ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED 10 TON/24H WASTE TYRE PYROLYSIS PLANT ON PLOT NUMBER KAWALA 'A'/399 SITUATED AT KOKOTONI IN KILIFI COUNTY

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CERTIFICATION

Certification by EIA/EA Experts

We hereby certify that this Environmental Impact Assessment (EIA) study report has been done under our supervision and that the assessment criteria, methodology and content reporting conforms to the requirements of the Environmental Management and Coordination Act, 1999 and Legal Notice No. 101 of 2003 (Environmental Impact Assessment and Audit Regulations).

Signature: _____ 03rd October, 2016
Joseph M. Kyalo
EIA/EA Expert
NEMA Reg. No. 6830

Signature: _____ 03rd October, 2016
Emmanuel Amani Karavina
Lead EIA/EA Expert
NEMA Reg. No. 7085

Certification by Proponent

Monarch Petrochemical Limited hereby confirms that the contents of this EIA study report are true and shall implement the mitigation measures proposed and undertake to implement further instructions as NEMA may deem appropriate in relation to the findings and from time to time as inspections may inform.

Signature: _____Date_____

Director
Monarch Petrochemical Limited

ACKNOWLEDGEMENTS

Many people have directly contributed to this EIA exercise. It would be impossible to thank each and every one of them individually. The EIA team hopes that its efforts in rendering the collective findings of this exercise will do justice to the many who assisted and facilitated this work.

The team must however acknowledge the logistical support provided by the proponent. We also recognize all project stakeholders and neighbours for agreeing to participate in the public consultative process. To all who helped and have not been mentioned individually, kindly accept our sincere thanks.

EXECUTIVE SUMMARY

This Environmental Impact Assessment study was conducted for and on behalf of the proponent, Monarch Petrochemical Limited in compliance with the Environmental Management and Coordination Act (EMCA, 1999) which requires that an Environmental Impact Assessment (EIA) be carried out for developments such as the proposed. Provisions of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003 also dictate the submission of such an assessment to the National Environment Management Authority (NEMA).

The assessment examined the potential impacts of the proposed project on the immediate surroundings with due regard to all the phases of establishment through to operation and decommissioning. It encompassed all aspects pertaining to the physical, economical, ecological, socio-cultural, health and safety conditions at the site and its environs. The assessment was based on laid down scientific qualitative procedures with the most recent methodologies and analysis required in EIA and strictly adheres to the relevant legislative framework governing the agriculture and production industry.

Project description

The proponent proposes to establish a 10 Ton/24h waste tyre pyrolysis plant on plot No. Kawala 'A'/399 situated at Kokotoni in Kilifi County. The primary objective of the plant is to derive Tyre Pyrolysis Oil (TPO), carbon black powder, steel wire and gas. Pyrolysis involves subjecting tyres to high temperature of 400 to 450 degree Celsius, in absence of oxygen. It is a great way of recycling waste tyres as it's a challenge in the country. During the process scrap steel is produced while tyre breaks down into smaller molecules of pyrolysis oil, pyrolysis gas and carbon black.

TPO is used as liquid fuel in industrial burners. Carbon black is a valuable feed stock for the manufacture of tyres, rubber products, paints, pigments, ink, powder coating, toner, etc. The gas generated by tyre pyrolysis will be effectively used to fuel the process. The scrap steel generated will be sufficiently clean to be sold to scrap metal processors.

The project implementation cost is estimated at kshs. 9,200,000.00.The proponent has paid Kshs 50,000.00 being the minimum payable fees for high risk projects to the NEMA Revenue Account: 1102298158 KCB, KICC Branch as EIA fees.

Project site and neighbourhood land use

The pyrolysis plant will be established on plot number Kawala 'A'/399 situated at Kalia Ng'ombe village in Kokotoni, Kilifi County. The proponent has leased 2 acres on land parcel No. 399 that covers an approximate area of 107 acres. The site is situated about 1.5 km off the Mombasa – Nairobi highway (A109) about 7 km west of Mazeras township and7.5km east of Mariakani town and lies between Latitude -3.90264 (3° 54′ 9.5″ S) and Longitude: 39.5279 (39° 31′ 40.43″ E). The basic land use within the locality is predominantly agricultural but dominated by quarries and light industries.

EIA objectives

The EIA process purposes to ensure that environmental concerns are integrated in all phases of the project cycle. In this regard therefore, the specific objectives of this EIA report included:

- To provide a description of the project cycle activities and the required legislative compliance;
- To predict and/or determine the potential impacts of the development in terms of the economic, social and environmental considerations;

- Propose appropriate mitigation measures to minimize or eliminate the environmental impacts associated with the development;
- Analyze project alternatives; and,
- To undertake a public consultative process aimed at obtaining the views of project stakeholders so as to mainstream their concerns and impact mitigation proposals into the Environmental Management Plan (EMP) developed for the project cycle.

Environmental impacts and mitigation

Both positive and negative impacts will result from the design, implementation, operation and possible decommissioning of the plant and associated infrastructure. The environmental impacts arising from the project have both ecological and socio-economic dimensions. The overall aim of the project is ensuring an environmentally friendly development by planning around and utilizing the existing resources. The following are some of the potential negative impacts:

- Potential health problems resulting from tyre storage and overall operations;
- Air pollutant emissions;
- Potential liquid waste generation;
- Fugitive emissions of Volatile Organic Compounds (VOCs);
- Spills and releases of oil from product storage tanks; and,
- Potential solid waste generation.

The facility will develop pollution prevention plans and implement Best Management Practices (BMPs) for pollution control. Appropriate mitigation measures have been discussed and an elaborate EMP outlined in this study. All the negative impacts will be mitigated to the highest degree.

Waste tyre pyrolysis has the following advantages:

- As a commercial venture the proponent will accrue income and employ several people;
- The system recycles synergy of waste tyre into usable fuel;
- It offers renewable energy source;
- The in product can be used as fuel in existing industrial boilers and furnaces. End products can also be used for generating electricity;
- Eliminates hazard of land pollution by waste tyres;
- Converts waste into energy; and,
- Clears dumping yards and environment of non-biodegradable tyre waste.

Public participation

An extensive public consultation process was engaged in gauging the sentiments of a variety of stakeholders in the development of this project. Besides the fact that this is a regulatory requirement under the Environmental Management and Coordination (EIA/EA) Regulations (2003), it was an excellent opportunity to offer the public an opportunity to ventilate their fears and concerns. Public participation was implemented using semi-structured interview strategy, questionnaires and informal consultations. The media including the local newsprintwith country wide circulation and the Kenya *Gazzette* will be included too.

The public participation process engaged for this study demonstrates that most respondents could not understand the concept of waste tyre pyrolysis and had the perception that such process is similar to the open air burning to melt waste tyres to retrieve steel scrap as it is common in Kibarani dumping site in Mombasa County. Some evidence of public consultation cannot be produced as in the form of questionnaires; some respondents sought anonymity. Majority respondents wish to see the actualization of the proposed EMP and recognized of the enormous economic

opportunities which this project represents.

Conclusion

This EIA study presents significant impacts that need to be adequately mitigated. However with the appropriate impact mitigation as proposed, the project will not occasion environmentally significant negative impact that could lead to environmental degradation on an appreciable scale. The commissioning of this project is considered economically viable, socially acceptable and environmentally sound.

Recommendations

The project will confer a net positive impact on the local economy and environment. Our recommendation is that, this project does not require to be subjected to further environmental impact assessment and should be favored with an EIA License subject to the conditions that NEMA may impose during the decision making process. The proponent should however use the EMP as monitoring and evaluation tool to submit an Environmental Audit report to NEMA annually or as may be directed by the Authority without fail.

Table of Contents

ABBREVIATIONS AND ACRONYMS

BMPs	Best Management Practices
CFCs	Chlorofluorocarbons
CIDP	County Integrated Development Plan
DOHS	Directorate of Occupational Health and Safety
EA	Environmental Audit
EDL	Effluent Discharge License
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act (1999)
EMP	Environmental Management Plan
EMS	Environmental Management System
GOK	Government of Kenya
HCVs	Heavy Commercial Vehicles
KEBS	Kenya Bureau of Standards
KFS	Kenya Forest Service
KIMAWASCO	Kilifi-Mariakani Water and Sewerage Company
KPLC	Kenya Power and Lighting Company
M & E	Monitoring and Evaluation
MSDS	Material Safety Data Sheet
NCA	National Construction Authority
NEC	National Environmental Council
NEMA	National Environmental Management Authority
ODSs	Ozone Depleting Substances
OHS	Occupational Health & Safety
OHSMS	Occupational Health and Safety Management System
PPE	Personal Protective Equipment
SERC	Standards and Enforcement Review Committee
TPO	Tyre Pyrolysis Oil
VOCs	Volatile Organic Compounds
WARMA	Water Resource Management Authority
WCE	World Congress on Engineering
WTs	Waste Tyres

DEFINITION OF TERMS

Analysis means the testing or examination of any matter, substance or process for the purpose of determining its composition or qualities or its effect (whether physical, chemical or biological) on any segment of the environment or examination of emissions or recording of noise or sub-sonic vibrations to determine the level or other characteristics of the noise or sub-sonic vibration or its effect on any segments of the environment.

Effluent means gaseous waste, water or liquid or other fluid of domestic, agricultural, trade or industrial origin treated or untreated and discharged directly or indirectly into the aquatic environment.

Environment includes the physical factors of the surroundings of human beings including land, water, atmosphere, climate, sound, odour, taste, the biological factors of animals and plants and the social factor of aesthetics and includes both the natural and the built environment.

Environmental Impact Assessment means a systematic examination conducted to determine whether or not a programme, activity or project will have any adverse impacts on the environment.

Hazardous substance means any chemical, waste, gas, medicine, drug, plant, animal or micro-organism which is likely to be injurious to human health or the environment.

Noise means any undesirable sound that is intrinsically objectionable or that may cause adverse effect on human health or the environment.

Pollution means any direct or indirect alteration of the physical, thermal, chemical, biological, or radio-active properties of any part of the environment by discharging, emitting, or depositing wastes so as to affect any beneficial use adversely, to cause a condition which is hazardous or potentially hazardous to public health, safety or welfare, or to animals, birds, wildlife, fish or aquatic life, or to plants or to cause contravention of any condition, limitation, or restriction which is subject to a license under this the Environmental Management and Coordination Act (1999).

Project includes any project, programme or policy that leads to projects which may have an impact on the environment.

Proponent means a person/entity proposing or executing a project, programme or an undertaking.

Pyrolysis refers to a thermochemicaldecomposition of organic material at elevated temperatures in the absence of oxygen (or any halogen). It involves the simultaneous change of chemical composition and physical phase, and is irreversible.

Soil includes earth, sand, rock, shale, minerals, vegetation, and the flora and fauna in the soil and derivatives thereof such as dust.

Waste includes any matter prescribed to be waste and any matter, whether liquid, solid, gaseous, or radioactive, which is discharged, emitted, or deposited in the environment in such volume composition or manner likely to cause an alteration of the environment.

CHAPTER ONE

1.1 Introduction and Background

For a long time, the world over, policy makers have been directing all their efforts in economic development without due regard to the nature of the resource base on which the economic development depend on. As a result, there has been unprecedented environmental degradation, during project implementation and operation stages, due to lack of integration of environmental concerns into the project design, planning and management, thereby resulting into unsustainable development. To ensure sustainability and revitalization of the degraded environment, all proposed development projects' activities and their subsequent operations are now required to be critically examined to evaluate the impacts (both positive and negative) they would have on the environment before they are implemented and to enhance Sustainable Environmental Management as well as controlling and revitalizing the much – degraded environment.

Some of the Environmental Management tools used to achieve this is the Environmental Impact Assessment (EIA) study, done before the implementation of a new project and an Environmental Audit (EA) done on existing projects. All these are emphasized in the Environmental Management and Coordination Act (EMCA) of 1999. An EIA identifies both negative and positive impacts of the proposed project, how it affects people, their property and the general environment. Environmental Experts registered by The National Environmental Management Authority (NEMA) should conduct the EIA study of new projects and Environmental Audits (EA) for the already existing projects pursuant to requirements of EMCA, Environmental Impact Assessment and Audit Regulations, 2003 and the World Bank Guidelines.

1.2 Scope and criteria

The study has been conducted to evaluate the environmental impacts of the proposed Waste Tyre (WT) pyrolysis plant in Kokotoni, Kilifi County. Upon evaluation, recommendations are made on the accentuation of positive impacts and the mitigation of negative ones. The scope for the assessment dwelled on impacts the project will have on the following:

- Physical environment;
- Socio-cultural environment;
- Land use;
- Socio-economic aspects; and,
- Health and safety.

The study was commissioned principally to comply with provisions of the Environmental Management and Coordination Act (1999) and the Environmental (Impact Assessment and Audit) Regulations 2003. However, due to the nature of the project and its eventual clientele, the experts have also taken into due consideration World Bank Guidelines and common international best practices in Environmental Impact Assessment Studies.

1.3 EIA objectives

The EIA process purposes to ensure that environmental concerns are integrated in all phases of the project cycle in order to contribute to sustainable development. In this regard therefore, the specific objectives of this EIA report are outlined as follows:

- To provide a description of the project cycle activities and the required legislative compliance;
- To predict and/or determine the potential impacts of the development in terms of the economic, social and environmental considerations;
- To propose appropriate mitigation measures to minimize or eliminate the environmental challenges associated with the development;

- To analyze project alternatives; and,
- To undertake a public consultative process aimed at obtaining the views of project stakeholders so as to mainstream their concerns and impact mitigation proposals into the Environmental Management Plan (EMP) developed for the project cycle.

1.4 Assessment methodology

The following various tools and instruments were utilized during the initial survey to collect data and information on the site.

- Site visits whereby the consultants utilized a pre-determined checklist developed on the basis of the scoping and screening exercise.
- Observable details were recorded using a note book and a camera.
- Baseline information for the site was further obtained through literature review of site documentation.
- A semi-structured interview strategy, questionnaires and informal consultations were used to obtain comments from neighbours.
- Desktop reviews were conducted using the internet and other EIA reports of similar nature in the area by the EIA consultants.

The information gathered using the above strategies was evaluated and data analyzed to determine the required level of environmental performance and make recommended environmental action plans for the development proposal.

1.5 EIA organization and structure

This EIA report is organized into 12 main chapters organized as follows:

- Introduction;
- Project description;
- Baseline information;
- Policy and legislative framework review;
- Public and stakeholder consultations;
- Impact identification and prediction;
- Environmental mitigation measures;
- Environmental Management Plans (EMPs);
- Analysis of project alternatives;
- Environmental monitoring programme; &,
- Conclusions and recommendations.

The report conforms to the guidelines issued by NEMA following the gazettment of Legal Notice No. 101 of 2003.

CHAPTER TWO

2.0 Project Description

The proponent proposes to establish a 10 Ton/24h waste tyre pyrolysis plant on plot No. Kawala 'A'/399 situated at Kokotoni in Kilifi County.

2.1 Project site

2.1.1 Location

The pyrolysis plant will be established on plot number Kawala 'A'/399 situated at Kalia Ng'ombe village in Kokotoni, Kilifi County. The proponent has leased 2 acres on land parcel No. 399 that covers an approximate area of 107 acres. The site is situated about 1.5 km off the Mombasa – Nairobi highway (A109) about 7 km west of Mazeras town and 7km east of Mariakani town and lies between Latitude -3.90264 (3° 54′ 9.5″ S) and Longitude: 39.5279 (39° 31′ 40.43″ E). The map below shows the location of the site with reference to Mazeras town on road A109.

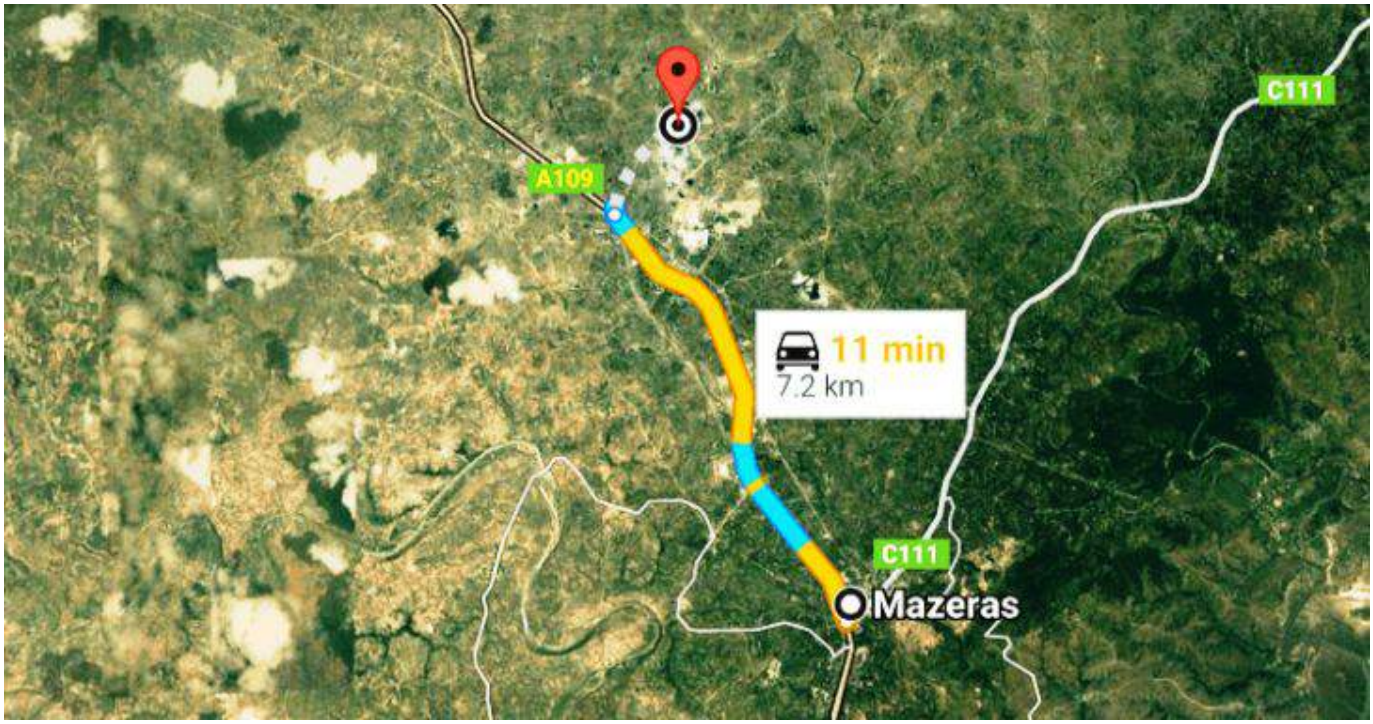


Figure 2.1: A Google Earth map image showing the location of the site situated off A109 in Kilifi County. Most white patches represent quarries under exploitation (Credit: Google Earth Maps, 2016).

2.1.2 Land use

The entire land parcel No. 399 has been used as a quarry. The immediate land parcel is installed with (and operating) an asphalt processing plant. The basic land use within the locality is predominantly agricultural with native permanent homesteads. However, the land use is gradually changing due to the emergence of commercial and light industrial establishments along and off A109. There are no squatters who ought to be relocated.

2.1.3 Suitability of the project site

The development trend along and off the A109 road depicts mixed land uses. However the 'default' land use within the locality is agricultural but due to rapid population and economic growth, the land use along the A109 and also other major highways in Kenya is changing to commercial/light industry. With this regard, it is without doubt that the project site is suitable and will be in character with the immediate surroundings.

2.1.4 Flora and fauna

The vegetation at the proposed project site is characterised by shrubs and grasses. Some of the shrub species include *Maytenus senegalensis* (Confetti tree) and *Pulmeria lubra* (Frangipani). Quarrying activities have greatly altered the area's potential to support animal life. Only a few reptiles such as lizards can easily be seen on site. The photograph below shows a section of the project site.

Figure 2.2: A section of the project site (Source: Joseph K. 2016).

2.1.5 Development and resources

The entire land parcel is enclosed by a 3000mm high stone boundary wall with an access gate close to the proposed site. Quarrying excavations led to the emergency of permanent well that is usually recharged by storm water. The lessor of the land usually allows the local community to exploit the resource. The figure below shows the water reservoir that is within land parcel No. 399 and barely 500m from the site.

Figure 2.3: A water reservoir near the project site and within land parcel No. Kawala 'A' 399 (Source: Joseph K. 2016).

The area is well served with electricity from the national grid and reticulated water from the Kilifi Mariakani Water and Sewerage Company (KIMAWASCO).

2.2 The construction designs and process

The plant will require the following:

- 2 No. sheds with an approximate area of 480m^2. Building plans have been appended in this report;
- A toilet block connected to a septic tank – soak pit system for waste water management; and,
- An office which will include 2 No. improvised Twenty Feet Equivalent Units (TEUs).

Construction process will involve the excavation of the site to create trenches for use in laying footings for the sheds. Foundations will then be laid, and eventually the structures. There will be use of machinery mainly for concrete mixing and lifting installations during the construction process.

2.3 Construction materials

Structural construction of the site will largely apply ordinary materials that are not expected to have significant impact on the environment. Among the material to be used include:

- Mined sand and building blocks- to be obtained from quarries which are mainly located within the fringes of the project site;
- Hardwood from indigenous forests, these will most likely be imported;
- Cement will be obtained mainly from suppliers in Mombasa town;
- Water fittings (pipes, valves and joineries) and other secondary materials such as, papers, polythene materials, and fabrics will be obtained from Mombasa town;
- Paints and decorating materials will be sourced from local outlets in Mombasa town;
- Electrical cables, lifts and other machinery will be sourced from Mombasa town; &,
- Finishing materials such as tiles, block boards are likely to be imported from India, China or Dubai.

2.4 Infrastructure construction

The project will be constructed based on applicable standards of Kenya and any other standards which may be incorporated. The constructions will as well incorporate environmental guidelines, health and safety measures. The project inputs will include the following:

- Construction raw materials will include sand, cement, stones, gravel/ ballast, metals, among others. All these will be obtained from licensed dealers and especially those that have complied with the environmental management guidelines and policies;
- Construction equipment will include machinery such as trucks, concrete mixers and other relevant construction equipment. These will be used for the transportation of materials, clearing of the vegetation and resulting construction debris. Most of the machinery will use petroleum/ diesel products to provide energy; &,
- A construction labour force of both skilled and non-skilled workers will be required.

2.5 By - products and disposal methods

In all construction projects, some waste or by products are usually produced on the project site. These wastes include nails and pieces of broken wood. In this project the construction wastes will be minimal. The removal and disposal of such refuse and other related wastes comes in handy. The contractor will work hand in hand with private refuse handlers and the County Government to facilitate waste handling and disposal from the site. The wastes will be disposed into the designated dumpsites.

2.6 Pyrolysis plant installation

The plant will be installed according to the requisite engineering specifications.

2.7 Plant operation

The plant will be operated in accordance to the requisite waste tyre pyrolysis plant operating procedures.

2.7.1 Project raw materials

2.7.1.1 Waste Tyres

Waste Tyres (WT) will be the primary raw material. The table below shows the typical composition of WT.

Table 2.1: Typical composition of WT (Source: Ryan K. 2015).

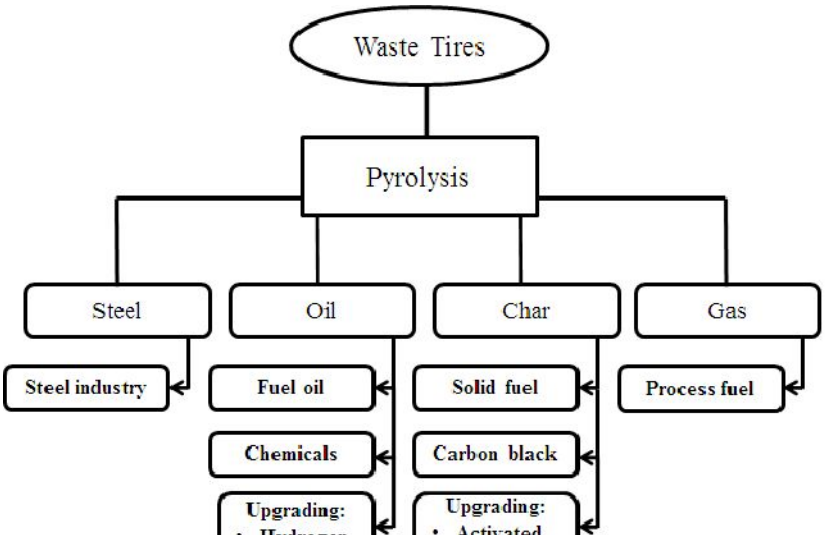
COMPOSITION OF WASTE TYRES	
Rubber	38%
Fillers (Carbon black, silica, carbon chalk)	30%
Reinforcing material (steel, rayon, nylon)	16%
Plasticizers (oils and resins)	10%
Vulcanisation agents (Sulphur, zinc oxide, various chemicals)	4%
Antioxidants to counter ozone effect and material fatigue	1%
Miscellaneous	1%
Elementary Composition	
Carbon	86%
Hydrogen	8%
Nitrogen	1%
Sulphur	2%
Oxygen	3%
Proximate Analysis	
Volatiles	62%
Fixed carbon	30%
Ash	7%
Moisture	1%

Waste tyres will be procured from tyre dealers across the country. The Waste tyres will be stored in an open space.

2.7.1.1.2 Water

The plant will utilize water for system cooling. The site is connected to the reticulated water supply by KIMAWASCo. The proponent may consider utilizing water from the nearby water reservoir. In such case the supply will be metered. The plant will require $1m^3$ /24hr during operation.

2.7.2 Pyrolysis



Pyrolysis involves subjecting tyres to high temperature of 400 to 450 degree Celsius, in absence of oxygen. Pyrolysis is a great way of recycling waste tyres as it's a challenge in the country. During the process scrap steel is produced while tyre breaks down into smaller molecules of pyrolysis oil, pyrolysis gas and carbon black as shown on figure 2.1 inset.

Figure 2.1: Pyrolysis process (Source: Ryan K. 2015)

2.7.2.1 Pyrolysis products and uses

All products of the tyre pyrolysis process will be handled as guided by the relevant Material Safety Data Sheet (MSDS) provided by the manufacturer and legislation in place.

2.7.2.1.1 Pyrolysis Gas

The approximate yield of gas from waste tyre pyrolysis is about 10-30% by weight and it increases with increasing pyrolysis temperature. The pyrolysis derived gas has a calorific value of approximately 30-40MJ N/m-^{3}and can be sufficient to provide the energy required for a small scale process plant. The gas generated by tyre pyrolysis will therefore be effectively used to fuel the process (WCE, 2014). The table 2.2 shows watste tyre pyrolysis gas constituents.

Table 4.5: Gas Composition from the Pyrolysis of Scrap Tyre

Constituent	Volume Percent (%)	Density (kg/m^3)	Weight Percent (%)
Hydrogen	35.83	0.0899	4.22
Methane	29.62	0.668	25.92
Ethane	18.52	1.264	30.67
Propane	5.70	1.882	14.05
Propylene	8.82	1.748	20.20
Isobutylene	0.73	2.504	2.39
Isobutane	0.34	2.489	1.11
Butane	0.23	2.489	0.75
Butene-1	0.14	2.504	0.46
Trans-Butene-2	0.07	2.504	0.23
Iso-butene-2	trace	2.504	-

Table 2.2: Pyrolysis gas constituents used for energy recovery in the gas burner for the waste plastic pyrolysis unit (Source: World Congress on Engineering, 2014)

2.7.2.1.2 Tyre pyrolysis oil (40 to 45%)

The main oil product produced by pyrolysis technology is the fuel oil that is widely used for industrial and commercial purposes. There is need for greener fuel alternatives due to fossil fuel depletion, increasing oil prices and emission challenges. Tyre pyrolysis liquids production pathways with their wide range of potential applications are as shown in figure 2.2 inset.

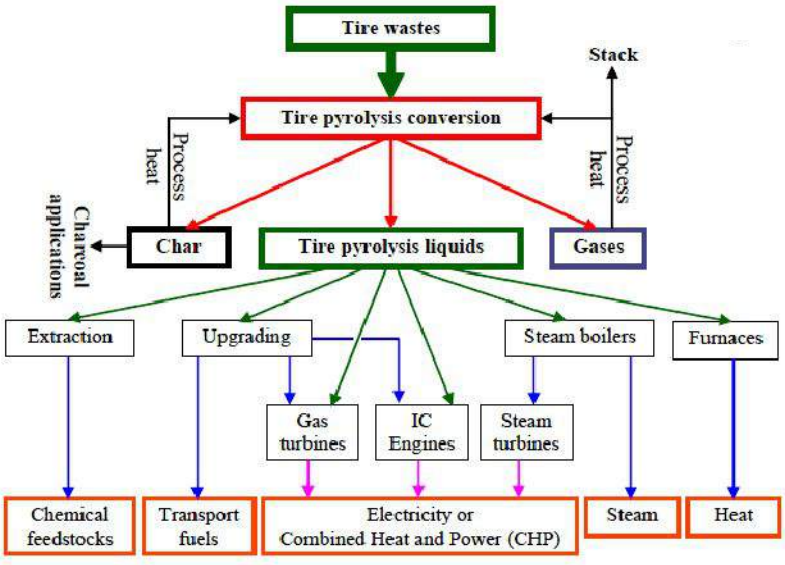


Figure 2.2 Tyre pyrolysis conversion and products applications (Source: World Congress on Engineering, 2014).

2.7.2.1.3 Activated Carbon (30 to 35%)

Activated carbon from pyrolytic char can be used for water purification and air purification, as well as in batteries and fuel cells. Pyrolytic char has a calorific value comparable to high-grade coal and may therefore be used as fuel either in pulverized or briquetted form. The application of pyrolytic char includes manufacturing of thermoplastics and low cost adsorbents for the treatment of industrial effluents. Active carbon can be used to absorb phenols, basic dyes, metals, p-chlorophenols, butane and natural gas

2.7.2.1.4 Scrap steel (10 to 15%)

Waste tyre pyrolysis can also generate scrap steel wire due to the fact that steel wires can be used as reinforcement agent for tyre.The scrap steel generated will be sufficiently clean to be sold to scrap metal processors e.g. Devki Steel Millers and Kenya United Steel Company.

2.8 Project cost

The project implementation cost is estimated at kshs. 9,200,000.00. The proponent has paid Kshs 50,000.00 being the minimum payable fees for high risk projects, to the NEMA Revenue Account: 1102298158 KCB, KICC Branch as EIA fees.

2.9 Project Decommissioning

All establishments determined to be removed from the plant shall be removed and disposed of using the following procedures:

- All on site machinery and shall be assessed to determine the presence of hazardous conditions, materials, or waste and a report prepared for the Management teams;
- All machinery components shall be surveyed to determine if they have potential for local re use or recycling;
- Quantities of all machinery components to be removed, relocated, sold, recycled or donated shall be estimated by site assessment;
- All utility connections, power, water, sanitary connections, etc., shall be identified, disconnected, capped and properly closed prior to or at the time of building demolition;
- All materials to be disposed of shall be taken to a licensed disposal facility, scrap yard or recycling centre. Manifests of all loads, including detailed material descriptions shall be maintained;and,
- A final Decommissioning Report shall be completed upon completion of the decommissioning activities.

CHAPTER THREE

3.0 Environmental Baseline

The environmental baseline of the project area offers both the present and future states of the environment which assumes the project does NOT take off. It takes into account changes which might be occasioned by natural and anthropogenic activities.

3.1. Administrative location and size

Kilifi County is one of the six counties in the coast region. The county lies between latitude 2° 20' and 4° 0' South, and between longitude 39° 05' and 40° 14' East. It borders Kwale County to the south west, Taita Taveta County to the west, Tana River County to the north, Mombasa County to the south and Indian Ocean to the east. The county covers an area of 12,609.7 km^2.

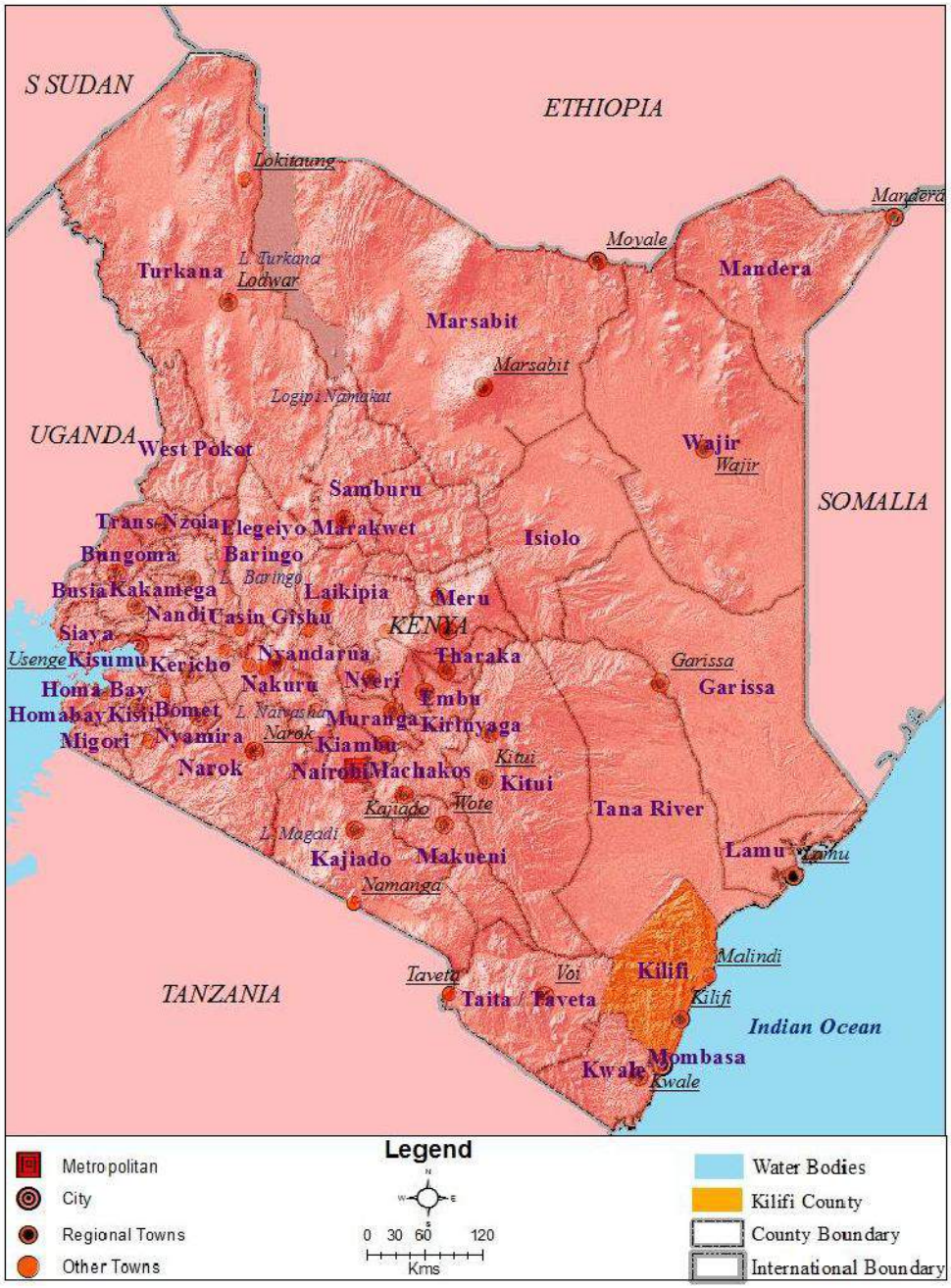


Figure 3.1: Map of Kenya showing the Location of County (Source: Kilifi CIDP, 2013)

3.2 Physiographic and Natural Conditions

3.2.1 Physical and Topographic Features

Kilifi County has four major topographical features. The first one is the narrow belt, which forms the coastal plain and varies in width of 3km to 20km. The coastal plain lies below 30m above sea level with a few prominent peaks on the western boundary including hills such as Mwembetungu. Across this plain run several creeks resulting in excellent marine swamps that are endowed with mangrove forests and present potential for marine culture. This zone is composed of marine sediments, including coral, limestone, marble, clay stones and alluvial deposits that support agriculture.

To the west of the coastal plain lies the foot plateau characterized by slightly undulating terrain. The plateau falls between 60m and 150m altitude and slopes towards the sea. A number of dry watercourses traverse the surface with underlying Jurassic sediments consisting of shells, sandstones and clays. In this zone, grassland and stunted vegetation prevail.

The coastal range falls beyond the foot plateau and has distinct low range of sandstone hills and ranges between 150m to 450m high. These hills include Simba, Kiwava, Daka, Wacha, Gaabo, Jibana, Mazeras and Mwangea. The Nyika plateau that rises from 100m to 340m above sea level and occupies about two thirds of the county area covers the lower lying ground along the western side of the county. The plateau is less populated with a thin vegetation cover, shallow depressions and gently undulating terrain. This is an arid and semi-arid zone, which is suitable for ranching.

The drainage pattern for the county is formed by a permanent river (Sabaki) and seasonal rivers, which drain into Indian Ocean through the various creeks along the coastline. The seasonal rivers are Nzovuni, Rare, Goshi and Kombeni. There are also streams which include Wimbi, Muhomkulu and Mleji (Source: Kilifi CIDP, 2013)

3.2.2 Climate

The project site is located along the inland coastal belt of Kenya. The area is characterized by a tropical and monsoon climate with temperatures high throughout the year. The rainfall pattern is bimodal with rainfall averaging at between 900- 1000mm annually. The long rains come between March and July with a peak in May while the short rains are experienced between October and December. Apart from the monsoon rains, the other dominant feature of the weather at the site is the heat and humidity.

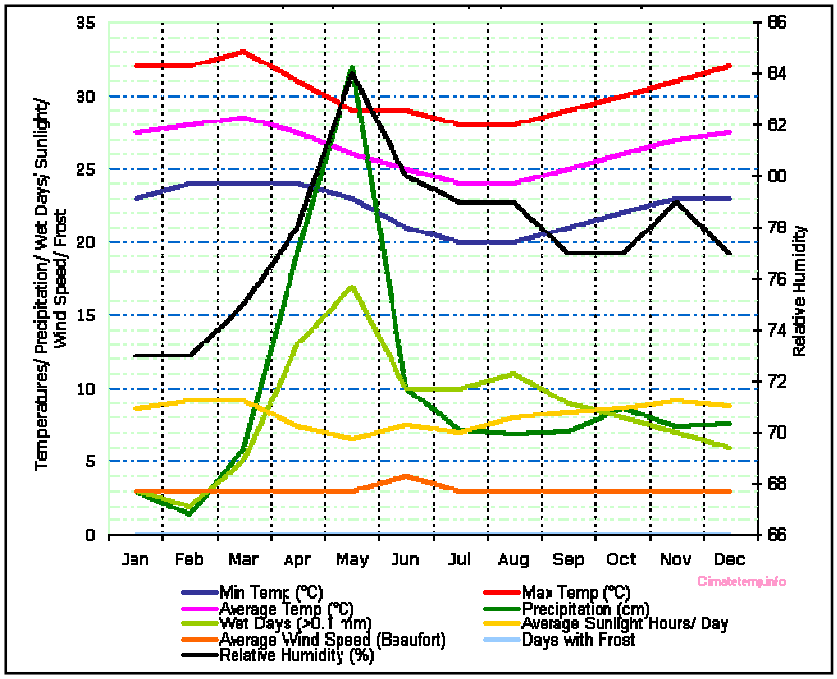


Figure 3.2: Climatic characteristics in Kilifi County (Source: GOK, 1997)

Maximum and minimum temperatures range between 26.5-34^{0}C and 22.5-24.5^{0}C respectively. The coastline experience more than 6 hours of sunshine daily exceeding 8 hours between October and March. The relative humidity (RH) varies from a minimum of 74% in October to 81% in January and May (GoK, 1997).

3.3.2 Population Density and Distribution

The County population density in 2009 was 88 persons per square km. This was projected to increase to 96 persons per km^2 in 2012, further to 105 persons per km^2 in 2015, and 116 persons per km^2 in 2017.

3.3 Demography

3.3.1 Population

The 2009 population census figures show that Kilifi District had a population of over 700,000 persons and a density of 144 persons per km² with a population growth rate of 3.05% against the national population growth rate of 2.49% (CBS 2009 estimate) compared to approximately 500,000 people in 1999.The population of Kilifi especially in its urban centers has been on the rise mainly due to rural urban migration, tourism and the influx of foreigners. The local population is culturally heterogeneous. The largest indigenous ethnic group being the Mijikenda which is comprised of nine sub-tribes namely: Giriama, Digo, Rabai, Duruma, Kauma, Chonyi, Kambe, Ribe, and Jibana. Other indigenous Coastal ethnic groups are: Taita, Pokomo, Bajuni, Orma, Sagala, and Swahili. Due to its socio-economic dynamics which offer great opportunities for livelihoods and leisure, Kilifi and the project site in particular has over the years attracted a multiplicity of ethnic and racial groups (Source: KNBS, 2010).

3.3.2 Settlement patterns

Settlement patterns in Kilifi County are influenced by infrastructure network (roads, water, and electricity) and high agricultural potential zones. High population densities are found in Kilifi Town, Kikambala and Kaloleni divisions along the tarmac road of Mombasa-Malindi and Mombasa-Nairobi up to Mariakani area (proposed project locality). These areas are also well supplied with piped water and electricity. High population clusters are also found in Chonyi division and some parts of Kaloleni division where there are high potentials for agricultural production. Sparsely populated divisions in the district are Ganze, Vitengeni, Bamba and some parts of Kaloleni division. These areas are rangelands and are less productive agriculturally. The three larger towns in the district (Kilifi, Mariakani and Mtwapa) have a total population of 100,000 (2009), which represents approximately 13% of the total district population. The resident population of Mariakani Town is estimated at 10,000 people.

3.4 Infrastructure and Access

3.4.1 Road, Rail Network, Ports and Airports, Airstrips and Jetties

The entire road network covers about 3000Kms. Of this 1,320 km is rural classified network, about 450kms is national classified network and the rest are unclassified. Approximate 30km of rural county roads are to bitumen standards, 220Km of rural county roads are graveled and the rest are earth roads (Source: Kilifi CIDP, 2013).

3.4.2 Posts and Telecommunications

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

3.4.3 Energy Access

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

hospitals. The county is also promoting the establishment of woodlots to ensure there is constant and sustainable supply of wood fuel (Source: Kilifi CIDP, 2013).

3.4.4 Housing

Majority of the houses in the county have walls made of mud/wood 59 percent as the main walling material, followed by brick/block at 22.05 percent and mud/cement at 5.95 percent. On the floor earth 73.5 percent as the main floor materials, cement 25.05 percent, tiles 1.15 percent on roofing *Makuti* leads with 41.4 percent, Corrugated iron sheets 32.9 percent and grass 20.2 percent as the main roofing materials. There are informal settlements coming up in the major urban Centres in the county especially Malindi and Kilifi towns (Source: Kilifi CIDP, 2013).

3.4.5 Sewage Management Infrastructure

The entire Kilifi County has no sewerage infrastructure. Hence the common methods for disposal of human wastes is through pit latrines and septic tank and soak pit systems. The problem is compounded by the fact that the local authority has not developed by-laws guiding generation and disposal of liquid waste. It relies on the Public Health Act Cap 242, which is inadequate in seeking lasting solutions to the problem of liquid waste. There is little evidence of adherence to the Water Act 2002 that stipulates the requirements for boreholes and pit latrines are located at far distances to protect ground water sources from contamination.

3.5 Land and Land Use

According to Kilifi CIDP, 2013-2017, it is estimated that 11.3 percent of the households in the county are landless according to the data available in the Lands offices. Many of these people are squatters on private land. In an effort to address the situation, the Government has put in place several schemes, although the number of people settled in these schemes is below target. This has led to an emergence of informal and unorganized settlements in Malindi, Kilifi and Mtwapa Towns. Many people in the rural parts of the county have no title deeds and they own the land communally. Absence of title deeds has discouraged long term investments on the land.

3.6 Major Contributors to Environmental Degradation in the County

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

3.7 Effects of Environmental Degradation

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

3.8 Human and economic development

The economy of Kilifi County is driven largely by the commercial activities that take place in neighboring Mombasa County. Although there are companies involved in the manufacturing of steel products for example Mabati Rolling Mills, Corrugated Sheets and Kalu Works, there is a recent upsurge in the establishment of truck marshalling yards for most of the major transport companies, container depots and Container Freight Stations (CFSs). The existence of the Kilindini port in Mombasa County and the attractions that Mombasa offers to tourists contributes significantly to the overall business activity in Kilifi.

3.9 Water resources

Kilifi County is generally water scarce both in terms surface and ground water and largely depend on piped water from the Mzima springs and Baricho water. The only permanent river is the Sabaki River which feeds the Baricho water works and crosses the northern part of Kilifi County. The others are temporary due to few catchment areas, sandy soils which have high infiltration rates and high evapo-transpiration rates. Ground water resources are exploited along the coastline through shallow wells and bore holes but diminish as one moves inland.The proposed development will be serviced by KIMAWASCO from their Mzima springs water mains pipeline. At the site location, the Mzima mains line is situated about 1.8km in the neighboring County of Kwale.

3.10 Energy supply

The main source of energy supply in the area is electricity from the Kenya Power and Lighting Company. Power mains traverse land parcel No. 399. However, this is mostly supplemented with diesel powered generators in times of power blackouts. A number of facilities have also ventured into harnessing solar energy by use of solar panels and accumulators. Wind energy has also been sparsely used especially in pumping water from boreholes in the remote parts of the County. In the rural areas, main energy sources are fuel wood, charcoal and paraffin. The proposed development will majorly rely on electricity.

3.11 Solid Waste

The main waste generation sources are domestic, commercial ventures, hotels, markets, industries and institutions including health facilities. The types of waste that are generated can be classified as follows.

- Mixed heavy plastics -Soft drink bottles, detergent bottles, cooking oil/fat bottles, household plastics etc.
- Mixed light plastics - Shopping bags, wrapping films, waste collection bags
- Rubber - Old tyres, shoe soles etc.
- Mixed paper - Books, office paper, newspapers carton pieces etc.
- Metals -Pieces and sheets of aluminum, steel and other metals
- Mixed glass - Colored and non-colored, broken or whole glass bottles, panes, household glass items etc
- Organics - Food remnants, wooden debris, yard waste etc.
- Biomedical waste- waste from hospitals, dispensaries and medical clinics.

All types of waste are transported to disposal sites including hazardous types containing pesticides, heavy metals, oils, batteries, acids, domestic and hospital wastes. The private sector has initiated ways to address the problem of waste management through construction of compost pits in areas where collection is limited and providing waste disposal services to complement those provided by the County Government.

3.12 Poverty index

Poverty in Kilifi County manifests itself, in the inability by the majority of the population to access basic needs due to geographical, economic and social-cultural barriers. The poverty index on the area is estimated at 50% and is slightly above the national average. Out of the 719,000 people in Kilifi District (2009), 65.35% are food poor and 43.02% hardcore poor meaning that they cannot meet the minimum food requirements even after spending all their income on food alone. Within the adult population, 66.8% people cannot meet the minimum cost of food and non-food items essential for human life and hence are absolutely poor. In terms of gender, 45% of the poor are male and 55 percent are female (KNBS, 2009).

Factors that contribute to the poverty incidence in Kilifi include climatic conditions, low levels of education and land ownership. Effects of the high poverty levels in Kilifi include high rate of school drop outs, deteriorating health

conditions, worsening literacy levels etc. The immediate cause of poverty within the proposed project area has been attributed to landlessness, high and increasing cost of living, inaccessibility to credit facilities, lack of entrepreneurial skills, unemployment, low incomes and HIV/AIDS and discrimination at places of work.

In general, poverty has led to over-use and destruction of natural resources where short-term development goals are pursued at the expense of long-term environmental sustainability. There is need to ensure that environmental concerns are integrated into development planning and that development plans lead to empowerment of local communities to engage in sustainable livelihood activities. Hence the development proposal will contribute significantly to reducing the poverty index at a local level through employment creation and the trickledown effect of the development on other business establishments.

3.13 Protected areas

Gazetted forests, kayas and marine parks constitute the protected areas in Kilifi County. The gazetted forests include a section of the ArabukoSokoke forest and mangrove forests mainly found at Takaungu, Kilifi creek, Mtwapa creek and part of the Mida creek in Uyombo, with an area of approximately 880Ha. The kayas (sacred forests) include Chonyi, Kambe, Ribe, Jibana, Kauma and Kaya fungo. The marine parks and reserves include, part of the Mombasa marine and National Reserve, Watamu-Voi Marine National park and Reserve (coral gardens) and part of the Voi Marine and National Reserve. The part of ArabukoSokoke forest which falls in Kilifi County constitutes 19,000 Ha out of the 37,000 Ha .The forest is situated between Kilifi creek and The Sabaki River. The forest has a very high biological diversity. It is one of the important sites for bird conservation in Kenya (Kesley and Langton). Six of the bird species listed as rare in the ICBP/IUCN Bird red data book occurs in this forest. Two of these bird species, the Sokoke Owl (*Otus arena*) and the clerk's weaver (*Ploceusgolandi*) are found nowhere else in the world except in this forest. In addition to the endemic bird species, ArabukoSokoke is also home to other terrestrial fauna. For instance it is the only known home for the endangered *Cephalophusadersi*, the frog *Leptopelisflavomacculatus*, and two butterfly species, the *Charaxesprotocles* and the *Charaxeslasti*. None of these protected areas are close to the project site.

3.14 Socio-economic profile

The socio-economic profile of Kilifi County is mainly defined by subsistence farming, artisanal fisheries, Tourism, mining and trade. However agriculture and tourism are the two primary forms of economic activity in the County. In Kilifi County tourism is concentrated around Malindi and to a lesser extent Kilifi. The revenue earned effects only a small proportion of the population. Under Vision 2030, the county is set to transform into a tourist destination featuring world class golf courses and a Resort City.

CHAPTER FOUR

4.0 Policy, Institutional and Legal Framework

4.1 Introduction

The relevant legislation which the project must comply with is intended to ensure project's sensitivity to environmental concerns, public safety, public health, physical planning regulations, County Government of Kilifi bylaws and National Construction Authority (NCA) construction standards. In response to environmental degradation, the Kenya parliament enacted the EMCA No. 8 of 1999 to comprehensively address the challenges of environmental management in Kenya. Later Legal Notice No. 101 was gazetted in 2003 as an attendant regulation to EMCA, 1999. Under this legal framework major changes in land use are required to undergo an EIA study which is later submitted to a statutory body i.e. NEMA for approval and granting of an EIA license. Similarly existing projects with a potential to impact on the environment, health and safety of the environment are required to undergo an initial environmental audit to determine compliance with environmental legislation and integrate environmental concerns into the operational stages of the project life cycle.

Environmental degradation is a major global challenge especially in terms of how to maintain sustainable development without degrading the natural environment on which people are dependent. It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound (Okidi and Mbote, 2001). Among the major environmental problems being experienced in Kenya today include land and habitat degradation, loss of biodiversity, environmental pollution and water management.

4.2 Policies

4.2.1 National Environmental Action Plan (NEAP, 1994)

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 programs that disregard environmental sustainability. Following on this, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. Under the NEAP, Environmental Impact Assessments and Environmental Audits were introduced targeting the industrialists, business community and local authorities.

4.2.2 National Policy on Water Resources Management and Development

While the National Policy on Water resources Management and Development (1999) enhances systematic development of facilities in all sectors for promotion of the country's socio-economic progress, it also recognizes the by-products of this process as waste water. It therefore calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution. Industrial and business development activities therefore should be accompanied by corresponding waste management systems to handle the waste water and other waste emanating from their activities. The same section requires that such projects should also undergo comprehensive Environmental Impact Assessment (EIA) that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighborhood and further downstream are not negatively impacted by their emissions. As a follow-up to this, EMCA 1999 requires annual environmental audits to be conducted in order to ensure that mitigation measures and other improvements identified during EIA studies are implemented. In addition, the policy provides for charging levies on waste 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 treatment. The policy provides for establishment of standards to protect water bodies receiving waste water, a process that has been accomplished through the gazettment of Legal Notice No. 120 of 2006 (Water Quality Regulations).

4.2.3 Policy Paper on Environment and Development

The key objectives of the Policy on Environment and Development include:

- To comply with and make provisions for effluent treatment standards that will conform to acceptable NEMA guidelines.
- To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation; &,
- To ensure that from the onset, all development policies, programs and projects take environmental considerations into account.

4.2.4 The Land Policy (2007)

Environmental management principles: To restore the environmental integrity the government shall introduce incentives and encourage use of technology and scientific methods for soil conservation and maintain beaches at high and low water mars and put in place measures to control beach erosion. Fragile ecosystems shall be managed and protected by developing a comprehensive land use policy bearing in mind the needs of the surrounding communities. Zoning of catchment areas to protect them from further degradation and establishing participatory mechanisms for sustainable management of fragile ecosystems will also be done. It will also develop procedures for co-management and rehabilitation of forest resources while recognizing traditional management systems and sharing of benefits with contiguous communities and individuals. Lastly all the national parks, game reserves, islands, front row beaches and all areas hosting fragile biodiversity are declared fragile ecosystems. Conservation and sustainable management of land based natural resources: The sustainable management of land based natural resources depends largely on the governance system that defines the relationships between people and resources. To achieve an integrated approach to management of land based natural resources, all policies, regulations and laws dealing with these resources shall be harmonized with the framework established by the Environmental Management and Coordination Act (EMCA),1999. The new land policy has a vision of 'efficient, sustainable and equitable use of land'. It designates all land in Kenya as Public, Community or Private; 'Community land' replaces the Trust Land category. It also recognizes and protects customary land rights.

Some key relevant issues:

- The exercise of (these) powers (compulsory acquisition and development control) should be based on rationalized land use plans and agreed upon public needs established through democratic processes (Section 43);
- Ensure that the exercise of development control takes into account local practices and community values on land use and environmental management (Section 51(f));
- Ensure effective public participation in the exercise of development control (Section 51(g)); and,
- Strategies for sharing benefits should be developed taking into account the nature of the resources involved and the contribution that diverse actors make to the management of the resources (Section 98).

The policy also addresses land management. Key issues include Section 3.4.3.2 – ecosystem protection (including wetlands). Measures for protection are required with sub-section 135 addressing fragile ecosystems to be managed and protected. Sub-section 137 focuses on Protection of watersheds, lakes, drainage basins & wetlands shall be guided by among other principles prohibition of settlement and agricultural activities in the water catchment areas, identification, delineation and gazettement of all water courses and wetlands as well as integrated resource management based on ecosystem structure. Section 3.4.3.3 addresses urban environment management on the face of the rapid urban development in the country. The section calls for control of waste dumping, regulation of quarrying activities and rehabilitation of material dumping sites and land.

4.2.5 National Policy on Water Resources Management and Development

The National Policy on Water Resources Management and Development (Sessional Paper No. 1 of 1999) was established with an objective to preserve, conserve and protect available water resources and allocate it in a sustainable rational and economic way. It also desires to supply water of good quality and in sufficient quantities to meet the various water needs while ensuring safe disposal of waste water and environmental protection. The policy focuses on streamlining provision of water for domestic use, agriculture, livestock development and industrial utilization with a view to realizing the goals of the Millennium Development Goals (MDGs) as well as Kenya Vision 2030. To achieve these goals, water supply (through increased household connections and developing other sources) and improved sanitation is required in addition to interventions in capacity building and institutional reforms. 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 waste water. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution. Development projects, therefore, should be accompanied by corresponding waste management systems to handle the waste water and other waste emanating there from. The same policy requires that such projects should also undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighbourhood and further downstream are not negatively impacted by the emissions.

4.3 Institutional Framework

4.3.1 Background and Administrative Structures

The Environmental Management and Co-ordination Act of 1999 received Presidential assent on January 6, 2000 and was gazetted on January 14, 2000. The main objectives of the Act are to:

- Provide guidelines for the establishment of a legal and institutional framework for the management of the environment in Kenya;
- Provide a framework of legislation for over 77 statutes in Kenya that contain environmental provisions; &,
- Provide guidelines for environmental impact assessment, environmental audit and monitoring, environmental quality standards and environmental protection orders.

In 2001, the Government established the administrative structure to implement the Act. The two main administrative structures are:

4.3.2 The National Environmental Council (NEC)

The National Environmental Council (The Council) is responsible for policy formulation and directions for the purposes of the Act. The Council also sets national goals and objectives and determines policies and priorities for the protection of the environment.

4.3.3 The National Environment Management Authority (NEMA)

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies relating to the environment. In addition to NEMA, the Act provides for the establishment and enforcement of environmental quality standards to be set by a technical committee of NEMA known as the Standards and Enforcement Review Committee (SERC).

4.4 Legal Framework

The key national laws that govern the management of environment resources in the country have been briefly discussed in the following paragraphs. Note that wherever any of the laws contradict each other, the Environmental

Management and Coordination Act 1999 prevail.

4.4.1 The Constitution of Kenya (2010)

The Constitution of Kenya 2010 is the supreme law of the land. Any other law that is inconsistent with the Constitution is null and void to the extent of its inconsistency. Under Chapter IV, article 42 provides for the right to a clean and healthy environment for all. Further, Chapter V of the Constitution deals with Land and Environment. Specifically Part 2 elaborates on the following components regarding the protection of the environment.

- Enforcement of environmental rights
- Obligations in respect of the environment
- Agreements relating to natural resources
- Legislation relating to the environment

Under the Constitution the proponent is entitled to carry out the project within legal limits and a fair administrative decision making process from NEMA and other State organs. On the other hand, he is required to ensure:

- ***That the project is carried out in an ecologically, economically and socially sustainable manner;***
- ***That the right to a clean and healthy environment for all is upheld in all phases of the development; &,***
- ***That all the applicable provisions of the Constitution are observed at all times.***

4.4.2 The Environmental Management and Co-ordination Act (EMCA), 1999

The purpose of this Act aims at improving the legal and administrative co-ordination of the diverse sectored initiatives in the field of environment so as to enhance the national capacity for its effective management. It has several Regulations that are discussed in the proceeding sections.

4.4.2.1 The Environmental Management and Co-ordination (EIA/EA) Regulations, 2003. (Legal Notice No. 101 of 2003)

The EIA/EA Regulations are meant to ensure the implementation of Sec. 58 of EMCA. It makes it illegal for anyone to undertake developments without an EIA license and stipulates the ways in which environmental experts should conduct the Environment Impact Assessment and Audits reports in conformity to the requirement stated. It is concise in its report content requirements, processes of public participation, licensing procedures, inspections and any possible offences and penalties under the Act.

Relevance to the proposed project

Acquisition of EIA license prior commencement of the project. The operations of the project are similarly licensed since the EIA report contains an Environmental Management Plan which forms the basis for approval of the project by NEMA and imposition of conditions to safeguard the environment. Environmental Auditing should be done annually.

4.4.2.2 Environmental Management and Co-ordination (Water Quality) Regulations, 2006. (Legal Notice No. 120 of 2006)

Water quality regulations were gazetted as a legislative supplement to mainly address the challenges of pollution of water sources and conservation. It consists of VI parts and eleven schedules dealing with protection of water sources for domestic use to miscellaneous provision. Effluent discharge and water for industrial use are dealt with under part III which sets out the following:

- Standards for discharge into the environment,
- Standards for discharge monitoring, and

- Application for effluent discharge license.

Generally the act addresses the challenges of pollution of water resources as well as their conservation. The regulation provides guides for water use and conservation as well as effluent standards for discharge.

Relevance to the proposed project

Important in protection of ground water resources. Since there is a potential of work force effluent to be discharged into the environment, the proponent will ensure that such effluent is managed accordingly. The proponent should seek Effluent Discharge License (EDL) prior operation.

4.4.2.3 The Environmental Management and Co-ordination (Waste Management) Regulations, 2006. (Legal Notice No. 121 of 2006)

In pursuit of the provisions of the Environmental Management and Coordination Act, 1999, the Minister for Environment in 2006 gazetted the waste management regulations focusing on management of solid wastes, industrial wastes, hazardous wastes, pesticides and toxic substances and radioactive substances The regulations are aimed at addressing the following concerns;

- Licensing of waste recycling and disposal sites,
- Licensing waste transportation waste,
- Reduction of waste through adoption of cleaner methods of production,
- Responsibilities for waste generators and obligations for disposal,
- Proper transportation and disposal of wastes,
- Management of waste disposal sites,
- Waste treatment requirements,
- Application of existing regulations in relation to waste management,
- Licensing of waste handlers and disposal sites, and,
- Licensing fees and procedures for waste handlers and pollution penalties

Relevance to the proposed project

- ***Seek waste recycling license after an EIA License is issued.***
- ***Ensure that entities delivering the WT are licensed to transport waste****.*
- *Ensure there is proper contractual agreement with licensed solid waste handlers and that solid wastes are disposed on the manner prescribed.*
- *Ensure proper disposal of any materials. This could include PPE, packaging, plastic wrappings, lunch containers, cartons etc.*
- *All solid wastes generated by the operations of the facility shall be disposed of by a contracted NEMA licensed solid waste handler.*

4.4.2.4 The Environmental Management and Co-ordination (Excessive Noise and Vibrations Pollution Control) Regulations, 2009. (Legal Notice No. 61 of 2009)

These Regulations were gazetted to manage noise levels to levels that do not cause a disturbance to the public. The proposed activities will however have a potential for the production of noise above the acceptable limits.

Relevance to the proposed project

Ensure compliance with the set noise level limits for the site especially during farm preparation activities. The contractor should ensure that employees are not exposed to noise levels above 85 dB (A) and in such cases provide suitable personnel protection equipment (ear protective devices). Zoning and visual marking of areas with potential

high noise or vibrations is recommended.

4.4.3 The Water Act No. 8 of 2002

While developing the National Water Policy, the Government also established a National Task Force to review the Water Act, Chapter 372 and draft a Bill to replace the Water Act, Chapter 372. The Water Bill 2002 was published on 15th March 2002 and passed by Parliament on 18th July 2002. It was gazetted in October 2002 as the Water Act, 2002 and went into effect in 2003 when effective implementation of its provisions commenced. The legal framework under the Water Act 2002 provides the guidelines in line with the existing policy changes, four key institutions with separate functions and decentralized decision making systems.

Relevance to the proposed project

The proponent should ensure that water usage in all phases of the project cycle is in line with the provisions of this Act and obtain a water abstraction permit from Water Resource Management Authority *(WARMA) if water will be abstracted from the nearby reservoir.*

4.4.4 The Occupational Safety and Health Act 2007, OSHA

The OSHA 2007 repealed the Factories Act, Cap 514 Laws of Kenya which had been originally adopted in 1962 and revised in 1972, underwent further and extensive amendments in 1990. The provisions of OSHA have far reaching implications on safety and health at the work place. The OSHA sets out to make provisions that aim to eradicate or minimize accidents at the work place. Throughout the world, work related accidents are a major concern for Governments and industry, the hospitality industry included. The ILO estimates that there are over 250 million work related accidents per year; 160 million work related ill health every year and that 3000 people are killed at work per day. Many of the accidents could be avoided if appropriate safety practices and information were used. Work related accidents affect not only the injured employee, but others as well – employers, family, co-workers, clients, suppliers, community etc.

The OSHA 2007 commenced on 26th October 2007. It is an Act to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces. Although the OSHA 2007 repealed the Factories and Other Places of Work Act, Cap 514 Laws of Kenya, it inherited all the subsidiary legislation issued under Cap 514. Examples of subsidiary legislation inherited include:

- Electric Power Special Rules L.N 340 of 1979
- First Aid Rules L.N 87 0f 1964
- Docks Rules L.N 306 of 1962
- Eyes Protection Rules L.N 44 of 1978
- Building Operations and Works of Engineering Construction Rules L.N 40 of 1984
- Cellulose Solutions Rule L.N 87 of 1964
- Health and Safety Committee Rules L.N 31 of 2004
- Medical Examination Rules L.N 24 of 2005
- Noise Prevention and Control Rules L.N 25 0f 2005
- Fire Risk Reduction Rules L.N 59 0f 2007
- Hazardous Substances Rules L.N 60 of 2007

Of particular importance to the project site is the requirement that all work places must be registered with the Department of Occupational Safety and Health Services. Further, there is a requirement that a Safety and Health Committee must be put in place and that employee and members of this committee must be inducted and trained on the provisions of the Act accordingly. The Act imposes various obligations on both employers and employees. These are all necessary for the health and safety of persons accessing and using the premises of the proposed site. Strict

provisions are made for in respect of equipment containing self-acting machines, hoists and lifts and the requirement for supervision and training of inexperienced workers. There must be put in place an SHC and proper training to be done.

Relevance to the proposed project

The proponent will ensure that the facility is registered with the DOSH as a work place. Further an abstract of the facility's safety and health policy should be exhibited at a conspicuous place within the property.

4.4.5 HIV/AIDS Prevention and Control Act (Act No.14 of 2006).

Part 11, Section 7 requires HIV and AIDs education in the work place. The government is expected to ensure provision of basic information and instruction on HIV and AIDs prevention and control to; Employees of all Government ministries, Departments, authorities, and other agencies; and, Employees of private and informal sectors. The information on HIV/AIDs is expected to be treated with confidentiality at the work place and positive attitudes shown towards infected employees and workers.

During project implementation the contractor is expected to create awareness to the employees and the local communities on the issues related to HIV/AIDS.

4.4.6 Traffic Act (Cap. 403)

Section 42 Part 1 forbids any driver to drive a vehicle at a speed exceeding fifty kilometers per hour on any road within the boundaries of any trading centre, township, municipality or city: The highway authority is expected to erect and maintain traffic signs as prescribed so as plainly to indicate to drivers entering or leaving such roads or areas where the fifty kilometer per hour speed limit restriction begins and ends.

Section 47 of the act states that any person who drives a motor vehicle on a road recklessly, or at a speed or in a manner which is dangerous to the public, shall be guilty of an offence and liable to a fine. Part VIII of cancelling any driving license or provisional driving license held by the offender and declaring the offender disqualified for holding or obtaining a driving license for such period as it thinks fit.

Section 52 Part 1, The driver of the vehicles are expected at all times to obey directions given by the police officer whether verbally or in signal, conform to the indications given by any traffic sign, and when any person in charge of any cattle raises his hand or in any manner signaling to stop, and keep it stationary for as long as it is reasonably necessary.

Section 53 Part 1, No vehicle shall be allowed to remain in any position on any road so as to obstruct or to be likely to obstruct or cause inconvenience or danger to other traffic using the road, and, save where the contrary is expressly provided in this Act, every vehicle on a road, when not in motion, shall be drawn up as close to the side of the road as possible.

Relevance to the proposed development

Drivers or machine operators should cause no obstruction but observe the recommended speed limits. The proponent will formulate site traffic rules, speed guidelines, mark vehicles pathways, have some trained site traffic marshals and install traffic signs within the site.

4.4.7 Occupier's Liability Act Cap. 34

The act regulates the duty that an occupier of premises owes to his visitors in respect of dangers due to the state of the premises or to things done or omitted to be done on them. It requires that the occupier warn the visitors of the

likelihood of dangers within his premises to enable the visitor to be reasonably safe.
Proponent should ensure safety of workers and visitors in all project phases.

4.4.8 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:

1. The need to protect and manage the environment, and conserve natural resources;
2. 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

Relevance to the proposed project

Electricity power installation and usage should be done in a manner that seeks to protect the health and safety of the project employees, the local and other potentially affected communities as well as the environment. All electrical systems to be installed and operated by KPLC certified/qualified electrical companies/persons.

4.4.9 Pest Control Products Act (Cap. 346)

The Pest Control Products Board is a statutory organization of the Kenya Government established under the Pest Control Products Act Cap 346, Laws of Kenya with a broad mandate of regulating the trade and use of pesticides (pest control products) in the country. It specifies the license requirements for the marketing, use and disposal.

Relevance to the operations of the facility:

Proponent should ensure that pest control methods used in the farm do not result to residual chemicals being drained into the environment. Proponent should seek services of qualified and licensed pest control service provider.

4.4.10 Energy Act, 2006

The Act established Energy regulatory Commission whose functions include regulating the importation, exportation, transportation, refining, storage and sale of petroleum and petroleum products, issuing construction permits for all petroleum related facilities in order to check proliferation of substandard sites.

4.4.11 County Government Act 2012

The County Government Act 2012, gives effect to Chapter Eleven of the constitution of Kenya 2010 and ascribes to the following: To provide for County Governments` powers, functions and responsibilities to deliver services and for connected purposes. To ensure sustainability the County Government is empowered to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and wellbeing of the inhabitants of its area. The By–laws prescribe the necessary easements required for the establishment of any project within the County.

The proponent is obliged to seek all necessary County approvals/licenses/permits.

CHAPTER FIVE

5.0 Public and Stakeholder Consultations

An extensive public consultation process was engaged in gauging the sentiments of a variety of stakeholders in the development of this project. Besides the fact that this is a regulatory requirement under the Environmental Management and Coordination (EIA/EA) Regulations (2003), it was an excellent opportunity to offer the public an opportunity to ventilate their joys as well as concerns. The exercise was carried in August, 2016.

5.1 Methodology

Public participation was implemented using semi-structured interview strategy, questionnaires and informal consultations. Sample questionnaires have been appended in this report.

For a wider public consultation, the proponent will publish a public notice on the Kenya *Gazette*and in at least two newspapers circulating in the project area and make announcement on radio.

5.2 Findings

- The overwhelming majority of the respondents could see enormous benefits accruing to them and to the enhancement of the environment by the coming into being of the project.
- The public participation process engaged for this study demonstrates that most respondents could not understand the concept of waste tyre pyrolysis and had the perception that such process is similar to the open air burning to melt waste tyres to retrieve steel scrap as it is common in Kibarani dumping site in Mombasa County.
- Within the locality there have been several incidences of open tyre burning which has been a nuisance. The locals doubt the suitability of the project with fears of air pollution by burning of WT.
- In the case that there will be job opportunities, the residents of Kalia Ng'ombe should be considered. They highlighted that the neighbouring light industrial investments have denied them such opportunities but considered 'outsiders'
- In the case that the project will interfere with 'community' water source or cause any sort environmental nuisance, the project will not be acceptable to them.

5.3 Conclusion

Some evidence of public consultation cannot be produced as in the form of questionnaires; some respondents sought anonymity. Majority respondents wish to see the actualization of the proposed EMP and recognized the enormous economic opportunities which this project represents.

CHAPTER SIX

6.1 Potential Environmental Impacts

This Chapter identifies both positive and negative environmental impacts likely to be occasioned by the project's construction, operation and decommissioning phases. Contained in this chapter is a detailed investigation of the proposed activity and site-specific potential impacts associated with the proposed Waste Tyre Pyrolysis project. It discusses the nature of impacts, their magnitude, spatial and time extent and significance.

The table below summarises the potential negative impacts.

Table 6.1: summary of potential negative impacts.

Potential Impact	Environmental Significance Pre Mitigation			Environmental Significance Post Mitigation		
	P[1]	M[2]	S[3]	P	M	S
General Environment						
Construction Phase: Harm to the environment in general	3	2	M	2	2	L
Operational Phase: Harm to the environment in general	3	3	M	2	2	L
Atmosphere and Noise						
Construction Phase: Degradation of ambient air quality due to dust generation	3	3	M	2	2	L
Construction Phase: Atmospheric pollution due to the release of emissions	3	3	M	2	2	L
Construction Phase: Noise pollution	4	3	H	3	3	M
Operational Phase: Air pollution due to the release of emissions from the Waste Tyre Pyrolysis Plant	5	3	H	5	2	M
Operational Phase: Air pollution due to the release of emissions from the Waste Tyre Pyrolysis Plant	5	3	M	5	1	L
Operational Phase: Air pollution due to the release of emissions from the backup diesel generator	3	3	M	2	3	M
Operational Phase: Air pollution due to the release of emissions from fires established on site	3	4	H	2	3	M
Operational Phase: Nuisance and air degradation due to the generation of dust and particulates	4	3	H	2	2	L
Operational Phase: Nuisance and degradation of ambient air quality due to increased traffic	3	3	M	2	2	L
Operational Phase: Disturbance and nuisance to adjacent receptors due to noise generation	4	2	M	3	1	L
Soil						
Construction Phase: Degradation and loss of topsoil	3	3	M	2	2	L
Operational Phase: Soil erosion	3	2	M	2	1	L
Soil, stormwater and groundwater pollution						
Construction Phase: Soil, stormwater and groundwater pollution due to spillages and/or improper handling, storage, mixing or disposal of cement and concrete	3	3	M	2	2	L
Construction Phase: Soil, stormwater and groundwater pollution due to poor management and accidental spills of hazardous chemicals	3	3	M	2	2	L
Construction Phase: Soil, stormwater and groundwater pollution due to poor waste management	4	2	M	2	2	L
Construction Phase: Soil, stormwater and groundwater pollution due to unsanitary conditions onsite	3	3	M	1	2	L

P – Probability
M – Magnitude
S – Severity

Potential Impact	Environmental Significance Pre Mitigation			Environmental Significance Post Mitigation		
	P[1]	M[2]	S[3]	P	M	S
Construction Phase: Soil and water pollution due to contaminated wash water entering the environment	3	3	M	2	2	L
Construction Phase: Hydrocarbon pollution of soil, stormwater and groundwater	3	3	M	2	2	L
Operational Phase: Soil, stormwater and groundwater pollution due to poor management and accidental spills of hazardous chemicals	4	4	H	3	3	M
Operational Phase: Soil, stormwater and groundwater pollution due to poor waste management	3	3	M	2	2	L
Operational Phase: Soil, stormwater and groundwater pollution due to unsanitary conditions onsite	3	3	M	2	2	L
Operational Phase: Soil, stormwater and groundwater pollution due to contaminated wash water	3	3	M	2	2	L
Operational Phase: Soil and groundwater pollution from leaking or broken sewerage pipes	3	3	M	1	3	L
Operational Phase: Contamination of clean stormwater runoff	4	3	H	2	2	L
Operational Phase: Soil, stormwater and groundwater pollution due to incorrect storage of waste & shredded tyres	3	4	H	2	2	L
Operational Phase: Soil, stormwater and groundwater pollution due to inadequate storage of pyrolysis oil	4	3	H	2	2	L
Operational Phase: Leaching of zinc and sulphur due to inadequate storage of ash	3	3	M	1	3	L
Resources						
Construction Phase: Wastage or depletion of valuable resources like water and electricity due to inefficient or redundant usage	3	2	M	2	2	L
Operational Phase: Wastage or depletion of water due to leaking or broken water pipelines & water storage vessels	3	2	M	2	2	L
Operational Phase: Wastage of diesel due to inefficient or ineffective operation of the backup generator	3	3	M	2	2	L
Operational Phase: Wastage or depletion of valuable resources, such as LPG and water, due to inefficient or ineffective operation of the Waste Tyre Pyrolysis Plant	3	2	M	2	2	L
Workers' Safety						
Construction Phase: Injury of employees and contractors working on the site	3	3	M	2	2	L
Construction Phase: Failure of the LPG storage tank due to inadequate construction	3	3	M	1	3	L
Construction Phase: Failure of the pyrolysis oil storage tank(s) due to inadequate construction	3	3	M	1	3	L
Operational Phase: Injury of employees working on site	3	3	M	2	2	L
Operational Phase: Explosions, fires and harm to employees due to the incorrect storage of LPG	3	4	H	2	3	M
Operational Phase: Fires and harm to employees due to the incorrect storage of pyrolysis oil	3	4	H	2	3	M

6.1 Construction Phase Impacts

6.1.1 Positive impacts during construction phase

6.1.1.1 Employment

During the project planning and design, the project proponent has already employed consultants including Architects, Quantity Surveyors, Engineers and EIA consultants. At construction stage the contractor will deploy workers to help in the construction activities. This will include both skilled and unskilled personnel especially from the local population. Vendors of various items and food are likely to enjoy additional market from the demand created by those who will be working at the construction site. The income obtained from the employment will help better the lives of the persons involved.

6.1.1.2 Income to the local population

If the economic labor policy is focused on the local community, unskilled labor from the neighborhood will earn them income. The income will boost the economic power of the local community.

6.1.1.3 Income to other businesses

Existing business establishments will benefit from increased sale of raw materials to service the construction site.

6.1.1.4 Income to the government in terms of taxes and statutory fees

The government intends to get income/revenue in terms of taxes generated during the acquisition of licenses. The construction material to be used during construction will also be taxable (16% VAT). Through the revenues generated, the government will be capable of financing its obligations to the country. The proponent is obliged to pay 0.1% of the total project cost to the NEMA Revenue Account prior submission of the EIA report.

6.1.2 Negative impacts during construction phase

6.1.2.1 Impact of raw materials at points of origin

Raw materials for the construction of the development proposal will originate from quarries, wetlands and industries which will have an impact on the environment through;

- Destruction of the physical environment where mining is involved or wood materials are required
- Disposal of pollutants into the environment from industries manufacturing raw materials
- Threat to water resources in the case of sand harvesting
- Occupational hazards on the part of the people employed by industrial establishments that supply raw materials

6.1.2.2 Destruction of the physical environment

The construction phase of the project will cause some destruction to the physical environment. The impacts on soil will be localized and will be caused by:

- **Excavation:** Excavation creates loose soil that is easily carried away by water or wind. This causes soil erosion and disturbance in soil quality. Soil and wind erosion will lead to pollution of air and water sources. Air pollution results to breathing infections and thereby need for money for medication. Pollution of water sources can lead to water borne diseases therefore impacting negatively on the health of the residents.
- **Soil Compaction:** Construction activities are normally accompanied by some form of compaction. Compaction seals the soil on the surface hence hindering the penetration of air or water beneath the surface. This limits the aerobic activities of the organisms underneath the soil, hence affecting soil productivity. Compaction also hinders the infiltration of water into the surface hence increasing the surface run-off increasing the possibility of flooding downstream of the site. Surface run- offs eventually find their way to water sources thereby polluting them. The result is water borne diseases which affects the health adversely.

6.1.2.3 Occupational health and safety hazards

The movement of materials into the construction site by workers and during construction per se may cause accidents with potential to cause injury. This will affect the health of the workers and their potential to work thereby impacting negatively economically.

6.1.2.4 Air pollution from construction dust

In the construction phase dust will be expected from excavation of soil and movement of vehicles. If generated in large quantities dust may present a respiratory hazard and also cause visual intrusion hence presenting accident risks. Dust is also a mechanical irritant to the eye. Air emissions would also be expected from exhausts of vehicles delivering construction material. Stand-by generators that may be brought in to serve during power outages are likely to release some emissions to the atmosphere. The health impacts as a result of the air quality will reduce the production of workers at the site and also have financial impacts on their treatment and medication.

6.1.2.5 Solid waste generation

Large amounts of solid waste will be generated during construction phase of the project. This will include metal cuttings, rejected materials, surplus materials, excavated materials andempty paint containers among others.

6.1.2.6 Workforce sanitation

Sanitation provisions for the work force will be an issue of concern during construction.

6.1.2.7 Noise pollution

Noise is expected from movement of vehicles and construction equipment. It would also arise from construction activities at the site such as loading and offloading of material, carpentry and masonry activities. Noise may lead to hearing impairments which will reduce the workmanship of the employees and also affect their finances due to treatment and medication. The workforce at the site will also be an important source of noise in the neighborhood.

6.1.2.8 Increased traffic

This will occur as contractors' vehicles bring in deliveries at the site and as workers leave or come to the site. The vehicles use diesel or petrol which after combustion produces fumes. These are potential air polluters adversely affecting the health of workers and neighbors and increasing greenhouse gases which contribute to global warming.

6.2 Operational Phase Impacts

6.2.1 Positive impacts during operation phase

6.2.1.1 Income to the proponent

The proponent will accrue income from operation of the facility. This is his key objective.

6.2.1. Employment creation

It is estimated that at least 11people will be employed during the operational phase of the project The employment will consist of cleaners, security officers and gardeners among others.

6.2.1.3 Benefits to other business establishments

There will be direct benefits to other businesses in the area especially those dealing in transport and shipment.

6.2.1.4 Other Benefits

- 100% tyre recycling will be achieved.
- The system recycles synergy of waste tyre into usable fuel;

- It offers renewable energy source;
- The in product can be used as fuel in existing industrial boilers and furnaces.If tyres are used for direct open air combustion for boiler firing, the impact will be severe and unbearable, rather use the by-product;
- End products can also be used for generating electricity;
- Eliminates the hazard of land pollution by waste tyres;
- Converts waste into energy; and,
- Clears dumping yards and environment of non bio-degradable tyre waste.

6.2.2 Negative impacts during operation phase

6.2.2.1 Impacts from tyre storage and management

Storage of whole tyres requires proper management to prevent potential health problems. Whole tyres stored outdoors may be treated with pesticides or insecticides for vector control (e.g., mosquito or other insect larvae, rodents, water snakes). Rain may wash dirt, road oil, and pesticides or insecticides off the tyres. Tyres, whole or in chips, may also leach substances into the soil. Thus, storm water runoff could potentially contaminate soils, groundwater, or nearby surface water.

6.2.2.1.1 Risk of tyre fires

Tyre fires are severe potential environmental impacts. When they burn in the open air, the tyres combust incompletely and produce air pollution. The latter comprise conventional air pollutants like particulates, carbon monoxide, sulphur oxides, nitrogen oxides and volatile organic compounds and hazardous pollutants like Polycyclic Aromatic Hydrocarbons (PAHs), dioxins, furans, hydrogen chloride, benzene, polychlorinated biphenyles (PCBs) and heavy metals (lead and arsenic). Consequently, short and long term health problems such as skin and eye irritation, cancer, depression and nervous system ailments may be created.

6.2.2.2 Potential solid waste generation

All the solid output generated by the plantfrom the tyre-pyrolysis processis tobe classified as solid waste if not sold, utilized, or recycled into the pyrolysis process. If classified as solid wastes, products or wastes might also be classified as hazardous wastes as indicated on the fourth schedule of Legal Notice No. 121 of 2006.

6.2.2.3 Potential liquid wastes

Some waste tyre Pyrolysis processes generate water as a by-product and this wastewater is likely to be contaminated with whatever constituents are found in the pyrolysis oil (e.g., benzene and toluene).

6.2.2.4 Air emissions

Air emissions may be the greatest environmental concern in pyrolysis operations using waste tyres. The gases from pyrolysis and gasification processes can contain a variety of air pollutants that must be controlled prior to discharge into the ambient air. These include particulate matter (PM), oxides of nitrogen (NOx), oxides of sulphur (SOx), dioxins and furans, hydrocarbon (HC) gases, metals, carbon dioxide (CO_2), and carbon monoxide (CO).Other key sources of air pollution are fugitive emissions from joints and valves and from the handling and processing of char.

6.2.2.5 Increased traffic

The operations will involve transportation of goods by use of Heavy Commercial Vehicles (HCVs). Expected visitors and will also increase traffic flow along the Mombasa – Nairobi highway. This potentially may cause traffic congestion along road A109.

6.2.2.6 Increased water and energy demand

There will be an increased demand for these resources to service the plant. This will add some pressure on these

resources within the area.

6.2.2.7 Fire hazards

Accidental leakage/spillage of substances, electrical faults are some of the possible causes of fire, which can cause considerable losses in terms of injury or even fatality to persons and damage to property and the environment. This has a negative financial impact to the proponent, workers and the neighbours.

6.2.2.8 Disaster and emergency situations

The term 'disaster' is used in this report to refer to any incident, accident, or natural occurrence that could affect the operation of the project in whatever way. Disasters and emergency situations for the development may result from any or a combination of the following:

- Fuel or oil spills and leakages from the plant;
- Fire hazards; and,
- Medical.

All potential types are both anthropogenic as well as natural in origin. Besides fire hazards, emergency situations may occur such as accidents during production activities. The management of the development will therefore need to put in place measures for control and mitigation of such occurrences.

6.2.2.9 E-waste generation

The use and activities to occur at the development will generate e-waste mainly composed of;

- Used computers
- Mobile phones
- Power accessories

6.3 Decommissioning Phase Impacts

This is the end of life of the facility. A number of factors may contribute to the need for decommissioning including;

- End of project life,
- An order by a court of law due to non-compliance with existing Regulations,
- Change of user, and,
- Natural calamities.

6.3.1 Positive impacts on decommissioning

6.3.1.1 Income to hired workers

Besides the consultants who would undertake a decommissioning audit, those hired to carry out the actual demolition will also earn an income to workers.

6.3.1.2 Recovery of construction material

Upon demolition re-usable construction materials will be recovered. These can be used in other constructions and thus reduce the pressure on environmental resources.

6.3.2 Decommissioning negative impacts

6.3.2.1 Economic decline

The national economic gain got from the investment activities will be lost in the event of decommissioning of the development. The proponent will also suffer huge losses and the workers on the premise e.g. managers, cleaners, pest control, security, etc. will be jobless. The business fraternity will be affected as they will have no place for doing their business. This will also impact on their economic status.

6.3.2.2 Dust

Large quantities of dust will be generated during demolition and is likely to affect the workers by generating respiratory tract infections.

6.3.2.3 Solid waste generation

Demolition of the housing units will generate large quantities of solid waste. This waste will mainly consist of metal, concrete, drywall, wood, glass, paints and adhesives which may release hazardous agents into the environment. Chemicals such as chlorides, sodium, sulphates and ammonia which may be contained in demolition waste leachate could pollute ground and surface water.

6.3.2.4 Excessive noise and vibrations

The decommissioning activities will lead to significant deterioration of the acoustic environment in the area. The noise and vibrations that are necessary at that time would adversely affect the neighbours and workers at the site.

6.3.2.5 Health and safety risks

Decommissioning of projects would normally be accompanied by health and safety risks from any leftover electrical cables, uncovered manholes and structures that may collapse and injure passers-by if left on site for a long time. Children may fall in the manholes while playing thereby causing deaths. There may also be environmental hazards from exposed left over substances which may cause soil and water contamination or generate noxious odor which can result to diseases.

CHAPTER SEVEN

7.0 Impact Mitigation

This chapter deals with the plan for the mitigation of anticipated adverse environmental impacts while enhancing beneficial impacts of the proposed project. The project's environmental mitigation plan has been drawn in accordance with legislative and regulatory frameworks on environmental and socio-economic aspects. In addition possible treatment and prevention measures have been discussed in this chapter.

7.1 Construction Phase Mitigation Measures

7.1.1 Impact of land preparation activities

The environmental impacts associated with land preparation activities will be mitigated in the following ways;

- The solid waste generated from the construction activities will be disposed of at a designated disposal area of the County Government of Kilifi,
- The contractor will use dust suppression techniques such as water sprinkling during land clearance and excavation to subdue dust,
- The contractor will provide safety training and Personal Protective Equipment (PPE) to all workers at the site.
- All workers will also be trained on the use and operation of machinery, equipment and tools during construction,
- A first aid box shall be available onsite to serve the workforce,fire and emergency rules to be in place and an emergency assembly point identified,
- The proponent shall avail financial resources to facilitate the above mitigation measures and ensure workers are continuously trained on the rules of engagement.

7.1.2 Bio-physical environment

Various activities will affect the structure of the soil and will have a number of related environmental hazards. The excavation of land to clear the site will involve scooping a considerable depth of the soil level. This will change the structure of the soil and have a long-term effect on the environment, including losing its aesthetics, loosening its soil structure besides interfering with the soil profile. To ensure that these hazards are dealt with, it is necessary that the following mitigation measures be applicable.

- Landscaping of disturbed areas.
- Planting trees and suitable indigenous grasses around the building will be undertaken where possible and as soon as the construction is completed.
- Controlling of earthworks to prevent compacting the loose soils.

7.1.3 Occupational Health and Safety

To ensure the health and safety of workers at the site, the contractor and the proponent must establish an Occupational Health and Safety Management System (OHSMS) which will be managed and operated for the proposed construction activities. The system will basically contain the following features;

a. Occupational Health and Safety Policy,
b. Organizational Framework of the OHSMS. This includes:
    - Staffing of OHSMS,
    - Competence requirements,
    - Operating procedures,
    - Training programmes,
    - System documentation,
    - Communication.

c. OHSMS objective,
d. Hazard prevention. This involves:
   - Risk assessment
   - Prevention and control
   - Management of changes
   - Emergency preparedness and response
   - Procurement (tools, equipment, services, contractors)
e. Performance monitoring and measurements. This includes:
   - Hazard prevention measures
   - Ambient working environment
   - Occurrence of work related injuries, ill health, disease and injuries
   - Record keeping with regard to occurrence of incidents and actions taken.

f. Evaluation
   - Formative and summative evaluation
   - Feedback
   - Remedial actions
   - Incident re-occurrence prevention plan (IRPP)
   - Performance improvement

7.1.3.1 Safety of workers at the construction site

The levels of implementation of occupational health and safety considerations at the workplace should begin with the deliberate effort by the contractor and the proponent to protect the employees at the construction site. In this regard this proposal makes the following recommendations;

- Registration of the construction site as a workplace with the Directorate of Occupational Health and Safety (DOHS)
- Provision of appropriate and adequate Personal Protective Equipment (PPE) to employees,
- Continuous training of workers on the use of PPEs and general safety matters,
- Enforcement and proper use of PPE by all construction workers,
- Provision and maintenance of appropriate tools, equipment and machinery in sound working conditions to employees to avoid accidents,
- Continuous training of workers on the safe and proper use and operation of machinery and equipment,
- Develop clear policies on first aid and treatment of injured personnel,
- Provide insurance cover to workers on site,
- Reduce employees' exposure to all work place hazards.

7.1.3.2 Safety of visitors, neighbors and general public

The proponent and the contractor will have an obligation to put in place measures that will protect the visitors to the construction site, neighbors, and the general public in the following ways;

- Visitors to the project site must be provided with protective clothing at all times,
- Inform all neighbors in writing on the commencement of the project at least two weeks in advance,
- Restrict access to the site by the public by fencing off the construction site,
- Limit construction work to daytime only,
- Heavy Commercial Vehicles accessing the site to deliver construction materials must observe speed limits and site traffic rules,
- Placing notices and safety slogans at strategic points to inform and educate neighbors and the general public displayed at the entry of the construction site and around the perimeter fence informing general

public of ongoing construction and safety requirements,
- Provide for security services at the site.

7.1.3.3 Tools, Equipment, Machinery Use and Electrical Safety

During construction work, it is expected that different machines, tools and equipment such as dumpers, cement mixers, elevators and excavators will be used. Most of this equipment will be powered internally by use of diesel. In regard to electrical safety, the following will have to be undertaken:

- Installation and fitting of proper electrical system to enable supply of electrical energy to utility point,
- All electrical installations and fittings are done according to electrical safety rules,
- All electrical wires must be safely insulated,
- Sockets and other electrical outlets must be securely fitted,
- When not in use all machines should be put off,
- Qualified and well-experienced electrician should be hired to carry out all electrical works in the building,
- Safety slogans should be strategically posted as a reminder to employees,
- All machine operating manuals should be clearly archived and availed for use when needed,
- Each machine operator should be conversant with the use of machine operating manuals.

7.1.3.4 First aid

The following should be adhered to;

- It will be the responsibility of the contractor to ensure that first-aid services are provided to employees at all times,
- An appropriately equipped first aid station to be easily accessible at the construction site,
- There shall be a well-trained first aider on site at all times during construction,
- An eye-wash station and/or emergency shower shall be provided where the recommended first aid response is immediate flushing with water,
- The first aid station shall be equipped with gloves, gowns and masks for protection against direct contact with blood and other body fluids,
- A written emergency response plan will be in place and drills conducted to help employees familiarize.

7.1.4 Ambient factors at the construction site

7.1.4.1 Noise levels

- Employees should snot to be exposed to noise levels greater than 85 dB (A) for a duration of 8 hours per day,
- No unprotected ear to be exposed to peak sound pressure level (instantaneously) of more than 140 dB (A), and
- The use of ear protectors must be actively enforced.

7.1.4.2 Respiratory hazards

- Exposure to dust to be controlled by ensuring dust accumulation at workplace is contained,
- Equipment to be selected for use, priority should be given to those with in-built dust extraction systems,
- Employees exposed to dust should be given disposable dust masks.

7.1.4.3 Dust management strategy

In the management of dust at the site, the contractor will ensure that the following mitigation measures are implemented.

- The contractor will secure the site using appropriate dust screens,

- Building materials that are likely to produce dust such as ballast should be sprinkled with water before use,
- Access road and dust surfaces at the construction site should be sprinkled with water,
- Employees will be provided with appropriate dust masks.

7.1.4.4 Noise abatement

Moderate noise levels are expected in the area during the construction phase. In line with the Legal Notice No. 71 (Noise and Excessive vibration pollution control) Regulations, the following mitigation measures are proposed to deal with noise emanating from the site.

- Shielding the site from the surrounding areas,
- Restricting construction activities to day time only,
- Ensuring that noisy construction equipment are fitted with silencers where possible,
- Providing workers with PPE for noise impact reduction.

7.1.5 Workforce sanitation

The proponent will procure portable toilets for use by the workforce. These will be emptied regularly and appropriately as required. The emptying entity should be licensed by the relevant authorities.

7.1.6 Traffic management

- Heavy commercial vehicles delivering raw materials shall observe designated speed limits for the area.
- Personnel (traffic marshals) shall be deployed at site entry and exit to direct traffic in and out of the site.
- Proper signage and warnings to be placed on the access route to forewarn other motorists on the use of the road by heavy commercial vehicles

7.1.7 Impact of sourcing of raw materials from environment

- Obtain raw materials from sources that are compliant with NEMA Regulations.
- Procure quantities that are sufficient for the intended works only.
- Recycle as far as practical to stem wastage.
- Commit to extensive use of recycled raw materials as will be appropriate and in a manner that does not compromise the safety of the development

7.1.8 Solid waste management

- Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Reduce 2. Reuse 3. Recycling 4. Dispose
- Through estimation of the sizes and quantities of materials required, order materials in the sizes and quantities they will be needed, rather than cutting them to size, or having large quantities of residual materials.
- Dispose -off waste at the designated dumpsites.
- Transportation of wastes from the site to be done by a NEMA registered solid waste handler who will use appropriate vehicles for conveyance of wastes from site to designated sites.
- Comply with the Waste Management Regulations, 2006

7.2 Operational Phase Impact Mitigation

7.2.1 Waste tyre storage and management

The facility will develop pollution prevention plan and implement Best Management Practices (BMPs) to control storm water discharges, and establish a monitoring program. The pollution prevention plan will include:

- Controlling of runoff through containment (e.g., berms) and capture (e.g., settling ponds) may be acceptable BMPs; and,

- The proponent will avoid stock piles by procuring WT quantities that are manageable such that the recycling plant is not converted into dumping site.

7.2.2 Potential solid waste generation mitigation

The pyrolysis process purposes to utilize all the products. Therefore the most viable option is to sell, utilize, or recycle the materials to avoid having to dispose of them as wastes.

7.2.3 Plant liquid wastes mitigation

- Consider the technology that would use water only for cooling, and the water does not to come into contact with any of the pyrolysis products or wastes.
- Implement BMPs (7.2.1).

7.2.4 Mitigating air emissions

A large percentage of chemical compounds considered toxic contain one or more of the halogen family (i.e., fluorene, chlorine, bromine, and iodine). The products of tyrepyrolysis are unlikely to contain halogenated compounds, because tyres do not contain halogens. The pyrolysis units are expected to have minimal air pollution impacts because most of the pyrolysis gas generated in the pyrolysis process will be burned as fuel in the process. During burning, the organic compounds will be destroyed.

The following measures will be undertaken to mitigate air pollution:

- Burn the pyrolysis gas as fuel in the process or burn it in a flare;
- Tyres will not be pyrolyzed with other materials;
- Undertake air quality monitoring and implement best available control technology in order to ensure compliance;,
- Undertake periodic maintenance of valves and joints that may potentially leak.
- Position portable gas detectors at strategic locations to monitor pyrolysis gas leak.
- Make available and train staff on the use and operation of Self-Contained Breathing Apparatus (SCBA).
- Avail SCBA to handle any emergencies in case any harmful gases are detected.
- A wet scrubber will be used which will minimise the impacts of emissions to the environment.

7.4.2.1 Wet Scrubbing

Wetted packed towers are the simplest and most commonly used approaches to gas scrubbing. The principle of this type of scrubber is to remove contaminants (NO_X, SO_X, fly ash, particulate matter) from the gas stream by passing the stream through a packed structure which provides a large wetted surface area to induce intimate contact between the gas and the scrubbing liquor. The contaminant is absorbed into or reacted with the scrubbing liquor. The packing of the tower is normally a proprietary loose fill random packing designed to encourage dispersion of the liquid flow without tracking, to provide maximum contact area for the 'mass transfer' interaction and to offer minimal back pressure to the gas flow. The reactivity between the contaminant and the scrubbing liquor influences the system designer's determination of gas and liquor flow and the height and diameter of the packed bed. A demister is fitted at the top of the tower to prevent entrainment of droplets of the scrubbing liquor into the extraction system or stack.

7.2.5 Effluent management plan

The domestic wastewater (about $1m^3$/day) from the toilets will be channelled to a manhole for connection to a septic tank – soak pit system. The proposed scrubber is of the wet type one. Water is sprayed into scrubber, through nozzles located at the base and the middle of the scrubber. This results in cooling down of the gas and triggering the reaction of SO_x with water, to occur H_2SO_3 and H_2SO_4. Some chemical foaming agent (having similar properties to

a detergent) is injected in the water line going through the dust and fly ash collector. The pH of the water being pumped to the scrubber is adjusted. The reaction tank is supplied with NaOH from the reagent tank. Under normal conditions, Na_2SO_4 (sodium sulphate) is dissolved (100%) in the water, thus effluent is produced every time until saturation of the solution. The wastewater containing Na_2SO_4 is then pumped to bag filters. The clean water coming out of the bag filters is then recycled to the spray nozzles of the wet scrubber. This unit is the perfect example of a sustainable technology, as there is resource conservation in terms of water consumption. The particulate solids obtained from the bad filter will then be collected and allowed to dry prior to disposal at the landfill.

The proponent will procure services of a NEMA licensed waste handler and adhere to the provisions of Legal Notice No. 121 of 2006 and Legal Notice No. 120 of 2006.

7.1.6 Traffic management

- Heavy commercial vehicles delivering raw materials shall observe designated speed limits of the area.
- Site traffic marshalsshall be deployed at site entry and exit to direct traffic in and out of the site.
- Proper signage and warnings to be placed on the access route to forewarn other motorists on the use of the road by heavy commercial vehicles.

7.2.7 Increased water demand

- All water for use shall be metered to determine consumption levels and yields of the underground water sources.
- Install self-regulating water taps for sinks and basins.
- Seek water extraction permit from WARMA if a borehole is to supplement the reticulated supply.
- Create awareness among employees on the importance of conservation of water resources.

7.2.8 Increased energy demand

- Use the pyrolysisgas to fuel the in pyrolysis process;
- Implementation of contingency practices aimed at preventing, reducing and containing potential wastage. In addition, preventative maintenance will be regularly carried out on the standby generator to address potential problems.
- The lighting systems will be controlled such that only facilities that require light at a given time have it.
- Install a pyrolysis reactor with less energy demand.

7.2.9 Disaster and emergency situations

The project proponent plans to develop and implement a project responsive Disaster Management Plan for the project aimed at identifying the different potential disasters that could impact the development. Once in operation, a more comprehensive and detailed plan will be developed and implemented for the project focusing on dealing with the potential disaster types identified above. Table 7-1 below provides a summary that can be used in preparing a comprehensive disaster management plan which is dynamic and responsive on a need to need basis. Depending on the scale of the disaster the disaster management policy of 2009 will take effect and will be coordinated by either the County/National governments.

Table 7.1: Summary guidelines in the preparation of a comprehensive disaster management plan.

Nos.	Disaster	Description	Response plan	Stages
1.	Fire	Fire outbreaks can vary in size and location and can cause irreparable damage to the project's infrastructure and are a serious threat to human life	Fire Prevention and Response Plan	Response
2.	Fuel/oil Spills and leaks	Affects quality of marine water if not properly addressed.	Spill Contingency Plan (Tier levels)	Response, Recovery

3.	Medical	Medical emergencies can occur at any moment without giving notice and therefore requires a quick and coordinated effort to respond to this need.	Medical Emergency Plan (Transportation and Evacuation)	Response, Recovery
4.	Climate change	This slow occurring natural occurrence can pose serious risks to the project if not adapted and monitored over time.	Tidal Rise Contingency Plan	Alert, Response
5.	Tsunami	Tsunamis can vary in strength damaging the project's infrastructure thus affecting the operation of the project. Like fire, they are a serious threat to human life.	Tsunami Preparedness Plan	Alert, Response, Recovery

The proposed development will take into consideration on the first three potential disasters i.e. Fire, Medical and Fuel/Oil Spill Plans in order to mitigate and remediate any negative effects these types of disasters could have on the infrastructure, operation and management of the development.

7.2.9.1 Disaster management plan

- The occupants and staff of the development to formulate an Emergency Committee to address the aforementioned Disaster Management Plan.
- The committee will be charged with the task of electing an Emergency Coordinator and his/her subordinate, who shall direct and execute all the activities outlined by the response plans.
- The emergency committee must conduct periodic meetings to address important issues concerning the disaster management plans.
- Such important issues should be the objectives of the committee, their roles and responsibilities, updates, training, drills as well as their terms of reference which they will abide by.

7.2.9.2 Fire prevention and response plan

Fire outbreaks whether small or large can be detrimental to the project and in some instances be life threatening. It is therefore important to consider its likelihood and the circumstances surrounding its propagation. The development will therefore develop a Fire Prevention Response Plan aimed at addressing the awareness and the mechanism necessary for its response.

7.2.9.2.1 Purpose of plan

The basic responsibilities of the Emergency Committee is to ensure that the coordinating mechanism that will ensure maximum safety of property and lives during a blaze, is put in place, and to make sure the proponent or occupants are familiar with the mechanism.The purpose of the Fire Prevention and Response plan for the proposed project is to:

- Increase awareness among guests, management and others of the need for a fire prevention and response plan;
- To establish the coordinating mechanisms necessary for management to prepare and implement measures to safeguard property and lives of all concerned should a fire occur anywhere within the site; and,
- Indicate all possible evacuation routes in the premises.

7.2.9.2.2 Fire prevention

Hydrocarbons are volatile under certain conditions and their vapors in specific concentrations are flammable. If precautions are not taken to prevent their ignition, fire and subsequent safety risks may arise. Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back.

Fire prevention will be achieved by:

- Use of flame retardant materials;
- Only qualified personnel to install electrical systems for the development;

- Engineering standards to meet provisions for adequate and safe wiring; plumbing, heating, and cooling systems will also be in conformity with acceptable building codes;
- Adhere to the information and guidelines provided in the MSDS;
- Tankers will be positioned such as to allow for rapid evacuation in forward gear;
- A warning triangle should be displayed to ensure no other vehicle is obstructing;
- The engine, lights and all the electrical apparatus such as radio and fan of the vehicle should be put off during offloading/loading;
- The windows of the truck are closed throughout offloading;
- The signage "NO SMOKING" will be displayed clearly throughout the facility;
- The battery circuit will be broken by use of battery cut out switch;
- Fire extinguishers (fully loaded) will be placed strategically within reach of the delivery point;
- There will be adequate space to receive diesel;
- The caps for the dipping pipes of the storage tanks will be securely closed;
- The condition of delivery hose will be checked periodically to ensure it has no leaks and no leaking couplings / connections;
- Fire fighting equipment including sand buckets, powder and carbon dioxide extinguishers will be installed;
- A heap of sand for replenishment of the sand buckets should be accumulated at one of the sides of the filling station;
- Fire inspection certificate to be issued by the County government annually;
- Staff to be trained in fire fighting skills;
- Fire drills to be conducted quarterly;
- Test employees competence in fire fighting through a reputable firm;
- Carry out a fire safety audit and implement recommendations;
- Carry out an Occupational Health and Safety Audit in line with the OSHA, No. 13 of 2007; and,
- Prepare an emergency response plan to be prominently displayed at the facility through a reputable Occupational Health and Safety firm.

It will therefore be very important to take public safety into account throughout the operational phase of the facility as the public and staff can be at risk from vapor emissions and fires.

7.2.9.2.3 Fire protection equipment/systems

All the units and buildings on the property will be protected from fire in one form or another. The proponent will install these systems to protect lives and property. The following are fire detection, notification and suppression systems that will be used to control a fire.

a. Fire alarm detection and notification systems.
   - Install smoke and heat detectors
   - Manually activated pull station

b. Fire Suppression Systems.
   - Hydrants
   - Commercial Kitchen hood exhaust/suppression system (foam): This only applies to the restaurants on the hotel.

- Fire Extinguishers: The proponent will install multi-purpose dry chemical (Class ABC) fire extinguishers. Dry chemical extinguishers will range in sizes of 2.5 to 5 Kgs and will be installed in all building components. These will also be installed at key areas such as walkways, containment walls, generators, electrical panels, maintenance areas, etc.

7.2.9.2.4 Fire response

Fire outbreaks are unpredictable but can be prevented. It is difficult to portray a response plan for the project site considering the different scenarios that might arise from a fire. It is important though, to have in mind certain tips and guidelines just in case of a fire. These guidelines may come in the form of a fire combating plan whereby trained staff may utilize the different fire controls to extinguish the fire. Fire outbreaks often require an evacuation plan and for this reason, a comprehensive evacuation plan will be required to be developed.

7.2.9.3 Oil spill management

The plant is anticipated to produce large volumes of TPO therefore the project is potentially a high risk venture. An Oil spill will be managed according to the following:

- *Storage:*Oil will be stored in properly sealed above ground storage tanks inside a containment wall.
- *Handling:* Used oils are a legal responsibility of the proponent and thus should be handled adequately and with care.
- *Disposal*: in the case of waste oil, it is important to properly discard it. Once stored, the waste oil should be sold to a NEMA licensed waste oil recycling plant.

7.2.9.3.1 Contingency equipment

Spill response equipment is the most important component in the Spill Contingency Plan. This equipment can vary depending on the size and type of the activity. For the interest of proposed plant, the following equipment will be required:

- Spill response Kits – these will be made available to the maintenance staff and installed at key locations such as generator rooms etc.

7.2.9.3.2 Safety and response priorities

The Emergency Committee will ensure that the following priorities are taken into consideration:

- Safety to human life is the highest priority in any response, and should be ensured that all management personnel are protected.
- Containment of incident to stabilize the situation.
- Minimize and prevent any adverse environmental impact

Basic response information that should be available whenever an action is taken includes the following:

- Type of oil involved: this could be TPO, lubricating oil, engine oil, waste oil, diesel fuel, and gasoline fuel.
- Size of spill
- Prevailing Conditions: choppy seas, windy, rainy, overcast, sunny, calm, low/high tide
- Environmental sensitivity of potential or actual impact area: this includes the sensitive area of the beach and inland locations.

7.2.9.4 Medical Response Plan

The proposed development will implement a medical response plan in the event of a medical emergency. In general, the proposed response plan will cater to basic first aid health care and will only include emergency transportation to a recognized health institution capable of treating the patient.

7.2.9.4.1 Components of the plan

The medical plan should include;

- Basic first aid personnel and first aid kit (Most first aid kits contain bandages for controlling bleeding, personal protective equipment such as gloves and a breathing barrier for performing rescue breathing and CPR (cardiopulmonary resuscitation), and sometimes instructions on how to perform first aid)

- Transportation of patients-when conventional First Aid requires additional medical attention, the patient must be transported to a recognized health institution for further treatment. A standby ambulance should be provided.
- Contact information-Contact information is an important factor in considering emergency situations. It can be used in cases of fire, medical and other emergencies

7.2.9.5 Training and development

The proponent will acknowledge the importance of having well qualified personnel to deal with disaster preparedness at the development. This implies making investments in quality training through recognized institution for the emergency response committee of the development. The proponent should organize for regular refresher training to maintain a state awareness/alertness at all times.

7.2.10 E-waste management

NEMA has published guidelines for E-waste management in Kenya. A key strategy for the proponent and the occupants of the development will be the collection and conveyance of the e-waste to licensed recycling centers. For the proposed development, the most appropriate place would be the East Africa Computer Recycling Limited situated off the New Mombasa – Malindi highway in Kisauni, Mombasa County.

7.3 Decommissioning phase impact mitigation

The mechanisms proposed to mitigate the impacts of decommissioning include due diligence survey. The proponent will undertake safety and environmental audit to identify and mitigate any impacts that may arise from any left-over articles and substances that could be harmful to people and/or the environment.

CHAPTER EIGHT

8.0 Environmental Management Plan

8.1 Introduction

The objectives of the Environmental Management Plan are:

- To guide the project implementer to prioritize environmental matters in project planning,
- To guide the project implementer on the likelyenvironmental impacts of the project and when they are likely to occur.
- To assess the capacity requirements for the implementation of the EMP,
- To guide the project implementer in allocating adequate resources needed to implement all the mitigation measures.

8.2 Plan Period

The EMP provided here is to cover the first year of the project's operations. It is then expected that an Environmental Audit will be undertaken at the end of the year to evaluate conformity to the EMP as well as identify any gaps and recommend corrective adjustments to the plan. This will then be addressed through a loop mechanism from construction phase to operational phase to identify the success of the project versus the failures. This should be analyzed through the environmental management criteria of impact and mitigation.

8.3 EMP Outline

The tables below outline the environmental management plans for the proposed development cycle. The plan considers the following;

- Predicted environmental impact
- Proposed mitigation measures
- Responsible party / parties
- Time frame
- Costs

8.4 EMP for the Construction Phase

Anticipated Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh.)
Impact of sourcing of raw materials from environment	– Obtain raw materials from sources that are compliant with NEMA Regulations. – Procure quantities that are sufficient for the intended works only. – Reduce, Reuse and Recycle as far as practical to stem wastage. – Commit to extensive use of recycled raw materials as will be appropriate and in a manner that does not compromise the safety of the development	Contractor	Throughout construction period	Nil.
Noise pollution	– Construction work and delivery of raw materials will be limited to day time hours only. – Delivery of raw materials will be done so as to exclude weekends. – Locate concrete mixers as far as practical from neighboring properties – Zone the areas and mark them with paint and signage as high noise areas where ear PPEs are needed. – Inform neighbors in writing prior to commencement of the development so that they are prepared psychologically at least two weeks in advance. – Employees using equipment that produce peak sounds shall be provided with ear protection PPEs. – Comply with the provisions of Noise Regulations (Legal Notice No. 61 of 2009) – Register the site as a workplace with the Directorate of Occupational Health and Safety (DOHS).	Proponent & Contractor DOHS	Throughout construction period	50,000.00
Dust and fumes	– Secure the site using appropriate dust screens. – Ensure strict enforcement of on-site speed limit regulations. – Avoid excavation works in extremely dry weather periods. – Ensure all construction equipment is serviced regularly to avoid excessive fumes. – Insist on use of low sulphur diesel & other environmentally friendly fuels. – Provide dust masks to all employees and ensure their proper utilization. – Sprinkle building materials that are likely to produce dust such as ballast with water before use to suppress dust. – Access road and dust surfaces at the construction site should be sprinkled with water twice a day. – Employees will be provided with appropriate dust masks and safety spectacles.	Contractor	Throughout construction period	80,000.00
Health and safety of employees at the workplace	– Provision of adequate and appropriate PPEs including safety shoes, helmets, gloves and overalls. – Train them in the use of all equipment that they will be required to operate. – Observe rest times and breaks as necessary. – Given employees the correct tools and equipment for the jobs assigned. – Hire the right number of workers to avoid overworking. – First aid services and an emergency vehicle to be readily available on site. – Securely protect moving parts of machines and sharp surfaces with guards to avoid unnecessary contacts and injuries during construction phase.	Contractor	Throughout construction	50,000.00 for acquisition of PPE for workers

	– There must be adequate provision for artificial or natural lighting in all parts in the working areas. – Ensure that all chemicals used in construction are appropriately labeled or marked. – The contractor to implement the provisions of the Occupational Safety and Health Act, No. 15 of 2007. – The construction site to be registered as a workplace with the Directorate of Occupational Health and Safety		period	
Solid waste management	– Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3. Reuse 4. Disposal. – Through estimation of the sizes and quantities of materials required, order materials in the sizes and quantities they will be needed, rather than cutting them to size, or having large quantities of residual materials. – Dispose of waste at the designated dump sites. – Transportation of wastes from the site to be done by a NEMA registered solid waste handler who will use appropriate vehicles for conveyance of wastes from site to designated sites. – Comply with the provisions of the Waste Management Regulations, 2006.	Contractor	Throughout construction period	45,000.00
Effluent from workforce	Procure a portable toilet facility to be emptied at appropriate intervals by licensed contractors.	Project Contractor	Entire construction period	40,000.00
Traffic management	– Heavy commercial vehicles delivering raw materials shall observe designated speed limits for the area. – Personnel shall be deployed at site entry and exit to direct traffic in and out of the site. – Proper signage to be placed on the access route to forewarn other motorists on the use of the road by heavy commercial vehicles.	Proponent, Project Manager & Contractor	Throughout construction period	40,000.00
Possible fire outbreak	– Display warning signs e.g. "No Smoking', 'Highly Flammable', etc. to mitigate lighting fire on or near flammable substances. – Create awareness among workers on safety (Train in fire safety).	Project Manager & Contractor	Throughout construction period	3,000.00
	Designate a storage area for fuel/highly flammable substances that will be guarded to limit access.	Project Contractor	Before onset of construction works	No cost
Increased water demand	– Create awareness among workers on the importance of conservation of water (resources). – All water for use shall be metered and consumption records kept determining consumption levels. – Seek water extraction permit from WARMA if the nearby water reservoir is to be used to supplement the reticulated supply from KIMAWASCO.	Project Manager & Contractor	Throughout construction period	100,000.00
Increased energy demand	– Create awareness among workers on the importance of conservation of energy resources. – Switch off engines when not in use. – Employ technologies that demand less energy consumption. – Use energy saving lighting systems.	Project Manager & Contractor	Throughout construction period	200,000.00
Oil spills	Build capacity of staff to manage spills	Contractor	Throughout construction period	Contractor's time.

8.5 EMP for Plant Operational Phase

Anticipated Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh.)
Waste tyre storage and management	− Develop pollution prevention plan and implement BMPs to control storm water discharges, and establish a monitoring program. − Avoid stock piles by procuring WT quantities that are manageable such that the recycling plant is not converted into dumping site.	Plant manager	Throughout operational phase of the project cycle	Nil
Potential solid waste generation from pyrolysis process	Sell, utilize, or recycle the materials to avoid disposing them as wastes.	Plant manager	Throughout operational phase of the project cycle	Nil
Effluent management plan	− Consider the technology that would use water only for cooling, such that the water does not to come into contact with any of the pyrolysis products or wastes. − Implement BMPs. − Waste water will be managed by a septic tank – soak pit system. − The proponent will procure services of a NEMA licensed waste handler. − Adhere to the provisions of Legal Notice No. 121 of 2006 and Legal Notice No. 120 of 2006.	Plant manager	Throughout operational phase of the project cycle	
Air emissions	− Burn the pyrolysis gas as fuel in the process or burn it in a flare. − Tyres will not be pyrolyzed with other materials. − Undertake air quality monitoring and implement best available control technology e.g.the use of a scrubber. − Undertake periodic maintenance of valves and joints that may potentially leak. − Install gas detectors at strategic points to sense/check the presence of any harmful gases. − Position portable gas detectors at strategic locations to monitor pyrolysis gas leak. − Make available and train staff on the use and operation of Self-Contained Breathing Apparatus (SCBA). − Avail SCBA to handle any emergencies in case any harmful gases are detected.	Plant manager	Throughout operational phase of the project cycle	200,000 for air quality monitoring quarterly
Traffic management	− Heavy commercial vehicles delivering raw materials to observe designated speed limits for the area. − Personnel to be deployed at site entry and exit to direct traffic in and out of the site. − Proper signage and warnings to be placed on the access route to forewarn other motorists on the use of the road by heavy commercial vehicles.	Plant manager	Throughout operational phase of the project cycle	20,000.00
Increased water demand	− All water for use shall be metered to determine consumption levels and yields of the underground water sources. − Install self-regulating water taps for sinks and basins. − Seek water extraction permit from WARMA if a borehole is to supplement the reticulated supply. − Create awareness among employees on the importance of conservation of water resources.	Plant manager	Throughout operational phase of the project cycle	80,000.00
Increased energy	− Use the pyrolysis gas to fuel the process.	Plant manager	Throughout	200,000.00

demand	− Implementation of contingency practices aimed at preventing, reducing and containing potential wastage. − Preventative maintenance will be carried out on the standby generator to address potential problems. − The lighting systems will be controlled such that only facilities that require light at a given time have it. − Use translucent roofing sheets to enhance the use of daylight in the shades − Install a pyrolysis reactor with less energy demand.		operational phase of the project cycle	
Possible fire hazards	− Prepare and implement a Fire Hazard Response Plan. − Use of fire/flame retardant materials in construction works of the development. − Only qualified personnel (electrical engineers) will be engaged to install electrical systems. − Engineering standards to meet provisions for adequate and safe wiring. − Plumbing, heating, and cooling systems will be in conformity with acceptable standards. − Install fire alarm detection and notification systems i.e. install smoke and heat detectors or manually activated pull station. − Use fire Suppression Systems such as hydrants and fire extinguishers and safety showers. − Prominently display guidelines on what visitors and staff should do in the event of a fire. − Designate a fire assembly point. − Develop and display visitor/occupier rules that will guarantee safety. − Kilifi County Government to inspect the premises and issue a fire safety certificate. − Regularly undertake fire drill to raise the level of awareness and preparedness. − Undertake fire audits.	Plant manager	Throughout operational phase of the project cycle	200,000.00
Medical emergencies	− Have well trained first aid personnel at the plant site at all times. − Ensure first aid facilities are adequate and staffs have been trained. − Have contact numbers of reliable health facilities and professional health practitioners. − Ensure that there is always a standby ambulance for transportation in case of emergencies.	Plant manager	Operational phase of the project cycle	To be determined on a need by need basis
Accidents and incidents	The proponent will implement a health and safety program to address and minimize internal accidents and safety incidents.	Plant manager	Operational phase of the development	Contingency fund to be established
Oil spills	− Oil to be stored in properly sealed above ground storage tanks inside a containment wall. − Waste oil to be sold to a NEMA licensed waste oil recycling plant. − Prepare and implement an Oil Spill Contingency Plan. − Engage services of a NEMA licensed waste oil handler to dispose of the sludge or re-use the waste oil in other activities e.g. use as wood preservative. − Build capacity of staff to manage oil movements and potential spills.	Plant manager	Throughout operation phase.	No cost.

8.6 EMP for Decommissioning Phase

Anticipated Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh.)
Legislative compliance	− Give adequate notice to the development's staff. − Engage the services of legal experts. − Undertake due diligence environmental audit for the decommissioning and submit to NEMA at least 3 months prior to decommissioning for approval − Obtain demolition permit from the Kilifi County Government.	Proponent and management	At least 3 months to decommissioning	To be calculated at the time
Demolition waste	− Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3.Composting and reuse 4. Combustion 5. Sanitary Land filling. − All buildings, machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible. − 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 materials should be taken to a licensed waste disposal site by a NEMA licensed transporter. − Donate reusable demolition waste to charitable organizations, individuals and institutions.	Proponent & contractor	Throughout decommissioning phase	To be calculated at the time
Vegetation restoration	− Implement an appropriate re-vegetation programme to restore the site to status as close as possible to its original − Consider use of indigenous plant species in re-vegetation − Trees should be planted at suitable locations so as to interrupt slight lines (screen planting). − Re-vegetation should be done in consultation with the Kenya Forest Service (KFS).	Proponent; KFS	After demolitions	To be calculated at the time

CHAPTER NINE

9.0 Analysis of Alternatives

9.1 Introduction

Investigating the available alternatives to the development proposal is an important aspect of the EIA process that could invariably help in mitigating the impacts predicted in the preceding chapters of this report. In this analysis, the consultants considered alternatives on the following basis:

- The arguments for or against the implementation of the project i.e. the "No" versus the "Yes" project alternatives;
- Siting of the project;
- Technological alternatives; &,
- Scale and extent.

9.2 The 'No Project' alternative

This alternative is the best in terms of mitigating the anticipated environmental challenges of the project since it maintains the status quo of the environmental conditions of the project area. However it does not add value to the status of the piece of the land under consideration. This alternative will in addition deny the proponent, contractors and other workers a reliable income; deny the government revenue from the tax obtained on materials and licenses related to construction of the building. This alternative will also deny the residents of Kalia Ng'ombe and their neighbours additional business opportunities. Effective management of WT – through recycling will be a pipe dream.

9.3 The "Yes Project" alternative

This option was considered as the most viable because of the following reasons:

- The proponent will accrue profits from the investment;
- There will be employment creation;
- It will contribute to addressing the needs for additional industrial fuel and products supply in the country;
- The proposal is consistent with the existing land use character of the area;
- It will provide income to the government and other business ventures;
- It will improve the development ranking of the area;
- The system recycles synergy of waste tyre into usable fuel;
- It offers renewable energy source;
- The in product can be used as fuel in existing industrial boilers and furnaces. End products can also be used for generating electricity;
- Eliminates hazard of land pollution by waste tyres;
- Converts waste into energy; and,
- Clears dumping yards and environment of non bio-degradable tyre waste.

9.4 Siting alternatives

Siting alternatives would be considered under the following assumptions:

- That the land proposed for the project is insufficient for the scale and extent of the project,
- The project is incompatible with the existing land use systems of the area; &,
- The site hosts sensitive ecosystems and the anticipated impacts cannot be reasonably mitigated.

Since the above concerns are not applicable to the proposed project site, it is deemed suitable for the proposed project site. The proponent further has adequate land to undertake the project. Choosing another site is negated by

the requirement for additional capital and the availability of suitable land for the development in the event that the capital is available.

9.5 Technological alternatives

Technological alternatives are driven by the need for a cleaner production technology and conservation of raw materials, construction labour, energy water resources. For the proposed development, we recommend the following options:

- Implement best available pollution control technology;
- All water for use shall be metered to determine consumption levels and yields of the underground water sources.
- Install self-regulating water taps for sinks and basins;
- Seek water extraction permit from WARMA if a borehole is to supplement the reticulated supply;
- Use the pyrolysis process gas in the system;
- Raw materials will be purchased from sources that are NEMA compliant and are environmental friendly;
- All electrical fittings should comply with the set standards and shall not contain Ozone Depleting Substances (ODS's); and,
- The development to drill a borehole.

9.6 Project scale and extent

The scale and extent of the project is considered adequate given the availability of sufficient land resource upon which the project will be implemented and readily available raw materials, WTs.

CHAPTER TEN

10.0 Environmental Monitoring Programme

10.1 Overview of monitoring programme

A monitoring plan is essential to assess the impact of the development on the environmental setting of the area where it is located. The principles underlying an environmental monitoring plan as it relates to any given development is to document, track and report any changes in environmental parameters over time that would be associated with the project. These changes would in principle vary over time in both magnitude and direction. In the case of the latter it is important to bear in mind that changes in environmental parameters may be positive or negative.

Thus in principle a monitoring program for the project would not necessarily focus only on the perceived or anticipated negative changes precipitated by a given development activity, but also on the positive or beneficial changes. The parameter chosen are those that have been identified in the analytical process as being affected in the most significant way by the proposed development.

10.2 Specific monitoring issues

The proposed monitoring plan for the project will entail those parameters and ecosystem components that have been identified through the mitigation matrix and other mitigation components. A number of these issues have also been highlighted in the mitigation plans and matrices associated with the previous section. These issues include:

- Water Quality monitoring (Effluent),
- Waste Management,
- Soil contamination (leachate),
- Air Quality,
- Environmental health and safety,
- Engineering aspects,
- Socio economic influence,
- Others.

The proposed monitoring program has been developed not only in relation to satisfying the statutory requirements of the EIA process, but also as a proactive tool for the proper implementation of the proposed development, within the context of its relationship to the integrity of the environment as well as the stakeholders in the area.

10.3 Water quality monitoring

As with so many of the EIA's, the monitoring component plays an important role in the overall scheme of the proposed development. With this in mind, it is critical to conserve the environment and its resources in order to promote a healthy and stable ecosystem around the proposed project.

Pollution from all the different sources can pose a serious threat to the environment and therefore considering the negative impacts, the proposed development will have to incorporate a complete water quality monitoring program. This program, which will further be developed by the proponent and NEMA in collaboration with accredited laboratories.Water samples will be collected and analyzed on a monthly basis for the following parameters using the recommended protocol required by **Water Quality Regulations** as stipulated in the act.

10.4 Laboratory Analysis

This will include the determination of the following effluent characteristics according to the specified standards for

effluent discharge into the environment in third schedule of legal notice 120 of 2006. The monitoring guide for discharge into the environment will be as prescribed in the fourth schedule of legal notice 120 of 2006 – Gas and Oil.

10.5 Solid waste monitoring plan

As part of the overall management structure, the proposed development plans to undertake an intensive solid waste monitoring plan in order to address all the relevant issues that can arise from the collection, storage and disposal of garbage. Table 10-1 describes the outline for which the activity will be monitored.

Indicators will be developed to keep track of this activity and report any incident/accident to the local authorities. Such examples include inadvertent spillage during barging, flying or 'blowing' away of uncontained garbage etc.

Table 10-1: Outline for solid waste monitoring plan

Parameter	Frequency
Collection	Daily
Disposal	Weekly
Storage	Daily
Management	Daily

The plan can become more dynamic if columns on critical levels and targets as well as responsible persons are added. This can be done once the development becomes operational.

Generally the proposed development will carefully evaluate its options and implement a waste minimization strategy to cope with the anticipated generated volume. Options however, are limited, especially considering that the local infrastructure for the handling and disposal of solid waste.

10.7 Social Monitoring Plan

Due to the increase in the demand for permanent employment in the country, this project will result in positive benefits for Kilifi County. It expected that over 70% of the labour force will be from the local community. The social monitoring plan will consider the following parameters.

Table 10-3: Social Monitoring issues

Parameter	Frequency	Critical levels
Income from occupants	Annually	− Assess income dynamics that may be related to the establishment of the pyrolysis plant within the area. − Evaluate reduction in fishing pressure as a result of employment.
Employment	Annually	Ratio of locals to migrant workers.
Services	Annually	Acceptable and Non-acceptable.

10.8 Air Quality

This should be undertaken quarterly to monitor the level of compliance with **t**he **Environment Management and Co-Ordination (Air Quality) Regulations.** This will enhance prevention, control and abatement of air pollution to ensure clean and healthy ambient air.

10.9 Environmental Auditing

The proponent shall undertake an initial environmental audit one year immediately following the operational phase of the project cycle in compliance with Legal Notice No. 101 of 2003. Thereafter annual audits shall be undertaken.

CHAPTER ELEVEN

11.0 Conclusions and Recommendations

11.1 Conclusion

This EIA study presents significant impacts that need to be adequately mitigated. The study has proposed appropriate control and mitigation measures on all the anticipated environmental impacts of the mentioned aspects. This has been done to ensure that, the project will not occasion environmentally significant negative impact that could lead to environmental degradation on an appreciable scale. Every measure has been taken to the extent possible; to ensure that sustainable use of land and other resources is attained. In our expert opinion, the commissioning of this project is considered to be economically viable, socially acceptable, and environmentally sound.

11.2 Recommendations

The project will confer a net positive impact on the local economy and environment. Further investigations and analysis to ascertain the level of environmental stress on any of the aspects should be done on an ongoing basis in order to be up to date on any challenges which may arise. The proponent must develop a very effective EMP encompassing enough checks/balances and hire competent personnel to implement, control and monitor it in all phases of the project. The basis of the proposed EMP provided in this report is a guideline based on the current legal standing and environmental best practice, however, the proponent is notified to remain vigilant on any new developments which may arise beyond the publication of this report.This report is specific in stating that that all due diligence must be done by the proponent to ensure compliance in all respects and be a respectable corporate citizen.

Public and stakeholder participation is seen as very key in creating a harmonious co-existence and has to be emphasized all the time. This report considers open air burning of tyres as ultra-vires and must be avoided at all times by all means possible. The pyrolysis process recommended herein is that of a closed system whereby all the pyrolysis products are stabilized to the acceptable established standard conditions/status before being released to customers or used for further processing.

The proponent is advised to continuously seek the opinion of an environment expert so as to be guided on proper pathways of ensuring legal and environmental compliance to any of his activities in all phases of the development. It is recommended that the proponent submit an Environmental Audit report to NEMA annually or as may be directed by the Authority without fail. Given all the measures stated in this report, we are of the opinion that the proposed project should be licensed.

12.0. REFERENCES

The Constitution of the republic of Kenya, 2010;

Occupational Safety and Health Safety (OSHA) Act No. 15 of 2007

Legal Notice No. 120: EMCA (Water Quality) Regulations, 2006

Legal Notice No. 61 EMCA (Noise and Excessive Vibration Pollution Control) Regulations, 2009

Legal Notice No. 121: EMCA (Waste Management) Regulations, 2006

The Water Act No. 8 of 2002 (Effective implementation of provisions in 2003)

Environmental Impact Assessment & Audit Regulations, 2003

The County Government Act (2012)

The Public Health Act – Laws of Kenya, Chapter 242

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13.0 APPENDICES

The following documents (in photo copies) have been appended.

1. EIA /EA experts practising licenses
2. Proponent's PIN certificate
3. Proponent's certificate of incorporation
4. Land ownership documents
5. Building Plan
6. Public participation questionnaires

FORM 7 (r.15(2))

nema
mazingira yetu | ubai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/2796

Application Reference No: NEMA/EIA/EL/4430

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Issued Date: **1/25/2016** Expiry Date: **12/31/2016**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P. T. O.

ISO 9001 : 2008 Certified

FORM 7 (r.15(2))

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NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/2777

Application Reference No: NEMA/EIA/EL/4493

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Issued Date: **1/25/2016**

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Signature.....

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