ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED HAZARDOUS AND NON HAZARDOUS WASTE DISPOSAL FACILITY FOR (MEDICAL, ELECTRICAL & ELECTRONIC EQUIPMENT, AND INDUSTRIAL WASTES) ALONG EASTERN BYPASS, NAIROBI COUNTY

This Environmental Impact Assessment (EIA) Project Report is submitted to Kenya National Environmental Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, 1999 (Cap 387) and the Environmental (Impact Assessment and Audit) Regulations, 2003.

PROPONENT

Sintmond Integrated Waste Management Limited

P.O BOX 11804-00100

NAIROBI, KENYA

Certification.

This environmental social impact assessment (ESIA) study report was prepared by a registered EIA/EA expert in accordance with environmental (impact assessment and Audit) regulation for submission to the National Environmental Management Authority (NEMA). We, the undersigned certify that all information contained in the report is accurate and truthful presentation of all findings relating to the proposed project. Environmental consultant

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Executive summary

Kenya and the implementation of Environmental Management and Coordination (Waste Management) Regulations, 2006, has necessitated the need to develop a waste disposal facility that can cope with the increased demand from domestic waste and at the same time meet the ever demanding regulatory framework. The proponent has seen the gap in handling of these wastes and is proposing to put up a waste disposal facility off Eastern bypass Nairobi County. The availability of a waste disposal site is not only a critical environmental issue, but an essential economic factor for a country that aspires to grow its base. Most international companies expect waste management program to be in place that is both economical and meets international standards, especially ISO 14000 considerations. Besides, without the means to dispose wastes, it is not possible to enforce the current environmental legislation.

The purpose of this EIA report submission to the National Environment Management Authority (NEMA) is to grant the proponent an opportunity to set up a dump site for handling hazardous and non-hazardous waste. . The facility, which will ride on a concept of SMART WASTE ZERO WASTE, will be equipped in such a way that it will enable to do segregation, sorting disassembly, crushing and separation. This process will result in what we call MATERIAL RECOVERY. After material recovery, all recovered material will be classified into recyclables and disposables after which a further treatment will be carried out especially on the hazardous materials recovered.

The area is well connected to road that will enable its operators to safely transport wastes by road from across the county for disposal. Upon realization of the growing wastes challenges, the proponent is seeking to build the facility to be able to provide a waste handling capacity to cater for the need of such waste disposal by ever increasing population in the county.

In compliance to the Environmental Management and Coordination Act (EMCA), Cap 387 as well as the related regulations, the proponent has undertaken this EIA Study through a NEMA registered Lead EIA Expert for review and necessary approval purposes.

Potential impacts

Our investigation examined the potential impacts of the project on the immediate surrounding with due regard to all the phases through to completing, operation and decommissioning. It encompasses all aspects pertaining to the physical, socio-cultural, health and safety conditions at the site and its environs during and after the project. During the screening exercise, issues identified as those that may be impacted upon by the project activities include: air quality, health and safety, and other environmental hazards and socio-economic welfare of the surrounding communities. The proposed site will be handling domestic wastes through disposal. It is, therefore, expected that there will be potential emission of various gases and particulate matter

into the atmosphere, depositions of particulate matter onto land and vegetation around the site. This scenario implies potential linkages with the surrounding environment and ecological setting that require to be addressed during the construction and upon commissioning. The following sections outline these linkages as well as proposed corrective measures.

ANTICIPATED IMPACTS

Positive Impacts

The disposal site has an overall positive implication to the country, and especially urban, agricultural and industrial sectors. The major threat to the environment and human health today is risks associated with waste management. The result of waste generators disposing wastes without appropriate equipment has been pollution of environmental resources and particularly water sources, air pollution, land contamination and even direct effects to human health. In this regard, therefore, the following are considered main benefits of the disposal site;

- The facility will provide a multiple of direct and indirect employment opportunities within the county
- The facility is a blue print of vision 2030 aimed at having a clean and healthy environment for all. It also encourages private investments in environmental conservation within the country.
- Cleaning up of domestic wastes from the Nairobi county residents.
- The facility will provide a safe point for reducing the volumes of domestic waste.

Negative Impacts

The project is anticipated to create negative impacts as well. This will emanate from the construction and subsequent operation activities of the facility. They include the following:

- Air pollution: Emissions released to the atmosphere.
- Impact to soil (soil erosion and degradation) especially when laying the foundation and other earthworks.
- Potential contamination of soil and water; due to oil spills and other leakages/releases.
- The health and safety of workers and immediate residents and neighbours may be compromised due to accidents, pollution and disturbance.
- Impact (constraints/pressure) to the existing infrastructure i.e. water, power, surface drains, roads among others.
- Vegetation clearing
- Visual Intrusion; likely to occur during earthworks for the foundation of the project.
- Increased waste generation (both solid and liquid) during construction and operation phases.

Proposed mitigation measures

To minimize the occurrence and magnitude of the negative impacts, mitigation measures have been proposed against each of the anticipated impact. Some measures have been integrated in the project designs with a view to ensuring compliance with applicable environmental laws and guidelines. The measures include the following:

- An adequately stocked “First Aid Box” will be provided and the employees at the site will be properly trained on how to administer first aid.
- Following the completion of the construction phase, measures will be undertaken to restore the affected biodiversity through landscaping; i.e. planting of trees and grasses to cover unpaved areas.
- The surface drainage system should direct all potentially contaminated surface water from the area into waste interceptor. The drainage and interceptor maintenance will be carried out regularly, including cleaning the interceptors of foliage, rubbish and grit.
- Capacity building of the workers and staff; to create awareness towards potential risks and recommended preventive measures through training. This will ensure that health and safety measures are followed. Conduction of regular drills on fire prevention and control will be encouraged to ensure proper preparedness for fire control.
- Formal procedures will be put in place for energy and water saving to optimize their use. A comprehensive firefighting equipment should be provided after completion of the project. This should be installed or provided at strategic points. The fire extinguishers should be serviced accordingly i.e. after every six months to ensure effective and efficient performance when required.
- The contractor and the proponent will implement the proposed mitigation and monitoring plan in order to protect the environment from any negative impacts.
- During the operation phase, conduct annual environment audit, health/Safety and Fire audits.
- Realization of cordial relations among various community, economic, social and cultural groups as well as between the local community and the contractor,
- Soil compaction and watering of loose soils on all unpaved access areas, construction materials at the construction sites to minimize air pollution and erosion by the agents of soil erosion i.e. water and wind.
- Provision of sound waste management systems and procedures. This will involve provision of solid waste collection bins; segregation of waste at source, appointing a reputable garbage collector etc. during operation phase. During the installation phase, the contractor should put in place effective and efficient waste disposal systems. Waste, including excavated soil and debris should be properly disposed of by backfilling or dumping in approved grounds by the County Government.
- Erection of warning /informative signs (bill boards) at the site during the construction phase.

Conclusion

The proponent should take note that apart from the positive impacts created, the project has negative impacts which should be closely monitored and evaluated. This will ensure that the environment is always safeguarded. It is important that the proponent conducts regular site assessments to provide early indication of leaks or releases of waste into the ground and other potential risks. Considering the proposed project, mitigation measures that will be put in place and the project's contribution to the environment and economy, its implementation is considered important and beneficial. The key effort should be geared towards safeguarding the environment. This can be effectively overcome through close following and implementation of the recommended Environmental Management Plan (EMP), consequently attaining sustainable development. It is concluded that the project is important for economic development of the county and has a balanced environmental considerations and benefits. This report gives adequate measures to mitigate the negative impacts and a management plan. The proponent will be committed to the proposed measures during the construction, operation and decommissioning phase of the project. Accordingly, as per part 11 section 10 (2) of the Legal Notice No. 101 on The Environmental (Impact Assessment and Audit) Regulations, 2003, we recommend that the project is granted an EIA license.

ACROYMNS

AIDS	Acquired Immune Deficiency Syndrome
EIA	Environmental Impact Assessment
ERC	Energy Regulatory Commission
ERP	Emergency Response Plans
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
GOK	Government of Kenya
IEA	Initial Environmental Audit
KWS	Kenya Wildlife Services
LPG	Liquefied Petroleum Gas
MENR	Ministry of Environment and Natural Resources
MOH	Ministry of Health
NEC	National Environment Council
Km	Kilometers
NEMA	National Environment Management Authority
NGOs	Non- Governmental Organizations
NPEP	National Poverty Eradication Plan
OSHA	Occupation Safety and Health Act
PPE	Personal Protective Equipment
PCs	Private Companies
SWM	Solid Waste Management
SDP	Spatial Draft Plan
TOR	Terms of Reference
UNEP	United Nations Environmental Programme
MDG's	Millennium Development Goals
WRMA	Water Resources Management Authority
WCC	Waste Collection Centre

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CHAPTER ONE
PROJECT BACKGROUND

1.1 Introduction: Project Background

Control of Pollution Act 1974 (COPA) defines waste as any given kind of substance or article that contains a scrap material or an effluent or other strange substance coming from the application of any process, which should be disposed of as being broken, worn out, contaminated or otherwise spoiled.

Nairobi generates approximately 2000 tons of waste daily. Of this, 68% is municipal waste generated from households with only 25% of the waste generated being collected (UNEP, 2000 & NEMA). Waste Electrical and Electronic Equipment (WEEE) generation from computers, monitors and printers is approximated at 3,000 tonnes per year. In 2010, UNEP estimated the WEEE generated annually in Kenya at 11,400 tonnes from refrigerators, 2,800 tonnes from TVs, 2,500 tonnes from personal computers, 500 tonnes from printers and 150 tonnes from mobile phones. Key waste management challenges include inadequate legislation and appropriate infrastructure for e-waste management, absence of frameworks for end-of-life (EoL) product take-back and implementation of extended producer responsibility (EPR) (Osibanjo & Nnorom, and Schluep).

Medical waste management process includes handling, segregation, mutilation, disinfection, storage, transportation and final disposal (Acharya *et al*., 2000). According to WHO (1998), 85% of the hospital wastes are non-hazardous, 10% are non-infectious and the remaining 5% are non-infectious but hazardous consisting of chemical, pharmaceutical, radioactive materials. Additionally, out of the quantity of waste generated in Kenya, 39% of the waste was infectious, while 61% was non-infectious (MOH, 2006). As a result of poor segregation practices in Kenya, approximately 50% of waste in some facilities is infectious.

The proposed development project of waste incineration (medical, electronic & electrical, and industrial wastes), is to be implemented on a plot of land privately owned and situated along Eastern Bypass next to Exxen Petrol Station on geographical positioning system coordinate of 1°13'56.6"S and 36°59'21.3"E in Nairobi County. The proposed project site currently hosts five storage metallic containers which will be used to store wastes once the project kicks off.

Project positive impacts include creation of employment directly through employing locals; Provision of clean environmentally friendly energy and building blocks/bricks; Improving living standards and livelihoods of the local people through employment and supplies opportunities; Reduced air, water, and soil pollution associated with the extraction, refining, and processing of raw materials; Reduction of greenhouse gases (GHGs) emissions; Reduction in use and demand of energy resulting in reduced fossil fuels burning and less carbon dioxide emission into the

atmosphere; Incineration of medical waste and municipal waste prevents the release of methane gas; Since medical and municipal waste incinerators turn solid waste to ash, it only requires a small portion of the landfill for safe disposal important in saving space that would have otherwise been occupied by landfill; Significant volume reduction of wastes, while requiring little processing of wastes before treatment; efficient industrial land use; Extraction of precious minerals from the obsolete items for reuse; provision of raw materials; and increased revenue generation to the proponent, community, county and national governments respectively, among other positive benefits associated with the project.

Anticipated negative impacts during project implementation process will entail emission of hazardous pollutants from emissions like dioxins and furans; Health risks (specifically, cancer risks) due to hazardous emissions and improper treatment of hazardous waste constituents in incinerated ash; Fire risk and occupational accidents; Dust emissions; Occupational, health, and safety impacts; Noise and excessive vibrations; soil erosion; Road traffic; and water contamination, among other negative impacts. The above anticipated project impacts will be mitigated and prevent through proper and in-depth consultation with the project stakeholders and neighbors before project execution; availing and provision of personal protective equipment to workers, visitors and all people accessing the workplace; and finally, proper implementation of all mitigation measures proposed in the study report.

During decommissioning phase, proper rehabilitation of the resultant project site will be carried out to ensure that the site is back to its near original state. The phase will mainly include drafting of a decommissioning audit and plan for implementation during the phase; Removal of all piping works and electrical installations by a contracted certified personnel; Covering hazardous manholes and openings within the resultant site; Resultant site revegetation; and backfilling with properly balanced aggregate, among other associated activities. The consultant has been contracted by the project proponent to conduct the ESIA study report in compliance with section 58 of the Environmental Management and Coordination Act (EMCA CAP 387), and its Amendment Act, 2015, and the Environmental Impact Assessment and Audit regulations of 2003.

1.2 Principal of Environmental & Social Impact Assessment

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

1.3 Specific Terms of Reference (ToR) for Environmental Impact Assessment Study for Waste Incineration Project

The following are the specific Terms of Reference for the proposed project as developed by the team of experts in conjunction with the project proponent;

- Developing terms of reference for the proposed development for submission to NEMA for approval prior to commencement of the EIA study as per the provisions of the Environmental (Impact Assessment and Audit) regulations, 2003, and the Environmental Impact Assessment Guidelines and Administrative Procedures of 2002.
- Carrying out assessment and description of baseline information (location/site), objectives, scope, and nature of the proposed project.
- Carrying out an analysis of the proposed project activities during the proposed project cycle; pre-construction, construction, operation, and decommissioning phases.
- Establishing the suitability of the proposed project in the proposed project area.
- Reviewing and establishing all relevant baseline information as will be required by NEMA regarding the physical, biological, social, cultural, infrastructural, and economic aspects of the project area and site, as well as identifying any information gaps.
- Description and analysis of policy, legal and institutional frameworks including but not limited to Kenyan policies, laws, regulation and guidelines; international guidelines, international conventions and treaties to which Kenya is party to, related to the proposed project, which have a bearing on the proposed project activities, and will serve as benchmarks for monitoring and evaluation, and future environmental audits.
- Conducting an in-depth description of the proposed project and its associated works together with the requirements for carrying out the works.
- Outlining clearly the proposed project products and by-products.
- Highlighting the intended methodology to be employed during the EIA compilation and conduction.
- Analysing the efficacy of the designs, technology, procedures and processes to be used, in the implementation of the works.
- Carrying out an in-depth consultation and public participation: Identifying key project stakeholders and affected persons**;** Securing written submissions from Lead Agencies (including but not limited to; Public Health, WRA, Physical Planning, County Government, Lands) and the public; conducting community meetings and public hearings

(barazas); as well as providing and collecting written evidence i.e. minutes, and administered project questionnaires (open and closed ended).

- Identifying and analysing the proposed project alternatives including project scale and extent; project site alternatives; no project alternatives; design alternatives; material alternatives; alternative processes; and technological alternatives giving reasons for preferring the proposed alternatives.
- Adequately identifying, predicting and carrying out in-depth analysis of all actual, potential and significant project impacts on flora, fauna, soils, air , water, the social, cultural and community settings; the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated to be generated by the proposed project, both positive and negative throughout the project cycle.
- Recommending and drafting sufficient mitigation measures for all the identified potential negative impacts identified and analysed in TORs.
- Developing an emergency response procedure for the entire project cycle.
- Identifying gaps in knowledge and uncertainties which will be encountered in compiling the information.
- Analysing materials to be used in the construction and implementation of the project, and wastes to be generated (liquid, solid, hazardous, non-hazardous), proposing alternative/appropriate options/technologies.
- Analysing occupational health and safety issues associated with the proposed project.
- Developing an Environmental and Social Management and Monitoring Plan proposing measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and those mandated to implement them.
- Designing and specifying the monitoring and audit requirements necessary to ensure the implementation and effectiveness of mitigation measures adopted.
- Preparing a comprehensive EIA study report in accordance with EMCA CAP 387 legislation for submission to NEMA for approval.
- Forwarding the draft EIA Study report to the project proponent for review and certification.
- Incorporating project proponent's comments (if any) into the EIA study report after review into the final EIA study report.

- Submit 10 hard copies and one soft copy of the EIA study report to NEMA for the purposes of seeking NEMA license that will approve the proposed project.
- Submit to the project proponent one copy of NEMA referenced EIA study report and the acknowledgment letter from NEMA.
- The consultant to follow up on the processing and issuance of EIA License for the proposed project from NEMA and submit the original EIA license to the project proponent upon issuance.

1.4 Project overview and justification

Globally, an estimated 1.3 billion tons of solid wastes is generated annually and is expected to reach 2.2 billion tons by 2025 with the low-income countries will contributing a significant portion (World Bank). According to UN-Habitat, solid wastes in Nairobi are as a result of industrial and manufacturing activities which constitute 68 percent of domestic waste. The bulk of the waste constitutes 57 percent food waste, 13 percent plastic, 8 percent paper and 14 percent industrial wastes. Of these wastes, only 25% is collected. All waste is taken to unprotected dumping sites. The current total recycling capacity in Nairobi is very low in comparison to the total waste being generated.

Privatization as an alternative to publicly provided waste management has been explored for developing countries since private sectors operate more efficiently than the public sector in providing municipal solid waste services (Bartone *et al.* (1991)) and (Cointreau-Levine (1994)). Key e-waste management challenges in Kenya include inadequate legislation and appropriate infrastructure for e-waste management, absence of frameworks for end-of-life (EoL) product take-back and implementation of extended producer responsibility (EPR) (Osibanjo & Nnorom, and Schluep).

Industrialization in Kenya and the implementation of Environmental Management and Coordination (Waste Management) Regulations, 2006, has necessitated the need to develop a domestic waste disposal facility that can cope with the increased demand from growth of population and at the same time meet the ever demanding regulatory framework. The area is characterized by lack of centralized domestic waste disposal.

The availability of a disposal domestic waste facility is not only a critical environmental issue, but also an essential economic factor for a country that aspires to grow its economic base. Most international companies expect a domestic waste management program to be in place that is both economical and meets international standards, especially ISO 14000 considerations. Besides, without the means to dispose hazardous wastes, it is not possible to enforce the current environmental legislation.

The management of disposal of domestic wastes in Kenya is regulated under the Environmental Management and Co-ordination Act (EMCA, 1999) CAP 387, EMCA (Waste Management) Regulations (2006). These regulations establish an order of preference for the management of domestic wastes to be: minimization, recycling, treatment, and land filling. The disposal of the domestic waste at Eastern bypass area and its environs will both assist the economic growth and provide a proper treatment and disposal route that is affordable.

The entrance of the proponent as a private investor in waste management in the county is important in ensuring that the existing gap and challenges in waste management is bridged to ensure that the local people live and work in a healthy, clean and secure environment as stipulated by the relevant national legislations. This is possible through conjunction with both the county and national government as a private investor to provide affordable, cost friendly and efficient waste management infrastructures and their associated facilities to help solve the problem waste management in the county thus contributing towards the national and global goal of eliminating the problem and helping accomplish Kenya's legislative, development goals and plans, strategic plans and policy frameworks in waste management like the Constitution, 2010, EMCA CAP 387, among others.

1.5 Scope, Objective and Criteria of the Environmental Impact Assessment (EIA)

1.5.1 Scope of the Report

The EIA exercise has been conducted to evaluate the impacts of the proposed domestic disposal site on the environment and proposals have been given on how to eliminate or minimize any undesirable effects resulting from its implementations (construction, installation and future operations). This report includes an assessment of impacts of the disposal site and operations on the following:

- ✓ Physical environment;
- ✓ Flora and fauna;
- ✓ Land use;
- ✓ Socio-economic aspects;
- ✓ Health issues;
- ✓ Fire response preparedness;
- ✓ Spill/leak containment;

The report has assessed the impacts of the proposed Site on the environment in accordance with the EMCA, Cap 387 guidelines and EIA/EA regulations. The scope of the EIA study covered:

- ✓ A review of the policy, legal and administrative framework
- ✓ Description of the proposed project
- ✓ Baseline information

- ✓ Provisions of the relevant environmental laws
- ✓ Assessment of the potential environmental impacts on the project area
- ✓ Development of the mitigation measures and future monitoring plans

1.5.2 Objectives of the EIA Project Report

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

Specific objectives include:

- To identify possible environmental impacts, both positive and negative
- To assess the significance of the impacts
- To assess the relative importance of the impacts of relative plan designs, and sites
- To propose preventive mitigation and compensative measures for the significant negative impacts of the project on the environment.
- Generate baseline data for monitoring and evaluating how well the mitigation measures are being implemented during the project cycle.
- To present information on impact of alternatives
- To present the results of the EIA that can guide informed decision making and safe operation of the disposal site.

1.6 Method and Criterion Used in the Report

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

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

1.6.1 Environmental Screening

This step was applied to determine whether an environmental impact assessment was required and what level of assessment was necessary. This was done in reference to requirements of the EMCA, The process was also guided by the recommendations from various legally established bodies like the Nairobi county Government, Physical Planning office and various government ministries and agencies.

1.6.2 Environmental Scoping

The Scoping process helped narrow down onto the most critical issues requiring attention during the assessment. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects.

1.6.3 Desktop Study

This included documentary review on the nature of the proposed activities, project documents, designs policy and legislative framework as well as the environmental setting of the area among others. It also included discussions with managers and design engineers as well as interviews with neighbors.

1.6.4 Site Assessment

Field visits were meant for physical inspections of the site characteristics and the environmental status of the surrounding areas to determine the anticipated impacts. It also included further interviews with neighbors.

1.6.5 Reporting

In addition to constant briefing of the client, this environmental impact assessment project report was prepared. The contents were presented for submission to NEMA as required by law.

CHAPTER TWO:
PROJECT DESCRIPTION, DESIGN AND CONSTRUCTION

2.1 Nature of the project

The proponent intends to develop a waste handling facility by identifying a disposal site at Eastern bypass. This is necessitated by the increased demand for proper waste handling facility by the increasing population within the county and the desire for maintenance of a clean environment.

2.2 Project description and Study Area

The proposed project shall entail recycling and disposal of all waste. The waste streams will include Municipal, Industrial, Medical, E-Waste, and Hazardous. The facility, which will ride on a concept of SMART WASTE ZERO WASTE, will be equipped in such a way that it will enable to do segregation, sorting disassembly, crushing and separation. This process will result in what we call MATERIAL RECOVERY. After material recovery, all recovered material will be classified into recyclables and disposables after which a further treatment will be carried out especially on the hazardous materials recovered.

The recyclables will be in form of metals, cables, PCBs, glass, wood, paper, plastic, bricks, concrete etc. This is the general outlay of the facility but all the waste will be handled separately depending on source. This means that we shall treat each waste as classified i.e. Medical, Industrial, E-waste or Municipal. All these waste streams will be handled separately to increase the efficiency of material recovery. The process flow for each will be the same in terms of collection, transport and handling within the facility.

1. E-waste

This will include all electrical and electronic waste which will be delivered to the facility. It will also include bulbs since some like the CFLs contain printed circuit boards. The process flow will result in recyclables and hazardous materials. Detailed recycling process will be sent later. The recovered hazardous material will be incinerated and gasified to recover more metals and to destroy all dioxins and hazardous material. The end product ash will be used for making bricks/ blocks while recovered heavy metals will be used for re-manufacturing.

2. Medical Waste.

At source, there will be a mobile incinerator to destroy all the hazardous waste at source and also a mobile microwave plant that will destroy all forms of hazardous chemicals at source. In the facility, we will continue to incinerate the waste to required levels and the resultant ash will be used for road blocks.

3. Industrial waste.

This will be inform of solid or liquid or gas which will be subjected to high temperatures in the incinerator to recover heavy metals and the ash will also used for the bricks making

4. Municipal waste.

This waste will be treated through a process that will result in material recovery. The same cycle mentioned above will be repeated with every waste stream. The equipment involved in the entire process have been summarized in the table below:

NO	MACHINE/ PLANT	DESCRIPTION
1	Balcan Lamp Crusher	The crusher has processing capacity of 1500-2000 fluorescent tubes per hour. During operation, the lamp must be fully encased prior to crushing thus preventing uncontrolled emissions of mercury. All Balcan lamp crushers are supplied with chute allowing 2.4m fluorescent tube to be crushed.
2	Used Dry cell battery recycling system	Mercury from used dry cell batteries will be recovered during the roasting process. The outer iron casings and residual zinc will be collected separately. Outer casings can be recycled into iron products and zinc residue will turn into raw materials for zinc ingots and micronutrient fertilizer.
3	Waste Lead Acid battery recycling plant	This battery recycling plant, with working process from inlet of waste battery to recycled LEAD. The process 1. The battery auto cutter is used to cut the battery into 4 part, making the acid liquid flow out. 2. The intelligent crusher is then used to crush the lead plate of lead battery into 1-2cm, then the crushed lead plate go to granulator by conveyor. 3. The granulator with 45kw motor is utilized to cut the battery into 1-4mm granule. Crushed battery are mixed with water becoming slurry. 4. Slurry goes to feeding silo via feeding slot. 5. The light material will float at the surface of water and go to deposit pool via Screw conveyor, the output from water pool is lead particular and lead

		power. 6. The heavy material will sink at the bottom of the feeding silo and then go to vibrating screen through Screw conveyor. 7. Vibrating screen will classify the material by size and output lead granule. The water will be circulated and reused.
4	Fluorescent lamp Recycling system	Used fluorescent lamp parts are crushed, separated, washed and made ready for distribution. Recycled glass can be transformed into glass wool insulation for homes and raw glass materials for fluorescent lamps. Recovered aluminum and metallic bases are converted into aluminum raw material. Mercury is recovered from wastewater and can be reused in new fluorescent lamps.
5	Refrigerant Cryogen Recovery Machine	This machine is only used to recycle: R404A、R407C、R410A、R134a、R507、R22 refrigerants. No mixing different types of refrigerants or the cross contamination will cause badly damage to the refrigeration system and maintenance tools of air-conditioner and the recycling equipment.
6	CRT cutter	CRT Cutting system CRTC-002 is to separates the glass at panel and glass at rear part called funnel, suck and collect the fluorescent powder. All steps are eco-friendly, no pollution produced. The process includes pre-dismantle, glass cutting through heating trough metal band and air blow. The machine separates cathode ray tube in TV and monitors in front and rear part. These are then separated into different fractions for recycling.
7	Toner Recycling plant	**Mechanical treatment:** The plant concept described is enabling an automatic removal of the toner powder from the toner cartridge. The unopened cartridges are fed to a shredding device via a feeding unit and are coarsely broken. Thereafter, a sieving machine separates the cartridge components from the toner powder. **Further processing steps:** The dust-free material mix produced with this processing plant can, for example, be separated in existing WEEE processing plants. After further shredding steps, the separation of ferrous metals, non-ferrous metals and the plastics are taking place. However, these shredding and separation steps would also be possible immediately after the toner cartridge treatment.
8	Pyrocrat System LLP	Pyrolysis is chemical reaction. This reaction involves molecular breakdown of larger molecules into smaller molecules in presence of heat. Pyrolysis is also known as thermal cracking, cracking, thermolysis, depolymerization, etc. During pyrolysis plastic and tire breaks down into smaller molecules of pyrolysis oil, pyrolysis gas and carbon black.

2.2.1 Project Products and Activities during Implementation Cycle

2.2.1.1 Products

The expected product from this development project is discussed as below;

i. **Medical Wastes: -** Medical wastes will be incinerated at high temperatures to form ash. The resultant ash from incineration process will be used to make bricks for housing construction.

ii. **Electronic and Electrical wastes: -** before incineration valuable materials will be recovered from the wastes. Rare earth metals will be recovered from processing of PCBs and these will be resold for use in manufacturing new electronic items. Recovered metals will be used for making new products like steel bars; Plastic will used to make synthesis oil through pyrolysis; and paper for making new paper materials.

iii. **Industrial, Batteries, and municipal wastes: -** These wastes will be incinerated after recovery of recyclable materials and will involve incineration or gasification of unrecoverable wastes only. This will be through bottom ash treatment which is a solidification process.

iv. **Organic Wastes: -** these wastes will be processed in an ecochar machine which will turn them into synthesis gas and fertilizer as the end products.

2.2.2.2 Material Inputs

Electrical and Electronic Wastes:- These will include the cable granulator, PCB line, E-waste line, fridge compressor fluid removal, motor dismantling system, CRT screen dismantling system, CFL (Mercury Compact fluorescent bulbs) Bulb recycling line, among others.

Industrial Wastes:- This will be inform of solid or liquid or gas which will be subjected to high temperatures in the incinerator to recover heavy metals and the ash will also used for the bricks making

Medical Wastes:- At source, there will be a mobile incinerator to destroy all the hazardous waste at source and also a mobile microwave plant that will destroy all forms of hazardous chemicals at source.

Municipal Wastes:-This waste will be treated through a process that will result in material recovery. The same cycle mentioned above will be repeated with every waste stream.

2.2.2.3 Activities during project implementation phase

Activities during this phase will include but not limited to:

i. Procurement of construction materials e.g. cement, sand, EPS panels, timber, ceramic tiles, stone coated tiles, windows, doors, among others
ii. General designing and planning of the proposed incineration facilities and their associated infrastructure.
iii. Construction work involving mainly provision of dump roof course under all external walls, construction of building slabs, treating of soils under slab and around external foundation for termite control, construction of building foundations and finishing window cills before internal plastering.
iv. Civil work involving mostly stabilizing of soils on cut embankments.
v. Structural work which will involve implementing all works to Structural Engineer's details, determining the depth of the building foundation and wall reinforcement.
vi. Mechanical works involving mainly plumbing and drainage works, all floors accessible service ducts, inspection plates in all bends, deep seal or anti-vac to all fittings connected to the SVP's, and waste pipes, encasing of underneath drain pipes, testing of pipes before plastering, and the coordination of mechanical and electrical works, air conditioning, air extraction system, mechanical ventilations in the washrooms.
vii. Electrical works involving laying of all conduits, and coordination of electrical and mechanical works, CCTV connections, ICT and wireless internet connections.
viii. Fire work consisting of installation of fail safe sprinkler system, fire hydrant & extinguishers, fire suppression in control rooms, and fully zoned fire detection & alarm system.
ix. Control Systems installation including water supply control & fault detection system, power supply control, & fault detection system including generators, lighting control & fault detection system, air conditioning, air quality, ventilation control & fault detection system, fire sprinkler, detection & alarm control.
x. Mobilisation of required equipment, machineries, labour, and plants for site vegetation clearance, soil excavation, levelling, compacting, and material transportation; concrete mixers; and transporting trucks.
xi. Identification, acquisition, supply and transportation of the required construction materials to the site.
xii. Masonry work, concrete mixing, plumbing, painting works, and steel metal processing (fabrication).
xiii. Installation of incineration equipment and their associated infrastructures.

xiv. Landscaping.
xv. Roofing works, landscaping, and gardening.
xvi. Development of vehicle parking, pavements, and walkway networks.
xvii. Final inspection of works, and
xviii. Occupation of the facilities upon inspection and issuance of an occupation certificate by relevant authorities in charge.

2.2.2.4 Activities during operation phase

This is the phase after construction and equipment installation phase. The proponent shall manage the development in conjunction with relevant administrative authorities and other project stakeholders to ensure that the prescribed environmental recommendations and monitoring apparatus are adhered to. This phase shall involve the following:-

i. Issuance of occupation certificate by the county and national government inspector to ensure that the facility is ready and to the required construction standards for use.
ii. Occupation of the facilities and operation of the installed incineration equipment.
iii. Solid waste and waste water management: The proponent shall provide waste skips/bins for temporary holding of the solid waste before incineration within the facility. Waste water (effluent and storm water) will be managed through safe disposal into septic tanks as the area does not have sewer connection while storm water will be managed through properly constructed drainage system within the compound which will dispose the same into the existing area storm water drainage channels.
iv. Cleaning: This will involve regular washing and cleaning of the pavements and other public areas. The proponent shall be responsible for this activity. The resultant water will be channelled into the existing storm drainage channels existing within the area.
v. General maintenance and repairs: This will involve activities such as repair of building walls and floors, repair and maintenance of electrical gadgets, incinerators, and equipment, repairs of leaking water pipes, painting, maintenance of gardens, lawns and replacement of worn out materials. The project proponent will be responsible for these activities.

2.3 Project location

The proposed project site is located along Eastern Bypass road next to Exxen Petrol Station on geographical positioning system coordinate of 1°13'56.6"S and 36°59'21.3"E in Nairobi County. The site currently hosts five storage metallic containers for future use once the project is operational. It neighbors mainly Exxen Petrol Station, batching plant, Shell Petrol Station,

Infinity Industrial Park, upcoming shopping center, residential housing blocks, Eastern Bypass highway, and electricity pylon, among others. The proposed site is accessible through a murram road a few meters off the main Eastern Bypass highway. The land is privately owned to which the proponent has valid land ownership title deed.

2.4 Waste Sorting

Waste sorting will be done before loading into the tracks. Necessary safety and environmental protection provisions will be provided.

2.5 Waste Disposal

The process does not use any water and therefore water will only be used for sanitary and washings within the site. Trenches will be dredged in the site. The domestic waste will be offloaded to the trenches. After they get filled up they will be covered by soil and compressed by a roller

2.6 Air Quality

As indicated in the report the area is inhabited and therefore the air quality need to be enhanced by constructing concrete perimeter wall and planting of trees within the region.

2.7 Support services

The site will not be complete until support facilities are put into place. These will include;

- Perimeter wall
- Sanitation facilities (toilets, wastewater drains.
- Health and safety provisions (signage, exits, first Aid points etc.)
- Security arrangements.

2.8 Project Approval

The project will be developed on land that the proponent already owns. Acquisition of NEMA approval should be done before commencement of the project. After the pre-requisites are met the proponent will then commission the development as is planned.

CHAPTER THREE
BASELINE INFORMATION

3.1 PHYSICAL ENVIRONMENT

The physical environment is where individuals live, learn, work, and play. People interact with their physical environment through the air they breathe, water they drink, houses they live in, and the transportation they access to travel to work and school.

3.1.1 Climate

At 1,795 meters (5,889 ft) above sea level, Nairobi enjoys a moderate climate. Under the Koppen climate classification, Nairobi has a Subtropical highland climate. The altitude makes for some chilly evenings, especially in the June/July season when the temperature can drop to 10 °C (50 °F). There are two rainy seasons but rainfall can be moderate. The cloudiest part of the year is just after the first rainy season, when, until September, conditions are usually overcast with drizzle. Temperature fluctuates between 15°C and 32°C in most areas

3.1.2 Topography

The site lies at an altitude of about 1795 meters above sea-level. It gradually slopes towards the northern part of the property. The area lies at a latitude of 1°13'56.6"S and longitude 36°59'21.3"E

3.1.3 Geology and Soils

The geology and soils of an area have a great influence on the type of physical development and also determine the type of land use appropriate for the area. The site has generally shallow black cotton soils which are well drained and easy to work on during construction.

3.1.4 Water Resources and Wetlands

Although Nairobi relies mainly on surface water supplies, the sources of these supplies lie outside the city. The surface streams, though numerous, are heavily contaminated by domestic and industrial effluents and solid wastes. Naturally rivers are expected to cleanse themselves as they move downwards, but this is not the case with the Nairobi River and its tributaries, because there are many sources of organic pollution along the river.

3.2 BIOLOGICAL ENVIRONMENT

This section describes key biological elements, including the identification and distribution of dominant, rare and the unique flora and faunal species within the proposed project site and other potentially affected areas.

3.2.1 Flora

Natural vegetation in Nairobi has been cleared to pave way for the establishment of both residential and commercial developments. The natural vegetation in the area has thus been greatly modified. The remnants of the natural vegetation of the site and its environs are few scattered trees and shrubs as well as grass. The site has exotic plants and the proponent is encouraged to do a lot of landscaping to provide greenery and maintain a healthy environment.

3.2.2 Fauna

There are different species of birds and animals such as cows, goats, sheep, and donkey's e.tc.

3.3 SOCIO-ECONOMIC ENVIRONMENT

3.3.1 Land Use

The surrounding area of the proposed project is a commercial area, with maximum activities of construction going on. Petrol stations, schools, churches, car wash, industries and few estates coming up. Urban land use refers to spatial distribution of social and economic activities. Accordingly, an up-to-date land use inventory is frequently required to facilitate urban planning and growth patterns as well as monitoring of urban expansion. A study by the Department of 26 Resource Surveys and Remote Sensing (DRSRS 1994) identified eight major land-use classes in major urban centres in Kenya. These include Residential use Industrial, commercial and service centres, Infrastructure land use, Recreational areas, urban agriculture as well as Water bodies and riverine areas

3.3.1.1 Current Physical Development Planning Policy

There is a physical and local physical development plan and regional physical development plan for the area where the local authority has issued a controlled development of the entire area.

3.3.1.2 Land Uses Adjacent to the Site

It neighbors mainly Exxen Petrol Station, batching plant, Shell Petrol Station, Infinity Industrial Park, upcoming shopping center, residential housing blocks, Eastern Bypass highway, and electricity pylon, among others. The proposed site is accessible through a murram road a few meters off the main Eastern Bypass highway. The land is privately owned to which the proponent has valid land ownership title deed.

CHAPTER FOUR
RELEVANT ENVIRONMENTAL LEGISLATIVE AND REGULATORY FRAMEWORK

4.1 Introduction

The following guiding policy, legal and institutional frameworks relevant to the proposed development project works will be key during project implementation phases of construction, operation and decommissioning as they relate and affect the proposed project works directly or indirectly.

National Policy Frameworks

- The National Environmental Action Plan (NEAP, 1994)
- National Policy on Water Resources Management and Development, 1999
- National Policy on Environment and Development (Sessional Paper No. 6 of 1999)
- Vision 2030
- Kenyan Information and Communication technology policy (2006)
- Kenya National Policy on Injection Safety and Medical Waste Management (2007)
- National Environment Policy (2013)
- The National Solid Waste Management Strategy (2014)
- The Nairobi city integrated Solid Waste Management Plan (2010-2020)
- The Nairobi Metro 2030 Strategy (2008)

National Legal Frameworks

1. The Constitution of Kenya, 2010
2. Environment Management and Coordination Act, CAP 387, and its Amendment Act, 2015;
    - Environmental Impact Assessment and Audit Regulations, 2003
    - Water Quality Regulations, 2006
    - Waste Management Regulations, 2006
    - Noise and Excessive Vibrations Pollution Control Regulations, 2009
    - Air Quality Regulations, 2013

Legal Notices

- Legal Notice Number 101: Impact Assessment and Audit Impact assessment (2003)
- Legal Notice Number 120: Water Quality Protection of water quality (2006)
- Legal Notice Number 121: Waste Management (2006)
- Legal Notice Number 73: Controlled Substances (2007)

- Legal Notice Number 60: Hazardous Substances (2007) Disposal of hazardous wastes
- Legal Notice Number 61: Noise and Excessive Vibration Pollution (2009) Regulation of noise and vibration

Environmental Health and Safety, & Other Related Laws

1. Occupational Health and Safety Act, 2007 and its subsidiary legislations
   - Fire Risk Reduction Rules of 2007,
   - Safety and Health Committee Rules of 2004,
   - Medical Examination Rules of 2005, and
   - Noise Prevention and Control Rules.
2. The Water Act, 2002
3. The Lands Act No. 6 of 2012
4. The Public Health Act (CAP 242)
5. Physical Planning Act (CAP 286)
6. The Nairobi City County Solid Waste Management Act, 2015
7. County Government Act (CAP 265)
8. Planning and Building regulations, 2009
9. The Penal Code (CAP 63)
10. Birth and Death Registration Act (2012) (Disposal of cadavers)
11. The Factories Act (1987) (Generation of waste in factories)
12. The radiation protection act (1985) (Generation and disposal of radioactive material)
13. Occupiers Liability Act (CAP 34)
14. The National Construction Authority Act, 2011
15. Food, Drugs and Chemical Substances Act (1992) (Disposal of Solid Waste)
16. Energy Act
17. Energy Act (CAP 314), 2006
18. The Traffic Act Cap 403
19. The Work Injury Benefits Authority (WIBA) 2007
20. Nairobi County Authority by-laws
21. The Building Code of Kenya, 2000 & 2009 edition
22. Energy (Energy Management) Regulations, 2012
23. Energy (Solar Water Heating) Regulations, 2012

National Institutional Frameworks

1. The Land and Environment Court
2. National Environment Council
3. National Government

4. Kenya National Cleaner Production Centre
5. Environment and Land court
6. Land, physical planning and environmental departments
7. Local Authorities and county governments
8. Provincial and District Environment Committees
9. Public Complaints Committee
10. Public Prosecution
11. National Ministries for Environment and Health
12. National Environment Management Authority (NEMA)

Global Policy Frameworks

i. 1972 Declaration of the United Nations Conference on the Human Environment (Stockholm)
ii. 1957 The Recommendations of the United Nations Committee of Experts on the Transport of Dangerous Goods (formulated in 1957 and updated biennially)
iii. 1982 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
iv. 1982 World Charter for Nature adopted by the General Assembly of the United Nations at its thirty-seventh session
v. 1987 The Cairo Guidelines and Principles for the Environmentally Sound Management of Hazardous Wastes adopted by the Governing Council of the United Nations Environment Programme (UNEP) by decision 14/30
vi. 1991 Bamako Convention on the Ban of the Import into Africa and the Control of Tran's boundary Movement and Management of Hazardous Wastes within Africa
vii. 1992 United Nations Conference on Environment and Development. Rio Declaration on Environment and Development
viii. 1997 Decision 19/13 C of the Governing Council of the United Nations Environment Programme to initiate international action to protect human health and the environment through measures which will reduce and/or eliminate emissions and discharges of persistent organic pollutants
ix. 2005 JICA Supporting Capacity Development in SWM in Developing Countries - Towards Improving SWM Capacity of Entire Society
x. 2007 Stockholm Convention on Persistent Organic Pollutants
xi. The Minamata convention
xii. The Strategic Approach to International Chemicals Management (SAICM)
xiii. ISWA policy document on health-care waste management
xiv. United Nations Committee of Experts on the Transport of Dangerous Goods

4.2 The Constitution of Kenya

This is the principal guiding law in the country from which all the subsidiary laws are drawn from. **Article 42** of the Bill of Rights of the Constitution grants every person has the right to a clean and healthy environment and thus forming a basis for this report.

4.3 The Environment (Impact Assessment and Audit) Regulations, 2003

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

4.4The Environmental Management and Coordination Act (EMCA)-1999

This is an Act of parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto. Part VII on Environmental Audit and Monitoring section 58 specifically detail the need to undertake Environmental Impact Assessment of all projects likely to cause negative impacts to the environment as listed in the second schedule of the act. Further, part V of the Environmental Impact Assessment and therefore mandatory that an Environment Impact Assessment process. It is therefore mandatory that an Environmental Impact Assessment must be undertaken by all ongoing projects to ensure that the activities at their premises comply with all legal and institutional frameworks that are in place to safeguard the environment, health and safety of the workers.

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

1) No person shall dispose off any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.
2) A waste generator shall collect, segregate and dispose such waste in the manner provided for under these regulations.
5 (1) A waste generator shall minimize the waste generated by adopting the following cleaner production methods:
a) Improvement of production process through

- Conserving raw materials and energy
- Eliminating the use of toxic raw materials; and
- Reducing toxic emissions and waste

b) Monitoring the products cycle from beginning to end by

- Identifying and eliminating potential negative impacts of the product;
- Enabling the recovery and re-use of the product where possible; and

- Reclamation and recycling; and

c) Incorporating environmental concerns in the design and disposal of a product.

4.6 The Water Act, 2016

Part II, section 18, of the water Act 2016 provides for national monitoring and information systems on water resources. Following on this, sub-section 3 allows the water Resources Management Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a facility operator and the information thereof furnished to the authority. Section 73 of the act allows a person with license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 75 and sub-section 1 allows the licensee to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction. The proponent intends build a septic system for use within the premises.

4.7 Physical Planning Act, Cap 286

The said Act section 29 empowers the local Authorities (Now County Governments) to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section allows for prohibition or control of the use and development of an area. Section 30 state that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local Authority.

4.8 Building Code 2000

A person who erects a building or develops land or changes the use of a building or land, or who owns or occupies a building or land shall comply with the requirements of these by- laws. For the purpose of this by- laws and the following operations shall be deemed to be the erection of a building:-

a) The alteration or extension of a building.

b) The changing of the use or uses to which land or building is put.

c) The formation or lying out of an access to a plot.

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

4.9 The Electricity Power Act, 1997

Section 55 (1) in the execution of works in connection with the construction, modification, maintenance or operation of an electric supply line or apparatus or conductor connected thereto, every licensee shall:-

> *In no way injure the works, conveniences or property belonging to any such other such authority, company or person, nor obstruct or interfere with public traffic, except with the previous consent of the board.*

4.10 The Penal Code (Cap. 63)

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

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

4.11 The Occupational Safety and Health Act, 2007

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

- General duties including duties of occupiers, self-employed persons and employees
- Enforcement of the act including powers of an occupational safety and health officer
- Registration of workplaces.
- Health General Provisions including cleanliness, ventilation, lighting and sanitary conveniences
- Machinery safety including safe handling of transmission machinery, hand held and portable power tools, self-acting machines, hoists and lifts, chains, ropes & lifting tackle,

4.12 Environmental Vibration Pollution (Control) Regulations, 2009

These regulations were published as legal Notice No. 61 being a subsidiary legislation to the Environmental Management and Co-ordination Act, 1999 (Cap 387). The regulations provide information on the following:

i. Prohibition of excessive noise and vibration

ii. Provisions relating to noise from certain sources
iii. Provisions relating to licensing procedures for certain activities with potential of emitting excessive noise and/or vibrations and
iv. Noise and excessive vibrations mapping.

According to regulation 3 (1), no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

4.13 County Environment Committee

County Environment Committees are responsible for the proper management of the environment within the County in respect of which they are appointed to. They are also to perform such additional functions as are prescribed by the Act or as may, from time to time be assigned by the Minister by gazette notice. The decisions of these committees are legal and it is an offence not to implement them.

4.14 Public Complaints Committee

The Committee is charged with the following functions:
Investigating allegations/ complaints against any person or against the Authority (NEMA) in relation to the condition of the environment and its management, Prepare and submit to the County periodic reports of its activities which shall form part of the annual report on the state of the environment, and to perform such other functions and excise such powers as may be assigned to it by the County.

4.15 Compliance of Solid Waste Management Legal Notice No. 121

The environment management and coordination Legal Notice No. 121 on (Waste Management) provides for the responsibility of waste generation, cleaner production methods, segregation of waste by generator, waste transportation license responsibility of waste transporter, transportation of waste by licensed transporters, license for disposal facility, waste treatment by operators of disposal sites, requirement of environmental audit and reuse and recycling plant. The legal notice provides mitigation measures to industrial waste and their treatment. The hazardous and toxic wastes have been specified by the legal notice that also provides for various requirements of EIA.

4.16 Work injury benefits Act-Act No.13 of 2007.

It is an act of Parliament to provide for compensation to workers for injuries suffered in the course of their employment. It outlines the following:

- Employer's liability for compensation for death or incapacity resulting from accident;

- Compensation in fatal cases;
- Compensation in case of permanent partial incapacity;
- Compensation in case of temporary incapacity;
- Persons entitled to compensation and methods of calculating the earnings;
- No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury;
- Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director.

The contractor will need to abide by all the provisions of WIBA. During the operation the occupier must also ensure that this legal provision is complied with.

4.17 Kenya's Vision 2030.

Efficient waste management infrastructure for transport and treatment of solid waste is imperative for the desired Kenya's socio-economic transformation and has been identified as a central pillar in Vision 2030. Clean environment has likewise been identified as one of the infrastructural enablers of economic, social and political pillars of Kenya's Vision 2030. Kenya aims to be a nation that has a clean, secure and sustainable environment by 2030. The goals for 2012 are:

(i) to increase forest cover from less than 3% at present to 4%; and
(ii) to lessen by half all environment-related diseases.

Specific strategies will involve promoting environmental conservation in order to provide better support to the economic pillar flagship projects and for the purposes of achieving the Millennium Development Goals (MDGs); improving pollution and waste management through the design and details on how toxic and hazardous waste should be handled, stored, treated, transported and even provision of permits. This has to apply to pesticides and toxic substances, biomedical waste, and radioactive waste whereby collection, transportation, storage, treatment and disposal of them have been specified. The legal notice further specifies offence, penalties and operation of regulation that have to be followed when dealing with any type of waste. The proponent will have to adhere to legal notice No 121 in its project cycle that is from construction, operational and decommissioning of the incinerator.

4.18 The Land planning act (Cap 303)

Section 9 of the subsidiary legislation (the development and use of land Regulations 1961) under which it require that before the local Authority to submit any plans to then minister for approval, steps should be taken as may be necessary to acquire the owners of any land affected by such plans. Particulars of comments and objections made by the landowners should be submitted, which intends to reduce conflict of interest with other socio economic activities.

4.19 The Land Registration Act, No.5 of 2012

An Act of Parliament to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes. The Act has repealed the following land related laws:

- *The Indian Transfer of Property Act 1882*
- *The Government Lands Act, (Cap 280)*
- *The Registration of Titles Act, (Cap 281)*
- *The Land Titles Act, (Chapter 282)*
- *The Registered Land Act, (Cap. 300)*

Section 26 of the Act states that Certificate of title to be held as conclusive evidence of proprietorship, except:

a. on the ground of fraud or misrepresentation to which the person is proved to be a party; or
b. Where the certificate of title has been acquired illegally, unprocedurally or through a corrupt scheme.

The project proponent has legally acquired this piece of land in possession of title deed.

CHAPTER FIVE
IMPACT IDENTIFICATION, PREDICTION & EVALUATION

5.1 Description of the Existing and Anticipated Impacts

5.1.1 Existing Impacts

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

5.1.2 Anticipated Impacts

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

5.2 Identification of Environmental Impacts

The proposed development will result in substantial ecological, economic and social benefits to local and national economies despite having negative environmental impacts that can be harmful to the surrounding environment. The construction works of the proposed development will involve direct land take, vegetation clearing, and removal of top soil, excavation and mass haulage. These activities will expose the land to elements of erosion such as wind and water, and thus, will trigger the process of land degradation especially during heavy rains.

The anticipated positive and negative impacts during project construction phase will include:

Positive Impacts

i. Increased employment opportunities for casual labourers, masons, carpenters, joiners, electricians and plumbers. Skilled, semi-skilled and non-skilled labour will be required during project implementation process.
ii. Improved living standards and livelihoods of the local people through employment, supplies opportunities as well as initiation of several businesses by entrepreneurs within/around the project area to cater for the needs of the project workers and staff.
iii. Provision of market for supply of building materials such as cement, machine cut stones, hardware among others
iv. Improved security due to improved lighting in the surrounding areas and presence of several security guards on duty around the clock.
v. Provision of clean environmentally friendly energy and building blocks/bricks.
vi. Reduced air, water, and soil pollution associated with the extraction, refining, and processing of raw materials.
vii. Improved business and economic growth.

viii. Revenue generation to the proponent, local communities around the area, the county and national governments used for development of various development sectors and service provision
ix. Increased incomes and improved livelihoods of involved local people improving their economic and social status.
x. Reduction of greenhouse gases (GHGs) emissions.
xi. Reduction in use and demand of energy resulting in reduced fossil fuels burning and less carbon dioxide emission into the atmosphere.
xii. Access to improved healthcare services.
xiii. Improved and efficient sustainable waste management infrastructure.
xiv. Exchange of technical knowhow.
xv. Incineration of medical waste and municipal waste preventing release of methane gas.
xvi. Since medical and municipal waste incinerators turn solid waste to ash; It only requires a small portion of the landfill for safe disposal important in saving space that would have otherwise been occupied by landfill.
xvii. Significant volume reduction of wastes, while requiring little processing of wastes before treatment; efficient industrial land use; Extraction of precious minerals from obsolete items for reuse.
xviii. Provision of raw materials.

Negative Environmental Impacts

i. Impacts on soil quality through (soil erosion and degradation) due to vegetation clearance, excavations, tailings and other earthworks.
ii. Noise and excessive vibrations.
iii. Increased water demand.
iv. Hospital wastes incinerators' air emissions and ash concentrations of emission constituents (production of more dioxins and furans per gram of waste burned) is more than what municipal incinerators produce.
v. Air pollution / Dust emission.
vi. Increased solid waste generation.
vii. Interference with fauna and flora.
viii. Alteration of natural environmental landscape.
ix. Increased water pollution and surface runoff (soil erosion).
x. Visual intrusion.
xi. Hazardous waste (oil leaks, spills) and liquid waste (effluent) pollution.

Negative Socio-Economic Impacts

i. An influx of strangers into local communities.
ii. An increase in crime and deviant behaviour (e.g. drug abuse, prostitution).

iii. Constraint/ pressure to the existing infrastructure and resources including space, water, and roads.
iv. Increase in population may create pressure on social amenities such as hospitals, schools and social facilities.
v. Increased traffic volumes in the area's access roads.
vi. Occupational safety and health hazards.
vii. Disruption of utility services like electricity supply, water supply, among others in the area.
viii. Public safety.
ix. Stress and anxiety due to job loss.
x. Increased prevalence of HIV/AIDS & other sexually transmitted infections.
xi. Increased insecurity.
xii. Occupational health (injuries and accident occurrence).

During the operation phase of the proposed development, anticipated positive and negative impacts include:

Positive impacts

i. Creation of employment opportunities.
ii. Improved aesthetics.
iii. Reduced visual impact.
iv. Improved security.
v. Sustainable waste management.
vi. Reduced waste volume.
vii. Availability of fertilizer, bricks, steel bars for construction and manufacturing processes all from incinerated, treated and recovered wastes materials.
viii. Optimal land use.

Negative Environmental impacts

i. Increased energy demand.
ii. Increased solid waste and effluent generation.
iii. Increased storm water/ run off resulting from decreased recharge areas, after paving areas e.g. drive ways.
iv. Increased risks of occupational health and safety incidences such as fire outbreaks, accidents.

Negative Social impacts

i. Increased demand and pressure on existing infrastructure and local social amenities e.g. water, electricity, roads, hospitals, etc.
ii. Increased incidences of HIV/AIDS, sexually transmitted infections, and other communicable diseases.
iii. Increased negative social behaviours and drug abuse.
iv. Increase in population in the project area.

v. Emergence of social and cultural conflicts.

5.3 Issues of Concern and their Respective Mitigation Measures

5.3.1 Soil Erosion

Soil erosion is loss of topsoil through agents of soil erosion like wind and water (rain), during the implementation phase of the project, light machinery under use will loosen the soil making it susceptible to soil erosion. In this particular project soil erosion will not be a major environmental issue of concern since there is hardly any major excavation or levelling to be done. However, it is important to note that the project will involve excavation and burying of underground fuel tanks, digging of foundation trenches and hence soil disturbance which will expose and set the soils loose to the agents of soil erosion.

Mitigation measures

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

5.3.2 Noise and Public Disturbances

Noise is unwanted/undesirable sound that can affect job performance, safety, and health. Psychological effects of noise include annoyance and disruption of concentration. Physical effects include loss of hearing, pain, nausea, and interference with communications when the exposure is severe. As explained earlier, construction activities will be generating some noise. Such noise will mainly emanate from the construction machinery and equipment which include concrete mixers and compactors and noise that will emanate from the workers on site.

Mitigation measures

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

5.3.3 Water

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

Mitigation measures

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

5.3.4 Air Quality

The construction activities on the site will result to increased dust and gas emissions. Some Construction machinery and trucks generate hazardous exhaust fumes such as Carbon Oxides (CO2), Sulphur Oxides (SO2) and Nitrogen Oxides (NO2). Dust, as caused by vibrations of machines and vehicle movement suspends in the air mostly during dry spells. Such dust and gases have direct negative impact to the quality of air.

Mitigation measures

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

5.3.5 Oil Leaks and Spills

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

Mitigation measures

- All machinery should be keenly observed not to leak oils on the ground. This can be ensured through regular maintenance of the construction machines and equipment.
- Maintenance should be carried out in a well-designed and protected area and where oils/grease is completely restrained from reaching the ground. Such areas should be covered to avoid storm from carrying away oils into the soil/water systems.
- All oils/grease and materials should be stored in a site's store which is usually located in the contractor's yard/site office.

5.3.6 Solid Waste

Construction activities results to increased solid wastes within the site. Such waste materials include stones, pieces of metal rods, pieces of iron, pieces of pipes, papers, equipment wrappings etc. On completion, the property management should adapt a waste management system to handle any waste that will be generated from various operations.

5.3.7 Flora and Fauna

Removal and disposal of such refuse and other related wastes comes in handy in this project.

Mitigation measures

- The waste materials should be properly segregated and separated to encourage recycling of some of them such as concrete debris which can be used as backfills with the approval of the site engineer. The site has minimal vegetation which has no conservation values. Some temporary and permanent disturbances will be caused to small animals.

Mitigation measures

- Flora and fauna on site should be conserved.

5.3.8 Construction Materials

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

Mitigation measures

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

5.4 Occupational Health and Safety (OHS)

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

Mitigation measures

- All workers should be provided with full protective gear. These include working boots, safety harness, overalls, helmets, goggles, masks and gloves.
- People preparing food for the workers on site should be monitored to ensure that food is hygienically prepared.

- A first aid kit should be provided within the site. This should be fully equipped at all times, site workers should also be trained on basic First Aid Skills.
- Some tasks require one to be in very good health, workers should be subjected to medical examinations before starting work. This will ensure that only medically fit persons are engaged for such tasks.
- The site workers should be warned of drugs and alcohol since they might affect their concentration at work causing accidents.
- Sanitary facilities should be provided on site during construction and should be kept clean at all times.

5.4.1 Security

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

Mitigation measures

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

5.4.2 Fire Safety

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

Mitigation measures

- Fire alarm and fighting equipment should be installed within the facility once it is complete.
- A “No smoking” notice should be placed strategically on site.
- Ensure that all firefighting equipment installed on the site once it is complete are regularly maintained and serviced.
- Dry sand buckets should be placed in strategic places in case of fire.
- The facility operators should be trained on how to use various firefighting devices.

CHAPTER SIX
ALTERNATIVES AND PROPOSED ACTION

6.1 Analysis of Alternatives

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

6.2 Relocation Option

The proponent has full ownership of the parcel of land (***see attached title deed – annex 2***) in anticipation of putting up the proposed waste disposal site. Relocation options means that the proponent will look for a different plot to establish the proposed development, bearing in mind that the land owner does not have another site in the area. This means that he has to look for land elsewhere. Searching for land to accommodate the space and size of the project and completing official transaction it may take a long time although there is no guarantee that such land could be available in the area. The developer will spend another one year planning and pulling all the resources together. Project design and planning before the stage of implementation will cost the developer another large sum of money. Whatever has been done and paid up to this level will be counted as a loss to the developer. Assuming the proposed project will be given a negative response by the relevant authorities including NEMA, the project will be delayed for about two year's period before implementation. During this period the proponent will not utilize the land leaving it idle with no returns, a delay that the proponent can ill afford. This will also lead to a situation like no other project alternative option; the other consequences of this will be an environmental hazard in the county since there is no other disposal site.

6.3 No Project Alternative

This means that the status quo remains and the proponent will have to contend with the land being underutilized. This will also require that the proponent abandon the proposed project and chose a new project for implementation which will involve fresh surveys, studies, designing, planning, acquisition of various project affiliated approvals, which will be more costly and time consuming as compared to implementing the proposed development project on the identified existing site. As a result, there will be loss of the anticipated project benefits to the proponent, local communities, local community members, county government, the country and other key project stakeholders. This option is the most suitable alternative from the extreme environmental perspective as it ensures non-interference with the existing conditions which is not the case for the proposed development project.

Socio-economically, this means that the proponent will not utilize the land for the purpose it was intended for leaving the property idle. Additionally, this will discourage potential investors in the sector; there will be no employment opportunities; local skills in the sector will remain under-utilized; development of infrastructural facilities (waste recycling and treatment facilities, energy facilities, roads, electrical etc.) will take place; and finally, Vision 2030 will not be achieved as it requires infrastructural improvement to gear the nation towards its realization. Given the project goal and objective of sustainable waste management through incineration and waste treatment, the proposed project has no any viable alternative as the problem has to be solved through such noble initiatives.

The no project option is the least preferred from the socio-economic and partly environmental perspective due to the following factors;

- Discouragement for environmentalist.
- Land will still remain idle
- No employment opportunities will be created for Kenyans bearing in mind that the proposed project will have employment opportunities both directly or indirectly during construction and operations phases and thus improve lifestyles and livelihoods
- Local skills would remain under utilized
- Development of infrastructural facilities (energy facilities, roads, electrical etc. will not be undertaken).
- Vision 2030 will be far from being achieved/ attained bearing in mind that this is one of sector which need infrastructural improvement to gear the nation towards realization of vision 2030.

From the analysis above, it becomes apparent that the No Project alternative is no alternative to the local people, and the government of Kenya.

6.4 Technology Alternatives

Incinerator design alternative should involve provisions for waste ash residues collection points within the same incineration concrete slab, to avoid instances where waste ash residues is collected from the incinerator for separate disposal in open ash pits, for safety and improved biomedical waste management. Due to its technicality and complexity in terms of design and construction, factoring in costs, it is advisable that the project proponent sticks to the already designed plans and works for the incinerator as it is cost effective and easy to implement. Alternative technology to incinerator as a means for biomedical waste disposal and management includes Autoclaving which involves heating bags of medical wastes at between 120 and 165^0C for 30 to 90 minutes in chambers using pressurized steam to destroy bacteria and pathogenic micro-organisms reducing their volume by 75 percent; Microwave disinfection which involves treating of hospital wastes with moist heat and conventional microwaves at temperatures of 940^0C reducing their volume by 80 percent; Superheated steam which comprises of a heated

shredder and sterilisation unit, in which organic liquids are vaporised in the shredder and solids reduced to gas by super-heated steam at temperatures between 500 and 700^0C as well as melting medical equipment into sterile mass reducing medical waste volume by 50 to 80 percent after which the residues are grounded or landfilled. These alternatives to incineration are not cost friendly and again involves landfilling of the resulting waste residues which is not very efficient and effective as required in terms of biomedical waste disposal and management. As such, construction of incinerator is advised as it is cost friendly and is very efficient since all wastes are burnt to ash before disposal. The incinerator will be constructed to the required standards as stipulated in the Kenya Public Health Act as well as the Physical Planning Act of 1996. Solar panels will be installed as alternative clean sources of energy for cost saving, as well as water harvesting tanks to help in collection of rainwater as an alternative to piped water supply, thus cost cutting.

6.5 Material Alternatives

The proposed project will be done using modern, locally and internationally accepted standards to achieve public health safety, security and environmental aesthetic requirements. Equipment's that save energy and water will be given first priority without compromising on cost or availability factors.

Key construction materials to be used in the implementation of the proposed project will be concrete mixture from quality cement, sand, ballast; water; steel and iron metals; red volcanic soil; water and oil based paints, among other materials which have no alternatives since they've been tested and proven as the best for construction works of any nature. Modern, locally and internationally certified materials will be used to ensure for public health safety, security and environmental aesthetic requirements. Equipment that save energy and water will be given first priority without compromising on cost or availability factors. Land will be optimally used economically through the implementation of the proposed project. Therefore, it is advisable that the recommended certified construction materials be for project implementation.

6.6 Analysis of Alternatives

The proposed development project is perfectly compatible with the land use in the area. The site neighbours a batching plant and an industrial park, which are categorized under light industrial zone, a land use zonation under which the proposed project falls. The proposed project option is the most suitable both from an environmental, social, and economic perspective. The socio-economic and environmental benefits of the project through sustainable waste management far outweighs the minimal negative impacts associated with it. This therefore qualifies the proposed development project for implementation to help end the waste management menace in the country through the concept of SMART WASTE ZERO WASTE.

6.7 Waste Water (Effluent) Management alternatives

1. Use of stabilization ponds/lagoons: This refers to the use of a series of ponds/lagoons which allow several biological processes to take place, before the water is released back to the river. The lagoons can be used for aquaculture purposes and irrigation. However, they occupy a lot of space but are less costly. No chemicals are used/heavy metals sink and decomposition processes take place. They are usually a nuisance to the public because of smell from the lagoons/ponds. This option is not preferable in the area because the required space is not only available, and the surrounding community is not likely to accept the option.

2. Use of Constructed/Artificial wetland: This is one of the powerful tools/methods used in raising the quality of life and health standards of local communities in developing countries. Constructed wetland plants act as filters for toxins. The advantages of the system are the simple technology, low capital and maintenance costs required. However they require space and a longer time to function. Long-term studies on plant species on the site will also be required to avoid weed biological behavioral problems. Hence it is not the best alternative for this kind of project.

6.8 Comparison of alternatives

The proposed project is the best alternative since it will provide domestic waste management facility within Nairobi County. In addition to this the facility will lead to revenue for the proponent and the government, improvement in service (domestic waste) delivery and will create employment opportunities for more people.

CHAPTER SEVEN
PUBLIC PARTICIPATION

7.1 Introduction

The need for public involvement in project development is enshrined in the Constitution of Kenya, 2010. This requirement is also provided for in the EMCA, 1999, the Environmental (Impact and Audit) Regulations, 2003, and is one of the guiding principles of the National Environment Policy, 2013. Sections 87 and 115 of the County Governments Act, 2012 also provides for public participation in county planning premised on timely access to clear and unambiguous information on any matter under consideration in the planning process. Chapter Four of the Kenyan Constitution on the Bill of Rights makes international law a key component of the laws of Kenya and guarantees protection of minorities and marginalized groups. Under Articles 33, 34, 35 and 36, freedom of expression, the media, and access to information and association are also guaranteed.

7.2 Objectives of the Consultation and Public Participation

The main objectives of the stakeholder consultation process were:

a) To inform stakeholders about the proposed project
b) To share with stakeholders, the impacts (positive and/or negative) that they should expect from the proposed project during construction and operation;
c) To collect stakeholders' views, comments, concerns and local knowledge regarding the proposed project; and
d) To seek consensus and stakeholder consent on the project

7.3 Issues raised

During the stakeholder engagement, there were various concerns by the locals who were involved during the first meeting that was done at the site. Due to the pandemic a total number of 15 participants were reached out and gave their feedback and views concerning the proposed project. A second meeting is being organized with the involvement of the local administrator (area chief) Summary of issues and mitigation measures are summarized on (chapter 5)

CHAPTER EIGHT
ENVIRONMENTAL MANAGEMENT PLAN

8.1 Introduction

The objectives of the Environmental Management Plan are:

- To guide the project implementers in project planning.
- To guide the project implementers on the likely impacts of the project and when they are likely to occur.
- To give an assessment of the capacity requirements for the implementation of the EMP.
- To guide the project implementers to allocate adequate resources for the implementation of the mitigation measures.

8.2 Costing

It will be noted from the plan, that some impact mitigation activities on which costing are not done. This is because costing for such activities may have been catered for, under another project component/phase for a similar or related activity. For instance, the cost of provision of dust coats and masks is entered once, as it is not expected that the contractor will have to buy this item again for all the purpose listed in the subsequent phases

8.3 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 is then 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 criteria of impact and mitigations.

8.4 Environmental Management Plan (EMP) - Planning and Construction phase

CONSTRUCTION PHASE				
Impacts	**Mitigation Measure**	**Responsibility**	**Indicator**	**Cost (KSh)**
Noise Pollution	Complying with the EMCA noise regulation Legal Notice 61 including: ✓ Observe normal working hours during noisy construction works (00800 to 1700) hours ✓ Ensure that all generators and heavy duty equipment are insulated or placed in enclosures ✓ Sensitize drivers to avoid unnecessary gunning of vehicle engines ✓ Ensure regular servicing of engines and other machines shall be adhered to ✓ Workers to wear ear muffs if working in noisy section.	Contractor; Management	Amount of noise generated (dB)	50,000
Construction Waste	Following EMCA regulations on Waste Management, Legal Notice 121 including: ✓ Making available suitable facilities for the collection, segregation and safe disposal of the wastes. ✓ All construction materials left over at the end of construction should be used in other projects or sold ✓ Ensure proper handling and storage of construction materials to reduce damage ✓ Accurately estimate the sizes and quantities of materials required to reduce amounts left ✓ Excavated waste should be re-used or backfilled.	Contractor; Management	Amount of waste on site	80,000
Air/Dust Pollution	• Enclosing the structures under construction with dust proof nets. • Using efficient machines with low emission technologies for the ones that burn fossil fuels. • Regular maintenance and services of machines and engines. • Use of clean fuels e.g. unleaded and de-sulphurized fuels.	Contractor; Management	Amount of gaseous Emissions Amount of particulate emission	50,000

Oil spills and leaks	• Machinery should be well maintained to prevent oi leaks. • Contractor should have a designated area where machinery servicing and maintenance is carried out and that is protected from rain water. • All oil products should be stored in a site store and handled carefully.	Contractor; Management	No oil spills or leaks on site	50,000
Drainage and Storm-water	• The drainage system should ensure that surface flow during pump testing is drained suitably to control flooding within the site.	Contractor; Management	Presence of drainage channels	25,000
Occupational Health and Safety Risks	• Provide all workers with the necessary protective gears • Ensure all workers are in protective gears all the time when on site • Place fire extinguishers in strategic areas within the site • Designate and mark smoking areas • Provide enough first aid kits within the project site • Ensuring all potential hazards such as movable machine parts are labelled.	Proponent/Contractor County Government of Nairobi County Public Health Officer	Visibility and clarity of signage and alerts Efficiency of equipment such as fire-fighting equipment Level of awareness of workers	20,000
Vegetation loss	• Designate access route and parking zones for drilling lorry and vehicles delivering accessories • Landscape the site after the activity	Proponent; Contractor	Warning signs on site Landscaped lawns	Within project cost
Operation Phase				
Impacts	**Mitigation Measure**	**Responsibility**	**Indicator**	**Cost (Kshs)**
Increased Water demand	• Provide information signs on means and needs to conserve water • Promote re-cycling and re-use of water as much as possible • Sensitize the occupants to conserve water by avoiding unnecessary wastage. • Detect and repair broken pipes promptly • Install water storage tanks	Proponent; Management	Presence of water Meter Presence of automatic water taps	15,000
Solid waste generation	• Waste should be properly segregated and separated • Provide litter bins	Proponent; Management	Amount of waste generated	50,000

	• Ensure regular waste collection • Making available suitable facilities for the collection, segregation and safe disposal of the wastes. • Creating adequate facilities for the storage of materials and chemicals and controlling access to these facilities.	County Government of Nairobi County Public Health Officer		
Demand for Electricity	• Energy conservation measures to be practiced • Lights to be switched off when not in use • Service solar panels regularly • Ensure standby general is functional • Install power meters to monitor power use	Proponent; Management	Presence of an KPLC meter Electricity bills	30,000
Fire Hazards & Accidents	• Keep well stocked and functional first aid box • Ensure proper storage of inflammables at the site. • Maintain fire-fighting equipment and ensure that they are regularly inspected • Create awareness among employees on proper safety measures.	Proponent; Management	Number of fire drills carried. Proof of inspection on firefighting equipment. Fire Signs put up in strategic places. Availability of firefighting equipment.	70,000

Occupational Health and Safety	• Provision of PPEs to all and replacing the PPEs on wear and tear. • Placing readable signs alerting people of flammable hazardous petroleum materials. • Servicing equipment and machine to ensure efficiency. • Providing fire-fighting equipment and maintaining them to ensure they are fully functional. • Delineating fire and emergency assembly points and creating awareness to ensure all people at site are aware of them, e.g. through the use map. • Putting in place and ERP and ensuring all people in the project are aware of it and the procedures to follow commensurate to the level of emergency. • Providing adequate storage for hazardous and flammable substances and controlling access to them.	Throughout project Period	Number of incidents/ accidents per monthly Number of drills per year Visibility and clarity of signs and alerts Efficiency of equipment such as fire-fighting equipment Level of awareness of workers Number of assembly Points Separate washrooms (Gents & Ladies) Copies of Annual Audit Reports	70,000
Insecurity	• Construction of a perimeter wall and have a barrier which is manned all the time. • Install security alarms • Partnership with the neighbors and police in community policing. • Control of secondary businesses. • Round the clock security for the facility. • Adequate lighting and an alarm system installed at strategic points.	Proponent; Management	Number of businesses around the site. Level of crime in the area	50,000
Generation of Noise	• Erecting signs and notifying other users of noisy activities. • Conducting all noisy activities during the day when permissible levels are higher. • Provision of PPEs such as ear plugs for employees working in noisy conditions or with noisy equipment. • Using equipment with low noise ratings or noise reduction technologies such as for the generators	Proponent; Management	Amount of noise generated per day: dB Adequacy and quality of noise PPEs (ear muff, ear plugs)	25,000

Washrooms	• Provide sufficient and suitable sanitary conveniences the washrooms should be kept clean, in good working and usable conditions	Proponent; Management	Separate washrooms (Gents & Ladies)	20,000
Increased Pressure on Available utilities	• Implementing water conservation techniques. • Using only the required amounts of water during normal operations. • Creating awareness through signs of conservation of water and electricity. • Using natural light during the day for lighting purposes. • Using machines and equipment with a high level of power efficiency in the station and servicing them as often as required to maintain their efficiency. • Using gas in the kitchens/restaurants for cooking purposes.	Proponent; Management County Government of Nairobi Members of the public	Amount of water consumed /day: m3/day Amount of electricity consumed per day: Kwh Number of machines and equipment serviced per month Amount of fuel consumed per day: m3/day Number of drainage blockages per month	70,000

8.5 Decommissioning Phase

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

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

- Remove all underground facilities from the site
- The site should be well landscaped by flattening the mounds of soil and
- Planting indigenous trees and flowers
- All the equipment should be removed from the site
- Fence and signpost unsafe areas until natural stabilization occurs
- Back-fill surface openings if practical

DECOMMISSIONING PHASE				
Impacts	**Mitigation Measure**	**Responsibility**	**Indicator**	**Cost (KSh)**
Disturbed environment	Undertake a complete environmental rehabilitation program Landscaping and introducing appropriate local vegetation	Proponent; Contractor	A rehabilitated site	100,000
Noise & Air pollution	Maintain decommissioning equipment Demolition works to be carried out only during normal working time (00800 to 1700) hours. Workers working in noisy section to wear ear muffs Workers should be provided with dust masks Sprinkling dusty areas Install dust trappers around the site Ensure strict enforcement of on-site speed limit regulations Avoid excavation works in extremely dry weathers if and where possible	Proponent; Contractor		40,000

Demolition waste	Demolition debris should be collected by a licensed private contracted waste collection company Demolition waste should be re-used or backfilled. Identifying all sources of wastes, and ensuring wastes are handled by licensed personnel Making available suitable facilities for the collection, segregation and safe disposal of the wastes.	Proponent; contractor	Amount of waste on site Presence of well Maintained receptacles And central collection point	80,000
Loss of income	The safety of the workers should surpass all other objectives in the decommissioning project. Adapt a project completion policy; identifying key issues to be considered. Compensate and suitably recommend the workers to help in seeking opportunities elsewhere.	Proponent	Proponent	50,000

Occupational Health and Safety Risks	Provide all workers with the necessary protective gears Ensure all workers are in protective gears all the time when on site Place fire extinguishers in strategic areas within the deport Designate and mark smoking areas Provide enough first aid kits within the project site Train workers in administering first aid	Proponent; contractor	Number of incidents/ accidents per monthly Availability of PPEs Visibility and clarity of signage and alerts Presence of First Aid Kits and fire-fighting equipment Level of awareness of workers	70,000

Summary of Environmental Management plan

Impact	**Mitigation Measures**
Water quality	✓ Application for EDL License ✓ Ensure periodical water quality analysis
Noise and excessive vibrations	✓ Machines that vibrate should be mounted on heavy, rigid bases to prevent vibrations ✓ Provide workers with PPEs ✓ Noise should be checked occasionally ✓ Ensure machinery are kept in good working conditions ✓ Use of natural dampers to reduce noise ✓ Conduct annual noise surveys
Air/Dust quality monitoring	✓ Using efficient machines with low emission technologies for the ones that burn fossil fuels. ✓ Undertake annual air quality analysis ✓ Raise the chimney to an height of 10M above the roof ✓ Enclosing the structures under construction with dust proof nets
Fire Hazards & Accidents	✓ Keep well stocked and functional first aid box ✓ Ensure proper storage of inflammables at the site. ✓ Maintain fire-fighting equipment and ensure that they are regularly inspected ✓ Create awareness among employees on proper safety measures.
Solid waste generation	✓ Compliance to waste management regulations, 2006 and provisions issued by the county government of Nairobi
Emergency Response Procedure	✓ Have an emergency committee in place ✓ Have a well-functioning Emergency alarm ✓ Have the operator trained on emergency response ✓ Have a well-documented emergency response plan for the facility
Water pollution and degradation and associated	✓ Comply to the provisions of water quality regulations 2006

ground water contamination	✓ No hazardous materials should be stockpiled within area prone to surface run-off ✓ Hazardous materials should be stored above flood levels
Occupational Health and Safety Risks	✓ Design and display on site emergency preparedness and evacuation procedures ✓ Implement procedures for reporting incidents, accidents and dangerous occurrence ✓ Workers must wear PPEs at all times when at the work stations ✓ Ensure strict compliance to OSHA 2007, PUBLIC HEALTH ACT and WIBA provisions ✓ Practice good site management and avoid stiff cliffs ✓ All access to hazardous areas should be secured with a fencing and signs
Vegetation loss	✓ Designate access route and parking zones for garbage lorries and vehicles delivering accessories ✓ Landscape the site after the activity

CHAPTER NINE

CONCLUSION AND RECOMMENDATION

9.1 Conclusion

The proposed project design has integrated mitigation measures with a view to ensuring compliance with all the applicable laws and procedures. The proposed project will be implemented to the approvals by among others physical planning department and NEMA. From the foregoing, it is concluded that the proposed domestic waste management site is in appropriate location in as far as land use and interactions with human social and economic setting is concerned. There are no extensive habitations in the neighborhood, there is significant sensitive environmental features found within the vicinity (schools). However, there are certain social concerns that touch on general environmental pollution, groundwater contamination, health of the workers, attraction of human settlements in future and soil contamination. For this reason, appropriate preventive measures have been developed in this report

During the project construction phase, the proponent and contractor will avoid inadequate/inappropriate use of natural resources, conserve nature sensitively and guarantee a respectful and fair treatment of all people working on the project, general public at the vicinity and inhabitants of the project. In relation to the proposed project, mitigation measures that will be incorporated during construction phase, the development's input to the society and cognition that the project proponent is economically and environmentally sound, this development will be considered beneficial and important. It is our conclusion that the proposed development is a timely venture that will increase the nation's domestic waste management facility.

9.2 Recommendation

This report recommends that the project be allowed to go ahead provided the outlined mitigation measures are adhered to. Major concerns should nevertheless be focused towards minimizing the occurrence of impacts that would degrade the general environment. This will be achieved through close follow-up and implementation of the recommended Environmental Management and Monitoring plans (EMPs). We recommend these:

- The contractor should provide adequate security during the construction period.
- The above environmental management plan shall be adopted and applied as the basis for addressing environmental and social aspects throughout the project cycle with necessary amendments as may found appropriate. In this connection, it will be the guiding tool for future audits and monitoring exercises

- The proponent should follow the guidelines as set by the relevant departments to safeguard and envisage environmental management principles during installation and operations of the proposed project.
- Ensure waste and wastewater management regulations are complied with through provision of appropriate facilities including wastewater treatment facility.
- It is important that warning or informative sign (bill boards) be erected at the site. These should indicate the operation hours and when works are likely to be started and completed.
- The signs should be positioned in a way to be easily viewed by the public and mostly motorists.
- During construction all loose soils should be compacted to prevent any erosion by water and wind.
- Once earthworks have been done, restoration of the worked areas should be carried out immediately by backfilling, landscaping/leveling and planting of suitable tree species.
- A fully equipped first aid kit should be provided within the site
- Workers should get food that is hygienically prepared. The source of such food should be legalized or closely controlled.
- The contractor should have workmen's compensation cover and is required to comply with workmen's compensation Act as well as other relevant ordinances, regulations and Union Agreements.
- Once earthworks have been done, restoration of the worked areas should be carried out immediately by backfilling, landscaping/leveling and planting of suitable tree species.
- A fully equipped first aid kit should be provided within the site
- Workers should get food that is hygienically prepared. The source of such food should be legalized or closely controlled.
- The contractor should have workmen's compensation cover and is required to comply with workmen's compensation Act as well as other relevant ordinances, regulations and Union Agreements.
- The contractor should provide adequate security during the construction period.
- The above environmental management plan shall be adopted and applied as the basis for addressing environmental and social aspects throughout the project cycle with necessary amendments as may found appropriate. In this connection, it will be the guiding tool for future audits and monitoring exercises

Appendix 1: Site neighborhood

Fig 1: The petrol station neighboring the proposed site

Fig 2: An industrial park withinthe vivinity of the proposed site

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