ENVIRONMENTAL IMPACT ASSESSMENT FULL STUDY REPORT FOR THE PROPOSED PETROL STATION ON LAND REGISTRATION NDALANI/NDALANI BLOCKS 1/1705.

SITE FOR THE PROPOSED PETROL STATION.

LOCATION: KITHIMANI OFF GARRISA ROAD.

PLOT NUMBER: Ndalani/Ndalani Block1/1705

PROPONENT: REUBEN MUTUKU MUNGUTI AND AGNES NDUNGE REUBEN MUTUKU

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This Environmental Impact Assessment (EIA) Project Report is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003

DECLARATION

Signed by:-

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On behalf of: -

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EXECUTIVE SUMMA RY.

Rural areas have in the past been left behind interms of development; this was majory attributed by the massive movement of able bodied people to the urban areas in search of jobs and the perceived 'good urban life". The government has reversed this trend through decentralization of development projects to the hitherto non-developed rural areas; this was by providing basic amenities meant to improve both the standards of living as well as creating the necessary platforms to set up business. This was through creation of County governments and creation of funds for developments such as CDF, Youth funds etc The subject project in this report is such which has been necessitated by the massive improvement of infrastructures and services to the rural areas; it is located in a very remote area between Kithimani market and Matuu market in the larger Machakos County. The construction of Garrissa highway road has opened up the interior areas thus need for transport services and the related facilities like petrol stations, garages, bus stops, access roads etc. the entire area has very few such a facility, The proponent of the project realized a ripe opportunity to construct a petrol service station in this remote area after realizing that the entire area had a an opportunity.

The report gives in detail the project background, its goal and objectives, scope, project justification and cost, baseline information, Policy- legal and institutional framework governing the exercise, identification of impacts and their respective mitigation measures, a clear description of the project's alternatives and a comprehensive environmental management plan to avert or minimize the anticipated impacts. The EIA Full Study project report has eight chapters in total.

CHAPTER 1: This chapter gives a brief background of the project, its goal and objectives, scope, terms of reference, and the methods used in conducting the study.

CHAPTER TWO: This chapter highlights a detailed description of the project design, implementation activities, project inputs which include approved designs and plans, raw materials to be used; the labor force to be used- both skilled and non-skilled, equipments and machines etc), the chapter also details the projects outputs which include the solid, liquid and gaseous waste to be generated in all phases of the project. This chapter also contains the project's cost breakdown.

CHAPTER THREE: Chapter three highlights the sites baseline information which includes spatial location, infrastructures to support the proposed development, current land use, soil and topography, drainage and water resources, flora and fauna, demographic characteristic, distribution and economic activities of the community around the project area and infrastructure establishment.

CHAPTER FOUR: This chapter gives the legal framework or rather the Acts and statutes governing the proposed development, some of the legal statutes which have been highlighted in this chapter include: - National Environmental Action Plan (NEAP), National Policy on Water, Energy Act, Resources Management and Development, Energy ACT, Petroleum Act, Water Act of 2002, Factories and other places of work Act of 1990, Physical Planning Act of 1996, way-leave Act among others.

CHAPTER FIVE: This chapter gives a detailed analysis of the highlighted impacts. It gives the anticipated impacts in all phases of the project which shall include pre-construction phase, implementation phase, operational phase and decommissioning phase. The environmental aspects considered in this chapter include Soil, Water, Air, Flora and Fauna, Biodiversity, Traffic congestion, Noise, Solid and liquid waste generated and community participation in the project.

CHAPTER SIX: This is the chapter that discusses the project alternatives which shall include an alternative site, technology involved and the scale and extent of the project.

CHAPTER SEVEN: Chapter seven clarifies the Environmental Mitigation measures and Environmental Management plan. It is a checklist of all the environmental aspects, anticipated impacts, mitigation measures to the said impacts and the cost implication of the mitigation measures as well as the responsible party.

CHAPTER EIGHT: This gives a detailed conclusion and recommendations to various aspects as discussed in the report. Lists of both reference materials and tables have been highlighted after this section.

ACKNOWLEDGMENT.

The EIA project report for the proposed project at Kithimani, Machakos County was prepared by James Kithinji in accordance with the provisions of Environment Management and Coordination Act (EMCA) of 1999. It provides baseline information on all environment aspects which would be affected by the implementation of the proposed project.

We acknowledge with appreciation, the valuable information provided for by the respondents of various questionnaires which were circulated at the site area i.e. Kithimani area; vital information provided for by various government authorities as well as the administrative authorities whose information immensely was used in the preparation of this EIA project report.

It is our sincere hope that the details highlighted on this report would aid in evaluation the suitability of the proposed project in the said area.

ACRONYMS.

ASL	Above Sea Level.
APS	Automatic Phase Selector.
CO2	Carbon Dioxide
EA	Environmental Audit
EIA	Environmental Impact Assessment.
EMCA	Environmental Management and Co-ordination Act
GoK	Government of Kenya.
MSV	Multi-Skilled site Visit.
NEAP	National Environmental Action Plan.
NEMA	National Environmental Management Authority
OHS	Occupation Health and Safety
PCC	Public Complaints Committee.
SERC	Standards and Enforcement Review Committee
UE	User equipments.
UFST	Underground Fuel Storage Tanks

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1.0 CHAPTER ONE.

1.1 INTRODUCTION: PROJECT BACKGROUND.

Rural areas have in the past been left behind interms of development; this was majory attributed by the massive movement of able bodied people to the urban areas in search of jobs and the perceived 'good urban life". The government has reversed this trend through decentralization of development projects to the hitherto non-developed rural areas; this was by providing basic amenities meant to improve both the standards of living as well as creating the necessary platforms to set up business. This was through creation of County governments and creation of funds for developments such as CDF, Youth funds etc The subject project in this report is such which has been necessitated by the massive improvement of infrastructures and services to the rural areas; it is located in a very remote area between Kithimani market and Matuu market in the larger Machakos County. The construction of Garrissa road has opened up the interior areas thus need for transport services and the related facilities like petrol stations, garages, bus stops, access roads etc. the entire area has few such a facility, indeed most of the petrol station services like servicing and repair of vehicles, purchase of bulk fuel etc.

The proponent of the project realized a ripe opportunity to construct a petrol service station in this remote area after realizing that the entire area has few such a facility.

This exercise is in line with the regulations stipulated in EMCA 1999, the subject project that forms the bases of this EIA Full Study project report is construction of petrol fuel station thus it will require an EIA Full Study report as form of compliance to the requirements of EMCA 1999.

1.2 PRINCIPAL OF ENVIRONMENTAL IMPACT ASSESSMENT.

The fundamental principle of the EIA is that every person is entitled to a clean environment and that every person has a duty to enhance and safeguard the environment. EIA is a planning tool which presents methodologies and techniques for identifying, predicting and evaluating potential environmental impacts of the projects, policies, plans and programmes in the project cycle (planning, implementation and decommissioning phases). EIA presents decision with the information necessary to determine whether or not a project should be implemented.

1.3 TERMS OF REFERENCE FOR THE EIA PROJECT REPORT.

The terms of reference for the preparation of an EIA Full Study Project Report are usually but not limited to: -

- A decisive look at objectives of the project.
- The proposed location of the project site.
- Description of the baseline information, national environmental legislative and regulatory framework, and any other relevant information related to the project.
- Assessment of the technology, procedures and processes to be used, in the implementation of the project.
- Assessment of materials to be used in the construction and implementation of the project and their sources.
- Evaluation and analysis of the anticipated potential environmental effects which are categorized into physical, ecological/biological and socio-economic aspects; this can be further classified as direct, indirect, cumulative, irreversible, short-term and long-term effects.
- Evaluation of the products, by-products and wastes to be generated by the project.

- To recommend a specific environmentally sound and affordable solid waste management system
- Evaluation and analysis of alternatives including the proposed project, project alternative, project site, design and technologies.
- An Environmental Management Plan (EMP), proposing the measures for eliminating/minimizing or mitigating adverse impacts on the environment. `
- Propose measures to prevent health and safety hazards and to ensure security in the working environment for the employees, residents and for the management in case of emergencies. This encompasses prevention and management of the foreseeable accidents and hazards during both the construction and occupational phases.
- Any other matters which may be required by NEMA.

This project report provides relevant information and environmental considerations on the project proponent's intention to seek approval from NEMA for the construction of the proposed project.

1.4 OBJECTIVES OF THE EIA PROJECT REPORT.

The overall objective of this Environmental Impact Assessment project report is to ensure that environmental concerns are integrated in all developmental activities of this particular project. It aims at identifying the potentially effects and risks of the proposed project, evaluating and suggesting mitigation measures for the significant negative impacts through a comprehensive Environmental Management Plan.

1.5 THE PROJECT SCOPE.

The extent of the project involves a comprehensive environmental assessment that generated environmental concerns in all phases of the project. This task involved: -

- Assessment of the potential Environmental Impacts of the project on the site and the surrounding areas.
- To identify the significance of these impacts.
- To propose the mitigation measures for the anticipated negative impacts to the environment.
- To generate baseline data for monitoring and evaluation of how well the mitigation measures are being implemented during the project cycle.
- To assess the importance of the impacts of alternative sites.
- To present information on the impacts of the alternative sites.
- A review of the environmental policy, legal and administrative framework.
- Social repercussions of the development within the locality and region.
- Development of an Environmental Management Plan with mechanisms for monitoring and evaluating the compliance and environmental performance.

1.6 METHOD AND CRITERION USED IN THE REPORT.

Several methods were employed to gather and compile data during the process of EIA project report making, these include: -

- Site visits to gather raw data on condition of the site and its surrounding.
- Use of self administered questionnaires.
- Secondary data collection: This involved study of various publications to gather data especially the legal guidelines governing this type of project.
- Analysis of activities to be carried out in the implementation process and their possible anticipated impacts.
- Experts view on the impacts of the project.

The process was also guided by the recommendations from various legally established bodies like the Machakos County Council, District Physical Planning office and various government ministries.

1.7 JUSTIFICATION.

Several factors were considered as valid reasons why the proposed development should be implemented on this particular site, this were either in form of demand for the services or the available infrastructural facilities to support this type of development or the little impact the project would have to the environment. Some of the validating factors considered include: -

I. **Demand for Petrol Station services: -**

The demand for petroleum and related services in this area is very high, this is because the motorised traffic between Kithimani and Matuu towns is high and there is few place to fuel or get motor services, the vehicle/motorbike operators in the area rely on vendors of this products who obtain them from few. With this facility in place, the motorists will have a shorter distance to obtain the products and services and secondly, the risk involved in ferrying the same will be highly reduced.

II. **Low risk to the locals:** The area with the site for the proposed petrol fuel station has very scarce population; this makes the project suitable for the area since there are very few people at risk from the activities of the project; in addition the land for the proposed project is so big thus there is enough space for all the proposed facilities.

III. **Accessibility.** The accessibility to the site is good; the site is located along the tarmac road connecting Garrissa highway between Kithimani market and Matuu market, the area is sparsely populated with very few people living on the farms, much of the population is concentrated on the two market centres.

IV. **Sewer System.** This area is not connected to any functional sewer line; there is a pit latrine on site which would be utilized by the site workers during the implementation phases, a septic tank

would be constructed which would be connected to the project once complete. This project does not pose any danger of human waste disposal to the environment. The project would be served by the proposed septic tank.

V. **Surface run -off.** Water from the roofs of the proposed development would be harvested into a collection tank; this would not only increase the water stock in this area where water is so scarce but also prevent any damage which may be caused by the roof waters. The compound would also be laid with gabral blocks to prevent any case of water stagnation or flooding. The grass to be planted within the compound would also enhance in absorbing run off which would otherwise cause damage to the roads.

VI. **Solid Waste Management.** Very little waste would be generated from the site during construction. The main solid waste will include the following:-

- Vegetation materials which will be cleared from the site. This will be very minimal since the site is not heavily inhibited by vegetation. The area to be occupied by the site is also very small thus the little vegetation cleared from it would not have any significant impact to the environment.
- Concrete materials and pieces of masonry blocks.
- Pieces of wood and metal bars.
- Material wrappings and un-used wooden boxes.

All waste generated during the implementation phase will be disposed off suitably into the approved dumpsites. A plan to handle all waste has been included in the Environmental Management Plan. (*Refer to the EMP Table*)

VII Energy supply. A source of energy would be required at both the implementation and operational phase of this project. The site area has hydro-power supply; this would be installed to the project once the construction work is fully done. Diesel energy would be utilized during the implementation phase; this would be mainly in the running of the poker vibrators, concrete mixture and compactors.

(VIII) Security. Security will be provided at all times (day and night) at all phases of the project; this would ensure the security of materials, operators and equipments on site. The site would also be fenced using a concrete perimeter wall as a measure of boosting security.

CHAPTER TWO.

1.1 PROJECT DESCRIPTIONS, DESIGN & CONSTRUCTION.

The proponent has already engaged a qualified and experienced Architects and Engineers to come up with a design which would be implemented. The proposed design has already been approved by the respective offices including Local authority, Lands office, Physical Planning and survey office. The proposed facility would comprise of two categories of facilities, this are the Petrol station services and shops. The shops area would have ground and upper floor.

The Petrol service would include: -

- 3No. underground tanks.
- Tyre centre, Air pump area, car wash, generator room, service bay and a 3set of dispensing pumps with an overhead canopy.

On the other hand, the shops area would include;-

A shop, 2No stores, the manager's office, two toilets (gents and ladies, , septic tank, kitchen/Fast food. There is also a verandah, acceleration and deceleration lane, and pavements for easy circulation within the facility.

A more detailed description of the installations/implementation activities has been analysed below: -

UNDERGROUND STORAGE TANKS: The three Single compartments Underground Storage Tanks (UST) will have single-walled mild steel plate of 6mm thickness and joints to be butt welded for circumferential joints and lap welded longitudinally. No longitudinal joint shall be located at the bottom of the tanks. The dished ends of tank will be bent to 25mm radius and welded lap or butt type on both sides to full penetration. Tests will be done on completion of fabrication with air pressure to 5psi and certified leak proof. The underground fuel tank will meet KS standards and Kenya Bureau of

standards as a requirement. The following specifications will be stamped on the surface; the Plate thicknesses in millimeters, Date of manufacture and Tank serial number.

There will be a reinforced concrete chamber which is water proofed. The underground tanks will be located on the forecourt and have manholes for product offloading and dipstick checks. Remote fill box will be typical incorporating spill containment to prevent accidental releases entering the environment. Single walled tank installation with excavation lined with geo-fabric will be done to prevent migration of native soil into the backfill material.

The installation of fuel filler points. The filling points will be positioned such that they allow for easy manoeuvring of the tankers and be contained within sealed pumps so that in the event of a spillage when connecting and disconnecting the pipes from the filler points, such spilled material would be contained within the pumps.

Pump islands: - This will be constructed with double hose pump per island will be able to dispense two different grades on either side. *(As per the Engineers' specification)*

Piping installation: - Installation of piping for the distribution of the fuel from the fuel filling points to the underground tanks and from the UFST's to the fuel dispensing units. All subsurface piping will be contained within the secondary piping and laid in reverse graded trenches on non-cohesive bedding material should product leak out of the pipes it will be contained within the secondary piping and drain back to the underground tanks.

The are other components within the Petrol station which would be installed for security and safety measures, this include:-

- Non slip tiles in all verandahs, corridors, pavements, accommodation and shops areas, this would prevent any form of sliding which may cause accidents.

- Danger signs especially on the pump area and the UFST area, this include 'no smoking' switch 'off the phone', 'switch off your engine' signs etc
- Sand bucket; This is placed at close proximity to the pumps incase of any fire outbreak
- Emergency contacts chart, these include police hotlines, fire services and ambulance services.

2.2 PROJECT IMPLEMENTATION.

2.2.1 Preconstruction phase: This involves study of the project area, design of the construction drawings and getting approvals for the same from the respective Local authority, NEMA, Physical Planning, District Lands officer and any other relevant authority. Soil tests are also done at this stage, soil tests provide the bearing capacity of the soil thus determining the type of foundation to be laid.

2.2.2 Site Construction.

The construction of the units would be based on applicable international building standards. Other building standards including the Building Code and the British Building Standards which include BS 8110, BS 5950, BS4449, BS4461 will be incorporated. The constructions will as well incorporate environmental guidelines, health and safety measures.

Implementation activities include the following: -

A) Site clearing and excavation of the foundations and space for underground fuel tanks. This entails removal of unwanted vegetation from the site and excavation of the projects' foundations. The few shrubs on the site would be cleared to pave way for excavation activities; the excavation of the site would not involve much machinery since the soil on site is light and well drained.

B) Civil works: Civil works involves: -

- Procurement of construction materials from approved dealers.

- Transportation of construction materials to the site and disposal of the resulting flora waste using light machinery.
- Storage of the construction materials.
- Laying and construction of the foundations.
- Disposal of the existing debris/ materials.

C) Electrical works: Electrical works involve installation of the Power Distribution Box, control panel, and all power supplying cables and equipments. All electrical works are done by qualified electricians so as to avoid faulty connections which may later cause fire outbreaks and short circuiting of the site equipments.

D) Plumbing works: Installation of the underground fuel tanks, fuel pumps, the hot/cold air compressor, pump sheds. Proper piping should be done to prevent any case of leakage which may cause fire and loses to the operators due to equipment damage.

2.3 CONSTRUCTION INPUTS (MATERIALS AND EQUIPMENTS).

The project inputs include the following:-

Construction inputs/ raw materials: These include i.e. sand, cement, machine cut stones, crushed rock (gravel/ ballast), steel metal bars, paint/painting materials among others. All these will be obtained from licensed dealers and especially those that have complied with the environmental management guidelines and policies. The site area is well endowed with sand, stones, gravel and murram, this are available at very low cost thus lowering the ultimate cost of the project.

Construction machines: These include machinery such as trucks, concrete mixers, masonry tools and other relevant construction equipment. These will be used for the clearing of the vegetation, transportation of raw materials and the resulting construction debris. Most of the machinery will use diesel or petrol energy as a source of power.

Labour force: Both skilled and non-skilled workers would be required at all phases of the project. The labour force will require services such as energy, water supply and sanitation facilities. Large volumes of water will also be required during the civil works.

2.4 PROJECT OUTPUTS.

There will be very little waste generated from the proposed project; this is due to the nature of the materials used and the magnitude of the project. Most of the waste materials generated will be re-used while the non-reusable waste would be disposed off in the appropriate manner as described in the management plan illustrated in this report. Some of the anticipated waste materials include pieces of Wood, Papers, Empty Tins, Electric cables, Plant materials, pieces of metal rods etc.

Waste would also be generated during the operation phase of the project, the anticipated waste would include:-

- Waste wasters/sewage: This would be directed to a septic tank since the area has no sewer system
- Used oils and grease: This would be trapped in oil interceptors, this would avoid spillage.
- Product/material wrappings: These materials would be sorted and disposed off in the appropriate manner. Waste bins would be placed strategically within the compound for dumping this form of waste.

2.5 PROJECT BUDGET.

The proposed project is estimated to cost approximately Ksh: **20,000,000(Nine Million Shillings)**. These include the actual cost of purchasing materials, labour cost and all miscellaneous expenses incurred in the implementation process. Cost of construction materials and labour is so low in this area thus lowering the project budget in general.

CHAPTER THREE: BASELINE INFORMATION. BASELINE DATA/INFORMATION GATHERING PROCEDURE.

Project information was gathered through discussions with the project owners, the architects and the neighboring community. The site was also visited for investigation of the physical environmental status and that of the immediate surroundings. A questionnaire (completed copy annexed to

this report) was used to record information gathered during the discussions with the neighboring community and interested parties.

Physical investigation took into consideration among other issues the hydrology and surface geology, drainage system, risk involved during operation, water availability and sanitation status in the area as well as typical socio-economic activities around the proposed site. Also investigated were the public services provided in the area including the drainage systems, water supply/abstractions, power supply and access roads.

The site for the proposed project is very remote and dry; very few people live in the area since most of the population is concentrated in the trading centres of Kithimani, Matuu and Sofia.

Administrative profile of Machakos county.

The county borders Nairobi and Kiambu counties to the West, Embu to the North, Kitui to the East, Makueni to the South, Kajiado to the South West, and Muranga and Kirinyaga to the North West.Local people are mostly of the Akamba ethnicit

The local climate is semi arid with hilly terrain with an altitude of 1000 to 1600 metres above sea level.. Tourist related activities such as camping, hiking safaris, ecotourism and cultural tourism, dance and music festivals among many more are more excitingly done due to the hilly terrain.

Subsistence agriculture is mostly practiced with maize and drought-resistant crops such as sorghum and millet being grown due to the areas semi-arid state. However, the County also plays host to the open air market concept with major market days where large amounts of produce are traded. Fruits, vegetables and other food stuffs like maize and beans are sold in these markets

The county is banking on projects such as the Konza Technology City, a new Machakos City and is proximity to Nairobi County to boost output in the economy.

SourceUSAid Kenya

Local authorities (councils)

Authority	Type	Population*	Urban pop.*
Machakos	Municipality	144,109	28,891
Mavoko (Athi River)	Municipality	48,260	22,167
Kangundo	Town	187,389	9,122

Matuu	Town	44,922	5,321
Masaku	County	481,964	9,088

* 1999 census. Source:

Administrative divisions

Division	Population*	Urban pop.*	Headquarters
Kalama	41,000	0	
Kangundo	91,238	3,786	Kangundo
Kathiani	95,096	2,929	Mitaboni
Machakos Central	143274	26,438	Machakos
Masinga	74,478	654	Masinga
Matungulu	99,731	4,734	Tala
Mavoko	48,936	19,177	Athi River
Mwala	89,211	2,708	
Ndithini	32,358	0	
Yathui	65,567	481	Wamunyu
Yatta	125,755	4913	Matuu

* 1999 census. Sources:

The county has six constituencies:

- Masinga Constituency
- Yatta Constituency
- Kangundo Constituency
- Kathiani Constituency (consists of Mavoko and Kathiani divisions)
- Machakos Town Constituency
- Mwala Constituency

3.1 Ownership & location of the site.

The land earmarked for the proposed Petrol station is located in Kithimani, Machakos County, the site for the project is located along the tarmac road which connects Kithimani and Matuu trading canters, the area has very little population as compared to other places within the District. The land measures

about 0.09Acres and it belongs to Mr Reuben Mutuku Munguti and Agnes Ndunge Reuben Mutuku, only a portion of the land would be occupied by the proposed development, the rest is left for grazing of goats and cattle, just like the abutting pieces of land.

3.2 Land use and Environmental.

Several site visits were made for the purpose of conducting a complete biological assessment of the proposed project site. The ecological site inspection was conducted to provide an overview of the site layout, types of habitats and their floral and faunal composition. The visit involved walking within the boundaries of the site, as well as along the bordering farms. The farm is currently under agricultural use, grazing of animals mainly goats, this is due to the arid nature of the area, the crops do not do well due to unreliable rainfall.

3.3 Topography.

The project site is located at the Yatta plateaus, the site however has a Flat slope thus drainage would not be a problem. The area is characterized by relatively flat type of topography. The area is covered by clay type of soil. Much of the land in the area is pastoralist use, with the main animals being goats.

3.4 Soils.

Soil types in the project area are primarily clay. Sandy loam and are the soils present in the area. These soils are known to have moderate internal drainage and are alkaline with low moisture supplying capacity and high natural fertility.

SOIL LABORATORY ANALYSIS.

To establish the baseline status of the soil at the site, three soil samples from the proposed site (s1, s2, s3) will be collected for total petroleum hydrocarbons (tph) analysis. The results of the soil and air analysis are intended to prove the following information,

- Baseline data of the site.

- To provide that the site has not been impacted prior to the development of the petrol station.

The consultant intends to make use of the **SGS** Kenya limited laboratory in Nairobi

Total petroleum hydrocarbons is sometimes referred to as mineral oil, hydrocarbon oil, extractable hydrocarbons, oil and greese.There are many analytical techniques available that measure tph concentrations in the environment. No single method measures the entire range of petroleum-derived hydrocarbons because the technique varies in the way hydrocarbons are extracted, cleaned up and detected. They each measure slightly different subsets of the petroleum-derived hydrocarbons present in each sample.

The chemical composition of petroleum products is complex and change over time following release into the environment because petroleum and petroleum derived products are such complex mixtures there is no single best method for measuring all types of petroleum contamination.

These factors make it difficult to select the most appropriate analytical methods foe evaluating environmental samples. There are several analytical methods for quantifying petroleum fractions. This includes gas chromatography, infrared spectrometry, gravimetry and immunoassay measurements. Some methods are appropriate for gasoline contaminated sample while others are designed for hydrocarbon contamination such as jet or diesel fuel.

Analytical methods in summary

Gravimetric a sample is extracted with organic solvent, filtered and the solvent evaporated to leave the oil/grease residue. This method does not give information of carbon range if methods are followed carefully, provides for exceedingly precise analysis. In fact, gravimetric analysis is used to determine the atomic masses of many elements to six figure accuracy. Gravimetry provides very little room for instrumental error and does not require a series of standards for calculation of an unknown. Also, methods often do not require expensive equipment. Gravimetric analysis, due to its high degree of accuracy, when performed correctly, can also be used to calibrate other instruments in lieu of reference standards.

Infrared: the sample extracted using a suitable solvent and hydrocarbon concentration is measured by infrared spectrophotometry .The solvent is not evaporated the light hydrocarbons are measured although the carbon range is not indicated. This method needs use of solvents such as CFCS so is no longer used routinely due to hazard associated with the use of CFCS.

Immunoassays: Is ratively new method which is largely used for field measurement of indicative concentrations or presence or absence of hydrocarbons. The method does not give information as to carbon range and is also prone to interferences from humic acids

Gas chromatography: this is the method which is largely used for extraction of tph.samples for diesel contamination is extracted with organic solvent using sonication, tumbling, soxhlet or microwave

extraction. The extraction is analyzed by gas chromatography with compounds present being detected in order of the boiling points of the compounds and quantified by comparison to standards.

The results can thus be expressed in relation to hydrocarbon ranges (c6-c9,c10-c15,c16-c28).best sensitivity for volatile hydrocarbons(c6-c9 range,VOCSBTEX)is achieved by using gcms headspace or purge and trap techniques.

3.5 Drainage and Water resources:

The project area is in general semi-arid and the nearest River is about 1Km away . Water is not a big problem in this area since many homes depend on water from rivers and boreholes.

3.6 Water Quality

The project is not expected to have any adverse impact on ground water quality as the level of effluents emanating from the project will be low and directed to properly installed septic tank.

3.7 Climate.

It is important to adopt a clean air policy as it relates to the construction and operation of the proposed development. For the purposes of this EIA, several parameters were examined as it relates to the air environment: meteorology, air quality, temperature and humidity. The area experiences bi-modal rainfall pattern with two rainy seasons lasting from March to May and October to December. The area receives a mean rainfall of between 350 and 550 mm. temperatures are highest in the months of July to august. The general climate is humid characteristic of highland subtropical, with seasonal dry and wet periods.

3.8 Ecological Environment.

There is no Wildlife, bird sanctuaries or conservation wetlands within 3 km radius of the project site. There no rare, endangered or endemic species recorded. The ecology of the project area is not very rich in diversity or high in endemism, and is typical of semi-arid / dry grassland.

3.9 Flora

There are no plants or grass at the proposed site however the major plant life that was observed to dominate Kithimani area are, Grasses: (Star grass (*Cynodon sp*: ,Acacias sp, Cactus (*Euphorbia sp; Opuntia sp.;*), Commiphora tree sp. The presence of acacias and Euphobia plants therefore indicates that the area is semi arid.

3.9.1 Fauna.

No animals were observed at the proposed project site probably due to the dry nature of the ground and inability to support plant life. The area has no site of economic significance.

3.9.2 Socio-Economic Environment

The main purpose of the socio economic analysis is to place the proposed project within the context of the local human environment, upon which it is expected to have an important influence. Similarly, the analysis also examined the ways in which the local human environment might impact the project and may be supportive of it. Of corollary concern, was the proposed project's impact on the existing site in relation to any potentially important heritage elements that exists, or is likely to exist.

3.9.3 Infrastructure

3.9.4 Energy Sources

The main source of energy to the facility will be Electricity, which is supplied by Kenya Energy generating Company (KENGEN) and Kenya Power and Lighting Company (KPLC). Opportunities for exploring the use of solar energy will also be made at the facility

3.9.5 Analysis of Alternatives

Alternatives to the project, including the no action alternative will be presented in this section, as well as the historical use of the overall area in which the project site is located. These alternatives will be discussed from environmental and socio-economic perspectives.

3.9.6 The No-Action Alternative

Without the proposed development, the location will remain in its current abandoned state. This no-action alternative in itself, presents environmental concerns, as the site in its current state is underutilized. From a socio-economic perspective, the no-action alternative will definitely not yield any benefit to the proponent and the surrounding communities. This alternative would mean that the project does not proceed

Advantages

- Air pollution from dust as a result of the construction process will not occur
- There would be no soil compaction as a result of heavy machinery use
- There would be no soil or water contamination
- No fire risk would be involved
- No noise from the vehicles would be experienced.

Disadvantage

- There will be no creation of employment
- There will be no additional facility to drive socio-economic development
- There will be no secondary development as a result of the project
- The improvement in infrastructure as a result of the project would not be realized
- The value of land might improve but it will remain underdevelopment
- The expected income in the form of profits to the developer and in the form of taxes to the government will not be realized
- Provision and supply of construction materials will not improve.

3.9.7 Relocation alternative

Relocation option to a different site is an option available for the project implementation. At the moment, there are no alternative sites for the proposed development (i.e. the project proponent does not have an alternative site). This means that the proponent has to look for the land if relocation is proposed. Looking for the land to accommodate the scale and size of the project and completing official transaction on it may take a long period. In addition, it is not guaranteed that such land would be available.

3.9.8 Comparison of alternatives

Under the NO Action alternatives, no development would be allowed therefore, there would neither be benefits from the project nor the insignificant affects. Under the proposed development alternatives, the proposed development would create temporary employment for contractors.

Provided the mitigation measures are implemented, including construction and best management practices, insignificant impacts on soils and water quality are anticipated. Commitments associated with this alternative would ensure that potential impacts are avoided or reduced to levels of insignificance.

4.0 CHAPTER FOUR

4.1 ENVIRONMENTAL LEGISLATIVE AND REGULATORY FRAMEWORK.

The law has made provisions for the establishment of NEMA, which has the statutory mandate to supervise and co-ordinate all environmental activities in the country. The Environmental Management and Co-ordination Act, 1999, and the Environmental Impact Assessment and Audit Regulations, 2003, are the legislations that govern Environmental Impact Assessment (EIA) studies.

In order to make the Act operational, the EMCA has established various administrative structures. These include the NEC, the NEMA, the PCC, the NEMA Board, Provincial and District Environment Committees, the SERC and the National Environment Tribunal.

The apex body under the Act is the NEC, which amongst other things is charged with the

responsibility of developing the national environment policy in Kenya as well as to set annual environmental goals and objectives.

NEMA is the organ that has been established to exercise general supervision and coordination over all matters relating to the environment in Kenya. Furthermore, NEMA is the Government's principal instrument in the implementation of all polices relating to the environment.

The PCC was formed to investigate environmental complaints against any person, submit their findings/recommendations to the NEC and to submit periodic reports of its activities to the NEC.

The SERC has been established under the Act to advise NEMA on the criteria and procedures for the measurement of water quality in Kenya. In addition, SERC is required to recommend to the NEMA minimum water quality standards for all waters of Kenya and for different uses.

Policies and legislations highlighting the legal and administrative requirements pertinent to this study are presented below:-

(i). National Environmental Action Plan (NEAP)

According to the Kenya National Environmental Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from industrial, economic and social development programmes that disregarded environmental sustainability. Established in 1990, the plan's effort was to integrate environmental considerations into the country's economic and social development. The integration process was to be achieved through a multi-sectoral approach to develop a comprehensive framework to ensure that environmental management and the conservation of natural resources are an integral part of societal decision-making. Under the NEAP process EIA was introduced and among the key participants identified were the industrialists, business community and local authorities.

(ii). Policy Guidelines on Environment and Development

Among the key objectives of the Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999) are to ensure that from the onset, all development policies, programmes and projects take environmental considerations into account and to ensure that an immediate environmental impact assessment (EIA) report is prepared for all kinds of developments before implementation.

Under this paper, broad categories of development issues among them the human settlement sector, have been covered that require sustainable approach. The policy recommends the need for enhanced re-use/recycle of residues including wastewater, use of low non-waste technologies, increased public awareness and appreciation of 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.

(iii). 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 the promotion of the country's socio-economic progress, it also recognizes the by-products of these processes as wastewater. It, therefore, calls for the development of appropriate sanitation systems to protect people's health and water resources from pollution.

Projects therefore, should be accompanied by corresponding waste management systems to handle the wastewater and other wastes emanating there from. The same policy requires that such projects should undergo comprehensive E.I.As.

IV) Weights and Measures Act, Cap 513. The named Act mandates the Weights and Measures Department to annually certify the mechanical pumps and dispensers in order to ensure that they are properly calibrated to dispense the right amounts of the petroleum products. During the

certification exercise, the measuring mechanisms inside the pumps are sealed with a seal-mark of quality assurance. The Weights and Measures Department issues a Certificate of Verification for all the mechanical pumps which is usually valid for 1 year.

V) Electricity Power Act No. 11 of 1997

The Electric Power Act No. 11 enacted in 1997 deals with generation, transmission, distribution, supply and use of electrical energy as well as the legal basis for establishing the systems associated with these purposes. In this respect, the following environmental issues will be considered before approval is granted:

The need to protect and manage the environment, and conserve natural resources;

The ability to operate in a manner designated to protect the health and safety of the project employees; the local and other potentially affected communities.

Under Schedule 3 of the Electric Power {licensing) Regulations

2003, it is mandatory to comply with all safety, health and environmental laws. Moreover, schedule 2 (regulation 9) of the Electric Power (licensing) Regulations 2003 stipulates that licensing and authorization to generate and transmit electrical power must be supported by the following documents which are approved by NEMA.

- Environmental Impact Assessment Report (EIA) or
- Initial Environmental Audit Report (IEA)

VI) Energy Act, 2006

In 2006, the Energy Act No. 12 of 2006 was enacted. This led to the transformation of the then Electricity Regulatory Board to the Energy Regulatory Commission (ERC) to also regulate petroleum and renewable energy sectors in addition to electricity. The Act states in Section

5(a)(ii) that the objects and functions of ERC include regulating the importation, exportation, transportation, refining, storage and sale of petroleum and petroleum products. Therefore one of the functions of the ERC is licensing of petroleum import, export, transport, storage, refining and sale. Construction Permits are also to be issued by ERC 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.

VII) The Petroleum Act, 1972 (Cap 116).

The legislation has noted several challenges that face the sector which include proliferation of substandard petroleum 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 proponent has already acquired a trade license under the trade Licensing Act.

VIII) *Water Act, 2002*

Part II, section 18, of the Water Act, 2002 provides for national monitoring and information systems on water resources. Following on this, sub-section 3 allows the Water Resources Management Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a facility operator and the information thereof furnished to the authority.

Section 73 of the Act allows a person with license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 75 and sub-section 1 allows the licensee to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction.

(IX). Factories and Other Places of Work Act – (Revised 1990)

The Act makes provision for the health, safety and welfare of persons employed in factories and other places of work. The provisions require that all practicable measures be taken to protect persons employed in a factory from dust, fumes or impurities originating from any process within the facility. The provisions of the Act are also relevant to the management of hazardous and non-hazardous wastes, which may arise at a project site.

(X). Physical Planning Act, 1996

Part V section 30 of the Physical Planning Act states that no person shall carry out development within an area of local authority without a development permission granted by the respective local authority. The Physical Planning Act has provisions to control development and use of land in particular areas, especially where a project may involve subdivisions or amalgamation of land parcels, or located in an area otherwise reserved for other uses. The Act grants power to the local authorities to consider and approve all development applications and grant all development permission.

(XI). Local Government Act (Revised 1986)

The sections of the Local Government Act that are relevant to this project include making by-laws in respect of suppression of nuisances, imposing fees for any license or permit issued in respect of trade or charges for any services. Local authorities are given power to control or prohibit all developments which, by reason of smoke, fumes, chemicals, gases, dust, smell, noise, vibration or other cause, may be or become a source of danger, discomfort or annoyance to the neighbourhoods, and to prescribe the conditions subject to which such developments shall be carried on.

(XII). Public Health Act (Revised 1986)

Under this Act, every local authority or health authority is mandated to take all lawful, necessary and reasonable practicable measures to prevent all injurious conditions in premises, construction condition or manner of use of any trade premises. Nuisances under this Act include any noxious matter or waste water, flowing or discharged from any premises wherever situated, into any public street, or into the gutter or side channel of any street or watercourse, or any accumulation or deposit of refuse or other offensive matter. Every municipal council and every urban area council may make by-laws as to buildings and sanitation.

(XIII). National Environmental Legislative and Regulatory Framework.

The EMCA (The Environmental Management and Co-ordination Act 1999) was enacted in 1999 with Presidential Assent given on January 6, 2000 and date of commencement of the Act being January 14, 2000. Prior to this Act coming into force, the sectoral laws that were however prevailed upon by the EMCA since its enactment though still in force addressed environmental issues.

(XIV). The Environment Impact Assessment And Audit Regulations, 2003

On June 13th 2003, the Minister of Environment, Natural Resources and Wildlife promulgated the Environment (Impact Assessment and Audit) regulations 2003 (EIA/EA Regulations) under section 147 of the EMCA. These regulations provide the framework for carrying out EIAs and EAs in Kenya.

XV). The Way Leave Act.

The areas zoned for communication lines, sewer lines, power lines, water pipes etc are known as way leaves. The way leave Act prohibits development of any kind in these designated areas. Thus any developer is bound by this Act to see to it that no development takes place in these areas.

5.0 CHAPTER FIVE: IMPACT IDENTIFICATION, PREDICTION & EVALUATION.

5.1 DESCRIPTION OF THE EXISTING AND ANTICIPATED IMPACTS.

5.1.1 Existing Impacts.

There are no existing environmental concerns on the site and the surrounding area. The site has no vegetation of value; only grass which is covering the site would be cleared for the new development.

5.1.2 Anticipated Impacts.

Impacts can either be positive or negative, direct or indirect. The magnitude of each impact is described in terms of being significant, minor or negligible, temporary or permanent, long-term or short-term, specific/localized or widespread and reversible or irreversible.

5.2 POSITIVE IMPACTS OF THE PROPOSED PROJECT.

The proposed development will have numerous positive impacts to the area residents and to the general area. Some of the anticipated benefits include:-

5.2.1 Provision of fuelling point and the related services.

This area lacks a single stop point where one can access fuelling of the vehicle and the related services offered in an ideal petrol station like servicing, puncture repair, car wash, wheel balancing etc, the proposed project would offer a single stop for all this services once its complete and full operational.

5.2.2 Creation of Employment Opportunities:

Several employment opportunities will be created for construction workers during the construction phase of the project and operators during the operation phase of the project. This will be a significant impact since unemployment is currently quite high in this area especially Kithimani centre.

5.2.3 Provision of Market for Supply of Building Materials

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

5.2.4 Increased Business Opportunities

The large number of project staff required provides ready market for various goods and services, leading to several business opportunities for small-scale traders such as food vendors around the construction site. For example construction workers and contractors may utilize motorbike services from Kithimani market to the project site since there is no other available means of transport.

5.3 NEGATIVE IMPACTS OF THE PROPOSED PROJECT.

There are a few negative impacts anticipated from the proposed project, these negative impacts however are not major enough to cause any major impact to the environment. They are also few compared to the anticipated positive impacts. The anticipated negative impacts include: -

5.3.1 Increased Soil Erosion

Land and excavation works will lead to increased soil erosion at the project site and release of sediments into the drainage systems and ultimately into water bodies. Uncontrolled soil erosion can have adverse effects on the local water bodies such as sedimentation, introduction of nutrients into the water bodies, de-coloration of water affecting the penetration of sunlight into the water.

5.3.2. Solid gaseous and liquid Waste Generation.

The three forms of waste will be generated at the site during construction and operation phases of the projects infrastructure. Such waste will consist of metal cuttings, rejected materials, surplus materials, spoilt, excavated materials, waste oils and grease, pieces of tryes, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. Such solid waste materials can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on human and animal health. This may be accentuated by the fact that some of the waste materials contain hazardous substances such as oils and grease, paints, cement, adhesives and cleaning solvents, while some of the waste materials including metal cuttings and plastic containers are not biodegradable and can have long-term and cumulative effects on the environment. They also pose danger to the safety of the public in case of accidental cutting or injury.

5.3.3. Extraction and Use of Building Materials

Building materials such as hard core, ballast, cement, rough stone and sand required for construction of the project will be obtained from quarries, hardware shops and sand harvesters who extract such materials from natural resource banks such as rivers and land. Since substantial quantities of these materials will be required for construction of the project, the availability and sustainability of such resources at the extraction sites will be negatively affected, as they are not renewable in the short term. In addition, the sites from which the materials will be extracted may be significantly affected in several ways including landscape changes, removal of vegetation, poor visual quality and opening of depressions on the surface leading to several human and animal health risks and associated impacts.

5.3.4. Dust Emissions

During construction, the project will generate substantial quantities of dust at the construction site and

its surrounding. The sources of dust emissions will include leveling works, excavation for the underground space for fuel tanks and to some extent, transport vehicles delivering building materials. Emission of large quantities of dust may lead to significant impacts on construction workers and the local residents, which will be accentuated during dry weather conditions.

5.3.5. Exhaust Emissions.

The trucks used to transport various building materials from their sources to the project site will contribute to increases in emissions of $C0_2$, NO and fine particulate along the way as a result of diesel combustion. Such emissions can lead to several environmental impacts including global warming and adverse human health impacts, the same can be experienced from the vehicles visiting the facility. Because large quantities of building materials are required, some of which are sourced outside the site area, such emissions can be enormous and may affect a wider geographical area. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent gunning of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas.

5.3.6. Noise and Vibration

The construction works, delivery of building materials by heavy trucks and the use of machinery/equipment including generators, metal grinders and concrete mixers will contribute high level of noise and vibration within the site and the surrounding area. Elevated noise levels within the site can affect project workers and the residents, passers-by and other persons within the vicinity of the project site.

5.3.7. Risks of fire Accidents and Injuries to Workers.

Because of the intensive engineering and construction activities including erection and fastening of

roofing materials, metal grinding and cutting, concrete work, steel erection and welding among others, construction workers will be exposed to risks of accidents and injuries. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others. Fire accidents are also prone in such a facility, proper care should be taken during implementation and operation phases of the project.

5.3.8. Energy Consumption

The project will consume fossil fuels (mainly diesel) to run transport vehicles and construction machinery. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability. Combustion of fossil fuels in engines leads to production of carbon dioxide, a green house gas, associated with global warming.

5.3.9. Oil and fuel Spills

The machines on site may be containing moving parts which will require continuous oiling to minimize the usual corrosion or wear and tear. Possibilities of such oils spilling and contaminating the soil and water on site are real. The same risk of fuel and oil spillage can be experienced from the facility during the fueling or servicing of the vehicles, this spillage if not attended can cause fires, slinding causing accidents, and bad visual look of the facility. Waste oils and greases should be disposed off in the designated oil receptors.

5.4 ISSUES OF CONCERN AND THEIR RESPECTIVE MITIGATION MEASURES.

5.4.1 Soil Erosion.

Soil erosion is loss of topsoil through agents of soil erosion like wind and water (rain), during the implementation phase of the project, light machinery under use will loosen the soil making is susceptible to soil erosion.

In this particular project soil erosion will not be a major environmental issue of concern since there is hardly any major excavation or levelling to be done. However, it is important to note that the project will involve excavation and burying of underground fuel tanks, digging of foundation trenches and hence soil disturbance which would expose and set the soils loose to the agents of soil erosion.

Mitigation measures.

- Avoid unnecessary movement of soil materials from the site.
- Use of heavy machinery which would loosen the soil should be discouraged.
- Control construction activities especially during rainy / wet conditions.

5.4.3 Noise and Public Disturbances.

Noise is unwanted/undesirable sound that can affect job performance, safety, and health. Psychological effects of noise include annoyance and disruption of concentration. Physical effects include loss of hearing, pain, nausea, and interference with communications when the exposure is severe.

As explained earlier, construction activities will be generating some noise. Such noise will mainly emanate from the construction machinery and equipment which include concrete mixers and compactors and noise that would emanate from the workers on site.

Mitigation measures.

- Construction works should be carried out only during the specified time of 0800 hrs to 1700 hrs.
- Machineries should be maintained regularly to reduce noise levels.
- Workers should be provided with protective materials when operating noisy machinery and when in a noisy environment. E.g. ear muffs.

5.4.4 Water.

The proposed project would need a lot of water since construction activities are known to be alot, the various structures would require water; construction workers will create additional demand to the supply in some ways. Once the project is complete, water would also be required. The site is also not located near a water source thus no pollution is anticipated. The contractor also will have storage tanks onsite to store water thus no waste will be experienced.

Mitigation measures.

- The contractor should install water tanks on site to conserve water for construction activities especially during periods of high water demand which would mainly be during civil works.
- Encourage water re-use/recycling mostly during construction to avoid water wastage.
- Keep the water taps off when not in use.
- Install tanks to tap rain water to increase to the water reserve.

5.4.5 Air Quality.

The construction activities on the site will result to increased dust and gas emissions. Some Construction machinery and trucks generate hazardous exhaust fumes such as Carbon Oxides (CO_2), Sulphur Oxides (SO_2) and Nitrogen Oxides (NO_2). Dust, as caused by vibrations of machines

and vehicle movement suspends in the air mostly during dry spells. Such dust and gases have direct negative impact to the quality of air.

Mitigation measures.

- Provide protective equipments and materials and clothing such as nose masks and goggles
- Regular and prompt maintenance of construction machinery and equipment. This will minimize production of hazardous gases.
- Areas generating dust particles should be sprinkled with water to reduce dust blowing out over the area and should be enclosed where possible to mitigate effects of wind on them.
- Workers should go for regular health check-ups to ascertain their health standards and should be encouraged to take milk regularly as this would control the level of congestion of dust in their chests.
- The generator exhaust should be directed away from the facility to avoid smoke clouding.

5.4.6 Oil Leaks and Spills.

Oil spills are prevalent in construction sites. Though this may not be common, it is wise to control and observe the little leaks and spills that would occur especially during maintenance of the involved machinery and vehicles.

Mitigation measures.

- All machinery should be keenly observed not to leak oils on the ground. This can be ensured through regular maintenance of the construction machines and equipments.
- Maintenance should be carried out in a well designed and protected area and where oils/grease is completely restrained from reaching the ground. Such areas should be covered to avoid storm from carrying away oils into the soil/water systems.

- All oils/grease and materials should be stored in a site's store which is usually located in the contractor's yard/site office.

5.4.7 Solid Waste.

Construction activities results to increased solid wastes within the site. Such waste materials include stones, pieces of metal rods, pieces of iron, pieces of pipes, papers, equipment wrappings etc. Removal and disposal of such refuse and other related wastes comes in handy in this project.

Mitigation measures.

- The waste materials should be properly segregated and separated to encourage recycling of some of them such as concrete debris which can be used as backfills with the approval of the site engineer.
- On completion, the property management should adapt a waste management system to handle any waste that would be generated from various operations.

5.4.8 Flora and Fauna.

The site has minimal vegetation which has no conservation values. Some temporary and permanent disturbances would be caused to small animals.

Mitigation measures.

- Flora and fauna on site should be conserved.

5.4.9 Construction Materials.

They include stones, sand, cement, ballast and steel rods for the raft, walls and the columns. They should be of the good quality.

Mitigation measures.

- Should be sourced only from licensed dealers and suppliers.
- Quality should be thoroughly monitored through regular tests e.g. cube tests.
- Recycling of raw materials should be encouraged, e. g, pieces of stones and construction waste can be used for backfilling.

5.50 Occupational Health and Safety (OHS)

During construction, there will be increased dust, air and noise pollution. These are considered as negative impacts. The residents and workforce involved would be more subjected to these environmental hazards. Food for the construction workforce is usually provided by mobile vendors most of which operates without health licenses. This can compromise the health of the workers especially if such foodstuffs are prepared in unhygienic conditions

Falls from high heights is also a common risk which is common is such works and proper protective gear is of importance during the erecting of the walls.

Mitigation measures.

- All workers should be provided with full protective gear. These include working boots, safety harness, overalls, helmets, goggles, masks and gloves.
- People preparing food for the workers on site should be monitored to ensure that food is hygienically prepared.
- A first aid kit should be provided within the site. This should be fully equipped at all times, site workers should also be trained on basic First Aid Skills.
- Some tasks require one to be in very good health, workers should be subjected to medical examinations before starting work. This will ensure that only medically fit persons are engaged for such tasks.

- The site workers should be warned of drugs and alcohol since they might affect their concentration at work causing accidents.
- Sanitary facilities should be provided on site during construction and should be kept clean at all times.

5.5.1 Security.

Security is a fundamental aspect to consider in any development. Good security ensures that materials and equipment are not stolen or vandalized from site and that construction activities are not disrupted with during the normal working hours.

Mitigation measures.

- A site office should be constructed on site to store materials and equipment while not in use.
- The site should be enclosed using suitable walls to beef-up security and to control movement in and out of site.
- Lighting as well as security alarms should be installed on site after completion.
- There should be security guard stationed on site to monitor movements of people in and out of the site area.

5.5.2 Fire safety.

Fire safety measures should be considered in any development plan. Fire outbreaks are common occurrences in many premises mainly due to poor installation of electric devices or poor handling of fire equipments or flammable substances. In this development proposal; proper care will be taken into account during and after the implementation phase so as to minimize chances of fire outbreaks.

Mitigation measures.

- Fire alarm and fighting equipments should be installed within the facility once it is complete.
- A “No smoking” notice should be placed strategically on site.

- Ensure that all fire fighting equipments installed on the site once it is complete are regularly maintained and serviced.
- Dry sand buckets should be placed in strategic places incase of fire.
- The facility operators should be trained on how to use various fire fighting devices.
- Emergency chart numbers should be placed strategically incase of any emergency.

5.5.3. Traffic Density.

Heavy traffic would be generated during the construction phase; this would be caused by construction trucks ferrying materials and equipments to the site. Stringent measures should be adapted to minimize or avert any vehicular congestion which may occur.

Mitigation measures.

- The traffic should be controlled during implementation and operation phases and mostly when large trucks for delivery of materials, this would control or prevent accidents.
- Transportation of materials should be done between 8.00AM-5.00AM and on the weekends only when the vehicles are few.
- The acceralation and deceleration lanes getting in and out of the facility should be wide enough and with no obstruction to avoid any vehicular snarl up.
- Signs of ‘MEN AT WORK’ should be placed on the side of the road to warn incoming vehicles.

5.5.4 Public participation.

The project would not be implemented without participation of the local people; public opinion was sought before the beginning of the project through the use of self administered questionnaires. The idea behind the distribution of questionnaires was to get the perception the community has towards the proposed project. In principle, the project was wholly accepted by the community, there was no

objection raised by the community towards the implementation of this project. Reasons which led to acceptance of the project by the community include: -

- **Provision petroleum services**: the proposed development will provide the community around with additional services which have not been enjoyed in the area before; the proposed facility will bring closer fuelling and other vehicular services closer to the community.
- **Social cohesion**: The implementation of the project would involve people from diverse cultural backgrounds, this would enhance social cohesion.
- **Aesthetic value**: The area would greatly improve with the coming up of the new unique facility, the aesthetic value would improve after the surrounding bushes are cleared and proper landscaping done after construction.
- **Employment/income**: The project would demand both skilled and non-skilled labour force, the required labour force would be provided by the local community; closely related to this is the source of income to the County Council in form of statutory payments.

6.0 CHAPTER SIX: - ALTERNATIVES AND PROPOSED ACTION

6.1 Analysis of Alternatives.

Alternatives to the project, including the no action alternative will be presented in this section, as well as the historical use of the overall area in which the project site is located. These alternatives will be discussed from environmental and socio-economic perspectives.

6.2 The No-Action Alternative.

Without the proposed development, the location will remain in its current abandoned state. This no-action alternative in itself, presents environmental concerns, as the site in its current state is prime but underutilized. From a socio-economic perspective, the no-action alternative will definitely not

yield any benefit to the proponent and the surrounding communities. This alternative would mean that the project does not proceed

Advantages

- Air pollution from dust as a result of the construction process will not occur
- There would not be soil compaction as a result of heavy machinery use
- There would be no soil or water contamination

Disadvantage

- There will be no creation of employment
- There will be no additional facility to drive socio-economic development
- There will be no secondary development as a result of the project
- The improvement in infrastructure as a result of the project would not be realized
- The value of land might improve but it will remain underdevelopment
- The expected income in the form of profits to the developer and in the form of taxes to the government will not be realized
- Provision and supply of construction materials will not improve

6.3 Relocation alternative.

Relocation option to a different site is an option available for the project implementation. At the moment, there are no alternative sites for the proposed development (i.e. the project proponent does not have an alternative site). This means that the proponent has to look for the land if relocation is proposed. Looking for the land to accommodate the scale and size of the project and completing official transaction on it may take a long period. In addition, it is not guaranteed that such land would be available.

6.4 Comparison of alternatives.

Under the NO Action alternatives, no development would be allowed therefore, there would neither be benefits from the project nor the insignificant effects. Under the proposed development alternatives, the proposed development would create temporary employment for contractors.

Provided the mitigation measures are implemented, including construction and best management practices, insignificant impacts on soils and water quality are anticipated. Commitments associated with this alternative would ensure that potential impacts are avoided or reduced to levels of insignificance.

6.2 Site decommissioning Phase.

No project would exist forever, at some point the site would be demolished and the space it had occupied be restored to its original form. This exercise would have some impacts to the environment. The following takes place during decommissioning:-

- All foundations must be removed and recycled, reused or disposed of at a licensed disposal site
- Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the material should taken to a licensed waste disposal site.
- Donate reusable demolition waste to charitable organizations, individuals and institutions
- Implement an appropriate re-vegetation programs to restore the site to its original status
- Consider use of indigenous plant species in re-vegetation.
- Trees should be planted at suitable locations so as to interrupt slight lines (screen planting), between the adjacent areas and the development.

The above activities would also have some impacts to the environment, this would involve:-

- Occupational health risks like cuts and bruises.

- Production of solid, liquid and gaseous waste.
- Pollution of air with dust particles.
- Likely spillage of fuel, oil and grease.
- Vibration caused by the site construction equipments and machines e,g drilling machines.
- Landscaping the land to its original form.

All buildings, machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused.

7.0 CHAPTER SEVEN

7.1 ENVIRONMENTAL MANAGEMENT AND MONITORING PLANS.

The environmental management plan involves risk management strategies that should be undertaken by the project proponent, project manager and the residents to mitigate environmental degeneration. They are approaches to monitor, control, reclaim and restore the environment back to its appropriate state. EMP's for projects thus provide logical frameworks within which the identified issues of environmental concern can be mitigated, monitored and evaluated.

Environmental monitoring involves measurement of relevant parameters, at a level of details accurate enough, to distinguish the anticipated changes. Monitoring aims at determining the effectiveness of actions to improve environmental quality.

The environmental management and monitoring plans has been developed and outlined to bring home the key findings of the Environmental Impact Assessment of the project in mention, recommending necessary mitigation actions, defining roles and the estimated cost.

The EMP outlined in the tables below addresses the potential negative impacts and mitigation measures as well as roles and costs that can help to determine the effectiveness of actions to upgrade the quality of environment; as regards the proposed project.

The EMP has considered construction, operational decommissioning phase.

Table 1: IMPLEMENTATION PHASE(IMPLEMENTATION/CONSTRUCTION PHASE)					
Soil, oil & grease, Noise & vibrations, Air pollutions, Topography and Public participations.					
ENVIRONMENTAL ASPECT	**ANTICIPATED IMPACTS**	**MITIGATION METHODS**	**PROJECT PHASE**	**RESPONSIBILITY**	**COST**
Soil erosion	Disturbance of micro-organisms in the soil loosening of the soil making is vulnerable to agents of erosion (mainly water & wind) Soil pollution as a result of burying unwanted or non-biodegradable substances.	All construction should be done using the recommended building materials and equipments. Use of heavy machinery which causes massive destabilization of soil and killing of organisms should be avoided. Natural organism niches should be conserved. And also construction activities to be confined within the site area.	Implementation Phase	Contractor	120,000.
Oil and Grease	Soil pollution killing micro –organisms. Pollution of water collection pans through surface flow. Drying of vegetation leaving the soil bare.	Regular maintenance of construction machines and vehicles to note leaking. All repairs and servicing of machines and vehicles should be done at the recommended sites. Proper disposal of used oils and grease.	Implementation phase.	Contractor	65,000
Solid waste generation	Lodging of unwanted materials on the ground like wrapping papers, pieces of pipes/metal bars, pieces of wood etc.	Installation of waste bins/pits on site to avoid scattering on the ground. Dumping of unwanted materials on the recommended places. Re-using any recyclable materials	Implementation phase	Contactor.	90,000
Noise and vibrations.	Hearing problems. May cause noise related illnesses like headache.	Use machines of low noise levels. Turning off construction machines and vehicles while not in use. Use of protective gadgets for the ears e.g. ear muffs.	Site implementation phase.	Contractor	85,000
Air pollution	Dust particles in the air causing in-hailing problems. Polluting of water bodies/storage facilities.	Sprinkling of water during the dry seasons. Construction workers should use protective clothing. E.g. dust masks and goggles.	Site implementation phase.	Contractor	70,000
Topography	Alterations of the landscape form Increased soil erosion	Proper landscaping should be done after the end of all the construction works. Planting of trees and grass in areas where they had been cleared.	Implementation phase.	Contractor	65,000
Public Participation	Resistance from the community on implementation of the project in fear of its impacts. E.g. depletion of other similar boreholes.	Proper sensitization of the community at the initial stages of the project with aim of educating them on advantage of the project. Involving the community on its implementation especially as casuals.	During the pre-construction/ Construction	Contractor	40,000.

			phase.		

Table 2: OPERATIONAL PHASE.

Water quality and usage, Electrical safety and oil/fuel spillage.

ENVIRONMENTAL ASPECT	ANTICIPATED IMPACTS	MITIGATION METHODS	PROJECT PHASE	RESPONSIBILITY	COST
Occupational safety and Health (OHS)	Injuries from shop task like tyre repairs. Inhaling contaminated air Illness from consuming unhygienic food/ water	Provide safety gears to the workers e.g. overalls, helmets, gloves Provide tyre repair/inflating chamber to avoid accidents Treating water before domestic use. Water should used sparingly to avoid wastage e.g. use of press on taps. Install sanitary facilities The generator house should be located away from the working area to avoid excessive noise.	Operational phase.	Proponent.	150,000
Electrical safety	Electrocution of site workers during the installation phase. Electrocution of the surrounding community during the operational phase Outbreak of fire.	Use of qualified electricians in the installation of all electrical gadgets. All electrical cables should be earthed in the correct manholes. Use of protective clothing for the workers on site. ''Danger warning'' warning signs should be placed at strategic place on site. Install fire extiquishers.	Operational phase	Contractor	85,000
Oil/fuel spillage	Outbreak of fires Skidding of vehicles causing accidents Bad smell	Standby Generator should be installed properly by qualified technicians to ensure they are not leaking any fuel or oil which may cause fire outbreak. The fuel channels (pipes, pumps, dispensers) should be well maintained to note any leakage. Only authorised operators should dispense products to customers. Pumps should be locked when not in use. Any spillage of fuel/paraffin should be washed with plenty of water and soap Fire hydrants and sand buckets should be placed strategically In case of fire. Frequent checks on piping system to note leakage	Operational phase.	Contractor	50,000
FIRE SAFETY	Loses from burning of facility Loss of life	Keep well services and working fire hydrants Keep dry sand buckets in place in case of outbreaks Train the operators on ways of fighting fire. Have a chart of hotlines within the facility, this include fire services, Ambulance, police et Keep the facility dry of any fuel or oil spillage Install warning signs on the facility e.g. DO NOT SMOKE, SWITCH ENGINE, SWITCH OFF			80,000

		Designate a FIRE ASSEMBLY POINT within the compound incase of fire.			

Table 3: DECOMMISSIONING PHASE.

Occupational safety, Public health, Noise & Vibrations, Dust pollutions, Landform.

ENVIRONMENTAL ASPECT	ANTICIPATED IMPACTS	MITIGATION METHODS	PROJECT PHASE	RESPONSIBILITY	COST
Occupation safety	Bruises and cuts caused during the demolition works. Falling from heights Inhaling of poisonous gases from the UFST Fire outbreaks	Providing workers with protective clothing and facilities like helmets, safety harness, boots and gloves. The dismantling exercise should be carried out separately to avoid accidents to people who might be on the ground. Train the site workers on basic first aid methods. Provide first aid kit on site incase of small cuts/bruises. Provide a public "NOTICE'' on the ongoing works.	Decommissioning phase.	Contractor.	50,000.
Public health	Ailments from contaminated food. Careless disposal of human waste.	Provide a sanitary unit on site. Food for the site workers to be prepared in hygienic conditions.	Decommissioning phase.	Contractor	60,000
Noise and vibrations	Noise and vibrations from the machines may cause illnesses like mild head aches, to the people who frequent the site.	Use of machine of low noise and vibration levels. Switching off machines while not is use. Switching off vehicles on site while not in use	Decommissioning phase.	Contractor	125,000
Dust pollutions.	Pollution of air with dust particles from the demolition works especially the concrete surfaces which may cause respiratory diseases. Pollution of water collection equipments which may turn cause diseases if consumed.	Providing workers with protective gadgets like dust masks and ear muffs. Sprinkling water on concrete surfaces to be demolished I case of excessive dust. Ensure all water vessels are tightly covered.	Decommissioning phase.	Contractor	100,000
Landform	Change of the landform after demolitions Accidents which may be caused by falls into the excavated pits.	Reverting the land to its original form by filling the excavations and planting trees or grass in the affected areas.	Decommissioning phase.	Contractor.	90,000
Solid waste	Generation of waste debris	Donate any re usable remains to any willing individual/organization. E.g. iron sheets Dispose off any un reusable waste into the approved dumpsites Sell metallic waste to licensed scrap metal dealers			85,000

		➢ Demolition's to be done in phases to avoid damage of re-usable items			

8.0 CHAPTER EIGHT

8.1 CONCLUSION AND RECOMMENDATIONS.

8.1.1 CONCLUSION

Any facility handling hydro-carbons products should be designed, implemented and operated with a lot of care due to the risks involved in handling this products, some of this facilities are petrol service stations, filling stations, LPG stands, etc some of the substances handled in this facilities are highly flammable and poisonous thus proper care should be taken in their handling and storage. The project under consideration in this report is a petrol station, it has met all requirements in terms of design and space, all the safety measures have also been put into consideration. The project is not expected to have any negative impact to the environment especially due to its location; the area is quite remote with very few human settlement and human activities.

It is our considerable opinion that the proposed development is a timely venture and will supplement considerably to the government policy. It is thus our recommendation that the project is allowed to go ahead with strict implementation of the mitigation measures provided to minimize anticipated environmental impacts. More focus shall be put to minimize the occurrence of impacts that would degrade the environment while exploiting those impacts that are positive.

Finally, the project proponent has promised to work closely with environmental experts, residents, local authority, local Divisional Environment committees and NEMA to ensure smooth facilitation of the issues that touch on environment to include; water supply, effluent

disposal, solid waste management, air pollution but to mention a few. This will ensure that environmental concerns are integrated into the project process.

8.1.2. RECOMMENDATIONS

Recommendation for the preventive and mitigation of adverse impacts is presented as follows: -

1. The proponent will ensure that the development has been approved by the relevant regulatory departments as Department of Physical planning, Ministry of Lands and Settlement, health, NEMA etc. the proponent should therefore follow guidelines as set by the government to safeguard EMP principles during the construction and operation phases of the proposed project.
2. It is important that warning information signage is erected strategically at the site. This will indicate the operation hours and works are likely to start and completed. The signage will be positioned in a way that both pedestrians and motorist will see.
3. All solid waste and debris resulting from the construction activities must be disposed off at approved dumpsites.
4. All construction materials to include, sand, gravel, hardcore, metals, treatment chemicals must be sourced from known and approved dealers or manufacturers who have environment sign of quality.

5. Ensure that construction activities must be undertaken only during the day i.e. 0800 hours to 1700 hours. This will minimize anticipated disturbance and nuisance to the residents of adjacent properties and the general public.
6. The service road to the site be well maintained even after use by the heavy machinery e.g. Lorries.
7. Traffic along nearby roads should be controlled and informed during construction hours especially of heavy turning Lorries and plant in and out. This will minimize potential accidents from unsuspecting motorists.
8. The contractor will ensure that loose soils must be covered to prevent erosion. Other soil erosion preventive measures including watering during dry season to prevent wind erosion will be implemented. Any stockpiles of earth will be enclosed or covered to reduce dust to the neighbors.
9. Once earth works have been done, restoration of the worked areas should be carried out immediately through backfilling by experienced landscape experts. This will include planting trees and grass, flowers etc.
10. Drainage system will be properly designed, installed, and regularly maintained to prevent storm water runoff.
11. Used and new oils from the motor vehicles and plant will be handled and stored properly. Due care on leakages and accidental spills will be taken.

12. Workers should be provided with complete personal protective equipment (PPE) and safety gear. They should be provided with safety boots, overalls, gloves, helmets, ear plugs and muffs, goggles etc. A fully equipped first aid kit must be within reach.
13. The contractor must have workman compensation cover. He or she must comply with Workman compensation Act as well as other ordinances that apply to the workers. Where the workers have a union, the Collective Bargaining Agreement (CBA) shall be observed.
14. A complete fire fighting system with water hydrants must be provided after completion of the project. A fire response emergency plan shall be designed and communicated to be used in situations of fire outbreak.
15. Due diligence should be exercised by the contractor or the project agent during the construction phase to safeguard and ensure that all the mitigation measures are adhered to the letter.

SITE PHOTOS.

The road along where the site is located

Kithimani trading centre which is the nearest trading centre to the proposed site

ANNEX I

References:

- Environmental Management & Coordination Act 1999
- The Environmental (Impact Assessment & Audit) regulations, 2003.
- Physical Planning Act 1996 (Cap 286)
- Local government Act Cap 265
- Public health Act.
- Way leave Act Cap 292
- Water Act 2002.
- Factories and other places of work Act.
- Policy guidelines on environment and development.
- Environmental Impact Assessment & Audit regulations.

ANNEX II

LIST OF TABLES.

- Project budget.
- Implementation phase: -Soil, oil & grease, Noise & vibrations, Air pollutions, Topography and Public participations.
- Operation phase: - Radiations, Electrical safety and oil/fuel spillage.
- Decommissioning phase: -Occupational safety, Public health, Noise & Vibrations, Dust pollutions and Landform.