders are stored in an open secure LPG cage to avert accumulation of potential & accidental leaks • Strategic location of Fire Fighting equipment at the depot • Provision of functional firefighting equipment at the depot Compliance to county council requirements on firefighting: use of periodic maintenance firefighting appliances, conducting an annual fire safety audit and display of a fire clearance certificate at site. • Conducting regular emergency drills to include but not limited to fire fighting and response. • Maintaining an Electrical maintenance Plan • Marking and checking to ensure all fire escape routes are available and clear at all times. • Having a marked Fire Assembly Pint at the depot	Number of fire drills carried. Proof of inspection on firefighting equipment. Fire Signs put up in strategic places. Availability of fire-fighting equipment		Within Project Cost
Aboveground	• Use properly maintained hoses and fittings	Proponent; Management	Monitoring Fuel and Oil spills	Within Project Cost

Fuel storage and Handling	• Make the cement screeds in all the chambers using water proof material. • Install a monitoring well next to the tanks to check on leaks • Use water finding dipstick and/or a hydrometer to check on density/specific gravity • Ensuring no spills during refilling and /or when offloading the fuel		Monitoring well	
Run-off and waste water disposal	• Waste water should empty to the oil interceptor and septic tank via well laid sewage pipes • Install spill control kit next to the interceptor during skimming • Conduct inspections for sewer pipe blockages or damages and fix them • Empty septic tank whenever its full by a licensed exhauster services	Proponent; Management	Presence of Oil interceptor Presence of Oil spills Effluent presence on open drains	Within Project Cost
Increased Pressure on Utilities (water, electricity, drainage)	• Employing water conservation techniques to prevent wastage. • Providing proper sanitary facilities for construction workers. • Using machines with power saving technologies. • Employing power saving techniques such as switching off equipment when not in use, using natural light whenever possible. • Inspecting the drainage facilities regularly to ensure they are free of debris	Proponent Contractor County Government of Nairobi KPLC	Amount of water consumed per day Amount of electricity consumed per day Amount of fuel consumed per day Number of drainage blockages per month	Within Project Cost
Solid wastes generation	• Waste should be properly segregated and separated & Provide litter bins • Ensure regular waste collection • Making available suitable facilities for the collection, segregation and safe disposal of the wastes. • Assessing and creating opportunities for Regulation, Reducing, Reusing, Recycling, and Recovering. • Ensuring bins are protected from rain and animals.	Proponent Management County Government of Nairobi NEMA County Public Health Officer	Amount and type of waste generated per day	Within Project Cost

Occupational Health and Safety	• Provision of PPEs to all and replacing the PPEs on wear and tear. • Placing readable signs alerting people of flammable hazardous petroleum materials. • Servicing equipment and machine to ensure efficiency. • Providing fire-fighting equipment and maintaining them to ensure they are fully functional. • Delineating fire and emergency assembly points and creating awareness to ensure all people at site are aware of them, e.g. through the use map. • Putting in place and ERP and ensuring all people in the project are aware of it and the procedures to follow commensurate to the level of emergency. • Providing adequate storage for hazardous and flammable substances and controlling access to them. • Monitoring the movement, handling and management of wastes to ensure they safely managed and don't present any EHS risks. • Performing emergency drills on a frequent basis, setting benchmarks for response and evaluating performance to ensure continuous improvement of response and preparedness. • Proponent to train employees on personal safety and how to handle equipment and machines • Record and report any accident/incidence, treat and compensate affected workers • Employees to ensure washrooms are clean	Throughout project Period	Number of incidents/ accidents per monthly Number of drills per year Effectiveness of drills Visibility and clarity of signs and alerts Efficiency of equipment such as fire-fighting equipment Level of awareness of workers Number of assembly points Separate washrooms (Gents & Ladies) Copies of Annual Audit Reports	Within Project Cost
Insecurity	• Maintaining a perimeter wall and have a barrier which is manned all the time. • Maintaining security alarms • Partnership with the neighbors and police in community policing. • Control of secondary businesses. • Round the clock security for the facility.	Proponent; Management	Number of businesses around the site. Level of crime in the area	Within Project Cost

	• Adequate lighting and an alarm system installed at strategic points.			
Washrooms	• Provide sufficient and suitable sanitary conveniences the washrooms should be kept clean, in good working and usable conditions • Provide a water tank for the washrooms incase the piped water supply is not available	Proponent; Management	Separate washrooms (Gents & Ladies)	Within Project Cost

9.3 Traffic Management Plan (TMP)

9.3.1 Scope of the Traffic Management Plan

The scope of the TMP includes an overview of the depot construction works, and nature of the traffic environment along Jogoo road.

9.3.2 Objectives of the Traffic Management Plan

The objectives of the Traffic Management Plan are;

i. To provide safe environment to all road users, and vehicles at the depot site
ii. To ensure controlled movement of traffic, pedestrians, and all road users at the station site,
iii. To protect all personnel, vehicles, visitors, and the general public from traffic hazards that may rise as a result of the station operations
iv. To minimize the disruption, congestion, and delays to all road users along Jogoo road
v. To ensure appropriate and sufficient warning and information signs and guidance are provided at depot and along Jogoo road
vi. To ensure that the needs of road users, motorists, pedestrians, cyclists, and all public transport passsengers are accommodated at the depot,
vii. To avoid build-up of traffic along Jogoo road

Table 37: Traffic Management Plan

Impacts	Mitigation Measures	Responsibility	Cost
Objective: To minimize impacts of increased traffic into/out of the site and on Jogoo road			
Increased Traffic	**Site Entrance** • Maintain the existing entrance/exits for delivery of construction materials/removal of debri and soil from the site. • The entrance to be controlled by a security personnel/gateman always. • During the hours of depot construction works, • Vehicle access onto site will be controlled via a manual barrier. • NO vehicles parking next to construction site along Jogoo road. • All drivers to register upon entering and leaving the site. • Drivers will instructed on the correct access into the site. **Site Exit** • Gateman shall always direct all drivers leaving the site. • The site exit/entrance shall be closed always when the site is not in operation.	Proponent, & Contractor	Within Project Cost
Increased Debri and Soil	**Removal of Debri and Soil for disposal** • Vehicles removing debri and soil and transporting from site for sound disposal shall be restricted to off peak hours. • If need be, removing debri and soil and transporting from site for sound disposal might be carried out at night in consultation with NEMA and the County. **Construction Material Deliveries** • Vehicles delivering construction materials to the site shall be restricted to night time and or night time	Contractor, NEMA and Nairobi County Government	Within Project Cost

Impacts	Mitigation Measures	Responsibility	Cost
Increase dust	**Dust Control** • Regularly sweep the entrance/exit to prevent a build-up of dust and debris, • Observe traffic speed on site to prevent the generation of dust, • Ensure water is sprinkled always to keep down dust • Ensure all construction materials are covered at the site • Ensure that the site is properly fenced and demarcated to contain dust	Proponent, & Contractor	Within Project Cost
Objective: To minimize impacts of accidents and incidents			
Increased accidents and incidents	**Personal Protective Equipment (PPE)** • It is a site requirement that all operatives and visitors accessing the construction site wear high visibility clothing at all times. • Appropriate signage will be displayed within the depot site and at the site entrance.	Proponent, & Contractor	Within Project Cost
Objective: To minimize impacts of vehicle/pedestrian movement at the site			
Vehicle and Pedestrian Movement	**Control of Vehicles** • Identify type/number of vehicle they anticipate to use during their works. • Enforce a site speed limit not exceeding 10 km/h at all times. • All construction equipment to be sound and operated by qualified personnel • Construction equipment to be switched off when not in use • The site to operate a one-way traffic system • Where turning point is not practical, someone should assist the when reversing. **Vehicle Movement**	Proponent, & Contractor	Within Project Cost

	For efficient vehicle movement at the site, the contractor shall ensure that; • All site roads shall be wide enough to enable vehicles to pass. • Suitable signage is provided to guide construction works, and vehicles. • Provide signage to indicate direction of traffic flow. • Vehicles requiring to park on site will do so in a designated parking area • Enforce a site speed limit not exceeding 10 k/h at all times. **Pedestrian Traffic** • Only access the site via the designated entrance • All pedestrians to pass through gateman to access the site. • All construction workers to sign to register to access and leave the site. • All operatives to adhere to the site signs and safety/instruction signs. **Parking** • No parking will be allowed on the operational area of the site. • Vehicles may park temporarily on site to unload stores/tools. Visitor parking shall be provided in front of the site offices.		
Objective: To minimize impacts of poor visibility			
Poor visibility	**Site Lighting** • There shall be lighting the depot site at night so as to; • Ensure safety of the site and construction workers and equipment at night • Boost visibility ensuring smooth working at night.	Proponent, & Contractor	Within Project Cost

9.4 Decommissioning Phase

Decommissioning is an important phase in the project cycle and comes last to wind up the operational activities of a particular project. Decommissioning phase will involve; notification of intent to all relevant agencies and liaising with the project engineers, architects and environmentalists in a bid to ascertain guidelines on possible impacts and mitigation measures.

It refers to the final disposal of the project and associated materials at the expiry of the project lifespan. If such a stage is reached, the proponent needs to remove all materials resulting from the demolition/decommissioning from the site. The following should be undertaken to restore the environment.

- Remove all underground and aboveground facilities from the site
- To landscape the site by flattening mounds of soil
- Planting indigenous tree, flowers and grass
- Removing all the equipment from site
- Fencing and signposting unsafe areas until natural stabilization occurs
- Backfilling all openings if practical

Table 38: Proposed EMMP for Decommissioning Phase

DECOMMISSIONING PHASE				
Impact	**Mitigation Measure**	**Responsibility**	**Indicator**	**Cost**
Fuel Tanks	• Ensure there is no spillage during emptying and removing of the underground tanks • Any fuels removed from the tanks, surrounding soil that maybe contaminated must be disposed into licensed dumpsites.	Contractor	Fuel spills Empty and disused tanks on site	**200,000**
Demolition waste	• Demolition debris should be collected by a licensed private contracted waste collection company • Demolition waste should be re-used or backfilled. • Identifying all sources of wastes, and ensuring wastes are handled by licensed personnel • Making available suitable facilities for the collection, segregation and safe disposal of the wastes.	Proponent; Contractor	Amount of waste on site Presence of well Maintained receptacles and central collection point	**450,000**
Disturbed environment	• Undertake a complete environmental rehabilitation program • Landscaping and introducing appropriate local vegetation	Proponent; Contractor	A rehabilitated site	**550,000**
Noise & Air pollution	• Maintain decommissioning equipment • Demolition works to be carried out only during normal working time (00800 to 1700) hours. • Workers working in noisy section to wear ear muffs • Workers should be provided with dust masks • Sprinkling dusty areas • Install dust trappers around the site • Ensure strict enforcement of on-site speed limit regulations	Proponent; Contractor	Amount of noise generated (dB) Amount of gaseous emissions Amount of particulate emission	**150,000**

Loss of income	• The safety of the workers should surpass all other objectives in the decommissioning project. • Adapt a project –completion policy; identifying key issues to be considered. • Compensate and suitably recommend the workers to help in seeking opportunities elsewhere.	Proponent	Proponent	1,330,000
Occupational Health and Safety Risks	• Provide all workers with the necessary PPEs • Ensure all workers are in protective gears all the time when on site • Place fire extinguishers in strategic areas within the deport • Designate and mark smoking areas • Provide enough first aid kits within the project site • Train workers in administering first aid • Ensuring all potential hazards such as movable machine parts are labelled. • Placing visible and readable signs around where there are risks. • Ensuring there is security in and around the site to control the movement of people. • Providing safe and secure storage for equipment and materials in the site. • Placing visible and readable signs to control the movement of vehicles and notify motorists and pedestrians around the, and workers in the site.	Proponent Contractor	Number of incidents/ accidents per monthly Availability of PPEs Visibility and clarity of signage and alerts Presence of First Aid Kits and fire-fighting equipment Level of awareness of workers	450,000
Working heights	• Use construction site barrier tape to isolate the site to guard site visitors from accidents and injuries; • Implement a fall protection program that includes training in climbing techniques and use of fall protection measures, • Provide Harnesses;	MOTL Site Restoration Contractor	Availability of appropriate Safety Gear/Records Proper use of PPE	200,000

	• Use of helmets and other protective devices i to mitigate against injury, Provide first aid facilities at the site			
Site area rehabilitation and restoration	• Remove all demolished waste material; • Repair and restore project area site • Evaluate site contamination • Plant trees and other appropriate vegetation.	MOTL Site Restoration Contractor	Site Pollution Report Well restored site	1,000,000
G. TOTAL				**3,330,000.00**

CHAPTER TEN: HEALTH, SAFETY AND ENVIRONMENT MANAGEMENT PLAN

10.1 Introduction

This HSE Management Plan outlines how the proposed project will manage its HSE risks commensurate to the significance and magnitude of these risks. The purpose of this management plan is not only to ensure that the project complies with the relevant HSE legislation and guidelines but also that it avoids (where possible), reduces or minimizes its risks. Together with the actions proposed in the Environmental Management Plan of this study report this management plan will synergistically enable the project to set environmental performance objectives, goals and targets and achieve them. This HSE Management Plan (HSEMP) is guided by both national HSE/OSH legislation and GIIP, which should always be made available in the project, these include:

10.2 National Legislation

- EMCA of 1999 revised 2015, and its subsidiary legislations
- OSHA of 2007
- The Public Health Act of 2005
- The Physical Planning Act, Cap 286
- The Energy Act of 2005
- The Kenya Water Act of 2016

10.3 Good international Industry Practice (GIIP)

- The World Bank General EHS Guidelines, April 30,2007
- The IFC Performance Standards of Environmental and Social Sustainability of 2012: Performance Standards 1, 2, 3, 4 & 6.
- The WHO Guidelines on indoor and outdoor Air Pollution

10.4 Health & Safety EMP Scope

This HSEMP covers all aspects that the project proponent has an influence over and all activities in the project's area of influence. This area of influence includes:

- The project's main and ancillary activities in the project site;
- Any works financed as part of the project that will be carried outside the project's site;
- Any works carried out by third parties or employees of the project, and

- The areas where the project's direct impacts will be felt and will cause a HSE risk.

This area of influence delineates the proponent scope of liability as legally defined and the measures proposed will assign adequate management control over these aspects and activities in order to manage risks.

10.4.1 Health & Safety Purpose

The primary purpose of this HSEMP is to ensure the proponent has an established benchmark for HSE legislative compliance and to ensure the project is carried out safely environmentally and ergonomically. This can be broken down in the following objectives:

- To ensure the project is undertaken without any incidents or accidents to its primary employees.
- To ensure the project is undertaken without any incidents or accidents to its secondary employees and members of the public.
- To ensure adequate facilities are put in place to carry out the project's principal and ancillary activities.
- To ensure that all of the project's employees are adequately trained, aware of and committed to of all HSE procedures.
- To ensure adequate resources are assigned towards HSE management.
- To ensure that period monitoring of HSE performance is undertaken so as to improve this performance.
- To ensure the project's compliance to HSE legislation is continuously and continually evaluated.

The proponent should also develop a HSE policy creating an umbrella of guidance for all its HSE functions and practices. This policy should be converted into sectoral goals (water, energy, OSH etc.) using the above objectives and targets developed for HSE performance. The proponent's top management should lead the commitment to the policy and it should be made available to all employees, contractors, sub-contractors and members of the public. This policy should also be integrated into the project's human resource and labor policies, which would delineate what the proponent would be liable to and what contractual obligations the project would have on the second and third parties involved in its supply and value chain.

10.4.2 Health & Safety Management Framework

In order for the project to successfully carry out all HSE procedures and achieve the goals of this HSEMP adequate human resources will be required on the part of the client to take a leading role of HSE. As a preliminary dependent on the resources available, the leading HSE responsibilities may be integrated into the roles of either primary or secondary staff charged with site and employee management. However if adequate resources are available it is suggested that the proponent creates a responsibility for an overall HSE manager who will oversee and direct all HSE functions of the project.

Under the HSE manager's docket, the HSE manager or person charged with HSE management duties will be responsible for monitoring, evaluation, reporting and developing internal HSE guidelines in line with national legislation and GIIP. Additionally HSE should be integrated into the procurement and human resources policies of the project, and thus roles should be defined for contractors working on behalf of the proponent. Each contractor should have a role in their company for HSE management if their activities fall within the scope of this HSEMP. They will report to the overall HSE manager and assist in the achievement of the project's HSE goals.

On an administrative scale the effectiveness of the HSEMP will depend upon the collaboration of other key institutional players who are mandated with HSE responsibilities legally and on national and locals scales. These include state agencies and offices who are charged with HSE responsibilities and they should be involved early in the project when developing the final HSE Management Plan and during its implementation.

10.4.3 Training and Capacity Building in HSEM

To ensure that the project staff with a role to play in HSEM and the implementation of this HSEMP, the proponent should always ensure all staff are recruited with adequate skills and knowledge in HSE and the HSE aspects of their roles. This also includes making sure the staff are medically fit to carry out their roles as part of its HRM and HSE policies. In addition to this the proponent should integrate training and capacity building in HSEM in its staff and career development training program. This also includes the training suggested in the ESMP.

Training can be undertaken in several ways dependent on its objectives, the initial capacity of the audience, and the level of control the audience has over the project's HSE performance. Some

methods can include: Induction training, Supervisor and management training, On-the-job training, Specific hazard training, Work procedures and skills training, Emergency procedure training, and First aid training among other trainings. All training and its content should be documented to enable monitoring and evaluation, and they should also training and education on social wellbeing and employee welfare through raising awareness of the principles of equal opportunity as well as communicable diseases.

Additionally, the proponent should as part of its capacity building program, create awareness on HSE practices, risks and new developments. This can be done through several ways such as: circulars, white papers, notices on notice boards, email, text messages, social media, meetings, workshops. Similarly these should also be documented to enable monitoring and evaluation.

10.4.4 Monitoring, Evaluation and Reporting

All aspects of the HSEMP should be recorded as required by its guiding principles, legislation and GIIP. Records should be kept onsite and backed up in case of any eventualities that may damage them. A monitoring plan should be developed as part of the HSEMP through which its different aspects will be monitored and documented based on aspect specific frequencies. The monitoring and records will include: training, training content, incidents, accidents, complaints, internal and external communications, levels of emissions, MSDS etc.

In this regard, the proponent should also develop adequate and efficient communication channels and procedures for the project through which all HSE will be communicated. The records should allow for the HSEMS to be audited or its performance evaluated periodically so that it may be improved continuously through a Plan-Do-Check-Act (PDCA) framework. Additionally audits should be undertaken as required by legislation such EMCA of 1999 (Amended 2015) and OSHA of 2007 and reported to the relevant authorities.

Incident and accidents should also be reported both internally and externally as required by legislations. A reporting schedule should also be developed as part of the HSEMP, which will guide the required reporting procedures based on their frequencies and format. Reporting and documentation should also cover corrective actions taken to close out non-conformities.

10.4.5 HSE Risk Management Measures

Several risk management measures are proposed in this subsection through which the project will adopt safe and self-improving measures in line with national legislation and GIIP, as part of its HSEMP. However, it is proposed that risks are best avoided early in the design and planning phases of the project following the hierarchy as below:

10.4.5.1 Risk Register

During all phases of the project, the proponent and their third parties where applicable such as contractors, should develop a risk register of all HSE risks in the project. This identification of risks can be done through an aspects-impacts register or log, which links the project's aspects to impacts and ranks the level of risk by analyzing its probability and likely consequences. Importantly, the risk register should also take into perspective the level of public concern over the risks involved and identified, as a matter of good practice.

As a matter of policy and good practice the proponent should ensure third parties have adequate skills in risk management and systems are put in place to manage all risks. Linked to the risks register are the remedial actions which reduce or avoid the risk where possible. The proponent through either the HSE manager and/or engineers should always seek to avoid risks early enough through design and planning but this is not possible they should develop the requisite remedial actions or plans to legally acceptable standards (such as EMCA of 1999 and OSHA of 2007) and GIIP standards.

The information of the risk register and these remedial actions should be documented, readily available and regularly updated to ensure it stays relevant and actual. Some of the HSE risks from the project will come from the following aspects:

10.4.5.2 Construction Phase HSE Aspects

- Air emissions
- Water emissions
- Moving parts
- Heavy equipment and trucks
- Inflammable materials
- Hazardous/Poisonous chemicals and substances

- Storage areas
- Ladders
- Working at heights
- Electricity
- Open pits
- Heated surfaces, solids and fluids
- Wastes
- Raised materials and equipment, etc.

10.4.5.3 Operational Phase HSE Aspects

- Slippery floors
- Moving parts and barriers
- Storage areas
- Heated surfaces, solids and fluids
- Cold surfaces, solids and fluids
- Hazardous/Poisonous chemicals and substances
- Inflammable materials
- Electricity
- Wastes
- Air emissions
- Water emissions
- Vehicles and service trucks, etc.

10.4.5.4 Decommission Phase HSE Aspects

- Falling debris
- Air emissions
- Water emissions
- Heated surfaces, solids and fluids
- Hazardous/Poisonous chemicals and substances
- Moving vehicles and trucks
- Heavy equipment and materials, etc.

10.4.6 HSE Resources and Responsibilities

An important part of the HSEMP is to delineate all the resources required for its effective implementation so as to ensure it remains as cost effective as possible. This will be the duty of the HSE Manager and all the resources human and financial should be listed alongside the remedial actions employed against each of the project's risks. Financial records should be maintained to ensure the HSE remains accountable and basically makes business sense by showing the costs avoided by maintaining the system in terms of lives saved, man hours saved, health care etc.

Whereas the human resources responsible for undertaking all activities that carry or create risk should be kept in record and maintained. This will ensure the project has a documented, maintained and established method of managing HSE responsibilities. This will in addition keep all the staff undertaking these activities abreast with not only the policies in place but also with the risks involved with their activities and importantly know how to manage the risks and carry out their duties safely. This information will also be vital when undertaking audits and targeting training towards the staff and foster greater accountability in the staff in terms of monitoring and reporting since all duties will be known and documented.

10.4.6.1 Medical Program and Insurance

The proponent and his contractors should also ensure the medical program is maintained for the project's staff on induction, during the job and include rehabilitation where appropriate and commensurate to the risks that the staff will be exposed to. This program should include regular check-ups to ensure the project's staff are medically and mentally fit to undertake their duties. It should also form part of training through an ergonomic and social curricular that will also include facilitations for lifestyle improvement and raise knowledge on diseases such as HIV/AIDS, STIs and other infectious illnesses.

The proponent and his contractors should additionally ensure adequate facilities and services are in place which promote employee rest, relaxation and rejuvenation. This may include rest and recreational areas, provision of clean water, undertaking stress relieving activities such as games, counselling and peer chats among others.

Importantly and as legally required the proponent and his contractors should provide a medical/insurance cover for all staff. The cover should in the least be able cover for all injuries,

illnesses and incidents that may occur on the job and follow up with rehabilitation that at least returns the employee(s) to their initial state before the occurrence where possible. It should be noted that although the proponent may provide insurance, it should be mitigation based by firstly promoting the actions of the HSEMP which when followed all risks will well managed.

10.4.6.2 Emergency Preparedness and Response Plans

The proponent through an all-inclusive process should develop an EPRP as part of the HSEMP and through which the project will stay ahead of risks presented by both man-made and natural hazards that have the capacity to turn into disasters. The proponent and his contractors should do this by first identifying all hazards pertinent to the project and its site in line with the risks register but with specific difference being that these hazards will have greater potential of turning into a disaster.

This should also be done in line with national policies on disaster management such as the National Disaster Management Response Plan of 2009, and involve all key players in disaster management nationally. This stakeholder involvement will enable the EPRP to be cross sectoral and multidisciplinary and the proponent should lead the process.

10.4.7 Grievance Redress System

The proponent should also develop a GRS and make it accessible to all stakeholders internal and external. The GRS should always seek to address grievances through legally acceptable methods and as fast as possible whilst not preventing any complainants from seeking other legally acceptable methods to justice. Such a GRS should be made available to staff on recruitment and to members of the public either through government agencies/offices through grievance application forms, and internally by establishing procedures for investigation and quick redress that will be recorded and tracked.

The GRS should be monitored through indicators of its efficiency and effectiveness of solving the grievance and producing lessons learnt through which corrective actions can be undertaken to improve the project's HSEMP. Additionally, as part of monitoring and review all grievances should be reported to the relevant authorities and the corrective actions taken, to ensure the system is credible and transparent. The process should also be culturally appropriate, transparent and non-coercive.

CHAPTER ELEVEN: DEPOT MONITORING AND MANAGEMENT GUIDELINES

11.1 Introduction to Environmental Monitoring Systems

The management of the construction of the proposed Makadara Oil Terminal Storage Depot will introduce a monitory system for the various activities.

11.2 Depot Air Quality Management Plan

The objective of the AQMP is to manage and minimize the impact of air quality from depot activities and operations on the environment and neighboring facilities and establishments. The following actions will be undertaken to achieve this objective:

a. Detail the methods to be used to minimize air quality emissions;
b. Maintain an air quality monitoring program;
c. Define the mechanisms for community consultation;
d. Detail the management measures to be undertaken where the air quality levels are demonstrated to exceed the criterion;

11.2.1 Air Quality Mitigation and Control Procedures

a. Dust Control Procedures

Dust can be generated from two primary sources, either windblown dust from exposed areas or dust generated by depot construction activities like excavations. Below are some of the control procedures that can be implemented by the MOTL management/contractor.

b. Short Term Dust Episodic Events

Periods of high dust emissions usually relate to periods of high wind speeds, especially when the wind speed exceeds 5m/s. Short term episodic events generally result from:

- Wind gusts related to changes in the wind direction; and
- Periods of high wind speeds.

Table 39: Procedures to manage short term episodic events are shown

Scenario	Control Procedures
Wind speeds greater than 5m/s towards the project site' construction works	• Initial warning provided to MOTL contractor • MOTL contractor to confirm that all available water trucks and fixed spray systems are operational. • Depot construction/excavation works may be deferred, if safe to do so. • MOTL contractor to inspect operations to identify any operations that are generating dust emissions and identify further mitigation measures.
Wind speeds greater than 10m/s.	• All topsoil stripping and/or placement activities are to be reviewed for ongoing operation. • Depot construction/excavation works may be deferred, if safe to do so • Maximum availability of dust suppression equipment to be used. • MOTL contractor to inspect operations to identify any activities that are causing excessive dust emissions and stop these identified activities.

Table 40: Procedures to manage other forms of dust at the site

Impact	Source	Mitigation Measure
Dust	Areas disturbed by construction works	• Only excavate minimum site area when necessary • Dust suppression system such as fill dampening prior to and during excavation works • Low elevation stockpiles • Excavate and backfill small manageable lengths of trench • Consolidate and relocate surplus spoil before excavation commences on next pipeline section • Reduced disturbed areas to maintain at site • Vegetation/grass to be cleared only when necessary • Reshape, topsoil and rehabilitate site areas after excavation works
	Depot roads	• All roads and traffic areas will be watered using water carts to minimize the generation of dust. • Long term haul roads will be sheeted with hard wearing material where practicable • Access roads to be kept dampened by water • Access roads to be regularly inspected and cleaned • Load transport vehicles on sealed access roads where possible

c. Depot Site Inspection and Monitoring

As part of the daily monitoring the, the MOTL contractor shall be conducting visual inspections for dust resulting from construction works in the areas including, but not limited to:

- General depot construction
  - ✓ Excavation faces
  - ✓ Stockpiling locations
  - ✓ Internal and external roads
  - ✓ Stockpiling locations
- Depot infrastructure (Pipeline, Tanks, Buildings, etc)
  - ✓ Construction location
  - ✓ Excavation faces
  - ✓ Stockpiling locations
  - ✓ Internal and external roads

NOTE

Weekly summary/monthly report for dust will be prepared, comparing the performance of the site, assessment of results against the performance criteria.

d. Depot Incident Reporting

Incidents are defined as an occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a noncompliance. The consequences of such incidents may result in material environmental harm, damage or asset loss. All environmental incidents and near misses must be reported to the MOTL Management and the incidents may include:

- Non-compliance of the Dust monitoring criteria
- Complaints received from regulatory authorities, community or neighbors
- Moderate to extreme dust emission from Site

e. Depot Works Continuous Improvement

Areas for improvement identified during daily inspections will be addressed by the contractor at daily pre-start meetings with the appropriate construction supervisor and crew to prevent their ongoing occurrence.

The contractor may also form the basis for formal Toolbox Talks which will be conducted on a weekly basis. Addressing non-conformance and areas for improvement with the construction management is aimed at continuously improving the environmental performance of the depot construction project and driving environmental awareness on site.

11.3 Depot Waste Management Plan

11.3.1 Purpose and Scope of the Waste Management Plan

The purpose and scope of a waste management plan for a MOTL shall include:

- Protecting human health and the project site/area,
- Identifying waste management regulatory, staffing, and resource needed,
- Identifying the types and quantities of wastes that are likely to be generated from the site,
- Establishing waste management strategies for each waste type, including collection, segregation, staging, temporary storage, minimization, treatment, and disposal,
- Establishing community outreach and communications processes; and
- Establishing health and safety practices in support of waste management activities.

11.3.2 Anticipated Depot Waste/Material Types

The types of wastes and materials expected from depot spills may have unique and different physical and chemical properties of the products involved (e.g., light crude, heavy crude, refined oil, shale oil), how the oil is released (e.g., release from a truck, pipeline break), weather conditions, and environmental conditions.

Table 41: Anticipated Depot Waste/Materials Type

Waste Type	Waste Description
Oily Solids	Oil-contaminated material that may include debris, soil, sand, boom, and vegetation; weathered oil (e.g., tar balls); oily personal protective equipment (PPE); disposal equipment; sorbents
Non-Oily Solids	Non-oiled material that has been recovered from support operations of the cleanup activities, including office trash, non-oiled beach debris, general garbage, non-oiled vegetation
Oily Liquids	Oil and water mixtures or emulsions (e.g., from skimming or oil recovery operations)
Liquids	Primarily water that may have an oily sheen or contain minor amounts of free oil droplets (e.g., onshore decanted water, storm water, decontamination water, treated water)
Hazardous Waste	Non-exempt oil and gas production wastes that are listed hazardous wastes or exhibit hazardous waste characteristics
Laboratory Analysis Waste	Analytical sample wastes generated from the analyses of samples at fixed analytical laboratories
Raw sewage	Waste generated by the MOTL workers, employees and staff. Typically, this waste is collected in the existing Nairobi City Sewer-line system
Recyclable Materials	Plastic bottles, hard boom, aluminum cans, scrap metal, glass, cardboard, soft absorbent boom from the MOTL facility

11.3.3 Proposed Depot Waste Management Strategies

The MOTL management should pre-identify best waste management practices including, as applicable:

- Identifying potential impact sites before oil has reached the depot
- Segregating different types of wastes (liquid, solid, debris, personal protective equipment (PPE), hazardous, non-hazardous) wherever possible;
- Implementing procedures to prevent spills, rainwater infiltration, and runoff at waste management sites;
- Labeling all waste containers and identifying the location they came from;
- Cleaning and reusing recovery equipment whenever possible, rather than discarding after one use;

- Using reusable personal protective equipment wherever possible;
- Reducing secondary contamination from the spread of oil by people, transportation, or equipment;
- Placing oil-contaminated materials in closed-top, gallon drums, sealed plastic bags, or roll-off boxes for temporary storage, all segregated within lined secondary containment areas;
- Avoiding mixing any oil or oily wastes with non-oiled waste and avoiding mixing hazardous and non-hazardous wastes;
- Minimizing day-to-day non-hazardous waste generated as part of response activities; and
- Properly categorizing, segregating, listing and transporting wastes accumulated in temporary storage locations.

11.3.4 Depot Waste Management Facilities & Assets

The MOTL Depot oil spill management strategies provided the potential need for the following waste management facilities and equipment for efficient waste management and response:

- Waste staging and storage locations;
- Equipment staging and storage locations;
- Decontamination stations (for personnel, equipment, etc);
- Oil recovery and recycling facilities;
- Water recovery facilities;
- Solidification facilities;
- Wastewater treatment facilities;
- Hazardous and solid waste treatment facilities
- Waste transfer stations;
- Oil skimming devices;
- Oil tankers for collecting skimmed oil;
- Oil/water pumps, separators, tanks, and trucks;
- Personal protective equipment.

11.3.5 Depot Waste Transportation Considerations

For efficient Depot waste management activities, MOTL management will involve transportation of a various types of waste using different kinds of vehicles and containers. Transportation of waste

may be regulated by NEMA approved and licensed waste handlers. The transportation plan shall include the following considerations, as appropriate:

- Types of vehicles to be utilized, categorized by waste type,
- Required waste permits, and documentation (waste profiles, vehicle, waste type, and area of operation, etc.),
- Insurance requirements for waste transporting vehicles,
- Spill response plan for vehicles,
- Required vehicle inspections by NTSA; and
- Decontamination of transport vehicles at the end of the process.

11.3.6 Depot Waste/Material Tracking & Reporting

The MOT management shall ensure proper management of various forms wastes generated from the depot activities and operations and the protection of public health and the environment. The management shall thus establish tracking and documentation of waste management activities as guided and provided for by NEMA.

A waste and material management tracking and reporting system may include, as feasible:

- Reporting of waste sampling and analysis results by location;
- Uniform tracking of waste and materials, covering recovered product and liquid and solid wastes; Tracking the quantity and volume handled at each waste management location, including;
    - ✓ Where waste is temporarily (e.g., staging areas) or
    - ✓ Permanently (e.g., disposal site, recovery operation) located;
- Reporting on the status of waste management activities on a regular basis for each type of waste and material;
- Cost recovery of waste management activities.

CHAPTER ELEVEN: CONCLUSIONS AND RECOMMENDATIONS

The proposed construction of depot has been well designed as per the standards of the Physical Planning department and the relevant regulatory agencies. The proposed development project will have economic benefits such as provide a facility for storage, handling and provision of petroleum products, providing oil reserves that will avert petroleum products crisis in the country, generation of income to the proponent, creation of employment, making use of un-utilized plot and increasing revenue to the National and County Governments.

11.1 Conclusion

The recommendations for the prevention and mitigation of adverse impacts are as follows;

- It is important that informative signs (bill board) to be erected at the site. These should indicate the list of all Engineers, Contractor, details of the proposed project and all the Approval numbers. Operation hours and when works are likely to be started and completed to be indicated.
- All solid waste materials and debris resulting from excavation and construction activities must be disposed-off at approved dumpsites. The wastes should be properly segregated and separated to encourage recycling of some useful waste materials; i.e. some excavated stone materials can be used as backfills.
- All construction materials and especially sand, gravel, hardcore and wood must be sourced/procured from legalized dealers.
- Construction activities must be undertaken only during the day i.e. between 0800 hours to 1700 hours. This will minimize disturbance to the general public within the proximity of the site/project especially the nearby residents
- Proper and regular maintenance of construction machinery and equipment will reduce emission of hazardous fumes and noise resulting from friction of rubbing metal bodies.
- Heavy construction activities should be limited (or avoided) during the rainy season to minimize the chances of soil degradation (soil erosion).
- Maintenance activities must be carried out in service bay to reduce chances of oils or grease or other maintenance materials, from coming into contact with environment (water or soil).

- Workers should be provided with complete personal protective equipment (PPE) and safety gear. They should have working boots, complete overalls, helmets, gloves, earmuffs, nose masks, goggles etc. A fully equipped first aid kit must be provided within the site.
- The contractor must have workmen's compensation cover; the contractor is required to comply with workmen's compensation Act as well as other relevant ordinance, regulations and Union Agreement
- The contractor must provide adequate security during the construction period and especially during the night when there are no construction activities.
- The Proponent is advised to ensure the contractor does adhere to the architectural plans and proper backfilling and landscaping be done so as to rehabilitate the environment and improve its aesthetic value.

Further recommendations for the prevention and mitigation of adverse impacts are as identified by the study shall be mitigated as outlined in the EMP.

11.2 Recommendations

Finally, having gone through the ESIA Full Study process for the proposed project to its conclusion, we hereby recommend approval of this report and subsequently issuances of the EIA License to the proponent to enable him commence, construction and implementation of the project.

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APPENDCES

- Architectural Drawings & Design Layout
- Title Deed
- Questionnaires
- Copy of EIA practicing license