ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED DEVELOPMENT OF A STEEL PROCESSING & STORAGE PLANT BY RAINHAM STEEL PLANT LIMITED, ON AMALGAMATED LAND REFERENCE NOs. MAVOKO TOWN BLOCK 2/,26177 AND 22616 IN KATANI AREA, MAVOKO SUBCOUNTY OF MACHAKOS COUNTY.

PROJECT PROPONENT

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PREPARED BY

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Study Report submitted to the National Environment Management Authority in accordance with section 58 of the Environmental Management and Coordination Amendment Act CAP 387, and Regulation 10 of the Environmental (Impact Assessment Audit) Regulations 2003, and legal notice No. 31, 2019 – & Physical and Land Use Planning Act of 2019.

JUNE 2022.

CERTIFICATION

We, the undersigned, hereby approve that all information given here in this report is accurate and true to the best of our understanding, knowledge and belief.

The preparation of this Environmental Impact Assessment study was commissioned by the proponent in fulfillment of requirements of Section 58 of the Environment Management and Coordination Amendment Act, CAP 387, Regulation 10 of the Environmental (Impact Assessment and Audit) 2003 amended 2016, legal notice No. 31 of 2019.

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Signature ……Designation……...……... Date …….

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ACKNOWLEDGEMENT

First and foremost, we would like to thank **Rainham Steel Plant Limited** for giving the Consultants the opportunity to conduct this Environmental and Social Impact Assessment study for the proposed Steel Processing & Storage Plant project.

We further thank every person who immensely assisted in logistics, provision of data, and providing a good environment for the impact assessment exercise.

The contribution, either direct or indirect, of all the stakeholders who took time out of their busy schedules to support the Environment and social impact assessors is highly appreciated. We are also indebted to the neighbors and other stakeholders who contributed their experiences during the exercise. We thank them together with the many others who have not been mentioned here.

Disclaimer

This Environmental Impact Assessment Study contains 158 pages and the study has been carried out to the best of our knowledge and ability and within the terms of contract with the client and is limited to the exercise of reasonable care. This report is not intended to relieve the Establishment from their contractual obligations. This report reflects our findings at the time and place of study and is issued under the General Conditions of Service.

EXECUTIVE SUMMARY

1.1 Overview and Background

This study was commissioned by **Rainham Steel Plant Limited** in accordance with Section 58 of the Environmental Management and Coordination Amendment Act (2015), CAP 387, and Regulation 10 of the Environmental (Impact Assessment Audit) Regulations 2003 amended in 2016, legal notice No 31 of 2019. Other national policies and legislations relevant to the proposed project were reviewed. The purpose of this study is to establish the potential environmental impacts as a result of the said construction and operation activities of the proposed development and thereafter prescribe possible mitigation measures. The report also provides baseline information on the project that may be used in decision-making during the project's evaluation process and is also expected to form the baseline for future environmental audits and monitoring.

The Study Process leading to this Project Report was further designed to address client expectations as stipulated in the Terms of Reference (ToR).

1.2 Project location, objective and scope

The primary objective of the proposed project is the design and installation of a steel reinforcement bars (Rebar) rolling mill plant of capacity of 12-15 Tones per hour (TPH) on amalgamate land reference Nos. Mavoko Town Block 2/26177 and 2/ 22616, situated in Katani area, off Katani road within Mavoko Sub-County, of Machakos County on GPS coordinates latitude **1˚20′58.55″S 37˚00′12.95″E**. Presently, the project site is not developed and the proposed development consist of a Steel Processing Plant with associated support facilities and services. The proposed plant will use the induction furnace melting and heating system. The project site is positioned within approximately 6.282 hectares and is regular in shape with a relatively flat terrain. However, the proposed development will not occupy the entire parcel of land rather it will comply with local planning and zoning regulations.

Specific objectives of the assessment are:

- ✓ To ensure that all environmental concerns are integrated at the implementation stage of this project in order to contribute to sustainable development of the general area:
- ✓ To identify potential impacts to the biophysical and human environment, both direct and indirect
- ✓ To align project activities with the National Social Protection Framework (policy, legal, regulatory and institutional);
- ✓ To obtain public views, concerns and values with regard to the proposed project by consulting communities living in the proposed project area;
- ✓ To create project awareness and opportunity for participation to the stakeholders;
- ✓ To determine the significance levels of the identified impacts and discuss the possible alternatives to the project;
- ✓ To generate baseline information for monitoring and evaluation of the effectiveness of mitigation measures implemented during the project cycle;
- ✓ To recommend preventive, and mitigate measures for the significant negative impacts of the project on human and biophysical environment;
- ✓ To develop an environmental and Socio-economic management and monitoring plan (ESMMP) for the proposed project;
- ✓ To prepare an ESIA report for the client through the project manager.

The scope of work included carrying out a detailed analysis of the positive and negative effects of the proposed development on the environment, and recommend appropriate solutions to minimize any undesirable effects resulting from construction of the steel plant. This report was conducted in accordance

with Section 58 of the Environmental Management and Coordination Amendment Act (2015), CAP 387, and Regulation 10 of the Environmental (Impact Assessment Audit) Regulations 2003 amended in 2016, legal notice No 31 of 2019. The scope covers three main areas: Natural Environment including Flora, Fauna, Soil, Water, Air, Climate, Landscape and the Aesthetic Environment; Human Environment Including- Socio-economic, Socio-cultural and Socio-legal; and Built environment including- Material Assets, Historical /Archaeological Sites and Monuments.

1.3 Study Approach and Methodology

The study approach is structured as required by the Environmental Impact Assessment and Audit Regulations. The approach identifies the possible impacts originated from the proposed Rainham Steel Plant project through an environmental scoping process based on the baseline conditions established during the field work and information obtained from the documents review. A detailed evaluation of the project area was undertaken to focus on significant environmental issues. The communities living near the proposed steel plant project coverage area were also involved during consultation meetings and participation processes to get their views and input on the proposed project. The tools that were used included questionnaires, site checklists, photography and discussions with stakeholders and host communities.

The Environmental and Social Monitoring and Management Plan (ESMMP) comprising the impacts mitigation plan was then developed to guide environmental management during all phases of the project development.

Public Participation Process

Diverse approaches were applied in stakeholder engagement as follows: -

Residents Consultations: The bulk of stakeholders around the project area are mostly quarry owners, informal business persons trading along the road and a few residential developments. Others are corporate stakeholders who rely on the road to provide service. Consultation involved talking to representative samples of all the diversity of stakeholders.

Consultative Forums: A Consultative forum bringing together the Consultant and Staff of Machakos County Government was arranged with the aim of agreeing on modalities for engagement between the County and the Consultant during the Project Design and subsequent operation Process. On their part, the County Government identified and nominated staff who would provide focal points in respective departments of the County Administration.

Discussions with the client: Following submission of the Inception and Feasibility Study Reports, consultative forums were held with the client during which, comments on the content, quality and focus of the environmental reports were made. Such comments have subsequently been used to update subsequent reports.

Key Informant Interviews: Key informants to the Study especially stakeholders in Central and County Government were approached and met in respective offices where they were engaged on issues of interest to respective sectors. Essentially, concerns expressed by respective sectors contacted proved to be useful checklists in the analysis of impacts anticipated from the proposed project. Further, from discussion with key informants, it was possible to identify other stakeholders previously not appreciated by the Study Team and this helped to widen the consultation base and by extension, the checklists for impact identification.

Outcome of the process: There was a call for involvement of young people from local communities during construction and the operational phase of the project. Most of those interviewed acknowledged that the proposed development will create employment for both skilled and unskilled workers. For the quarry

owners and small-scale business people around the area, they observed that their livelihood will be improved from increased sales of their various products. They also cited the importance of observing safety especially during construction by putting written notices A majority of stakeholders were clear that the proposed project should not lead to environmental degradation and require that comprehensive assessment of potential impact areas be carried out on material borrow areas, civil works sites, fuel storage/maintenance camps all of which should be reported in standalone reports.

Policy, legal and regulatory framework: This Project Report has been developed to ensure that the proposed steel plant conforms to national policy aspirations towards securing sustainable development. Specifically, this Report is written in compliance with requirements of the Environmental Management and Coordination Act (EMCA), 2015 and the National Constitution. Section 58 of EMCA requires that all development proposed in Kenya are subjected to environmental assessment in line with the Second Schedule (of EMCA) and the Legal Notice 101 (Regulations for Environmental Assessment and Audit) of June 2003. The entire Study process has been designed to conform to the regulatory framework stipulated by the National Environmental Management Authority that will review and grant the environmental license to the development of this report

1.4 Project Justification

There is a growing concern in Kenya and at global level that many forms of development activities cause damage to the environment. This has been aggravated by lack of awareness and inadequate information amongst the public on the consequences of their interaction with the environment. In addition, there is limited local communities‟ involvement in participatory planning and management of the environment and natural resources. Recognizing the importance of natural resources and the environment in general, the Kenyan Government has put in place wide range of policy, institutional and legislative framework to address the major causes of environmental degradation and negative impacts on ecosystems emanating from development programs. It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound. The ESIA assesses the impacts of a proposed project before commencement of implementation. In addition to helping formulate proper development policy, ESIA provides for public participation in the decision-making process in a proposed project.

Steel plays a very key role in the transformation of an economy, as it is the key driver in any industrial revolution majorly being used in transport, building and construction, power generation and machinery. Kenya's future growth in industrialization lies in high-value production, with steel production topping the chart as it is the overly used material in manufacturing, building and construction. The proposed steel plant will therefore increase local production of steel material, consequently facilitating local manufacturing, building and construction, creation of quality jobs for the locals through the expansion of the manufacturing sector and reduction of steel prices in the country.

1.5 Project cost and components.

The proposed development project is estimated to cost Ksh. 150,000,000.00 (Kenya Shillings, one hundred and fifty million only). The main design components of the project include, but not limited to the following:

- A Steel Processing Plant.
- Staff residence
- Development of external works/services – driveway, car parking lots, water supply, septic tank, electricity supply etc.
- Site landscaping.

1.6 Process Inputs and products.

Alloy steels contain metallic elements other than iron, such as chromium (present at 14% in stainless steel), nickel, vanadium, molybdenum, manganese, cobalt, and tungsten. The proposed plant will use the induction furnace melting and heating system. Some of the raw materials that will be used in the plant will be 50% Scrap metal and 50% billets; fuel that will be used will be Industrial Diesel Oil and furnace oil, water will be the main coolant. Expected products will be steel reinforcement bars.

1.7 Plant's Expected Waste

Some of the expected waste will include slags, dusts, mill scales, steel scrap, damaged furnace lining insulating materials, used oil, used grease and effluent from sanitary facilities and waste water.

For this development to take place, an Environmental and Social Impact Assessment (ESIA) study is required. This is a requirement of the section 58 of the Environmental Management and Coordination Amendment Act of 2015 and Regulation 10 of the Environmental (Impact Assessment and Audit) Regulations 2016, legal notice No. 31 of 2019. These statutes require that all new developments are to undertake an Environmental and Social Impact Assessment study before project commencement. An ESIA process ensures that the environmental implications of the various proposed development are taken into account prior to the commencement of the project. It entails aspects that include: analysis of the potential impacts on the environment, recording the impacts, undertaking public consultation exercise, evaluating alternatives to the proposed project, taking into consideration the comments and informing the public about the decision beforehand. This ESIA has been carried out to determine the current environmental status of the site and to assess the impacts that are likely to arise from the implementation of the project. From the study, it has been established that some of the basic approvals for the project have been obtained from relevant authorities.

1.8 Grievance Redress Mechanism

A Grievance Redress Mechanism (GRM) is an instrument through which dispute resolution is sought and provided. It involves the receipt and processing of complaints from individuals or groups negatively affected by activities of a particular project. It is a critical component of effective implementation of the environmental and social management plan (ESMP). The purpose of GRM is to provide a forum to the internal and external stakeholders to voice their concerns, queries and issues with the project. Such a mechanism would provide the stakeholders with one project personnel or one channel through which their queries will be channeled and will ensure timely responses to each query. This will allow for trust to be built amongst the stakeholders and prevent the culmination of small issues into major community unrest. The GRM will be accessible and understandable for all stakeholders in the project and for the entire project life. The GRM will be communicated to all relevant stakeholders and will also be applicable for any contractor that will occupy and/or use land during the construction and operations phase.

1.9 Background on steel processing

Steel is everywhere in our lives and is at the heart of a sustainable future. The steel industry is an integral part of the global circular economy. The circular economy is a move from linear business models, in which products are manufactured from raw materials and then discarded at the end of their useful lives, to circular business models where intelligent design leads to products or their parts being repaired, reused, returned and recycled. In the manufacture of steel, the term 'primary production' generally refers to the manufacture of iron (hot metal) from iron ore in a blast furnace (BF), which is subsequently processed in the basic oxygen furnace (BOF) to make steel. 'Secondary production' refers to the 'recycling' route and is typically the electric arc furnace (EAF) process, which converts scrap into new steel by re-melting old steel. However, primary steel production is not unique to the BOF route, and similarly, secondary steel production

is not unique to the EAF. It is common practice to use 10–30%scrap as iron input in the BOF route. Primary steel production also occurs in the EAF route, when pre-reduced iron is used as a feedstock to the EAF process. Steel is 100% recyclable and scrap are converted to the same (or higher or lower) grade steel depending upon the metallurgy and processing of the required product. Some recycled products such as rebar require minimal processing, whilst the higher value engineering steels require more metallurgical and process controls to meet tighter specifications. The final economic value of the product is not determined by recycled content, and there are many examples of high value products that contain large amounts of recycled steel. Some steel products are principally sourced via the primary route mainly because the steel specifications require low residual elements and this can be achieved most cost-effectively using more primary material. In most cases, scrap with a lower number of residual elements commands a higher market price owing to the ease of processing through the recycling routes. The main sources of steel in Kenya are recycled scrap and imports. Steel is usually imported in the form of billets. Recycling of steel scrap is preferred as it uses 60% less energy to produce steel from scrap than from iron ore. The government of Kenya banned the exportation of scrap steel in its 2009/2010 financial year budget. This is expected to spur local recycling of steel.

1.10 Economic Importance of Steel.

Globally, steel consumption has been steadily increasing over time. World iron and steel production has continued to show large increase since 2002, due to rapidly increasing steel demand in China, India and other developing countries. Kenya has large quantities of iron and steel that could be exploited for commercial ventures. Large deposits are found in Kitui, Taita Taveta, Homa Bay and Kakamega. In Kenya, steel is mainly used in the construction industry and in the manufacture of wire products such as barbed wire, chain link and nails. Steel is a major engineering material due to its availability, relatively low cost and high strength. It may be used in the `as cast' form or it may be further processed by hot or cold working to become wrought steel.

1.11 ESIA Study Team

The table below presents key specialist who will be involved in the ESIA study. Registration certificate and practicing license of the experts is attached in appendix as an annex.

Table 1: List of experts and task undertaking in the ESIA process:

Expert	**Task in undertaking the ESIA**
Environmentalist 1. Alex Mugambi 2. Purity Muthoni 3. Dr. Mark Boit	i. Overall coordination of the study ii. Compiling, synthesizing and analyzing information from all other experts iii. Organizing and coordinating public participation forums iv. Report writing v. Submission of the report
Sociologist 1. Samuel Waweru Kibuchi 2. Purity Muthoni	i. Undertaking the social survey ii. Analyzing the socio-economic implications of the project iii. Developing a socio-economic report

Occupational Health and safety Expert 1. Mrs. Irene Mueni	i. Analyzing the proposed work environment and procedure ii. Identification of potential occupational risks in the project iii. Design and propose preventive programs for work safety
Surveyor/GIS Expert 1. Dr. Mark Boitt	i. Land demarcation ii. Development of project area maps
Research Assistants 1. Danvas Otieno	i. Undertake household survey in the proposed project area

1.12 A summary of key findings of the study

The following baseline information was derived from the assessment of the proposed project. The assessment identified some potential adverse impacts of the project on the physical and socio-economic environment. The impacts that were further investigated and analyzed were:

Positive:

- ✓ Increased income to the proponent
- ✓ Improved aesthetics
- ✓ Increased tax revenue to county and national government
- ✓ Increase in foreign exchange earnings through exports
- ✓ Creation of employment opportunities and on-job training to locals
- ✓ Increased support for development of local community through company CSR programme
- ✓ Improvement of local economics
- ✓ Optimal use of land area
- ✓ Close proximity of Steel processing plant
- ✓ Increased access to Steel products
- ✓ Creation of market for goods and services
- ✓ Improved security

Negative:

Various negative impacts are foreseen in the lifecycle of the project and include:

- ✓ Generation of dust and air pollution during construction
- ✓ Possible accidents amongst workers
- ✓ Solid and liquid Waste generation and its disposal or management
- ✓ Additional strain to the available existing natural resources within the area and other amenities
- ✓ Noise generation and vibrations that may increase ambient noise levels
- ✓ Increase in soil erosion and change in soil structure resulting from excavation
- ✓ Increase in storm water runoff due to increase in paved areas
- ✓ Possible accidents to passersby
- ✓ Fire outbreaks
- ✓ Increased traffic along the main road

Some other potential impacts are short term and of low significance. These will be ameliorated through proposed mitigation measures which includes:

- ✓ Ensuring construction work is undertaken during the day
- ✓ Erection of a temporary barrier of iron sheets to condone the area from unauthorized trespassers
- ✓ Collection and appropriate disposal of solid waste from the construction works and materials.
- ✓ Use of hessian cloth to protect workers from falling objects where necessary.
- ✓ Provision and enforcement of protective gears to the workers.
- ✓ Enhanced monitoring and control of vehicular movement
- ✓ Placement of speed bumps on the access road to curb speeding motorists
- ✓ Training and awareness of construction workers and staff on safety precautions.
- ✓ Transport and storage of materials in bulk.
- ✓ Signage to alert general public
- ✓ Regular inspection of underground tanks for leakages
- ✓ Prioritizing the upgrade of equipment and installation of existing facilities of a network after a defined age.
- ✓ Careful siting of the project to ensure that it lies in an environment that is far from environmental receptors including sewers, tunnels, vaults, surface water reservoirs etc.
- ✓ Provide fire extinguishers, alarms and hydrants in areas which are probable source of fires
- ✓ Landscaping and replanting of vegetation after all installation and construction is done to form a green belt which will provide habitat for small mammals and birds.
- ✓ Excavated soil will be used for levelling of low-lying areas within the plant
- ✓ Channelize excess storm runoff efficiently
- ✓ Recycle most water used in the plant
- ✓ Provision of appropriate stack heights to control air pollution.

1.13 Environmental and Social Management Plan

The potential Environmental and Social Impacts identified and the parameters they affect, are classified into the following categories: Impacts on air quality, water resources, ecological quality, biodiversity and socio-economic environment. Mitigation measures have been developed in respect of the significant negative Environmental and Social Impacts. In addition, the ESIA team has developed an Environmental Management Plan, which should be adopted in order to ensure that the mitigation process is successful and ensure environmental safeguards are appropriately implemented.

Table 2: A Summary of the Environmental and Social Impact Management Plan:

Potential Negative Impact.	**Mitigation Measures**
CONSTRUCTION PHASE	
Biodiversity and Vegetation Loss	✓ Do not site project in environmentally sensitive area e.g., watershed, wetland and riparian land. ✓ Clear vegetation only when and where necessary. ✓ Comply with land use plans and approved designs. ✓ Resurface and re-vegetate exposed bare areas preferably by using natural indigenous vegetation. Scientific evidence should be put in consideration to avoid introduction of invasive species. ✓ Have a green belt which will provide habitats for birds and small mammals once construction is done. ✓ Use manual labor rather than machinery
Disruption of existing natural environment and Modification of micro climate.	✓ Development to be restricted to approved density, building line, land coverage, land ratio and zoning plan.

	✓ Careful layout and orientation of structures to respect wind and sun direction ✓ Adequate provision of green and open space planted with grass, shrub and tree cover ✓ Minimum use of reflective building material and finishes for roof, walls and pavements ✓ The flow of storm water to be harmonized with neighborhood and directed to well-designed drainage channels
Waste generation	✓ Contract a NEMA licensed waste handler and dispose offsite at county designated dumpsite. ✓ Develop appropriate and adequate waste collection measures and facilities. ✓ Provide for waste segregation into organics, metals, plastics at source for efficient management. ✓ Maintain waste disposal records. ✓ Manage materials responsibly to recover, reuse, recycle as appropriate. ✓ Develop clean-up plans for wastes and spills.
Health, Safety and Security Concerns	✓ Provide appropriate PPEs to the construction workers. ✓ Maintain updated firefighting and detecting infrastructure. ✓ Awareness training to construction and installation workers and staff on safety precautions. ✓ Secure the construction area from unauthorized persons by ensuring that access is confined to restricted work sites (including those with operation of mechanical and electric equipment) to persons with permits. ✓ Maintain a first Aid kit on site and train the workers on its use ✓ Implement appropriate traffic plans with the help of local police when (partial) closure of roads is required. ✓ Put up appropriate safety signage
Air emissions	✓ Service and maintain machinery and vehicles regularly according to schedule. ✓ Switch off machines when not in use. ✓ Use standard fuel and lubricants ✓ Ensure water sprinkling on bare surface including access roads to arrest dust emission. ✓ Provide all construction staff with appropriate personal protective equipment (PPEs) such as dust masks, overalls, helmet, dust coats, safety boots and goggles. ✓ Ensure that all construction workers make proper use of the PPEs provided at all the time they are on site. ✓ Install air conditioning systems that uses and document a phase out program as per schedule by

	Montreal protocol and in accordance to control substances regulations ✓ Clean access routes in surrounding area on a daily basis to prevent dust. ✓ Collect and hold cleaning wastes (e.g., rags) in appropriate containers. ✓ Workers who may unavoidably have to work in dusty workplaces should be provided with nose and ear masks to protect them from excessive dust. ✓ Carry out regular inspection and maintenance of equipment to reduce levels of Green House Gas (GHGs) emissions into the environment.
Noise pollution	✓ Maintain regular servicing of machines to produce less noise. ✓ Construction and installation work undertaken during day hours ✓ Workers to wear PPEs. ✓ Use of human labor where appropriate rather than machines. ✓ Switch off machines not in use. ✓ Use of noise mufflers for noise attenuation. ✓ Fence off the construction area from unauthorized persons ✓ Develop and implement a comprehensive noise conservation programme that includes training, equipment maintenance, engineering controls, use of PPEs, noise measurements among others. ✓ Ensure the construction site is secured by appropriate noise attenuators
Occupational health and safety	✓ Ensure that work sites (especially excavation works), have proper protection with clear marking of safety borders and signals and fence off all dangerous areas. ✓ Carry out training of staff in EH&S monitoring and evaluation. ✓ The contractor should recruit H&S person during construction. ✓ All construction workers to first be trained on the appropriate use of the provided personal protective equipment. ✓ Project proponent to ensure each construction worker and visitors to the construction site also use the provided personal protective equipment. ✓ The project proponent to ensure that tools and equipment provided for use at the proposed construction site are well serviced and maintained. ✓ Project proponent to ensure that the construction site is free of hazards. ✓ The project proponent to ensure that among the construction workers are trained first aiders. ✓ Project proponent to ensure there is a fully equipped first aid station at the proposed project site.

	✓ The contractor will ensure clear human resources policy against sexual harassment that is aligned with national law ✓ The contractor will integrate provisions related to sexual harassment in the employee Code of Conduct (COC) ✓ The contractors will ensure appointed human resources personnel to manage reports of sexual harassment according to policy ✓ The contractor will ensure comply to provisions of Work Place Injuries and Benefits Act (WIBA) 2007 ✓ Provide sex-segregated clean toilets for male and female workers ✓ Undertaking training and capacity building for all workers on use of chemicals.
Traffic related impacts	✓ Use reflective signature to direct traffic to designated areas. ✓ Use flag men/women to give directions to traffic. ✓ Sensitize drivers to observe speed limits ✓ Develop and implement a traffic marshal plan for the construction site ✓ Provide sufficient parking/ holding area for traffic delivering and collecting materials from the construction site. ✓ Liaise with traffic police if temporary closure of road is required
Sexual Exploitation and Abuse	✓ Develop and implement and SEA action plan with an Accountability and Response Framework as part of the ESMP. The SEA action plan will follow guidance on the World Bank's Good Practice Note for Addressing Gender-based Violence in Investment Project Financing involving Major Civil Works (Sept 2018).
OPERATION PHASE	
Waste generation	✓ Manage materials responsibly by applying principle of reuse, recover and recycle. ✓ Segregate the waste at source ✓ Maintain waste disposal records. ✓ Contract a NEMA licensed waste handler. ✓ Dispose waste in designated County government dumpsite by licensed NEMA waste handler ✓ Develop a septic tank for waste water management especially for domestic quarters ✓ The Proponent should prepare a Solid Waste Management Plan, which should contain an inventory of the types and quantities of waste to be produced. ✓ The most appropriate waste management approach for each type of waste including details on

	(temporary) storage, transport and final destination of the waste should be adopted. ✓ An assessment of any opportunities for reducing solid waste generation, in particular of hazardous and undesirable (persistent and non-reusable) types of wastes. ✓ The Proponent should maintain records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste, and make these available to the works supervisor upon his request, as proof of proper waste management practices. ✓ Any waste including excess soil and quarry spoil should be disposed of at gazetted sites. The solid waste shall not accumulate on site, to cause odour, fly, or rodent problems. ✓ Ensure all waste generated during operational phase is managed and disposed as per the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006
Health and Safety Concerns	✓ Form a Health and Safety Committee to monitor these issues and concerns. ✓ Enhance a health and safety policy and emergency response procedures and inform all staff in the processing plant ✓ Conduct regular fire drills, fire training and general awareness and ensure firefighting equipment are serviceable. ✓ Place clear signage strategically located ✓ Provide appropriate PPEs and enforce their usage ✓ Conduct regular and scheduled medical examination of the employees ✓ Provide First Aid Kits for emergency purposes
Increased water and energy demands	✓ All sources of water have been metered to monitor consumption ✓ Proponent will ensure that usage avoids wastage ✓ The proponent will purpose to use the most readily available water at the site without compromising availability to other water users in the area ✓ Contaminated water will be treated before discharge to the required standards in line with the water quality regulations. ✓ Minimize water demand by ensuring used water from the cooling circuit is routed through an adequately sized and effective cooling tower and pressure filter to filter the water for recycling purpose. ✓ Explore alternative sources of water that can be used such as roof catchment, rock catchment and collection from rain water pits to minimize drawing water from local borehole and pipeline for industrial use.

	✓ Provide adequate water storage tanks on site to store water from roof catchment from the extensive roofs of the go-downs during rainy season that can be used in cooling of plant and equipment. ✓ The proponent will liaise with KPLC to power the plant appropriately. ✓ The plant machinery will be designed to maximize power usage efficiency. ✓ The proponent should consider supplementing electrical supply from the national grid with renewable energy such as solar to power the lighting system of plant and domestic or staff quarters. ✓ Excavation and construction machines will be in serviceable condition to reduce consumption of fuel ✓ The proponent will ensure installation of generators and ensure they are in good working order to maximize fuel use efficiency.
Socio-economic Impacts and Social Conflicts	✓ County government authorities to control and monitor unplanned commercial activities around the site ✓ Encourage public participation and other parties in project planning, design and implementation ✓ Hold regular consultative meetings with neighbors to ensure good relationships ✓ Resolve any conflicts with other parties amicably
Noise Pollution	✓ Carry out baseline noise mapping ✓ Adhere to the national standards set out by the EMCA noise and vibration regulations (legal notice No. 61 of 2009) ✓ All noisy plant machinery will be housed in sound proof buildings. ✓ Roller bearing to be used ensure that the noise levels do not go beyond 70 dB (A) ✓ Insulation against noise should be applied where applicable. ✓ Provide appropriate PPEs ✓ Delivery of raw materials will be limited to day time only
Air Pollution	✓ Concern is the emission from the induction furnace flue gas emissions from the induction furnaces will be directed through the bag filter as the air pollution device with the appropriate stacks (pipes) of 30-40 meters stack height area recommended
Oil spills and leakages	✓ Fit hoses with quick-acting leak-proof cock or with an approved nozzle ✓ Train and supervise employee to ensure minimal spillage of fuel. ✓ Use of approved fuel tanks and monitor fuel quantities to detect leakages.

	✓ To prevent any leaks from getting into the environment, the tanks should be properly treated. ✓ A layer of clay should be used to encase the tanks during installation. ✓ The underground tanks must satisfy the national standards and be corrosion free.
Traffic related impacts	✓ Develop and implement a traffic marshal plan for the for the operational phase ✓ Provide sufficient parking/ holding area for traffic delivering and collecting materials from the hot rolling steel mill
Occupational health and safety	✓ Ensure that work sites (especially excavation works), especially in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas. ✓ Carry out training of staff in EH&S monitoring and evaluation. ✓ The proponent should recruit H&S person during construction. ✓ Inform neighbors about the construction programme in advance and adhere to it. ✓ Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits. ✓ The proponent will ensure clear human resources policy against sexual harassment that is aligned with national law ✓ The proponent will integrate provisions related to sexual harassment in the employee COC ✓ The proponent will ensure appointed human resources personnel to manage reports of sexual harassment according to policy ✓ The proponent will ensure comply to provisions of Work Place Injuries and Benefits Act (WIBA) 2007 ✓ Provide sex-segregated clean toilets for male and female workers ✓ Undertaking training and capacity building for all workers on use of chemicals ✓ Provide PPE to all workers using chemicals.
Gender Based Violence at Community Level	✓ Develop and implement provisions that ensure that gender-based violence at the company and community level is not triggered by the Project, including: effective and on-going staff and community engagement and consultation, particularly with women and girls; ✓ Review of specific project components that are known to heighten GBV risk at the community level, e.g., compensation schemes; employment schemes for women; delivery of water supplies; etc.

	✓ Specific plan for mitigating these known risks, e.g., sensitization around gender-equitable approaches to compensation and employment; water services; etc. ✓ Ensure adequate referral mechanisms are in place if a case of GBV at the community level is reported related to project implementation
Violence against Children (VAW)	✓ Develop and implement a Children Protection Strategy that will ensures minors are protected against negative impacts associated by the Project. ✓ All staff must sign, committing themselves towards protecting children, which clearly defines what is and is not acceptable behavior ✓ Children under the age of 18 years shall not be hired on site as provided by Child Rights Act (Amendment Bill) 2014
Labor Influx	✓ The Proponent should prepare Influx Management Plan ✓ The Proponent should prepare Labor and Recruitment Plan ✓ The Proponent should prepare a "code of conduct for workers". This code of conduct will be signed and followed by all workers involved in the project.
Decommissioning Phase	✓ Constitute a decommissioning team and inform relevant authorities ✓ A due diligence decommissioning survey (audit) will be undertaken and submitted to NEMA for approval at least three months prior to the exercise. ✓ Dispose of all wastes responsibly ✓ Rehabilitate the degraded soil and natural flora. ✓ Recycle, reuse or recover demolition materials where appropriate ✓ Use of covered transport vehicles to avoid waste getting being blown off

1.14Conclusion

This ESIA exercise is intended to inform project planning and implementation processes on issues of significant environmental and social concern. It has determined elements that may not be environmentally compliant and addressed them through the proposed mitigation measures as presented in this Report. After assessing the project impacts, the ESIA Expert (s) are of the view that the negative impacts arising out of the proposed project development are manageable and therefore the Proponent should be allowed to proceed with this development as long as the proposed Environmental and Social Management Plan is implemented and compliance with all the relevant principal laws, by-laws and regulations relating to the proposed project are met.

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ACRONYMS.

BOD – Biological Oxygen Demand

CBD – Convention for Biological Diversity

CGM – County Government of Machakos

COC – Code of Conduct

CPP – Consultation, Public involvement and Participation

CSR – Corporate Social Responsibility

EA – Environmental Audit

EIA – Environmental Impact Assessment

EMCA – Environmental Management and Coordination Act

ERC – Energy Regulatory Commission

ESMP – Environmental and Social Management Plan

ESIA – Environmental and Social Impact Assessment

KFS – Kenya Forest Service

NEMA – National Environment Management Authority

NHC – National Housing Corporation

PPE – Personal Protective Equipment

ToR – Terms of Reference

WRA – Water Resource Authority

WMT – Waste Management Team

CHAPTER ONE

1.15 INTRODUCTION

1.1 Project Background

Steel plays a very key role in the transformation of an economy, as it is the key driver in any industrial revolution majorly being used in transport, building and construction, power generation and machinery.

Kenya's future growth in industrialization lies in high-value production, with steel production topping the chart as it is the overly used material in manufacturing, building and construction. The proposed steel plant will therefore increase local production of steel material, consequently facilitating local manufacturing, building and construction, creation of quality jobs for the locals through the expansion of the manufacturing sector and reduction of steel prices in the country.

The Government through the National Environment Management Authority (NEMA) requires that projects which are likely to have significant impacts on the environment undertake an environmental impact assessment so as to incorporate and integrate environmental concerns into development plans and policies. NEMA is mandated to receive and review EIA reports and make informed decisions in regard to project approval and licensing as per EMCA cap 387.

The process of undertaking this project has both positive and negative environmental implications. In this regard the project proponent, Rainham Steel Plant LTD, has appointed Geoplan Associates to carry out an Environmental and Social Impact Assessment (ESIA) to identify potential environmental impacts of the projects, establish mitigation measures against anticipated negative impacts and provide a practical and effective Environmental Management Plan (EMP). The EMP will allow for implementation of the assessment results into the project during the construction, operation and decommissioning phases.

1.2 Project objectives

The project objectives as follows;

i. To construct, install and operate a Steel Processing and storage Plant with associated amenities including water reticulation system and installation of electrical power in auxiliary structures
ii. To meet the growing need of Steel products in the County and Country at large.
iii. To create job opportunities to the society for both skilled and semi-skilled workers
iv. To increase availability and affordability of steel products particularly for the construction industry.
v. To Assist the National Environment Management Authority (NEMA), to decide on the implementation of the project.

1.3 Project Cost

The proposed project is estimated to cost an approximate of KES 150,000,000 Kenya shillings one hundred and fifty Million shillings itemized in section 2.7 project budget in the body of the ESIA report.

1.4 Project Justification

The project is necessitated by the emerging high demand for steel products in the country. With the current economic growth in Kenya, (5.72 % in 2015, 5.88 % in 2016, 4.81 % in 2017, 6.32 % in 2018, and 5.37 % in 2019), many opportunities will be created for investors. Since steel is a major raw material for most industries, high growth in the steel industry is expected. This proposed project is meant to stimulate economic and social development of our country through meeting the high demand of steel products in the country and also to meet proponent's economic desires and returns on investment. The project area is in Katani neighborhood in an area with low residential density and high industrial development (Quarry use) and therefore suitable for such project hence there will be no land use conflict.

Further, it will stimulate economic and social development of Mavoko sub county and Machakos County as a whole. It is therefore hoped that once the project is implemented, the proponent's goal to stimulate economic and social development of our country and its own economic goals through meeting the high demand of steel products will be achieved. The suitability of this kind of development can be justified on diverse of use. This includes the demand based on nature and trend of developments in most urban areas, policy focus; plot area and zoning regulation, land-use and infrastructure compatibility, economic impacts and Environmental Impact Assessment findings among others. It also contributes to governments Big 4 agenda through promotion of manufacturing sector.

1.5 The ESIA Report.

1.5.1 ESIA Justification

The proposed Rainham Steel Plant project is expected to have an overall positive impact to the people and the environment. However, project construction phase, operational phase and decommissioning phase are anticipated to have environmental and social impacts that would require to be mitigated. Environmental impacting projects including the proposed steel plant are listed in the second schedule of EMCA, as among project that should undergo EIA.

The magnitude of the projects further justifies the ESIA study to provide an environmental management and monitoring plan (EMMP) for integration into implementation process. In addition, the National Policy on building and construction as well as the building Act calls for environmental impact assessment on construction related projects for long-term sustainability and acceptability by the beneficiaries.

The ESIA report has been conducted in Compliance with Environmental Impact Assessment Regulation as outlined under the Gazette Notice No. 56 of 13th June, 2003 established under the Environmental Management and Coordination Act (EMCA), 1999 of Kenya and repealed in 27th May 2015. All existing facilities, activities and programs requires that an Environmental Impact Assessment is carried out at the planning stages of any proposed project undertaking that is likely to harm the environment to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of the proposed development. This ensures that significant impacts on the environment and the surrounding communities are taken into consideration at all times during the operations of the respective sites.

The EIA study report includes an assessment of impacts of the construction and operations on the following:

- A review of the policy, legal and administrative framework
- Description of the proposed project
- Baseline information (Biophysical and Socio-Economic environment)
- Assessment of the potential environmental impacts of the proposed project on the biophysical, socio-economic and cultural aspects.
- Development of the mitigation measures and future monitoring plans
- Occupational Health and Safety –OHS.

1.5.2 ESIA Objective

The broad objective of this assessment is to identify potential environment and social impacts of the project and formulate recommendations to ensure that the proposed development takes into consideration appropriate measures to mitigate/minimize any adverse impacts through all phases of its implementation. The specific objectives of this ESIA are to

- Identify and assess all potential environmental and social impacts of the proposed project;
- Identify all potential significant adverse environmental and social impacts of the project and recommend measures for mitigation;
- Verify compliance with the environmental regulations and relevant standards;
- Identify problems (non-conformity) and recommend measures to improve the environmental management system;
- Generate baseline data that will be used to monitor and evaluate the mitigation measures implemented during the project cycle;
- Recommend cost effective measures to be used to mitigate against the anticipated negative impacts;

- Prepare Environmental Impact Assessment Report complaints to the Environmental Management and Coordination Act (1999 Amended 2015) and the Environmental (Impact Assessment and Audit) Regulations (2003), detailing findings and recommendations.
- Identify and quantify different categories of project-affected people (PAPs) who would require some form of assistance, compensation, rehabilitation or relocation.
- Provide guidelines to stakeholders participating in the mitigation of adverse social and environmental impacts of the project

1.5.3 Scope of ESIA works

The scope of work included carrying out a detailed analysis of the positive and negative effects of the proposed project on the environment, and recommend appropriate solutions to minimize any undesirable effects resulting from construction of the steel plant. This report was conducted in accordance with the Environmental Management and Coordination Act of 1999 (amended 2015) Schedule II including the ESIA and audit regulation of 2003. The scope covers three main areas: Natural Environment including Flora, Fauna, Soil, Water, Air, Climate, Landscape and the Aesthetic Environment; Human Environment including Socio-economic, Socio-cultural and Socio-legal; and Built environment including- Material Assets, Historical /Archaeological Sites and Monuments.

The detailed scope analyses included the following factors:

- ✓ Role of the project in the development plans at national and regional levels;
- ✓ The preservation of areas and land use of particular value including agricultural and natural conservation areas;
- ✓ Disturbance of vegetation plans for re-vegetation and conservation of biodiversity;
- ✓ Prevention of soil erosion and sedimentation;
- ✓ Prevention of health hazards arising from ponding water and pollution of water courses and sources;
- ✓ Measures for the rehabilitation of sources of construction materials, borrow pits etc.;
- ✓ Health and sanitation for the steel plant construction labor units;
- ✓ The avoidance of and reduction of visual intrusion;
- ✓ Assessment of the impacts on demographic factors including the prevention of roadside developments, and recommending regulations and measures to limit negative impacts on adjacent communities throughout the project development cycle.

1.5.4 Terms of Reference

The Terms of Reference (ToR) for the ESIA study were prepared and submitted to the National Environment Management Authority (NEMA) for approval. The ToR was approved by NEMA as evidenced by a copy of the ToR approval letter from NEMA.

The following broad Terms of Reference apply to the ESIA assignment:

i. **Description of the project background.** This includes providing a contextual background of the proposed steel plant project and a justification for undertaking Environmental and Social Impact Assessment (ESIA). The consultant will provide information on the major components of the project, historical background and current status of the project, implementing agencies and scope of the project including specific project components at the construction, operation and decommissioning phase, target beneficiaries, project affected persons and project cost.

ii. **Environmental assessment study.** Standard environmental impact assessment techniques will be used including site reconnaissance; desktop research; field work-household interviews, focused group discussions with community representatives, key informant interviews, stakeholder consultative workshops, observations and measurements; data analysis and presentation according to NEMA guidelines. In order to undertake a comprehensive study, the following tasks will be performed:

iii. **Description of the Environment.** An evaluation of baseline data on the environmental characteristics of Machakos County and more specifically the project area. This include information on any changes anticipated before the project commences (e.g., agricultural use and value), i.e.:

a. ***Physical environment:*** geology (general description for overall study area); topography; soils and erosion patterns; climate, including rainfall and runoff characteristics; surface and ground water hydrology; identity of streams, lakes and receiving water quality).

b. ***Biological environment:*** flora (e.g., types and diversity; weeds; fauna (e.g., movements, including migration); rare or endangered species within or in areas adjacent to Programmed-related development sites; sensitive habitats, including wetlands, parks or reserves, significant natural habitats within or near programmed-related development areas; species of commercial importance in areas affected by the program.

c. ***Social-cultural environment (both present and programmed):*** e.g., population (i.e., full time and seasonal); land use (i.e., year-round and seasonal); planned development activities; community structure; employment and labor market; distribution of income, goods and services; recreation;

public health; education; cultural properties (e.g., archaeological and historically significant sites); indigenous peoples and traditional tribal lands; customs, aspirations and attitudes.

iv. ***Legislative and Regulatory Considerations:*** Describe the pertinent laws, regulations and standards governing environmental quality, health and safety, protection of sensitive areas and endangered species, siting, land use control, etc., at international, national, regional, county and local levels.

v. ***Determination of the Potential Impacts of the Proposed Project:*** Identify all significant changes that the project is likely to generate. This may include, but not limited to, changes in land cover and land use, changes in soil structure and composition, loss of natural habitat and other vegetation; unintended effects of agrochemical use, access to shared resources particularly the water resources, grazing areas, loss of land/displacement and noise.

vi. ***In this analysis, distinguish between significant positive and negative impacts, direct, indirect and cumulative impacts, and immediate and long-term impacts***. Identify impacts that are unavoidable or irreversible. Wherever possible, describe impacts quantitatively in terms of environmental and social costs and benefits and assign economic values when feasible.

vii. ***Characterize the extent and quality of available data, explaining significant information deficiencies and any uncertainties associated with predictions of impact***. For information not be obtainable until after project execution, provide Terms of Reference for studies to monitor operations over a given time period and to modify designs and/or operational parameters based upon updated impact analysis.

viii. ***Analysis of alternatives to the proposed project:*** The ESIA should include an analysis of reasonable alternatives to meet the ultimate project objectives. This analysis may suggest designs that are sounder from an environmental perspective than the originally proposed project. Include the "no action" alternative (not developing the project) to demonstrate environmental conditions without it. Describe how the alternatives compare in terms of: potential environmental impacts; capital and operating costs; suitability under local conditions (e.g., skill requirements, political acceptability, public cooperation, etc.); and institutional, training, and monitoring requirements. When describing the impacts of alternatives, indicate which impacts would be irreversible or unavoidable and which may be mitigated.

ix. ***Public participation.*** The consultant will engage the entire project affected persons and relevant government and non-governmental entities throughout the ESIA process. The methods to be used for public participation will include: household survey in the project area; focused group discussions with community representatives; key informant interviews and stakeholder workshops. Public participation process, groups consulted and the issues raised in the various forums will be documented in the study report

x. ***Impact identification and analysis.*** An assessment of the potential changes on the biological, physical, social, cultural and economic due to the proposed project activities at the construction, operation and decommissioning phase. Impact analysis to determine the nature, significance and likelihood of the identified impacts.

xi. ***Development of an Environmental Mitigation Management Plan:*** This will include identification of the preventive actions and/or mitigation measures recommended to eliminate, reduce or mitigate the potential adverse environmental and social impacts of the project, as well as who will be responsible for implementing such measures, how much they will cost, etc.

xii. ***Development of a monitoring plan:*** Preparation of a detailed plan to monitor the implementation of mitigating measures and the impacts of the project during construction and operation. Include in the plan an estimate of capital and operating costs and a description of other inputs (such as training and institutional strengthening) needed to carry it out.

xiii. To determine the training needs for community and stakeholders for implementation of mitigation measure.

1.6 Methodology

1.6.1 The General Approach

Positive and negative, real and potential implications of the proposed steel plant project were identified and appropriate measures to mitigate any adverse effects that may arise from the proposed construction, operational and decommissioning phases have been proposed. Environmental and Social Impact Assessment (ESIA) was designed to ascertain the relationship between the steel plant project and the natural environment and social fabric. The study linked the project with key environmental and socio-economic aspects and related linkages for ease of integration in the implementation of the project from the inception stage through the tendering process, construction, commissioning, periodic maintenance and eventually long-term use. The ESIA basically involved information collection, evaluation and presentation for the purpose of using it in planning and decision making.

Identification of the anticipated impacts was determined on the basis of the baseline conditions established and information obtained from the documents reviewed. To enable subjective predictions, the proposed site was assessed in its individual capacity for physical environmental variations and social patterns. The proposed site and neighborhood were then subjected to screening against the potential nature of impacts, impact targets and the level of impacts. The following is a summarized general approach to the process under biophysical, socio-economic and cultural environment categories.

1.6.2 Bio-physical Environment

Studies of the biophysical environment provide a profile of the study area and specifically emphasized relief; soils; climate; drainage patterns and ecological resources. It is upon these factors that possible environmental impacts of the project were assessed and evaluated. The assessment of impacts was carried out in the following sequence:

- ✓ Review of previous reports, published and unpublished works on the environment of the study area;
- ✓ Field investigations and collation of baseline data on the environmental conditions of the project area.
- ✓ Qualitative and quantitative assessment of the current state of the environment in the project area;
- ✓ Identification, prediction and evaluation of positive and negative environmental impacts;
- ✓ Identification of mitigation measures for adverse environmental impacts;

Finally, an environmental management and monitoring plan was developed based on proposals for preventive, compensatory and mitigation measures during the project's lifespan.

1.6.3 Socio-Economic Environment

The Socio-economic Impact Assessment Study adopted an integrated participatory approach to determine the feasibility of the proposed steel plant project development. The study assessed the current socio-economic situation under the prevailing land use conditions as well as the impacts of the proposed steel plant development.

The socio-economic impact assessment focused on evaluating the impacts of the proposed steel plant on communal social and economic well-being. Identification of the anticipated impacts was determined on the basis of the social and economic baseline conditions established and information obtained from the documents reviewed. The broad focal areas addressed included:

- Social and cultural issues (social indicators such as health and safety, cross-cutting issues of gender, poverty and HIV/AIDS, demographic aspects, land use and urban trends, typical modes of transport, welfare indicators including education, labor force, poverty and income levels);
- Economic issues (economic activities, tourism activities, trade and industry, acquisitions and compensations);
- Administrative and institutional arrangement (development actors and their roles in the project area notably line ministries, local authorities, state corporations and religious organizations among others, local, regional and international linkages to the project area, grassroots administrative divisions affected by the steel plant project and conservation institutional structures).

The steps undertaken to determine the socio-economic feasibility for the proposed steel plant project included:

- ✓ Comparative method;
- ✓ Population multiplier methods.
- ✓ Scenarios;
- ✓ Consulting experts;
- ✓ Calculation of 'futures foregone'.

A multi-disciplinary approach was used in this assessment in order to address holistically all pertinent impacts of the project (both avoidable and potential) on the biophysical, cultural and socio-economic setting of the area. The key methods that were used in the ESIA assessment are discussed below.

1.6.4 Reconnaissance and Scoping Survey

This process was used to determine the issues to be addressed, the information to be collected and the analysis required to assess the environmental and social impacts of the proposed Rainham Steel Plant project to conduct an ESIA and to prepare the ESIA report.

1.6.5 Document (Literature) Review

Relevant documents were reviewed to obtain information on the baseline information on the project area. This document review provided understanding of local micro (social and economic) conditions, data on demographic trends, land use sizes and practices, development strategies and plans (local and national). Document review also yielded information on the biophysical environment and socio-economic factors.

Intensive documentary review included the area GIS data, area maps, Development Plans of the project districts, National Development and Economic Surveys, Soil and hydrological study reports, plant design manuals, the Kenya Constitution, relevant legislations, regulations and guidelines, and relevant literature sources.

1.6.6 Field Survey Techniques

The field survey adopted various techniques of baseline data collection on the existing socio-economic and environmental conditions. Field observations and recordings (including photography around the proposed site location and its vicinity) were conducted using the following techniques:

a. Checklists

Checklists are study instruments that aid in assessing possible socio-cultural, economic and environmental impacts during both construction and operational phases of a project. In this study, checklists were utilized to:

- ✓ Facilitate identification of potential impacts;
- ✓ Provide a means of comparing the predicted impacts;
- ✓ Indicate the magnitude of both positive and negative impacts;
- ✓ Indicate possible adverse impacts that are potentially significant but about which sufficient information cannot be obtained to make a reliable prediction;
- ✓ Indicate negative potential impacts in the project area which merit mitigation measures and monitoring during project implementation.

b. Transect walks

Information gathering was conducted through site walk assessment surveys at the project site and its surrounding areas, including households. This involved a systematic field traversing to quantify perceived impacts of the project on:

- ✓ Road infrastructure and other facilities which will be used during project implementation;
- ✓ Hydrological sites and river basins, to identify the baseline conditions for hydrology & hydraulic structures;
- ✓ Land conflicts, ownership and usage
- ✓ Areas of insecurity;
- ✓ Institutions and organizations in the area;
- ✓ Vegetation cover of the area;
- ✓ Existing sensitive environmental receptors including underground and surface waters; animal breeding sites, feeding grounds and routes, and methods of protection from destruction, interference, contamination and extinction;
- ✓ Waste management and disposal methods;
- ✓ Environmental Health and Safety (EHS);
- ✓ Material sources to be used during the project implementation and maintenance phases; and
- ✓ Effluent management.

c. Public Participation (PP), Consultation and Disclosure

Structured stakeholder engagement was undertaken around the proposed site area to capture the views and concerns of potentially interested and affected parties. The engagement process entailed one-on-one interviews and holding of public meetings (barazas) at the proposed site. Consultation and Public Participation were held to:

- ✓ Facilitate involvement and participation of affected persons throughout the project cycle;

- ✓ Ensure a sense of responsibility and commitment towards implementing the proposed EMP;
- ✓ Solicit issues and concerns from the affected communities about the forthcoming steel plant project.

Several methodologies were employed to collect the required data, including structured checklists for community consultations; semi-structured checklists to conduct personal interviews; and, systematized questionnaires to survey affected households. The collected data were then collated, analyzed and synthesized for the report compilation.

d. Other Information Collection Approaches

Combinations of other methods used were:

- ✓ Comparative method
- ✓ Population multiplier methods;
- ✓ Scenarios;
- ✓ Consulting experts; and
- ✓ Calculation of 'futures foregone'.

1.6.7 Impact Assessment

Anticipated impacts that may result from the proposed steel plant project was analyzed against the baseline conditions and were fully established during the detailed fieldwork and information obtained from the documentary reviews. Effects of the project on the environment and economic and socio-cultural wellbeing was evaluated against issues such as vegetation cover, land and soil, environmental pollution, health and safety, cultural integration and overview of economic benefits to the residents and the country at large.

1.6.8 Development of an Environmental and Social Management Plan

After identification of the impacts of the project, appropriate measures were drawn up to mitigate the impacts. This then led to the development of the social, cultural, economic and environmental management plan to guide the project implementation. Having established the impacts and the mitigation measures, integration of the impacts in the project implementation was necessary. This ensured proper integration of the recommended mitigation measures in the project implementation process. The monitoring plan will serve as a supervisory schedule with respect of the socio-cultural, economic and environmental aspects.

1.6.9 Reporting

Reporting involved compilation of the field findings, documentary information and data, results from discussions and public consultations as well as harmonizing the monitoring and socio-environmental management plans. The reporting followed the following steps:

Step 1: Contribution to the Inception Report as part of the feasibility studies and design process;

Step 2: Preparation of a Project Report to be endorsed by the Client (Rainham Steel Plant Limited) and submitted to National Environment Management Authority (NEMA) for review and instruction to move to the next phase (preparation of Terms of Reference for a detailed ESIA study);

Step 3: Preparation of Terms of Reference for the detailed ESIA study and submission to NEMA for review and approval;

Step 4: Preparation of a detailed ESIA Study Report for review and approval by Rainham Steel Plant Limited and submission to NEMA and other relevant authorities.

1.7 Screening and Scoping

Screening was determined by reference to mandatory and discretionary provisions set out in the Environmental Management and Co-ordination Act (EMCA) No. 8 of 1999 Amended 2015. EMCA has made it mandatory for project proponents to carry out an Environmental Impact Assessment (EIA) of development projects and incorporate environmental and social mitigation actions as part of the project planning for projects likely to impact positively and negatively on the environment.

Section 58 of the EMCA requires that all projects listed under the Second Schedule be subjected to Environmental Impact Assessment (EIA).

The proposed steel plant is categorized under this schedule hence the necessity to subject the proposed construction, operational and decommissioning phases of the proposed project to Environmental Impact Assessment.

1.8 Presentation of the report

The report is presented as outlined below:

Executive summary: This section presents a summary of the entire report.

Chapter 1: Introduction: This chapter gives description of the Project Background, Project History, Consultants Assignments and TORs, Justification of the Project, Study Methodology and Field Findings, and Scope and Content of the project.

Chapter 2: Project description: This chapter gives a description of the status of the project in the project cycle, specifically during construction, operation and decommissioning.

Chapter 3: Policy, legal and institutional / administrative framework: This chapter outlines the overview of legislative framework, regulatory, international guidelines and conventions relevant to this project.

Chapter 4: Environmental setting: This chapter gives description of the environmental setting of the proposed project and surrounding areas, e.g., climate, soils, geology, vegetation, fauna, land use, human populations, socio-economics, cultural heritage.

Chapter 5: Public consultations and disclosure: This chapter gives description of the objectives, methods used and summary of results of the public consultation activities undertaken during the ESIA.

Chapter 6: Analysis of alternatives: This chapter gives a description of the project details of the proposed project, alternative options, designs and implementation strategies.

Chapter 7: Assessment of environmental impacts and mitigation measures: This chapter presents the analysis of beneficial and adverse impacts of the project on the biophysical and human (social, cultural and economic) environments. The analysis covers anticipated impacts during the construction, operation phases and decommissioning phases and also describes the enhancement and mitigation measures proposed to enhance benefits.

Chapter 8: Environmental and social management and monitoring Plans: This chapter presents the proposed Environmental and Social Management and Monitoring Plans prepared for the project.

Chapter 9: Conclusion and recommendations: The conclusion briefly presents the environmental and social acceptability of the project, taking into account the impacts, measures and recommendations identified during the assessment process.

Annexes: This section presents supplementary documents to the report

1.9 ESIA Study Process

1.9.1 The General Approach

Both positive and negative implications of the proposed steel plant project were identified and appropriate measures to abate any adverse effects that may emanate from the construction phase, operational phase and decommissioning phase have been proposed.

Environmental and Social Impact Assessment (ESIA) was designed on the basis of the scoping findings to ascertain the relationship between the proposed steel plant project, natural environment and social fabric. The study linked the project with key environmental and socioeconomic aspects and related linkages for ease of integration in the implementation of the project from the inception stage through tendering process,

construction, commissioning, periodic maintenance, and eventual long-term use. The broad focal areas that were addressed included:

- Natural Resources;

- Physical Environment;
- Conservation Aspects;
- Social and cultural issues;
- Safety and Health Aspects;
- Economic issues under RAP; and
- Administrative and Institutional Arrangement.

Identification of the anticipated impacts was determined on the basis of the baseline conditions established and information obtained from the documents reviewed. To determine potential steel plant construction impacts, the area was assessed in its individual capacity for physical environmental variations, socio-economic and cultural patterns.

The total cost of the project should include the full cost of all resettlement activities, factoring in the loss of livelihood and earning potential among affected people and this must be provided in the BOQ. Displaced persons should be appropriately compensated for their losses at "full replacement" cost prior to their actual move or before taking of land and related assets or commencement of project activities, whichever occurs first.

Cost-effective measures to be implemented to safeguard livelihoods of PAPs must clearly be illustrated in the RAP report as required by EMCA and other international and national laws, guidelines and regulations.

CHAPTER TWO

2.0 PROJECT DESCRIPTION, ACTIVITIES AND BUDGET

2.1 Project Description

The project involves the design and installation of a steel reinforcement bars (Rebar) rolling mill plant of capacity of 12-15 Tones per hour (TPH). The reinforcement bars are integral material in the construction industry. Moreover, the products of the steel mills find their application in wide range of areas. Steel consumption is a major indicator of national economic development. With Kenya being among the fastest developing countries in Africa, at a rate of 6 to 7% per annum, it is expected that the steel demand will continue to grow at a similar proportionate rate to feed the infrastructural development needs of the country.

2.2 Project details

The proposed facility will utilize local materials for construction and is designed to be sustainable in the use of natural light and ventilation for most of the facilities provided. The facility will also provide adequate parking and use solar to substitute for the electricity and fuel energy demand.

Overview

Proponent : Rainham Steel Plant LTD

Project Description : Proposed Steel Plant

Features of the proposed Plant : Administration block, proposed inroad infrastructure, electricity substation, master store, scrap material yard, finished material yard, raw material yard, roll workshop, panel room, the main processing area, cold billet storage, water storage facilities, pump room area, truck parking bay and a green area.

Plot No. : LR.No. Mavoko Town Block 2/26177 & 22616 (amalgamated)

Plot Size : 6.282 Ha.

Access Road : Katani Road

GPS Co – ordinates **: 1˚20′58.55″S 37˚00′12.95″E**

Neighbors : Irucha Investments Quarry, H-Young quarry, Bizrock quarry, Shengli Quarry

2.3 Steel processing by induction furnace.

The proponent proposes to utilize the induction furnace melting and heating processing system. Medium frequency coreless induction furnace is generally used for the production of steel in the steel melting shops

of low capacity. The induction furnace is equipped with a converter for producing the necessary medium frequency from the 50 Hz frequency of the power supply. For this, a direct voltage is produced in a rectifier, and is fed to the inverter via a smoothing choke, and a medium frequency voltage is produced in the inverter with the aid of compensating capacitors and the inductivity of the furnace coil. The regulation of the converter is carried out by the built-in control electronics. The control of the furnace is carried out using the devices in the operating cabinet and if necessary, with the aid of a processor. A transformer is used for the energy supply. The furnace transformer is connected to the power supply network. The transformer converts the supply voltage to the voltage required for the operation of the furnace which is generally 770 V for medium frequency induction furnace. The transformer is usually equipped with the built-in monitoring devices such as thermometers, oil filling level monitoring, Buchholz relays and air de-humidifiers.

The smelting is carried out in the refractory crucible made normally with either acidic (silica based) or neutral (alumina based) monolithic refractories. The crucible is heated by an induction furnace coil surrounding the crucible.

Making of a heat in an induction furnace consists of certain cyclic activities. These activities are known as 'heat cycle' or 'production cycle'. A heat cycle has two components namely (i) melt cycle, and (ii) non-production cycle. The melt cycle is the period when maximum power is continuously applied to the furnace and the charge is added. The non-production cycle is when no or reduced power is being applied, such as when the initial charge is being added, when slag is being removed, when a temperature dip or analysis sample is being taken, waiting for an analysis result, and tapping of the furnace empty etc. The furnace utilization is the melt cycle divided by the heat cycle expressed as a percentage. If the melt cycle is of 80 minutes and the non-production cycle is of 40 minutes, then the heat cycle is 120 minutes. The 80 minute of melt cycle divided by the 120 minute of the heat cycle times 100 gives a utilization of 66.67 %. If in induction furnace, it is a process which requires 10 tons of liquid steel to be tapped per heat and the heat cycle is such that it can only achieve 66.67 % utilization, then it is necessary to have power supply capable of melting 15 tons per heat.

The induction furnace for melting sponge iron is required to have a large ratio of cross-sectional area to volume so that the heat transfer is high and to keep the slag hot and fluid. The induction furnace uses the transformer principle of induction, i.e., when an electrical conductor is placed in a fluctuating magnetic field then a voltage is induced in the conductor. In crucible furnaces, this voltage causes strong eddy currents, which due to the resistance of the material, cause it to be heated and ultimately to melt. The water is used for the cooling of the coil. The cooling water lines are monitored with regard to volume and temperature.

During the production of steel, substantial quantity of electrical energy is needed. Besides the theoretical energy required for producing steel, energy is also required for compensating the losses which are taking place while producing steel. The energy losses increase the specific energy consumption and decrease the furnace efficiency. The losses which take place during the production of steel are (i) thermal losses, (ii) furnace coil losses, (iii) capacitor bank losses, (iv) convertor losses, and (v) losses on main side transformer. Thermal losses are the main losses and contribute maximum towards loss of energy. The major thermal losses in induction furnace are (i) radiation loss from the furnace top, (ii) conduction losses from the refractory lining, (iii) heat losses in the cooling water of the coil, (iv) heat carried by the removed slag, and (v) heat carried by the gases being emitted from the furnace top. Further, during the making of a heat, the furnace is constantly losing heat both to the cooling water and by radiation from the shell and the exposed metal surface at the top. Electrical energy is required to be spent to substitute these heat losses. Hence longer is the heat time the greater is the energy consumption and lower is the furnace inefficiency.

2.3.1 Factors affecting consumption of energy in induction Furnace

Metal losses for metallic charge materials depend upon the physical size of the component and their quality, but are normally less than 5 %, with a fair proportion of this loss being due to spillage and splash during the de-slagging and pouring operations. The one factor which has the maximum effect on the energy consumption is the level of the furnace utilization. Higher is the utilization means energy efficient production cycle. Charge materials used for making the heat are important for controlling the quality of steel being made in the induction furnace. The materials ensure that the liquid steel made has the aimed mechanical properties and chemical composition after its casting and is free from defects. Besides the quality of steel, the charge materials also affect (i) volume of slag produced, (ii) life of refractory lining, and (iii) safety of both the plant and the working personnel. Further, the charge materials along with the charging practice have a considerable influence on the specific consumption of electrical energy and the furnace productivity.

In induction furnace, the main charge materials are metallics consisting of scrap and sponge iron. Both the steel scrap and iron scrap are used. Iron scrap brings carbon to the furnace bath. Pig iron is also sometimes used in some furnaces for the purpose of introducing carbon to the bath. The ratio of these materials used for producing heat depends on their relative availability at the economic cost at the plant location. In case of induction furnaces using high sponge iron to scrap ratio, a carburizer (e.g., anthracite coal or petroleum coke) is also added for controlling carbon content of the bath. Metallics are charged in the furnace either mechanically or manually. The control of the melting operation in the furnace and the chemistry of the liquid steel are dependent on the degree at which the mix of metallics can be optimized. The qualities of metallics are required to be known for proper charge mix for efficient operation of the furnace.

For improving the quality of produced steel, input scrap quality is required to be controlled. The important parameters needed to be controlled in scrap charge are (i) size, (ii) bulk density, (iii) chemical composition, (iv) cleanliness of the scrap materials meaning that they are to be free of contamination such as rust, scale, sand, dirt, oils/grease, and (v) non-metallic coatings such as zinc, tin, and chromium etc. The most troublesome residual elements (such as copper, cobalt, tin, arsenic, antimony, nickel, and molybdenum etc.) from scrap are ultimately concentrated in steel. Their presence in steel induces undesirable resistance to deformation, hot shortness, and mechanical defects. If the scrap sections are long and extend out of the top of the furnace, these, though ultimately melt but take time, and hence influence the furnace utilization. The size of the scrap is important to ensure the charge does not bridge. On an average, each piece is not to have a dimension greater than 33 % of the furnace diameter and no dimension is to exceed 50 % of the furnace diameter. The feed rate of the system is to be able to deliver the full charge into the furnace within 65 % to 70 % of the actual melt cycle.

The initial materials are required to be charged in the furnace as quickly as possible and of sufficient density to allow maximum power. For optimum performance, the density of the charge materials is needed to be high and is not to be less than 1.3 tons per cubic meter. The quantity of initial furnace charge materials is to constitute a substantial percentage of the rated capacity of the furnace.

During the melting of steel scrap, most of the scrap is suspended with air inside the furnace. As the induction field raises the temperature of the scrap, it now must go all the way to the melting point of steel, because there is no carbon present to lower the melting point. Hence, this requires more energy and time for the initial melting. In addition, once the steel reaches a temperature of around 700 deg C the increase in oxidation becomes dramatic and during the heat up from 700 deg C to around 1540 deg C, the surface of the steel scrap continues to oxidize at a higher and higher rate.

Once molten, the droplets of steel continue to oxidize as they fall down the charge until they reach the bottom of the furnace and join the molten bath with hopefully higher carbon. The carbon in the bath stops the oxidation of the iron. The thinnest steel scrap can go from room temperature to glowing cherry red color within just one or two minutes increasing the oxidation. The oxides of iron increase the amount of slag formed. All of this oxidation produces a highly reactive FeO slag.

Cleanliness of the scrap is very important since dirty or contaminated scrap tends to deposit a slag layer on the furnace refractory. This occurs at, or just below, the liquid level in the crucible and restricts the quantity of power which is drawn by the furnace. The effective reduction in the internal diameter of the furnace can also be there which makes the charging more difficult and protracted.

This again affects the energy efficiency of the furnace. Further, rusty scrap takes more time to melt. It also contains less metal per charging. Dirty metallics charge results into higher volume of slag which means higher specific consumption of power. For every 1 % slag formed at 1500 deg C energy loss is 10 kWh per ton. The sponge iron charge in the furnace is characterized by (i) high porosity, (ii) low density, (iii) low thermal conductivity, (iv) high specific surface area, (v) high oxygen content, and (vi) intermediate carbon content. Sponge iron has uniform chemical and physical characteristics. It has low percentage of tramp metallic elements (around 0.02 %) and low sulphur content but usually is associated with high phosphorus content. Sponge iron with higher carbon content is preferred since it reduces the requirement of the carburizer in the furnace.

The melting process of sponge iron is considerably influenced by the physical, chemical, and thermal characteristics of the sponge iron. Some of these characteristics are shape, size, density, chemical analysis, and degree of metallization. Other parameters such as the method of charging, the type of furnace, the temperature of the bath, the chemical composition of liquid metal in the furnace, and the flow of fluid inside the furnace and around the particles are also of appreciable importance.

The gangue content and unreduced iron oxide content of the sponge iron is needed to be as low as possible. Low iron oxide content is important for safety reasons as well as for energy consumption reasons. If a large quantity of unreduced iron oxide is introduced into a high carbon bath at high temperature, there is a vigorous carbon boil which can be extremely dangerous. Advantages of using sponge iron in induction furnace are (i) no additional desulphurization is needed and at the same time the low sulphur content in the steel can be achieved, (ii) final product contains low amount of residual metals like chromium, copper, molybdenum, tin etc., (iii) charging time decreases which also reduces the overall heat loss, and (iv) improves the product quality consistency.

The role of carburizer during steelmaking in the induction furnace is to remove oxygen from the sponge iron which is present in the form of FeO and to provide carbon pick up in the liquid steel to the desired level. Anthracite coal and petroleum coke are the two popular carburizers being used during steelmaking in the induction furnace. Recovery of carbon depends on the size and quality of the carburizer, method of addition, and time of addition. It can be expected to be within a range of 85 % to 95 %. Higher ash content in the carburizer lowers the carbon being added to the bath, while increasing the generation of slag. Carbon input in the bath through pig iron or cast-iron scrap is more desirable in order to have better recovery of carbon. Use of very fine particle size of the carburizer is to be avoided because of excessive loss. Other carburizers which can be used are metallurgical coke, iron carbide and metallurgical silicon carbide (63 % silicon and 31 % carbon).

Silicon carbide is normally charged with scrap and has the advantages of (i) faster absorption, (ii) acts also as a de-oxidizer, and (iii) improves the lining life.

Besides metallics and carburizer, deoxidizers are used for making of steel in an induction furnace. Deoxidizers are ferro alloys (silico-manganese, ferro-manganese, and ferro-silicon), and aluminum. The yield of the ferro alloys depends on their specification (size, grading, and composition).

An accurate calculation of the charge-mix based on material analyses is necessary. Also, a precise weight determination and metering of the charge materials and additives (carburizer and deoxidizers) are basic prerequisites for minimizing melting times and power needs besides ensuring proper composition of the liquid steel. The use of clean and dry charge materials is necessary for better result.

Regardless of whether the furnace is to be charged manually or mechanically, the charge materials are required to be weighed and the materials are to fit into the furnace. A crane scale can be used to weigh the charge material.

2.3.2 Charging and melting operation

Medium frequency coreless Induction furnaces for making steel are operated without a sump (heel). The material is charged into the empty furnace up to the upper edge of the furnace coil. Immediately after the tapping of the previous heat, the condition of the lining material needs to be inspected and then the scrap charging is to start. With the start of scrap charging, the heat cycle starts. The quality of charge materials, sequence of their charging has substantial influence on the heat cycle. As soon as the first lot of scrap is charged in the furnace, power is switched on and current starts flowing at a high rate and a comparatively low voltage through the induction coils of the furnace, producing an induced magnetic field inside the central space of the coils where the crucible is located. The induced magnetic fluxes are thus generated through-out the available charge in the crucible. As the magnetic fluxes generate through the scrap and complete the circuit, they generate and induce eddy current in the scrap. This induced eddy current, as it flows through the highly resistive bath of scrap, generates tremendous heat and melting starts. It is thus apparent that the melting rate depends primarily on two things namely (i) the density of magnetic fluxes, and (ii) compactness of the charge. The denser is the charge and occupying more space in the furnace, it reduces the melting time and hence the energy consumption.

The heating of the scrap starts as soon as sufficient charge material is in the furnace to enable power to be applied. The goal is to get the energy into the charge as quickly and efficiently as possible. A power supply able to deliver maximum power throughout the heat cycle, always achieves the best melt rate. As the charge goes through the melting process, the voltage applied to the coil is allowed to increase. This increase gives two advantages namely (i) it ensures maximum kilowatts are continuously applied to the coil, and (ii) a

high coil voltage means that the voltage induced into the charge is higher and hence the contact heating in the charge is more efficient.

Typically, this results in a 10 % improvement in the melting rate as compared to a power supply where the power draw drops as the charge passes through the melting process.

In a medium frequency furnace, the heat is developed mainly in the outer rim of the metal in the charge but is carried quickly to the centre by conduction. Soon a pool of liquid metal is formed in the bottom causing the charge to sink. The melting material settles together, and the furnace can be recharged with more material. In the medium frequency furnaces, the material is not charged into the liquid bath, but onto the still solid material. At this point, additional charging is to be done gradually. The eddy current, which is generated in the charge, has other uses. It imparts a molten effect on the liquid steel, which is thereby stirred and mixed and heated more homogeneously. This stirring effect is inversely proportional to the frequency of the furnace. The melting continues till around one half of furnace volume is filled with the liquid steel. At this point a sample is taken for the analysis and the furnace is deslagged in a slag pot by tilting. Slags generally developed in medium frequency coreless furnaces are not fluid and is quite heavy and sticky and often dry and in the form of a dross. During the removal of the slag, the power is to be off to ensure all the slag floats to the surface and can be removed. The longer the power is off the greater is the effect on the overall furnace utilization.

Based on the analysis results, the requirement of further charge of scrap, sponge iron and carburizer is determined and the charging is continued. In case the bath develops a convex surface, then the power input is decreased temporarily to flatten the convexity and to reduce the circulation rate.

Sponge iron can be added directly into the liquid metal when the stirring action accelerates the transfer of heat to it and promotes the melting. Care is required to be taken to have enough molten pool before adding sponge iron. When sponge iron is charged in the furnace, continuous removal of slag is required for smoothening of the melting operation. This is because slag gets solidifies on top of the liquid bath and hinders further melting of the sponge iron. The continuous removal of slag is carried out by scooping the slag out of the furnace. Removal of the slag is generally facilitated by the use of de-slagging spoons fitted with long steel bars. These spoons are specially made for the purpose. The slag removal with spoon is possible since the slag is thick at this stage and its viscosity is high. The manual slag removal is a hard and unpleasant job.

Manual removal of slag can be enhanced by using a slag coagulant. The slag coagulant exfoliates to tie the slag pieces together so they can be lifted off. If slag coagulants are used to aid the removal of the slag, their use is to be strictly controlled to prevent chemical attack on the furnace lining material. Slag volumes can

be reduced by selecting clean and proper charge materials and with sponge iron having higher percentage of total iron. The enhancing of the melting rate also reduces the slag formation. In case of higher amount of sponge iron in the charge, there is a need for carbon (anthracite coal or petroleum coke) addition to the bath for the removal of oxygen. The oxygen present in the sponge iron is in the form of FeO, which reacts vigorously with carbon in the liquid bath and improves heat transfer, slag-metal contact and homogeneity of the bath.

Irrespective of charging mode, sponge iron is always charged after initial formation of molten pool (i.e. hot heel) by melting of steel scrap. Melting of sponge iron is greatly influenced by factors like carbon content of the liquid bath and degree of metallization of sponge iron. Carbon content of the liquid bath reacts with unreduced iron oxide content of the sponge iron giving evolution of CO and CO2 gases from liquid bath i.e. carbon boil takes place, which results into subsequent removal of hydrogen and nitrogen gases, ultimately producing clean steel. Carbon boil occurs at slag metal interface by the reaction 3 FeO + 2C = 3 Fe + CO + CO2. Carbon content in the liquid bath is to be kept at a proper level in order to maintain appropriate carbon boil during the melting period.

The amount of carbon required (C, in kg) to reduce the FeO content of the sponge iron is given by the equation C = 1.67 [100 – % M–{(% Slag /100) x % Fe}]. Here, M is degree of metallization and Fe is amount of iron in the slag.

2.3.3 Making the heat ready, tapping, and emptying of the furnace

When the liquid filling level reaches around the upper edge of the coil, i.e., heat is about to be completed, bath analysis sample and bath temperature is taken with the help of dip probes. For this activity power is kept under hold. Immediately after the temperature dip and analysis sample are taken, holding power is restored to the furnace. For the sake of accuracy and speed, spectrographic analysis is usually done. Based on analysis results trimming additions are carried out in the baths for adjustment of bath analysis. The trimming addition material is melted, and the bath temperature is brought up to a temperature of 80 deg C to 100 deg C below the tapping temperature. The carburizer used for trimming needs to be small-grained to increase its surface area as this ensures that it goes into solution quickly. When the tapping ladle is ready, the furnace is skimmed and brought up to the tapping temperature. In the case of medium frequency furnaces, 2 to 5 minutes are needed for this activity. The tapping temperature is to be decided taking into account, the chilling effect of the ferro-alloy addition. Before tapping a small amount of ferro alloys are charged in the furnace so as to avoid any boiling action during tapping. In the teeming ladle, the required amount of ferro-alloys and carburizer (if required) is put in the ladle bottom and the metal is tapped. During tapping, the faster the furnace is emptied the better it is. The time taken for emptying of the furnace affects the furnace utilization

2.3.4 Precautions required and safety issues

The smelting process is always associated with dangers due to molten material which cannot always be accurately estimated in advance. It is often said that known dangers are no dangers, or at least dangers which can be anticipated and counteracted. The important safety related issues during steelmaking in induction furnaces are due to the ejection of molten metal in the form of splashes, small and large drops, heat radiation from the melting bath and water vapour explosions. These occurrences are explained here. Metal splashes with a relatively low volume of melt are created when very small metal parts come into contact with the melting bath and are ejected from the melt.

If these parts are also wet or damp, this leads to the ejection of small and large drops. The operator on the operating floor is exposed to a great deal of heat. If the operator is not using proper protective equipment (PPE), this can lead to burns on the skin and damage to the eyes. Water vapour explosions always occur when liquids get under the surface of the bath. In extreme cases, 1 cc (cubic centimetre) of water penetrating deep below the surface can expand in a moment to 1,600 times its original volume. Water can get into the melting bath during the melting process from the materials charged or by damp or wet tools. When operating the induction furnace, it can happen that the ramming mix has suffered damage, and the melt has been moved forward up to the coil. If this condition leads to a blockage of the windings and the release of water, water can also penetrate under the melt, resulting in a sudden upward ejection of the melt. This can cause powerful water vapour explosion causing the melt thrown out onto the furnace platform.

The important precautions required and the safety issues are described below.

- ✓ Neatness and tidiness of the workplace which means that the furnace platform is to be tidy at all times, with the necessary tools ready to hand in their proper places. Any other materials or objects lying around are required to be removed without delay.
- ✓ Adequate lighting at the workplace ensures that irregularities or problems on the furnace platform can be recognized and rectified in time.
- ✓ Damage to equipment, operating switches, electrical and hydraulic lines are to be noted in the log book and reported to maintenance so that the repairs can be carried out. Indicating lights are safety devices, and need to be tested in planned intervals.
- ✓ The condition of the crucible is required to be inspected visually after every emptying or every tapping. Possible cracks in the crucible wall are indicated by dark traces, which can then be inspected more closely.
- ✓ The materials to be charged are to be inspected when being prepared. Pipes, tubes or hollow components are to be sorted out by hand, and checked to ensure that they do not hold any water since it can lead to water vapour explosions.

- ✓ Visitors or personnel from other areas are to be made aware of the dangers and they are to be told to remain at a safe distance.
- ✓ The minimum PPEs required by the personnel at the furnace operating floor are safety helmet, safety shoes, long trousers, cotton clothes, and protective goggles with side protection.
- ✓ The emergency outlet channel must be kept dry and clean at all times.
- ✓ The furnace body is to be inspected once every week, and cleaned every month of dust, small particles of scrap and other impurities.
- ✓ Any oil which has leaked out is to be picked up and the spot is covered with sand. The leak is to be located and repaired.
- ✓ Two emergency escape routes are to be available from the furnace platform in the event of accidents. These routes are to be kept clear at all times, and are not to be blocked even for short periods.
- ✓ When working with metal tools in the melting bath, and with the furnace switched on, the tools are to be earthed, or the operator is to at least wear dry leather gloves. Such work is only to be carried out with the furnace switched off. The tools are to be warmed up over the bath before immersion, in order to remove any damp or humidity.
- ✓ The formation of bridges is to be avoided in order to prevent the unforeseen breakthrough of molten material to the outside. If a bridge has formed, the furnace is to be switched off and tilted, so that contact with the melt can be made using a thin handspike. In some cases, the bridge can be melted with the furnace at low power and in the tilted position and the furnace then recharged with more material through this opening in the basic position, and then fully melted.
- ✓ In the event of a power failure when the furnace contains a full melt, and it is not known how long it will take to correct the problem, the further procedure must be established. There are two options – either to allow the melt to solidify, or to empty the crucible.
- ✓ The electrical insulation of the live components against earth is measured with the aid of an earthing relay. If the melt at earth potential approaches the coil, the resistance is going to fall, and the system is to be switched off.
- ✓ If work is to be carried out with the furnace in the tilted position, the furnace is required to be secured against tipping. The furnace is also to be secured when pushing out the crucible.

The condition of the crucible is needed to be inspected visually, and the remaining wall thickness determined with the aid of measuring devices. An assessment of the average remaining wall thickness can be made from the frequency display.

2.4 Plant Design Scenarios

The plant will produce using 50% Billets and 50% Scrap metal as the input materials. This plant design option will operate with operate with both imported billets and scrap metal smelting. The plant will operate with one induction furnace for melting the scrap metal, a preheat furnace and the rolling mills.

The induction furnace will be making the billets independent of the milling process and may be decoupled from rolling mills.

The following data will be used in plant Design.

- ✓ 50% Billets + 50% Scrap Metal
- ✓ Key Equipment
- ✓ Induction Furnace -1Unit
- ✓ Casting Machine (CCM)
- ✓ Preheat Furnace
- ✓ Rolling Mills
- ✓ TMT Unit
- ✓ Rolling Capacity: 12 TPH
- ✓ Furnace: 10Tons @ 2 Hours Cycle Time; Operating 24Hrs/Day
- ✓ Furnace Electricity Consumption: 650KWH/Ton
- ✓ Mills Electricity Consumption: 150KWh/Ton of Steel
- ✓ Heavy Fuel Oil will be used for preheating furnace. HFO consumption is approximated at 35Ltr/Ton of Steel
- ✓ Production Schedule: 20Hrs/Day x 330Days/Year

2.5 Utilities and Services

i. Water Supply

The proposed development will be connected to a proposed borehole which will be drilled on site for water supply. The new development will require a new and larger water connection. It is recommended that the plant retain 2 – 3 days' water storage of about 10,000 litres. This is to cushion the plant against the frequent water shortage in the area. The plant will also be treating and recycling the water to ensure availability of water for processing and to minimize usage and wastage.

ii. Foul Water Drainage

In the area surrounding the project site, sewage management is a major problem since the area is not connected to any central or municipal sewer network and therefore the developments mainly rely on septic

tanks for sewerage management. The proponent of the proposed development will therefore undertake to connect the building to a septic tank and soak pit to be constructed to Engineer's specifications.

iii. Storm Water Drainage

The proposed development will increase paved area. This will result in increased surface water discharge. It is therefore recommended that adequate drainage channels and rain water harvesting be provided to accommodate the increased discharge and to harmonize it with neighboring premises.

iv. Electricity Supply.

Electricity is to be connected to the proposed development from the main national electricity grid by Kenya power and lighting company.

v. Telecommunication.

Both fixed landline and cell phone services are available on site for connection.

vi. Site Landscaping

The project will involve excavation of soil material. The site development involves landscaping with excavated soil and rock material. Excess material will be disposed off-site at the recommended site by the County government of Machakos. A green belt should be created within the site to provide a habitat for birds and small mammals.

2.6 Project activities

2.6.1 Overview

The activities of the proposed project include –

- ✓ Site preparation and clearance of existing vegetation
- ✓ Excavation and earth works
- ✓ Construction of foundation
- ✓ Construction of super structure and associated facilities
- ✓ Installation of Steel processing plant
- ✓ Development of external works
- ✓ Final Inspection
- ✓ Operation and business
- ✓ Decommissioning.

2.6.2 Site Preparation

i. Fencing: - The exact site location will be secured by hoarding along the property perimeter.

ii. Site Clearance: - The site clearance entails removal of any obstructions on the way of the intended construction activity. In the proposed project, this will involve clearing of grass vegetation and removal of the top loose soils. Site clearance will not involve the use of heavy machinery or explosives.

iii. Laying Out the Site: - The site will then be laid out to identify the location of the proposed plant's structure on the site. The corner points and edges of the proposed plant's structures will be established accordingly. The marking out will use stakes and strings as well as chalk lines. The technology to be used in the design of the proposed project will comply with both local and international standards. It will be the responsibility of the design engineer and the contractor to ensure design standards and constructions implementation from certifying bodies such as Engineers Registration Board, Ministry of industrialization and manufacturing and National Construction Authority are also referred to prior and on operation of the construction and installation activities.

2.6.3 Excavation and Earth Works

In order to develop the proposed Steel processing plant, excavation and earth works are involved. The main method of excavation to be used is trenching in order to accommodate the underground tanks and structural footing. The site is on black cotton soil which will be excavated to find a proper surface for the foundation. As much as possible, the excavated material is to be used for backfilling and landscaping. The excess excavated loose soil material will be disposed off-site at a location approved by the County government of

Machakos. No major rock obstruction is registered on site to warrant use of explosives. The load bearing capacity of the underlying soil is adequate and safe to support the building foundation without additional stabilization

2.6.4 Construction of the Steel Processing Plant

The proposed Steel processing plant will be constructed and installed as per engineering standards and quality.

2.6.5 Construction of the administration block and other support facilities

The super structure comprises of the floor slaps, walls, doors, windows, internal finishes and the roofing. All these will be constructed as per the engineer's specifications. The proponent in liaison with the contractor is therefore obliged to abide by the provisions of the engineer.

2.6.6 Internal /Utility Services

i. **Plumbing System Water Supply: -** The internal water supply will be split into two – cold water system and hot water system. Since the supply is under pressure, the whole water supply system is designed leak proof and has valves to control the flow of water. To ensure reliable

water supply, the plant will have adequate storage to cushion against unforeseen water shortage – 100,000 litres of water stored for the plant.

ii. **Waste Water Drainage: -** The wastewater drainage system consists of both drain and vent pipes. These pipes also incorporate traps, gullies and other assorted fittings. The sewer plumbing will mainly be single stack, single-vent type. The development does not provide for air conditioning installation since the construction will be well ventilated, sufficient for natural air circulation.

iii. **Electrical System: -** The installation of electrical wiring and fittings will cater for lighting, appliances, heating and cooling system. The installation will also cater for internal communication, telecommunication and alarm system. All installations shall be to Kenya Power and Lighting Company approval.

2.6.7 External Works

i. **Driveway, Walkway and Parking: -** Paved driveway, parking and walkways shall be constructed to give motor vehicle and pedestrian traffic proper surface on which to move. The sub-grade will be made up of compacted quarry stone chippings and the sub-base will be of natural gravel and the base shall be 150 mm thick hand-packed hard quarry stone. The road surface shall be 50 mm thick standard cabro paving blocks.

ii. **Water Supply: -** The development will be connected to a borehole to be drilled on site for water supply.

iii. **Foul Water Drainage: -** The plants development will be connected to a septic tank and soak pit. Liquid waste will be directed to the septic tank with a soak pit to be constructed to engineers' specification, hence increase the efficiency of the septic tank.

iv. **Surface Water Drainage: -** Surface run-off from the proposed development site will collect in an open drain 300 mm wide and 600 mm deep and with steel grating cover. The drain will discharge onto an open main storm water drain along the local access road which will be harmonized with design drainage of neighboring premises. The storm water can be used for irrigation of lawns and flower gardens within the plant's compound. Alternatively harvest roof water and do not mix with waste water from washings and washrooms

v. **Solid Waste Disposal: -** The plant will have a cubicle for storage of solid waste which is to be provided next to the access gate. The storage capacity is one week and waste will then be collected by the a NEMA licensed private contractor for final disposal.

vi. **Landscaping: -** The site is to be landscaped to plan. This will entail planting of selected trees species, shrubs, grass and related ground cover in top soil. The top soil will also be treated with manure and/or fertilizer where necessary to encourage faster and improved plant growth. The

common lawn/garden will be planted with continuous bed of grass lawn and provide aesthetically pleasing view. To enhance aesthetics, trees will be planted along the fence line of the plot and care taken not to introduce invasive species through consultation with the local KFS office to create a green belt.

vii. **Gate**: - Access is to be provided on the local access road.

viii. **Clearing of Site: -** The site will be given a general cleaning, and any left-over material and debris will be carted away. Similarly, any tools and equipment still on site will be removed.

2.6.8 Construction Procedure

Appointment of Contractor

The proponent will appoint a competent registered contractor to construct the various infrastructure characterizing the proposed Steel processing plant.

Construction Supervisor

During the construction phase, the proponent through his consultants will ensure close supervision so as to make sure that:

a. A construction site plan indicating where different construction and installation activities such as concrete mixing, stone dressing and others will be carried out in drawn and adhered to.
b. Traffic signs including movement of heavy vehicles are put up on roads in the zones
c. Safety signage that conveys warnings against potential hazards are put up and remain within the construction site
d. Hoarding of areas undergoing demolition and farming possible foot paths that are within 2 meters from the construction site to prevent any damage to the adjoining environment. The hoarding should be 2.4m high galvanized iron sheets
e. Workers put on safety gears at all times (including dust masks, hand gloves, helmets, safety boots with metal tipped toes and hardened soles to prevent injury from prickle of sharp objects, safety harnesses, ear muffs, overalls and dust coats).
f. Workers operating vibrating equipment (e.g., air compressors) put on ear muffs and protective goggles.
g. Equipment is checked and certified to ensure that they are competent, in good working condition and safe to use
h. Dust is reduced to minimum by constant watering
i. Well stocked First Aid kit and firefighting equipment (fire extinguisher water hydrants and sand buckets) are provided and placed at strategic positions that are easily accessed

j. Emergency response procedures are put in place and all workers trained in them. Emergency contact details should be clearly displayed

2.6.9 Final Inspection and occupation

Final inspection will be undertaken to ensure that the project has been done properly and according to the terms of the contract. The inspection team will normally include the project proponent/client, the architect, the engineer and the contractor or their representatives and the County inspection team. The inspection will normally begin at the bottom of the construction to the top and look at and inspect every detail of construction, functioning of mechanical and electrical installations etc. The inspection team shall prepare a punch list indicating the items that need to be corrected. The list will be given to the contractor for necessary action within a specified period. If no new defects are noted, the job will officially be completed. A plant inspection report and certificate of occupation will subsequently be issued. In issuing the certificate of occupation, the inspection will take into account health and safety considerations of intended occupants. Upon certification of the building for occupation, and upon receipt and consideration of necessary legal and other relevant documentation from the contractor, the project proponent will file a formal 'Notice of Completion'. The project will then be handed over to the proponent.

2.6.10 Environmental auditing

The project proponent will carry out an initial environmental audit and Annual Environmental Audit for the project activities as provided for in the Environmental (Impact Assessment and Audit) Regulations 2003. The Audits will serve to confirm the efficacy and adequacy of the proposed Environmental Management Plan.

2.6.11 Decommissioning

Decommissioning of the project once the project cycle comes to an end or when it has outlived its usefulness and will be demolished. The decommissioning of the plants building will involve the following:

- Demolition and removal of all concrete works, metal works and furnace and associated structures
- Demolish and remove all the sanitary utilities (sewerages lines and manholes)
- Demolish and remove all wooden and roofing materials
- Carefully remove all the electrical fittings and associated cables
- Ensure proper handling of debris and other materials
- Ensure authorized and guided transportation and disposal away from the project site
- Reuse, recover and recycle any useful demolition materials
- Disposal of the remnant oils properly

2.7 Project budget

2.7.1 Overview

The total project cost is estimated at Ksh. 150,000,000 (One hundred and fifty million Kenyan Shillings only)

2.7.2 Capital Investment Costs

The main capital investment costs relate to:

- Land
- Site preparation
- Purchase and installation of the Steel plant system
- Building structures and support facilities
- External / site work – access road, landscaping, water supply, power supply and waste management system etc.

2.7.3 Professional Fees and Labor Costs

The project involves lawyers, town/physical planners, environmental experts, architects, engineers, quantity surveyors etc. It is estimated that 5% of the project development cost will be allotted for labor charges. Labour force of 150 casual workers and 30 permanent staff will also be employed.

2.7.4 Cost of Materials

Cost of construction materials is estimated to take 70% of the total development cost.

2.7.5 Project Time Schedule

The whole project cycle from inception, planning and design, and construction is estimated to take 12 months.

2.7.6 Financing

The proposed project will be financed from both private savings and bank loan facility

2.8 Project material and products

2.8.1 Project Material and Inputs

The plant will produce using 50% Billets and 50% Scrap metal as the input materials. This plant design option will operate with both imported billets and scrap metal smelting. The plant will operate with one induction furnace for melting the scrap metal, a preheat furnace and the rolling mills. The induction furnace will be making the billets independent of the milling process and may be decoupled from rolling mills

Inputs Industrial Diesel Oil (IDO), furnace oil, electricity, water, oils and lubricants will be the necessary process inputs. IDO will be the fuel used for hot rolling in the rolling mill; furnace oil will be used for heating the furnace, electricity will power the entire mill, water will be a coolant.

For the mill will oils and lubricants will lubricate the plant and equipment. In summary, the main material input in the project include: -

- Raw material including Iron ore, limestone, coal and coke.
- The Complete plant components
- Underground oil storage tanks
- Water tanks
- Generator
- Masonry stone and Expanded polystyrene (E Ps) panels
- Sand
- Cement
- Crushed stone
- Gravel
- Soil
- Timber
- Steel (reinforcement, casement, wiring, pipe etc)
- Glass
- PVC material (tiles pipes, conduits and fittings)
- Concrete tiles and paving blocks
- Paint
- Plant material – grass, tree seedlings etc.
- Water

2.8.2 Project Products

The project involves the design and installation of a steel reinforcement bars (Rebar) rolling mill plant of capacity of 12-15 Tones per hour (TPH). The reinforcement bars are integral material in the construction industry. Moreover, the products of the steel mills find their application in wide range of areas. Steel consumption is a major indicator of national economic development. Other products from the project are –

- A fully equipped Steel processing plant
- Administration block
- Security office
- Parking lot
- Septic tank and soak pit
- Washrooms

- Paved driveway, walkway and car parking spaces
- Landscaped site planted with grass, shrubs and tree cover
- Increase surface water runoff
- Increased foul water discharge
- Increased solid waste generation
- Increased resident population
- Increased traffic (motor vehicle and pedestrian

CHAPTER THREE

3.0 LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK.

3.1 Legal and Policy Framework

There are several pieces of legislations and policy documents related to manufacturing and construction development in Kenya. These include, but not limited to the Constitution of Kenya 2010, Energy Act 2006, Physical Planning Act (Cap. 286), the Penal Code (Cap 63), the Environmental Management and Coordination Act (No 8 of 1999 Amended 2015) CAP 387, the Public Health Act (Cap.242), the County Government Act (2012), the Building Code, the Factories and Places of Work Act (Cap. 514), Occupational health and safety Act, Sessional Paper No. 9 of 1999 on Environment and Development, National Environmental Action Plan (NEAP), Sessional paper No. 9 of 2012 on the National Industrialization policy framework for Kenya, Millennium Declaration and Brutland Commission Report of 1987.

The relevance of the aforementioned legislations as well as policy papers (national and international) and institutional framework related to the proposed development are discussed in the following sections:

3.1.1The Constitution of Kenya, 2010

In chapter four, Article 42, it is clearly stipulated that every person has the right to a clean and healthy environment which includes the right:

a. To have the environment protected for the benefit of present and future generations through legislation and other measures, particularly those contemplated in Article 69
b. To have obligations relating to the environment fulfilled under article 70 Part 1 of the chapter dwells on land, outlining the principles informing land policy, land classification as well as land use and property. The second part of this chapter directs focus on the environment and natural resources. It provides a clear outline of the state's obligation with respect to the environment, thus;

The state shall

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
- Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
- Encourage public participation in the management, protection and conservation of the environment;
- Protect genetic resources and biological diversity;

- Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- Eliminate processes and activities that are likely to endanger the environment; and
- Utilize the environment and natural resources for the benefit of the people of Kenya.

In conformity with the Constitution of Kenya, 2010, every activity or project undertaken within the republic must be in tandem with the state's vision for the national environment as well as adherence to the right of every individual to a clean and healthy environment.

Relevance to Project.

The proponent will safeguard all the rights of the citizens as enshrined in the constitution in executing the project. The proponent will also ensure environmental considerations are mainstreamed into all phases of the project cycle.

3.1.2 The Physical Planning Act (Cap. 286)

The Physical Planning Act (Cap. 286), which commenced on 29th October 1998, aimed at developing a sound spatial framework for co-existence, through plan proposals that enhance and promote intergraded spatial/ physical development of socio-economic activities. Because building/construction constitutes making of material change to land, the activity constitutes "development", hence need to be controlled by local authorities. From the foregoing, the Physical Planning Act (Cap. 286) has made specific provisions in respect to the mandate of local authorities in the need for physical planning. As concerns, city, municipal, town and urban councils:

- ✓ Section 24(1): The Director may prepare with reference to any Government land, trust land or private land within the area of authority of a city, municipal, town or urban council or with reference to any trading or marketing center, a local physical development plan.
- ✓ Section 24(3): the Director may prepare a local physical development plan for the general purpose of guiding and co-coordinating development of infrastructure facilities and services for an area referred to in subsection (1), and for the specific control of the use and development of land or for the provision of any land in such area for public purpose.
- ✓ Section 25(b): a local physical development plan shall consist of such maps and description as may be necessary to indicate the manner in which the land in the area may be used

According to Section 33 of the Physical Planning (Building and Development Control) Regulations, the Director of Physical Planning shall refuse to recommend any new building or proposed development, or alteration or addition to any existing building if:

- ✓ The proposal is not in conformity with approved development plan
- ✓ Such plans disclose a contravention of the physical planning (Building and Development) rules
- ✓ The plans are not correctly drawn or omit to show information required
- ✓ On such being required, a separate application accompanied by sets of plans has not been lodged in respect of buildings on separate plots or subplots
- ✓ The land or the proposed building or structure is not used for any purpose which might be calculated to depreciate the value of neighboring property or interfere with convenience or comfort of neighboring occupants
- ✓ The proposed building or land use is unsuitable, injurious to amenities or detrimental in respect of appearance or dignity or fails to comply with physical planning requirements in regard to sitting, design, height, elevation, size, shape, structure or appearance
- ✓ The development is likely to become objectable on environmental grounds
- ✓ Roads of access, parking bays, vehicular and pedestrian circulation spaces or other services to the plot or premises are inadequate
- ✓ The building is not sited in a satisfactory position.
- ✓ The system of drainage, including soil, waste and surface water of the plot, or subplot upon which the building is to or stand, is not satisfactory
- ✓ Provision has not been made for adequate natural light and ventilation, or
- ✓ Any other physical planning issue

Section 36 of the Act (Cap. 286) further compels that if in connection with a development application, a local authority is of the opinion that proposals for industrial location, or any other development activities (such as building developments) will have injurious impact on environment, the applicant will be required to submit together with application an environmental impact assessment report. The above provision compares well to Section 29 (a), which confers upon local authorities the powers to prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area. The proposed development is an area with similar developments and therefore the proposed project fits in the proposed site and zone. The proponent has reached the requisite approval under this Act.

Relevance to project.

The proposed development is an area with similar developments and therefore the proposed project fits in the proposed site and zone. The proponent has reached the requisite approval under this Act.

3.1.3 Environmental Management and Coordination Act of 1999, amended 2015

This ESIA report has been undertaken in accordance with Part VI of EMCA 1999 amended 2015 and its subsequent supplements. Part II of the Act states that every person is entitled to a clean and healthy

environment and has the duty to safeguard the same. The Act also proposes that projects listed under the Second Schedule of the Act must undergo an Environmental and Social Impact Assessment. This Schedule listing includes the establishment of the proposed steel plant project.

Section 73 requires that all operators of projects which discharge effluent or other pollutants to the environment submit to NEMA accurate information on the quality and quantity of the waste thereof. In this respect, it is noteworthy that materials used in the plant construction have the potential of polluting both the above and underground water bodies and as such it is recommended that the project meets the requirements of the Act which aims to reduce environmental pollution by appropriate controls.

The Section below reviews the relevant statutes that guide the development and management of steel plant projects to ensure environmental and socio-economic sustainability.

A. Environmental (Impact Assessment and Audit) Regulations, 2003

These Regulations guide in the procedures for conducting an ESIA study by detailing the parameters to be evaluated during the Assessment. This also provides guidelines for the payment of the ESIA license fees, conducting of environmental audits and development of project monitoring plans. It is also important to note that the legal ESIA license application fee was reviewed through Gazette Notice No. 13211 of 17th September 2013 to 0.1% of the project cost with no upper capping.

By commissioning an ESIA study, the project proponent is complying with the regulation proponent to pay NEMA 0.1 percent of the total cost of the project as the EIA Fees, during the project life (construction; operation and decommissioning phases), the proponent will implement the ESMP; It is also recommended that the subsequent requirements of the Regulations which include the conducting of continuous monitoring and annual audits be fully observed after commissioning of the project.

B. EMCA (Controlled Substances) Regulations, 2007

These Regulations control the production, and consumption, as well as exports and imports of controlled substances. Controlled substances are grouped into three lists, as indicated below:

- ✓ Group 1 list consists of halogenated fluorochemicals with ozone depleting substances;
- ✓ Group 2 list consist of hydrobromoflourocarbons with ozone depleting substances;
- ✓ Group 3 list consist of bromochloromethane with ozone depleting substances;

Products containing controlled substances include: air conditioners, air coolers, refrigerants, portable fire extinguishers, heat pump equipment, dehumidifiers, insulation boards, panels and pipe covers, prepolymers

etc. It is thus recommended that this regulation be observed so as to ensure that equipment, machinery, vehicles and chemicals containing such components are not imported for use on this project.

C. EMCA (Noise and Vibration Control) Regulation, 2009

These Regulations provide guidelines for acceptable levels of noise and vibration for different environments during the construction and operation phase. Section 5 of the Regulations warns on operating beyond the permissible noise levels while Section 6 gives guidelines on the control measures for managing excessive noise. In this context, the project team should observe the noise regimes for the different zones especially so for working in areas termed as silent zones which include hospitals, academic institutions, and worship places, amongst others. These areas have permitted exposure to Sound Level Limits of 40 dB (A) during the day and 35 dB (A) at night.

The regulation states that a day starts from 6.01 a.m. to 8.00 p.m., while night starts from 8.01 p.m. –6.00 a.m. Construction sites near the silent zones are allowed maximum noise level of 60 dB (A) during the day, whilst night levels are maintained at 35 dB (A). The time frame for construction sites is adjusted and the day is considered to start at 6.01 a.m. and ends at 6.00 p.m. while night duration starts from 6.01 p.m. and ends at 6.00 a.m.

Part III of the Regulations gives guidelines on noise and vibration management from different sources. Sections 11, 12 and 13 give guidelines on noise and vibration management from machines, motor vehicles and night time construction respectively. Section15 requires owners of activities likely to generate excessive noise to conduct an ESIA.

D. EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009

The aim of these Regulations is to ensure conservation and sustainable use of wetlands in Kenya. The Regulations provide guidelines on wetland management even for those found on private land. These Regulations indicate that clear guidelines on management of the different types of wetlands found in the country have not been developed and thus it is recommended that while working in aquatic environments, the relevant Lead Agencies should be consulted to guide on the correct application of the law, although, the regulations also recommend for the use of the precautionary principle when working near wetlands in order to conserve them. It should also be noted that the proposed steel plant development doesn't affect any significant wetland; however, the various streams in the area must be conserved.

E. EMCA (Waste Management) Regulations, 2006

These Regulations provide guidance on the appropriate waste handling procedures and practices. It is anticipated that the proposed project will generate a large quantity of solid waste during construction and

these will need to be managed through reduction of wastages, reuse, and recycling or appropriate disposal. It is therefore anticipated that the amount of materials to be discarded as waste during the project implementation will be minimal.

As regards waste reduction, it is recommended that the consulting engineer/proponent put in place measures to ensure that construction materials requirements are carefully budgeted for so as to ensure that the amount of construction materials left on site after construction is minimal. It is further recommended that the proponent considers the use of recycled or refurbished construction materials including those excavated from the existing roads. Purchasing and using once used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste. In addition to the above-mentioned recommendations, and in order to comply with the requirements of these regulations, the proponent should undertake the following:

- NOT allow disposal of any wastes on the highway, street, road, recreational area or public places;
- Encourage segregation of wastes and grouping them according to their similarity, for example plastics, toxics, organics, etc;
- Ensure all wastes are deposited in designated dumping sites approved by the local authority;
- Ensure all waste handlers engaged by the proponent are licensed by NEMA and possess all relevant waste handling equipment and documentation, such as waste transport license, tracking documents, license to operate a waste yard, insurance cover, and vehicle inspection documents, amongst others;
- Implement cleaner production principles of waste management namely reduce, reuse and recycle;
- Label all hazardous wastes as specified in Section 24 (1-3) of the regulation.

The fourth schedule lists wastes considered as hazardous and these include solvents, emulsifiers/emulsion, waste oil/water and hydrocarbon/water mixtures. As regards, steel plant development and operational projects involve use of inputs which are likely to generate the fore-mentioned wastes and which will need to be handled as required of by the regulations.

F. EMCA (Water Quality) Regulations, 2006

These Regulations provide guidelines on the use and management of water sources and the quality of water for domestic use and irrigation. The proponent will be required to observe the requirements of these Regulations that prohibit anyone from undertaking development within 6m of the highest ever recorded flood level. Section 4(2), 6 and Section 24 of the regulation prohibits pollution of water bodies and requires that all substances discharged into the water bodies should meet the standards set under the Third Schedule of the regulation. In response to the above, the project design team should be advised of the requirements of these Regulations and appropriately incorporate the regulations in the project design document.

G. EMCA (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006

These Regulations require proponents to conduct an ESIA if their activities may have adverse impacts on ecosystems or lead to unsustainable use of natural resources or/and lead to introduction of exotic species. The regulation aims at increasing the coverage of protected areas and establishing new special status sites by providing guidelines for protecting endangered species Section 5 of the Regulations provides guidelines on conservation of threatened species and Part III of the regulation guides on the access to genetic materials. Section 5 states that the Authority shall, in consultation with the relevant lead agencies, impose bans, restrictions or similar measures on the access and use of any threatened species in order to ensure its regeneration and maximum sustainable yield. It is recommended that landscaping programs should involve use of certified plant species to prevent them from affecting the project area negatively in terms of invading wetlands, indigenous forested areas, grasslands, farmlands, etc.

H. EMCA (Fossil Fuel Emission Control) Regulations, 2006

This Regulation aims at eliminating or reducing emissions generated by internal combustion engines to acceptable standards. The Regulations provide guidelines on use of clean fuels, as well as use of catalysts and inspection procedures for engines and generators. These regulations are triggered in that the proponent will use vehicles and equipment that depend on fossil fuel (coal) as their source of energy. As such, it is recommended the requirements of the regulation are implemented in order to eliminate or reduce negative air quality impacts. All equipment that will be used in the project should be kept to manufacturers' specifications to reduce any incomplete combustion and the contractor should use fuel with the right catalyst

Relevance to project.

The proponent in preparing this EIA report complies with the requirements of EMCA and expects to receive the EIA license on NEMA's evaluation of the report. At the expiry of one year into the operation of the project, the proponent will submit an Initial Environmental Audit report to NEMA to test the efficacy of the EMP developed during the project cycle.

3.1.4 The Public Health Act (Cap. 242)

Environmental degradation may pose a health hazard to the general public. This is among the factors considered by the Public Health Act to constitute "nuisance". For the interpretation of the Act, Section 15 (IX) indicates that any noxious matter or wastewater discharged from any premise, such as a building constitutes nuisance. Any premise not kept in a clean and free from offensive smell such as gases which are injurious to health such as those from commercial establishments shall therefore generate nuisance. The Act therefore stresses that no person shall cause a nuisance to exist on any land or premise occupied by

him. Because of the above, the Act acknowledge that it shall be the duty of all local authorities to take all lawful measures for maintaining its district at all times in a clean and sanitary condition for remedy of any nuisance or condition liable to be injurious to health. To safeguard against this, Part X of the Public Health Act states that where in the opinion of the Medical Officer of Health that food stuffs within a warehouse, or a building are insufficiently protected, the owner shall be compelled to observe the required regulations, else he/she shall be guilty of an offense.

Relevance to project.

The proponent has acquired the requisite approvals from the Public Health Department for the project and shall ensure high standards of sanitation are maintained throughout the project life cycle and will comply with any instructions that may be provided by the Public Health Department for continuous improvement.

3.1.5 Weights and Measures Act, CAP 513.

This is the principal Act dealing with weights and measures in Kenya, it defines the standards and units to be used and the regulations to be adhered to. Section 20 makes it an offence for any person to use or possess or control for use for trade a weighing or measuring instrument not constructed to indicate in terms of weight or measure as authorized by the Act. The next section (section 21) prohibits use for trade any weight, measure, weighing or measuring instrument which is false or unjust. It further requires that the weights, measures, weighing or measuring instrument used for trade be examined, verified, stamped or re-stamped at least once in every year- section 27(1) and a certificate of verification be issued -section 27(7). It is under the provisions of this Act that the plant system must be examined and verified for their accuracy at least once in a year. Failure to do so is an offence under the Act

3.1.6 The County Government Act of 2012

The local government act was repealed after the final announcement of all the results of the first elections held under the Constitution as per the County Governments Act of 2012. Under section 134 subsection (1), The Local Government Act is repealed upon the final announcement of all the results of the first elections held under the Constitution. It further states in section 134, subsection (2) reads “All issues that may arise as a consequence of the repeal under subsection (1) shall be dealt with and discharged by the body responsible for matters relating to transition”.

The project will according to the County Government act of 2012 ensure that the project activities conform to the regulation that shall be passed. (Section 135 (1) The Cabinet Secretary may make regulations for the better carrying out of the purposes and provisions of this Act and such Regulations may be made in respect of all county governments and further units of decentralization generally or for any class of county governments and further units of decentralization.) comply to the set regulations and by laws. This is the

primary law governing the development of counties and thereby will be key during implementation of the project. The proponent ensured that all organs established under this law have been consulted and approvals sought from the relevant authorities in relation to the County Government of Machakos. The proponent has obtained the necessary approvals by the relevant county departments.

Relevance to project.

The proponent has obtained letters of authority from the County Government of Machakos to commence development. Development Plans have also been approved by the County Government prior to commencing the construction and commissioning of the project.

3.1.7 The Occupation and safety Health Act, 2007

The main objective of the Act is to secure the safety, health and welfare of the persons at work and to protect persons other than persons at work against risks to safety and health arising out of or in connection with the activities of persons at work. It assigns duties and liabilities to employers, employees and public in order to facilitate this and promote healthy work environments subsequently enhancing outputs ergonomically. Under part (ii) of the Act the duty of occupiers in section 6(i) is to ensure the safety, health and welfare at work of all persons working in his workplace, sub section (2)(a) to (g) outlines specific duties under section 6(i). These include provision of personal protective equipment (PPEs), preventing risks, information, notifications and maintenance of places of work. Sub section 3 stipulates that occupier must carry out risk assessment and section 4 require that the proponent sends a copy to the occupational health and safety officer in the area. Section 13 (a) to (g) also stipulates the duties of the employee in efforts to ensure that he/her safety and health is guarantee at the place of work. Section 21 gives the procedure and duty of giving notices of accidents and dangerous occurrences.

In case of any accidents during the project cycle, this Act will guide the course of action to be taken by the proponent and the project contractor.

Relevance to project

All personnel working at the site during installation, operation or possible decommissioning of the plant shall be provided with appropriate Personnel Protective Equipment (PPE) and their use enforced.

3.1.8 Work Injury Benefits Act, 2007.

This provides for compensation to employees for work related injuries and diseases contracted in the course of employment. The proponent must comply with the provisions of this legislation with regard to the above Act at the proposed premises.

3.1.9 The Building Code, 2000

In recognition of the role of local authorities as lead planning agencies, the adoptive by-law compels any potential developer to submit development application to relevant local authority for approval. The local authorities are empowered to disapprove any plan submitted if it is not correctly drawn or do not provide sufficient information that complies with the by-law. Any developer, who intends to erect a building, must give the concerned local authority a notice of inspection, before the erection of the structure. After erecting the building, a notice of completion shall be issued to the local authority to facilitate final inspection/approval. No person shall therefore occupy a building whose certificate of completion has not been issued by the local authority. As a precaution against fire breakout, the by-law states that the walls of any premise shall be non-combustible throughout, similarly, in every building, other than a small house, which comprises more than one storey, shall have fire resistance. The by-law, in Section 214 indicates that in any public building where floor is more than 20 feet above the ground level, the council may recommend the provision of fire-fighting equipment that may include one or more of the following: hydrants, hose reels and fire appliances, external conations, portable fire appliances, water storage tanks, dry risers, sprinkler, drencher and water spray spring protector system. The proponent has acquired all approvals for the architectural and structural engineering drawings as attached in the appendix.

Relevance to project.

The proponent has acquired all approvals for the architectural and structural engineering drawings as attached in the appendix.

3.1.10 The Penal Code (Cap. 63)

The chapter on “Offences against Health and Conveniences” contained in the Penal Code enacted in 1930 strictly prohibits the release of foul air into the environment, which affects the health of other persons. Any person who voluntarily violates the atmosphere at any place, to make it noxious to health of persons in general dwelling or carrying out business in the neighborhood or passing along public ways is guilty of misdemeanor, i.e., imprisonment not exceeding two years with no option of fine. Under this code, any person who for the purpose of trade or otherwise makes loud noise or offensive awful smell in such places and circumstances as to annoy any considerable number of persons in the exercise of their rights, commit an offence, and is liable to be punished for a common nuisance, i.e., imprisonment not exceeding one year with no option of fine. The proponent has planned for waste treatment mechanism to avoid release of foul air into the environment.

Relevance to project.

The proponent has planned for waste treatment mechanism to avoid release of foul air and water into the environment.

3.1.11 The Way leave Act

The areas zoned for communication lines, sewer lines, power lines, water pipes etc. are known as way leaves. The way leave Act prohibits development of any kind in these designated areas. Thus, any developer is bound by this Act to see to it that no development takes place in these areas. The proposed project will not encroach on any way leave and will leave the required space for such services.

3.1.12 The Water Act, 2016

Part II, section 18, of the Water Act, 2016 provides for national monitoring and information systems on water resources. Following this, sub-section 3 allows the Water Resources Authority (WRA) 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 WRA. Section 73 of the Act allows a person with a license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 75 and subsection 1 allows the licensee to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or upon land for preventing of pollution of water sources within his/her jurisdiction. The waste water regulation, 2006 states that; No person shall abstract ground water or carry out any activity near any lakes, rivers, streams, springs and wells that are likely to have any adverse impact on the quality or quantity of the water without an EIA license issued.

Relevance to project.

The proponent will ensure drilling of a borehole and harvest rain water. The proponent will as well ensure proper management of effluent, sewage and solid wastes to avoid any potential contamination of water resources.

3.1.13 The Environmental Management and Coordination (Water Quality) Regulations

These regulations enacted in 2006 were formulated with the aim of protecting water sources from pollution and setting the standards for wastewater disposal. Section 12 (1) requires that every in local authority, a person operating a sewerage system or owner or operator of any trade or industrial undertaking obtain an effluent discharge license as stipulated under the EMCA and shall comply with the standards set out in the third and fourth schedule to these regulations. A discharge monitoring record shall be maintained. Any person discharging wastewater into public sewer or aquatic ecosystem is required to obtain a discharge

license and regularly monitors qualify of effluent. The proponent will not discharge any waste water into the environment and will endeavor to seek services of NEMA licensed operator when necessary.

Relevance to project

The proponent will provide a regular exhausting service of waste water treatment system for managing both effluent and sewage from the plant. The proponent will not discharge any waste water into the environment and will endeavor to seek services of NEMA licensed operator when necessary.

3.1.14 The Traffic Act (CAP 403)

The act it prohibits obstruction of traffic, either by persons or facilities constructed in such a way as to interfere with the flow of traffic on roads or road reserves. The law also regulates the quality of exhaust emissions from such mobile vehicles.

Relevance to project.

The proponent will liaise with the traffic police to temporarily control traffic if need be.

3.1.15 Sessional Paper No 9 of 2012 on National Industrialization Policy Framework for Kenya

This National Industrialization policy framework has been developed through a consultative process involving the public sector, private sector, civil society, development partners and non-governmental stakeholders. It takes into cognizance the Vision 2030 aspirations; current status of the Kenyan economy; changes and development in the global economy; challenges of the industrial sector; and opportunities arising therefrom. It also takes into account some of the lessons learnt and best practices from Newly Industrialized Countries (NICs). This policy is aligned to the Kenya Vision 2030 which aspires to transform Kenya into a middle income rapidly-industrializing country, “a globally competitive and prosperous nation, offering a high quality of life to all its citizens” in a secure and healthy environment. It envisions to making Kenya be the leading industrialized nation in Africa with a robust, diversified and globally competitive manufacturing sector.

On the metal sub-sector, the policy recognizes that the industrialization of any nation is largely dependent on the availability and affordability of iron and steel. It has been established that vast amounts of iron ore reserves exist in several locations in Kenya, including: Meru, Ikutha, Taita, Embu, Lolgorien, Samburu, and Funyula districts. There are also smaller deposits in various parts of Nyanza, Western and Coastal regions including pyritic ores in Bukura area, limonitic ores on Lugulu Hill south of Sio and and goethite ore on Mrima Hill in Kwale. The second main ingredient in iron and steel production is coal which has also been reported to be in Mwingi and Kitui districts. The third main ingredient in the iron and steel production

is limestone, which occurs in various parts of the country including Mutomo, Kajiado, Taita, Pokot, Baringo among other areas.

In pursuit of the need to grow and expand the potential that is inherent in the iron and steel industry in Kenya, it is proposed that the following policy measures be pursued:

1. Establish a sub-committee of the proposed National Industrial Development Commission to deal exclusively with the development of steel and iron.
2. Rationalize the tariffs and any other anomalies within the industry to ensure local competitiveness and value addition in the development of down-stream industries, including machine tool industry, forging industry, agro machinery and motor vehicle assembly.
3. Establish the types, location, quantities and qualities of iron, coal and limestone in the country,
4. Establish a mini-steel plant.
5. Develop an institutional framework to promote development of iron and steel mills industries in the country, within the framework of Kenya Vision 2030
6. Establish a coal power generation plant.
7. Impose a ban on export of scrap metal and iron ore.
8. Promote stockpiling of the iron ore and limestone while initially exploring ways of mining the coal and producing the coal.

3.1 Other Policy Documents and International Treaties.

3.2.1 The World Commission on Environment and Development

The commission commonly referred to as "the Brutland Commission" focused on the environmental aspects of development, in particular, the emphasis on sustainable development that produces no lasting damage to biosphere, and to particular ecosystems. In addition, environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources.

While social sustainable development maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well-being, adequate nutrition, and shelter, cultural expression and political involvement.

3.2.2 The Rio Declaration on Environment and Development

Agenda 21 – a programme of action for sustainable development worldwide, the Rio Declaration on Environment and Development was adopted by more than 178 governments at the United Nations Conference on Environment and Development, known as the Earth Summit, held in Rio de Janeiro, Brazil from 3rd to 14th June 1992. Principle No. 10 of the declaration underscored that environmental issues are

best handled with participation of all concerned citizens at all the relevant levels. At the national level, each individual shall have appropriate access to information that is concerning environment that is held by public authorities, states shall encourage and facilitate public participation by making information widely available.

Effective access to judicial and administrative proceedings, including redress and remedy shall be provided. The foregoing discussion is relevant to the proposed development because EMCA CAP 387 demands that public must be involved before any development project that is likely to have adverse impacts to the environment is initiated by a proponent. The Act has further established Public Complaints Committee (PCC) where the issues raised by the public in regard to any proposed development can be addressed.

3.2.3 Sessional Paper No. 6 of 1999 on Environment and Development

Every person in Kenya is entitled to a clean and healthy environment and has a duty to safeguard and enhance the environment (Kenya, 1999). As envisioned in Sessional Paper No. 6 of 1999 on Environment and Development, Kenya should strive to move along the path of sustainable development to meet the needs of the current generation without compromising the ability of the resource base to meet those of future generations. The overall goal is hence to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development (Kenya, 1999). The policy paper emphasized environmental impact assessments must be undertaken by the developers as an integral part of a project preparation. It also proposed for periodic environmental auditing to investigate if developer is fully mitigating the impacts identified in the assessment report.

3.2.4 The National Environmental Action Plan (NEAP)

The NEAP for Kenya was prepared in 1994. It was a deliberate policy to integrate environmental considerations in to the country's social and economic development process. The integration was achieved through multi-sectoral approach to develop a comprehensive framework to ensure that environmental management and conservation of natural resources is an integral part of societal decision-making process.

3.2.5 The National Shelter Strategy to the Year 2000

This strategy followed the International Year of Shelter for the Homeless in 1987 and was formulated to advocate a change in policy in order to allow other actors to come in and assist the Government in providing housing. The Government was to simply facilitate other actors such as for the proposed housing developers to invest in shelter and hence requires use of steel.

3.2.6 The National Poverty Eradication Plan (NPEP)

The NPEP has the objective of reducing the incidence of poverty in both rural and urban areas by 50% by the year 2015; as well as strengthening the capabilities of the poor and vulnerable groups to earn income.

It also aims to narrow gender and geographical disparities and create a healthy, better-educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for Social Development (WSSD) of 1995. The plan focuses on the four WSSD themes of the poverty eradication; reduction of unemployment; social integration of the disadvantaged people and the creation of an enabling economic, political, and cultural environment. This plan is to be implemented by the Poverty Eradication Commission formed in collaboration with Government ministries, community-based organizations, and private sector such as the proposed development will create employment opportunities for Kenyans, hence contributing to poverty eradication.

3.2.7 The Poverty Reduction Strategy Paper (PRSP)

The PRSP has the twin objectives of poverty reduction and economic growth. The paper articulates Kenya's commitment and approach to fighting poverty; with the basic rationale that the war against poverty cannot be won without the participation of the poor themselves. The proposed project during and after implementation, will offer jobs to many Kenyans as a way of contributing to this noble objective of reducing poverty in the nation.

3.4 Institutional Framework

The environmental impact assessment for the proposed development is bound to be influenced by the operational interests of several lead agencies, whether exclusively or concurrently. These include, but not limited to the following key institutions:

3.4.1 County government of Machakos.

This is the principal lead agency in all matters pertaining to planning within the Machakos County. The County Government Act (Cap 103) requires counties to facilitate the development of a well-balanced system of settlements and ensure productive use of scarce land, water and other resources for economic, social, ecological and other functions across a county; The Physical Planning Act (Cap286) also confers upon local authorities the powers to control development in their areas of legal jurisdiction. Accordingly, Section 29 (a) has granted all local authorities in Kenya, the County government of Machakos being no exception, the power to prohibit or control the use and development

3.4.2 National Environment Management Authority (NEMA)

In 2002 the government created the National Environmental Management Authority (NEMA) as the supreme regulatory and advisory body on environmental management in Kenya. NEMA is required to coordinate and supervise the various environmental management activities being undertaken by statutory organs with a view to promoting their integration into development policies, programs, plans and projects that provide sustainable development and a safe and healthy environment to all Kenyans. The key functions of NEMA through the National Environment Council include: responsibility for policy formulation and

direction for the purposes of the Act; setting national goals and objectives and determining policies and priorities for the protection of the environment; promotion of cooperation among public departments, local authorities, private sector, non-governmental organizations and such other organizations engaged in environmental protection programs; and perform such other functions as are assigned by the Act.

NEMA will remain in charge of coordinating all activities related to environmental management in the project area, such as enforcement of environmental impact assessments, as well as environmental audits and undertake environmental inspections as it deems necessary in carrying out its mandate.

3.4.3 Director of Physical Planning

The Physical Planning Act (Cap 286) established the office of the Director of Physical Planning. The duties of the Director of Physical Planning shall include the following:

- Formulate national, regional and local physical development policies, guidelines and strategies
- Be responsible for the preparation of all regional, local and national physical development plans
- From time to time, initiate, undertake or direct studies and research into matters concerning physical planning
- Advise the Commissioner of Lands and local authorities on the most appropriate use of land including land management such as change of user, extension of user, extension of leases, subdivision of land, and amalgamation of land, and
- Require county authorities to ensure proper execution of physical development control and preservation orders.

3.4.4 Energy and Petroleum Regulatory Authority.

The Energy and Petroleum Regulatory Authority (EPRA) is established as the successor to the Energy Regulatory Commission (ERC) under the Energy Act, 2019. The Authority is responsible for the economic and technical regulation of the electric power, renewable and petroleum sub sectors. Its role of in the Petroleum Subsector as provided by the Energy Act 2019 include:

1. Review of government policy on petroleum.
2. Governing the petroleum sector with focus on licensing, issuing of construction permits, developing standards for bulk petroleum transportation and petroleum costs and prices monitoring.
3. Take the lead in the formulation, review and enforcement of rules, regulations and codes for the petroleum sector.
4. Identifying gaps in EHS and developing interventions to address the gaps to ensure that EHS clearly understands standards and rules that it is expected to regulate. This will include the review and enhancement of existing standards.

3.4.5 Neighborhood Associations and/or General Public

The proposed steel processing plant development project is likely to attract the interests of the area's neighborhood association(s)/general public. An extensive public participation hence formed a major component of the study. From the foregoing, particular reference is made to Section 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003, which states that:

> ***…The proponent shall in consultation with the authority, seek the views of persons who may be affected by the project…***

The above expression clearly underscores the concept of "participatory environmental planning and management" in the context of urban development.

3.5 Conclusion

The institutions guided by relevant policies and legislations must regulate urban development and planning projects. The above expression is envisioned as a basic principle component of coordinated and harmonious development in urban areas, and is one of the core pillars for attaining sustainable development. These provisions will therefore guide the proposed project.

CHAPTER FOUR

4.0 ENVIRONMENTAL BASELINE INFORMATION

4.1 Overview

The climatic and physical conditions of the site in Katani area compares favorably to that of the wider Machakos County where the proposed project is located. A combination of one or more of these factors directly influence urban development, and are prerequisite to site analysis and planning.

4.2 Location of the steel plant project

The proposed steel plant project will be located on amalgamate land reference Nos. Mavoko Town Block 2/26177 and 2/ 22616, situated in Katani area, off Katani road approximately 1.5 Km from Katani Primary school, within Mavoko Sub-County, of Machakos County on GPS coordinates latitude **1°20′58.55″S 37°00′12.95″E**. Presently, the project site is not developed and the proposed development consist of a Steel Processing Plant with associated support facilities and services. The proposed plant will use the induction furnace melting and heating system. The project site is positioned within approximately 6.282 hectares and is regular in shape with a relatively flat terrain. However, the proposed development will not occupy the entire parcel of land rather it will comply with local planning and zoning regulations.

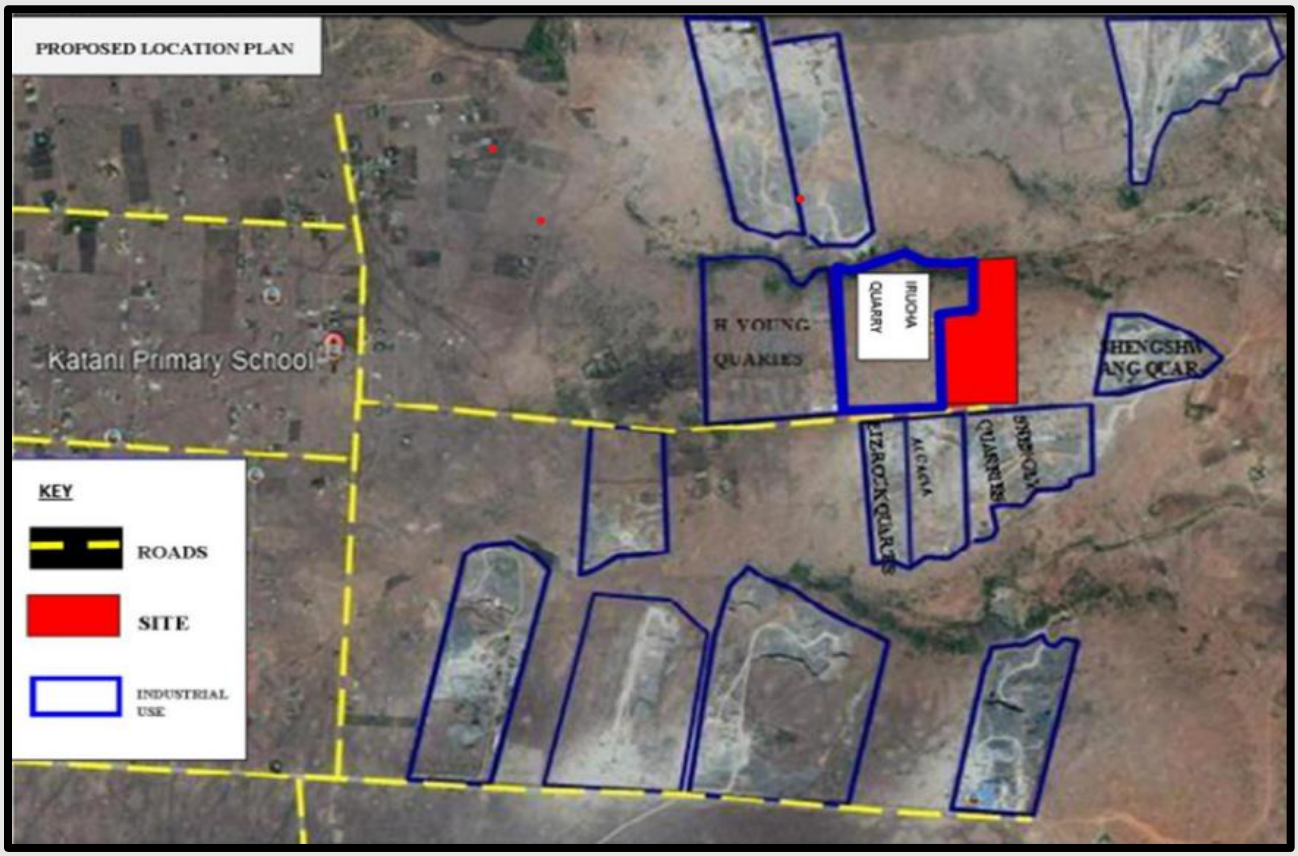


Figure 4-1: Map of Katani area showing location of the proposed Rainham Steel plant project Source: Google Earth 2019

4.3 Machakos County

4.3.1 County Overview

Machakos County is one of the 47 counties in Kenya with a population of 1,421,932 in 2019 according to the national census data. It is largely inhabited by the Akamba community with most of the major towns being cosmopolitan. The County is within the greater Nairobi metropolitan consisting of four other counties including Nairobi, Kiambu, Murang'a and Kajiado.

The largest town is Machakos, which is also the headquarters of the County Government. It was named after Masaku wa Munyati, who was an Akamba chief. Machakos was established in 1887 as the first administrative center for the British colony before they moved it to Nairobi in 1899.

Agriculture is the main economic activity in the County, which is largely semi-arid. Most of the crops grown include maize, beans, fruits, vegetables and drought-resistant crops such as sorghum and millet. The County also plays host to the open-air market concept with major market days where large amounts of produce are traded.

The County boasts of good road network connecting all the sub-counties. Most of the major roads such as Mombasa highway, Namanga road, Machakos – Kitui road, Garissa Road and Wote road pass through the County. The County also borders Jomo Kenyatta International Airport and SGR Nairobi Terminus. It also hosts Athi River SGR terminus.

The County is banking on projects such as the Konza Technology City, new Machakos City and its proximity to Nairobi County to spur its economic development.

4.3.2 Position and Size

The County borders eight counties: Nairobi and Kiambu counties to the West; Embu to the North; Kitui to the East; Makueni to the South; Kajiado to the South West and Muranga and Kirinyaga to the North West. It lies between latitudes 0º45´South and 1º31´South and longitudes 36º45´ East and 37º45´ East. It covers a total area of 6208.2 km².

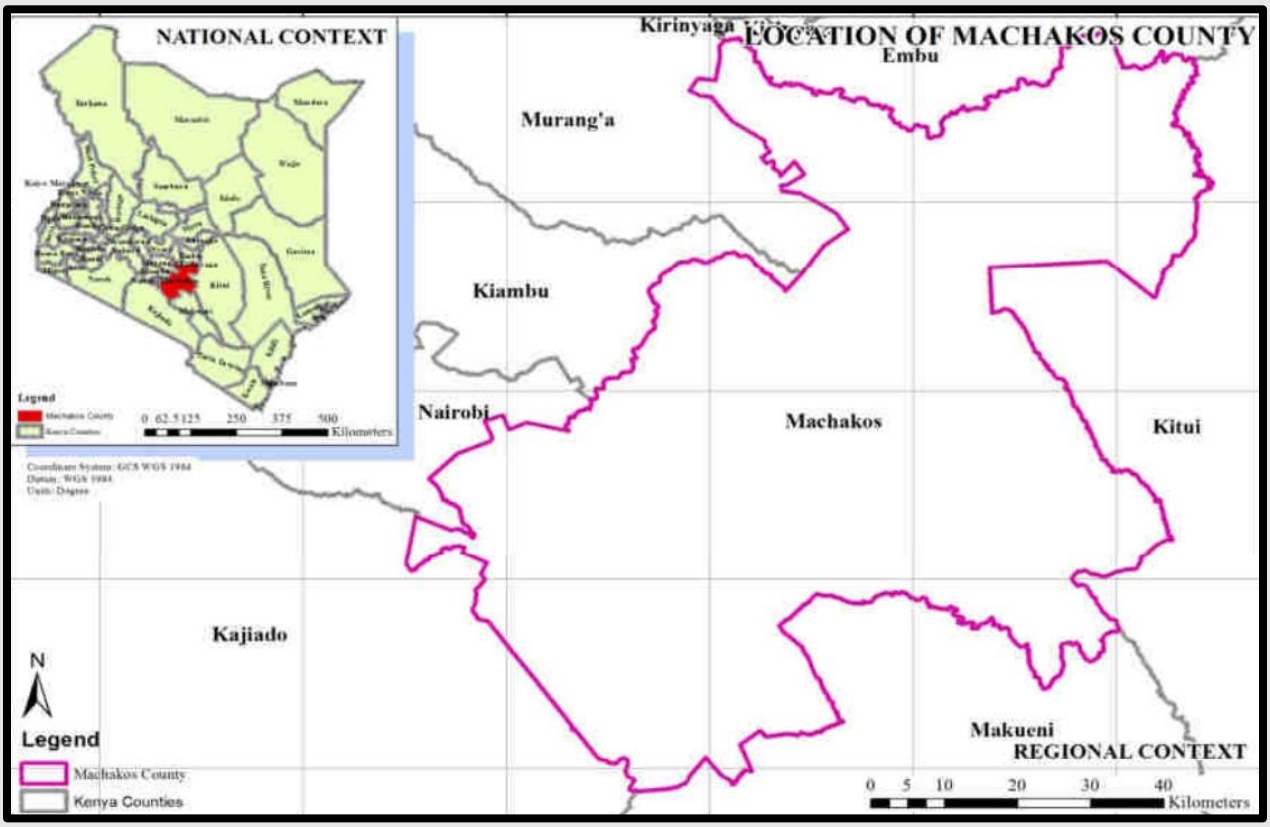


Figure 4-2: Geographical Location of the Machakos County in Kenya.

4.4 Physiographic and Natural Conditions.

2.4.1 Physical and Topographic Features

The County has unique physical and topographical features. These include hills rising between 1800 – 2100m above sea level and Yatta plateau, which is elevated to about 1700m above sea level and slopes to the South East. There are isolated hills in the North West. In the plains, the soils are well-drained, shallow, dark and red clay soils. In addition, the vegetation across the entire County varies according to the altitude. The plains receive less rainfall and are characterized by open grassland with scattered trees as compared to high altitude areas, which receive high rainfall and have dense vegetation.

2.4.2 Ecological Conditions

The County has several hills namely Iveti, Lukenya, Komarock, Ithanga, Mavoloni, Kangonde, Kamuthamba, Nzii, Ekalakala, Kyanzavi, Mua, Kiima kimwe, among others. In addition, the County is home to Yatta plateau and has two main permanent rivers, that is, Tana and Athi.

2.4.3 Climatic Conditions

The County receives bimodal rainfall with short rains in October and December while the long rains from March to May. The rainfall range is between 500mm and 1250mm, which is unevenly distributed and

unreliable. The altitude mainly influences rainfall distribution in the county. The high areas such as Mua, Iveti and Kangundo receive an average rainfall of 1000mm while the lowland areas receive about 500mm. Temperatures vary between 18˚C and 29˚C throughout the year. The dry spells mainly occur from January to March and August to October.

2.4.4 Major Agro-ecological Zones

The table below represents the major Agro-ecological zones across the County.

Major AEZ	**Wards**	**Precipitation amounts & adequacy**	**score**
Lower Highlands (LH) 2-3	Upper Kaewa, Kathiani Central, Mua,	Moderate (1000 - 1250mm)	3
Upper midland (UM) 2-3	Machakos Central, Upper Kaewa, Kathiani Central, Kangundo Central, Kangundo East, Kangundo West, Kangundo North, Tala, Matungulu East, Mutituni, Mumbuni North	Moderate (1000 - 1250mm)	3
Upper midland (UM) 4	Kalama, Kola, Muvuti-Kiima kimwe, Lower Kaewa, Mitaboni, Kangundo East, Matungulu West, Matungulu East, Matungulu North, Kyeleni,	Low (500-750mm)	4
Upper midland (UM) 5-6	Athi river North, Kinanie, Muthwani, Syokimau-Mlolongo	Low (500-750mm)	4
Lower Midland (LM) 3	Kangundo East, Masii	Very low (<500mm)	5
Lower Midland (LM) 4	Kangundo East, Masii, Mbiuni, Muthetheni, Mwala-Makutan	Very low (<500mm)	5
Lower midland (LM) 5	Wamunyu, Kibauni, Ikombe, Katangi, Matuu, Ndalani, Kithimani, Kivaa, Ekalakala, Masinga central, Muthesyia, Ndithini	Very low (<500mm)	5

4.5 Socio Economic Baseline Conditions

4.5.1 Demographic Features

4.5.1.1 Population Size and Composition

The total population of the County was 1,421,932 as per the 2019 Kenya Population and Housing Census. The population for different age cohorts is almost equally distributed. This is as indicated in table below.

The projected male population stands at 705,118 while that of the female stands at 721,094 in 2019. This translates to a sex ratio of 1:1.02.

Population Projections by Gender and Age Cohort									
Age cohort	2019			2020			2022		
	male	female	total	male	female	total	male	female	total
0-4	95,940	93,838	189,779	101,669	99,442	201,111	107,741	105,380	213,121
5-9	95,490	92,725	188,214	101,192	98,262	199,454	107,235	104,129	211,364
10-14	92,412	88,598	181,009	97,930	93,888	191,818	103,778	99,495	203,273
15-19	82,365	73,982	156,347	87,283	78,400	165,683	92,495	83,082	175,577
20-24	63,651	65,824	129,475	67,452	69,755	137,206	71,480	73,920	145,400
25-29	54,527	59,996	114,523	57,783	63,579	121,362	61,233	67,376	128,609
30-34	46,299	49,459	95,757	49,063	52,412	101,475	51,993	55,542	107,535
35-39	38,198	40,110	78,308	40,479	42,505	82,984	42,896	45,043	87,939
40-44	27,986	29,838	57,824	29,657	31,620	61,277	31,428	33,508	64,937
45-49	25,848	29,265	55,112	27,391	31,012	58,403	29,027	32,864	61,891
50-54	21,578	23,077	44,655	22,866	24,455	47,322	24,232	25,916	50,148
55-59	17,035	18,966	36,001	18,053	20,098	38,151	19,131	21,299	40,429
60-64	13,408	14,175	27,583	14,209	15,022	29,231	15,057	15,919	30,976
65-69	7,931	10,516	18,447	8,404	11,144	19,548	8,906	11,809	20,715
70-74	7,837	9,086	16,924	8,305	9,629	17,934	8,801	10,204	19,005
75-79	4,578	6,134	10,712	4,851	6,500	11,351	5,141	6,889	12,029
80+	9,503	15,041	24,544	10,070	15,939	26,010	10,672	16,891	27,563
NS	534	463	996	565	491	1,055	599	520	1,118
TOTAL	**705,118**	**721,094 1**	**1,426,211**	**747,224**	**764,154**	**1,511,377**	**791,845**	**809,786**	**1,601,629**

The table further indicates that the male population projections from age cohorts 0 – 4, 5 – 9, 10 – 14 and 15 – 19 remain slightly higher than that of female. However, from age cohorts 20 – 24 onwards, the female population projections are higher than that of male. This can be attributed to rural urban migration where most men move from rural areas to other urban centers outside the County. It is also observed that the projected population in the age cohort 75 – 79 is lower than that above 80+ years. The population distribution shows a pyramid that is heavy at the base.

4.5.1.2 Population Density and Distribution

The population density and distribution in the County is mainly determined by the economic activities carried out in the specific sub-counties. As at 2019, the County had a population density of 177 per km2

and was projected at 188 per km2 as at 2018.

4.5.1.3 Population of Persons with Disabilities

From table below, there are more females with disabilities compared to males. Physical/self-care disability is the most common followed by visual, hearing and mental disabilities respectively.

More appropriate programs have been put in place to cater for people with different types of disabilities to enhance their productivity. It is also necessary to incorporate persons with disabilities in programme development and implementation process. In addition, the County will promote any initiative geared towards offering training to the persons with disabilities so as provide them with adequate skills.

4.5 Human Development Approach

According to the United Nations Development Programme (UNDP), one of the measures of human development is the Human Development Index (HDI). The HDI represents a push for a broader definition of well-being and provides a composite measure of three basic simple measures of human development that include health, education and income. Though the HDI does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities.

The HDI estimate for Machakos County was 0.54 in 2012, which was above national average of 0.520. This indicates that there is a fairly greater achievement relative to the maximum to be achieved on the aggregate of the factors entering the HDI.

4.6 Infrastructure Development

4.6.1 Roads, Rail Network, Ports and Jetties, Airports and Airstrips

The County has an averagely good road network. Major roads include the Mombasa Highway, Machakos – Kitui, Machakos – Wote, Garissa and Kangundo roads, among others. The County has successfully constructed the following roads among others, the Mwala – Kithimani road, Kathiani – Kangundo road and Athi river road. It has also upgraded most access roads within the County. There are ongoing road initiatives in the County through partnership with the national government and other development partners. These include dualing of Mombasa Road (Namanga road interchange to Makutano Kyumbi), Koma – Konza, Matuu – Ekalakala, Kenol – Kaseve, Tala – Oldonyo Sabuk roads, among others.

Access to the site is via a 12 meters gravel road which is well maintained.

Section of Mombasa Road at the Namanga interchange

Existing 12 meters access to the proposed site

4.6.2 Information, Communication and Technology

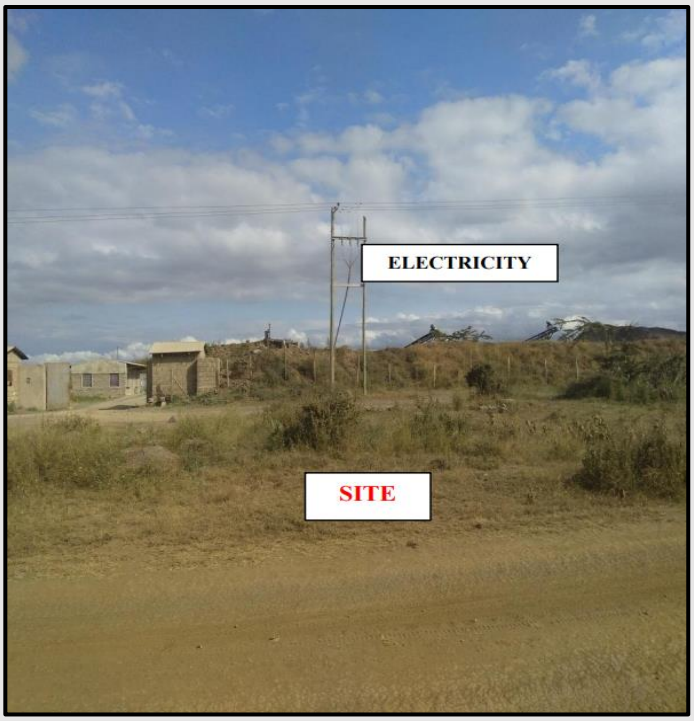
The County has estimated mobile network coverage of about 85% with good internet connectivity supported by both the mobile network and fibre optic cable. According to 2019 Kenya population and Housing census, Machakos County was ranked position 11 out of 47 with 67.7% of households owning mobile phones. However, Mwala, Kibauni, Yathui and Kalama are some of the areas with poor network coverage.

4.6.3 Energy Access

The main source of energy for cooking and lighting is wood and electricity respectively. Other sources of energy across the County are solar, wind, biogas, gas, charcoal and paraffin.

Masinga dam is one of the Seven Folks dams, which produce hydroelectric power for the national electricity grid. There is increasing connectivity to the national grid across the County because of the implementation of 'last mile' power project by the national government.

The proponent proposes to apply for electricity connectivity from the Kenya Power and Lighting company. pending on the estimated energy demand KPLC might decide to set up a substation to cater for the plant's energy demand. The site is within reach to the already existing electricity grid system. Electricity demand will be supplemented by use of a standby generator and solar renewable energy



4.7 Land and Land Use

4.7.1 Land Ownership Categories/Classification

Land is a very important factor of production in the economy. It is mostly used for agriculture, livestock keeping, ranching, industrialization, mining, forestry, government reserve, housing and urban development. The absence of a county spatial planning framework in Machakos has led to the proliferation of informal settlements, congestion, environmental degradation, unplanned urban centers, pressure on agricultural land and land use conflicts.

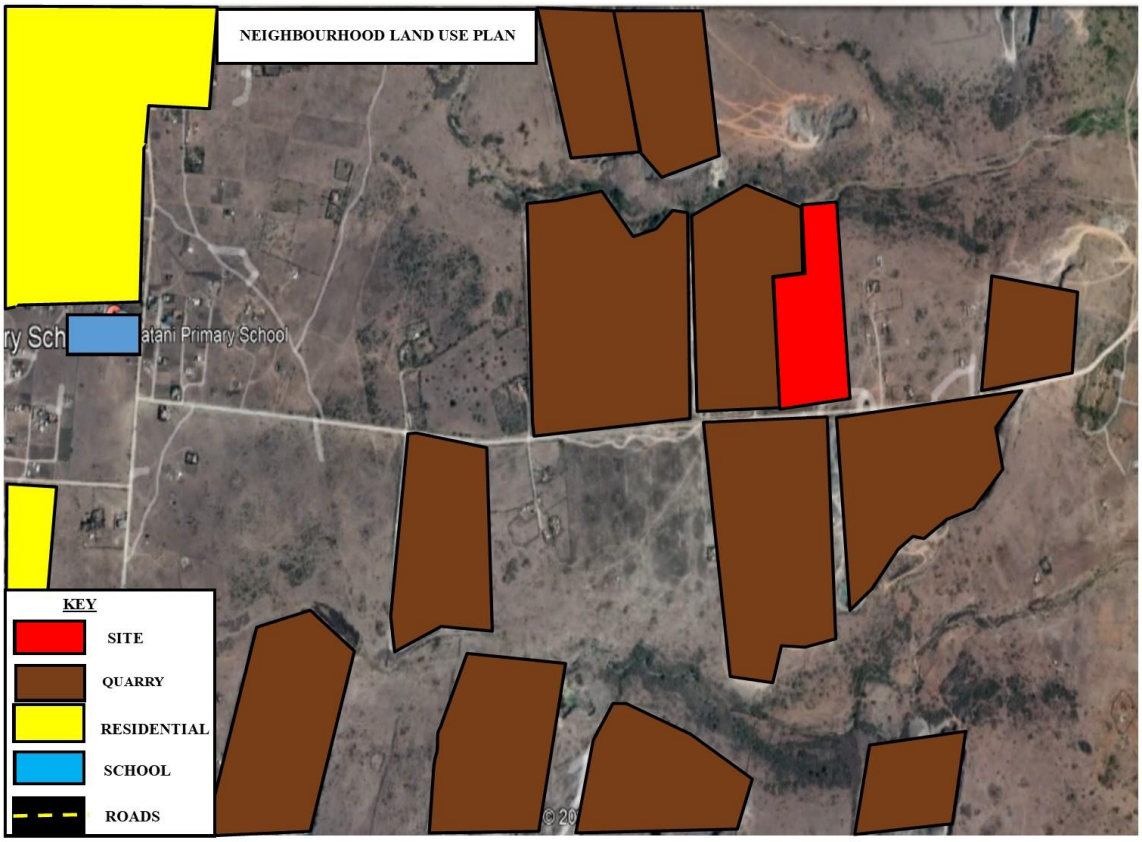
Land use in Machakos County urban centers is generally mixed development. There are no clear-cut zones for specific land uses in the county. This is because all the existing physical development plans except Machakos New Town Local Physical Development Plan are outdated hence not in force. There is no well-defined zoning policy in the county that guides land use development in all its urban centers sometimes leading to overlaps and mixing of incompatible land uses. There are 2 basic land use structures which are rural and urban. Rural: Agriculture (arable), Urban: residential, commercial, industrial, recreational, wildlife, rangeland.

The subject property was registered as agricultural user. The property owners made an application to the Machakos County government and a change of user approval was granted from Agricultural use to Industrial use (Steel plant). The approval (PPA2) is annexed. This is intended to conform to all the planning requirements, more so the plot coverage and plot ratios of the neighborhood character. The operational activities of the proposed plant shall be done in harmony with the general neighborhood in all aspects.

Accordingly, the idea is to synchronize the site development with the local environmental factors so as to create visual and ecological harmony between the developments in scale and design style.

4.7.1.1 Agriculture land use

Agriculture is the dominant land use in Machakos County with over 75% of the land in Machakos County



is used for agricultural purpose. About 20% of the total land of Machakos County is cultivated. Most people live on their farms and sub-divide them for different uses.

The proposed site neighborhood used to be predominantly agricultural land but the owners have changed used both through illegal developments and statutory applications through the county. The proponent has applied and obtained a change of use approval from Machakos County Government from Agricultural to Industrial use (Steel Mill).

4.7.1.2 Residential land use

In general, the residential land use in the County is mainly concentrated in urban centers. Low density residential land use is mainly observed as one moves away from the urban centers. The current growth of the residential land use is largely informal since most developments do not seek development permits.

However, the rural setting that dominates Machakos County presents a scenario where people live on a portion of land where they do their farming.

There are visible residential developments in Katani area and Mavoko Subcounty at large. Residential development in the area is well planned. This has been depicted through organized gated communities and individual developments like the ones outlined below.

Gratewall gardens gated community in Mavoko Subcounty

Individual residential development in Mavoko Subcounty

4.7.1.3 Commercial land use

The commercial activities are mainly concentrated along the main roads and highways passing through the urban centers, rural centers and market centers forming a linear pattern. The commercial activities here include retail outlets, stalls and street traders, hotels/restaurants.

Similarly, more pockets of commercial nodes are emerging within some of the residential areas but in an informal trend.

In the immediate project area, some of the most common commercial activities include, general stores, general hardware's, hotels, roadside vending activities, grocery stores. Most of these activities are found in Katani shopping center.

4.7.1.4 Industrial land use

Most of the heavy industries in Machakos County are concentrated in Mavoko Sub County. The other towns mainly have light industrial establishments. Machakos County has a potential for agricultural and fruit processing plants mainly for maize and other grains grown as well as indigenous and exotic mango fruits.

Some of the industries in the area include the following;

1. **Cement factories**

Simba cement company in Mavoko Subcounty

Mombasa Cement Company in Athiriver- Mavoko Subcounty

2. **Steel Mill Factories**

Endmore Steel Millers Factory in syokimau Mavoko Subcounty

Devki Steel Mills Factory in Athiriver Mavoko Subcounty

3. Quarry activities

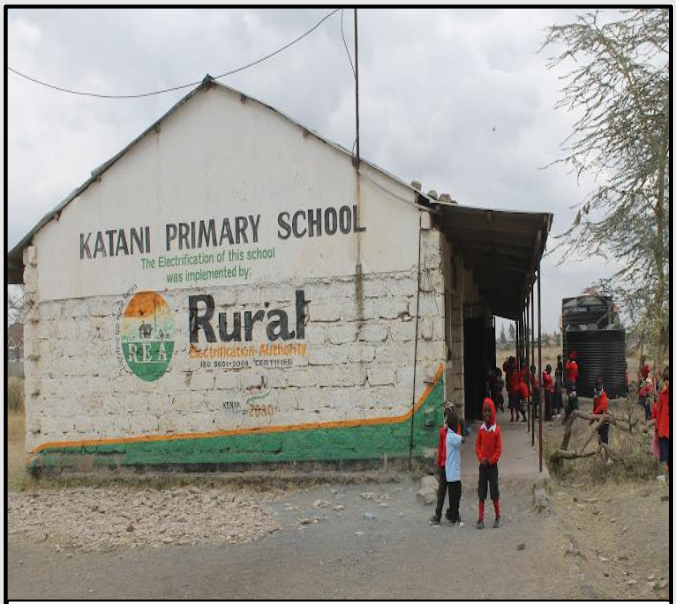
Quarry activities in Katani area (Irucha Quarry)

H-young Quarry in Katani area near the proposed project site

4.7.1.5 Educational land use

There are more than 896 public primary schools, 301 public secondary schools, 147 private primary schools, 73 private secondary schools, village polytechnics, colleges and universities such as Daystar University.

Viraj International School in Katani area of Mavoko Subcounty



Katani Primary School, In Katani Area of Mavoko Subcounty.

4.7.1.6 Recreational facilities land use

Most of the County's urban centers have inadequate recreational facilities. The open spaces in existence are not easily accessible and lack the necessary facilities for recreation purposes with exception of Machakos People's Park in Machakos Town which is open to the public for range of recreational activities such as boat ridding, children's games, events, zip-line, filming etc.

4.7.1.7 Mean Holding Size

The County has total land area coverage of 6,028km2. Out of this, approximately 2,793KM2 is arable land while rest is non-arable and under water mass. According to Kenya Integrated Household and Business Survey 2005/2006, Machakos County had a mean holding size of 3.9 acres and mean agricultural parcel of 2.4 acres.

4.7.1.8 Percentage of Land with Title Deeds

According to Kenya Integrated Household and Business Survey 2005/2006, Machakos County has 28.5% of proportion of parcels with title deeds. The most affected areas without title deeds are Athi River, Machakos and Kathiani. This has led to land ownership conflicts among interested parties.

4.7.1.9 Incidences of Landlessness

Most landlessness incidences are prevalent in urban areas such as some parts of Machakos Town, Mavoko and Matungulu Sub-counties. Landlessness in the County is as a result of high population and urbanization.

4.8 Employment

4.8.1 Wage Earners

There are few formal employment opportunities within the County. Majority of employees in the County are casual laborer's working in the farms, construction, manufacturing and textile industries.

4.8.2 Self Employed

Most residents in the County are self-employed. Those living in the rural areas engage in agricultural activities while those in the urban areas engage in small scale businesses as their sources of livelihood. The national government has set up various funds such as Youth Fund, Uwezo Fund and Women Fund to provide affordable credit to small businesses and/or self-help groups to start or improve their businesses and agricultural activities. On the other hand, the County Government has set up a fund to support women commonly referred to as table banking.

4.8.3 Labor Force

The County has a high number of skilled and unskilled labor which is steadily increasing. This poses a major challenge in matching employment opportunities with the surplus labor.

4.8.4 Unemployment Levels

The unemployment rate in the County is high due to increasing level of labor force with unmatched slowly growing commercial sectors. In addition, land use change from agricultural to real estate development and other uses has shrunk employment opportunities in agriculture sector.

Mostly, the youth are unemployed due to their preference for white collar jobs, shying off from agriculture and inadequate financial empowerment.

4.9 Irrigation Infrastructure and Schemes

4.9.1 Irrigation Potential

The County has a great potential for new irrigation schemes and enlargement of the existing ones. There are 15 proposed new irrigation schemes, which sum to 1,725 acres spread across six sub-counties

4.9.2 Irrigation schemes

Currently, the County has 12 irrigation schemes established by both the National and County Governments. The total area under irrigation is 3,220 acres. Four of these are large scale, namely:

i. Yatta Furrow – 1,000 acres
ii. Kabaa Irrigation Scheme – 750 acres
iii. Kamuthambya Irrigation Scheme – 500 acres
iv. Kayatta Irrigation Scheme – 400 acres

4.10 Crop, Livestock, Fish Production and Value Addition

4.10.1 Main Crops Produced

Approximately 60% of total land area in Machakos is arable. Agriculture is the main activity carried out in most of the sub-counties. The main cash crops are coffee, mangoes, citrus, french beans, pineapples, flowers, sorghum and vegetables. The food crops grown include maize, beans, pigeon peas, green grams, cowpeas and cassava which are cultivated in small scale. The County aims to increase the productivity of arable land through use of quality farm inputs, appropriate mechanization, irrigation and good agricultural practices.

4.10.2 Average Farm Sizes

The average farm size for small scale and large-scale farming are 0.756Ha and 10Ha respectively. The County is experiencing a constant decline in arable land due to climatic change risks and change in land use mainly from agriculture to real estate development.

4.10.3 Ranching

The County has 13 ranches namely Kasisi, B&T Malinda, Carol Malinda, Machakos ranch, Kyelu, Lukenya, Game ranch, Maanzoni, Kakenyi, Kapiti, Mwambi, New Astra and Lisa. Three (3) are located in

Machakos Sub- County while thirteen (13) in Mavoko Sub- County. The livestock in these ranches include cattle, sheep and goats.

4.11 Mining

4.11.1 Ongoing Mining and Extraction Activities

The major mineral deposits within the County are limestone, granite and sand. Most of the major cement factories in Kenya are located in Mavoko Sub- County namely Bamburi Cement, East Africa Portland, Mombasa Cement, Ndovu Cement, Simba Cement, Athi River Mining and Savanna Cement. Sand is mostly harvested along the river beds by private individuals. In addition, there are quarries for stone mining.

4.12 Industry and Trade

Industries in the County are mostly located in Athi River, Mavoko Sub- County. Some of these include cement industries, agro-chemicals industries, steel plants and textile industries in EPZ, among others. Trade across the County is mainly on small scale basis. However, there are large scale businesses like godowns, business parks, industrial parks, malls and supermarkets. These are bound to increase drastically because of development of modern infrastructure across the County.

4.13 Water and Sanitation

4.13.1 Water Resources

Machakos County is a water scarce County with its water situation levels below the national natural endowment of 647m3 per capita per year. Its arid and semi-arid areas are critically limited in water endowment. This serious water stress adversely affects food production and often disrupts economic development. To address the water scarcity situation, more investment in water storage infrastructure should be done to increase water storage per capita.

Water resources in the County are mainly seasonal rivers, dams and springs. Furthermore, the County has two perennial rivers. One of them traverses the County namely Athi River and the other namely Tana River forms the County boundary with Embu and Tharaka Nithi counties. The dams include Maruba, which is the main source of the water consumed in Machakos town whereas Masinga dam on Tana River is shared between Machakos and Embu counties. In addition, several earth dams and springs across the County serve as water resources. Underground water sources (boreholes and wells) supplement surface water sources. Most of these water sources are under threat of pollution from agricultural chemicals, urban and industrial wastes especially Athi River, which is under threat of pollution from the Nairobi city and adjacent towns. The water resources are also under pressure for use in agricultural irrigation, domestic, industrial and use for hydroelectric power generation.

4.13.2 Water Supply Schemes

We have water supply schemes managed by water companies; these are Machakos Water & Sewerage Company (MACHWASCO) whose source of water is Maruba dam and various boreholes, Mavoko Water & Sewerage Company (MAVWASCO), Yatta Water Company (YAWACO), Matungulu-Kangundo Water & Sanitation Company (MAKAWASCO), Mwala Water & Sanitation Company (MWAWASCO), Kathiani Water & Sanitation Company Ltd (KAWASCO) and other various community water supply schemes. Water companies, also known Water Service Providers (WSPs) are officially under the County Government as per the Water Act 2016.

4.13.3 Water Management

There are several bodies whose mandate is to regulate and control the use and management of water resources, namely:

- Water Resources Authority (WRA) – this body regulates, manages and protects water resources
- National Environmental Management Authority (NEMA) – this body formulates and implements policies on water resource use and conservation
- Water Services Regulatory Board (WASREB) – this body sets and regulates water tariffs for Water Service Providers (WSPs)
- Ministry of Water & Irrigation – both National and County Government
- Water Resource Users Associations (WRUAs) − It's a grassroots water resources management and conflict resolution body.

4.14 Sanitation

The County Government has improved sanitation through provision of super clean and free toilets in public places such as bus parks and market centers across the County. This aims to make Machakos County an open defecation free County. There are two sewer lines in Machakos and Athi River towns. However, the former is partially connected to sewer lines- this includes parts of Kariobangi and Mjini where more than 50% use pit latrines. Garbage disposal is done by the County Government, private firms and individual households.

4.15 Health Access

The construction of health facilities programme through Economic Stimulus Programme (ESP) and Constituency Development Fund (CDF) led to increase in health facilities in all sub-counties.

The County Government has greatly improved the health facilities with one Level 5 hospital located at Machakos town and four Level 4 hospitals in Kathiani, Mwala, Matuu and Kangundo.

Other health facilities by ownership include 193 under the County Government, 32 owned by FBOs, 9 owned by NGOs and 128 private-owned. The total health facilities in the County are 367.

Most of the health facilities are found in the urban areas. Patients/clients in rural areas travel longer distances to access health services. In response, the County Government has instituted measures to ensure access to well-equipped health centres within the wards.

4.16 Education, Skills, Literacy and Infrastructure

Education provides individuals with technical or professional skills and increases their chances and capacity to obtain a higher income and standard of living. Literacy levels in the county stand at 92.4% of which male and female literacy levels is 95.4% and 89.4% respectively.

4.16.1 Pre-School Education

Pre-school Education is fundamental for child development and literacy improvement in the County. There are 1,468 ECDE centres with enrolment of 57,581 children and 2,115 ECDE teachers. The Gross Enrolment Rate (GER) and Net Enrolment Rate (NER) is 53% and 50.7% respectively with teacher pupil ratio of 1:27. This figure of pre-school enrolment is small relative to population of 155,230 children falling within the age group of 3 to 5 years (pre-school). There is therefore need for strategies to ensure 100% enrolment to pre-school.

4.16.2 Primary Education

The County has 862 public and 252 private primary schools with a total population of 332,089 pupils and 7,947 teachers. The GER and NER is 116.9% and 96.7% respectively with teacher pupil ratio of 1:42. Since the introduction of free primary education, the enrolment rate for both girls and boys has increased and transition rate from primary school to secondary school improved.

Infrastructure in schools has also improved through devolved funds e.g., Constituency Development Fund (CDF). However, the County still needs to invest more in the provision of education facilities to cater for the increasing school going population.

4.16.3 Non-formal Education

Education enrolment in non-formal institutions is 79, 290 and 37, in primary, secondary and vocational institutions respectively, giving a total enrolment of 406.

4.16.4 Secondary Education

There are 434 secondary schools both private and public with a population of 115,000 students and 3,890 teachers in the County. The GER and NER in secondary schools is 94.4% and 79.4% respectively with teacher student ratio of 1:30.

4.16.5 Youth Polytechnics

The County has 37 youth polytechnics spread across the County with a population of 3,150 students and 260 instructors. This figure is bound to increase as the County Government embarks on promotion of skilled based centres.

4.16.6 Tertiary Education

There are three fully fledged universities in the County i.e. Machakos University, Daystar University and Scott Christian University located in Mavoko and Machakos Constituencies. In addition, there are other university colleges and various learning institutions located in the major towns across the County. The County also has 2 public medical training colleges namely Manza and Machakos and 2 teacher training colleges which are Kilimambogo and Machakos.

416.7 Adult Education and continuing Education

There are 209 adult education registered centres offering basic education with a student population of 6,672 and 161 teachers. The enrolment of females in adult education is higher as compared to males; like in 2016, the females and males were 5,726 and 946 respectively.

4.16.8 Technical, Vocational Education and Training

There are 23 registered TVTs in the County offering certificate and diploma courses in technical skills. Notable training institutions in the County include Agriculture Training Centre (ATC), Kenya Meat Training Institute (KMTI), National Industrial Training Authority (NITA) and National youth service school of Agriculture.

4.16.9 Special Schools

The county has four special schools. These are Machakos school for the blind and Machakos school for the deaf which cater for the sight and hearing impairment respectively, Wamunyu and Katangi schools for the mentally challenged.

CHAPTER FIVE

5.0 PUBLIC CONSULTATION AND PARTICIPATION

5.1 Legal Requirement

During the field survey for the proposed development of a Steel Processing plant, public consultation formed an integral part of project development. This was done pursuant to the Environmental Management and Coordination Act CAP 387. Section 17 of the Environmental (Impact Assessment and Audit) Regulations of 2003 amended 2016, requires that all E&SIA Studies incorporate Public Consultation (PC). The aim of the PC is to ensure that all stakeholders interested in a proposed project (including project beneficiaries and the general public in the vicinity of the proposed project) are identified and their opinion considered during project planning, design, construction, operation and decommission phase.

5.2 Overview.

Community Consultation and Public participation is a key part that aims at involving the public in the project development and implementation. The main aim of public participation is to ensure a participatory approach in development which ensures acceptability of the project by the community and neighbours and any uncertainties addressed. For this proposal public participation conducted involved: enlightening the public on the proposed development documenting their opinions and views from the meeting.

During the writing and preparation of this ESIA on the proposed project site, the project team and experts visited the site and assessed the suitability of the site to the proposed project. The team and ESIA expert also visited the community and held consultative meeting with more than 50 community members and neighbours about the proposed project. The minutes of the meeting together with photos and attendance list are provided in this brief report and is annexed at the end of the ESIA final report.

Further consultation was done through the use of 30 semi structured questionnaires that were randomly given to the area residents around the nearest neighborhood 0.5-2km away. The respondents were mainly residents or villagers and had resided in the area for a period of between 2 months-37 years. Out of those interviewed, 2% were not aware of the proposed project while 98% were aware of it. Mostly, the respondents had the same views on the impacts associated with the development, however, some respondents had different opinions of importance that would arise as a result of the implementation of the proposed project development. The perceived benefits were as follows: -

- The proposed development will provide steel products to the county and country at large.
- The proposed development would create employment opportunities to the local community.
- There will be improved aesthetic and development in the area
- The already existing businesses will have a boost from workers in the proposed project site.

- Optimal use of land area.
- The project will open up the area for more developments
- As an obligation of corporate social responsibility (CSR), the proponent promised to further initiate and fund community projects either in water, health or education sector

The respondents also cited the following as possible problems or negative impacts which could arise from the proposed project:

- Generation of dust temporarily during construction phase
- Solid and liquid waste generation and management
- There will be noise pollution arising from the construction activities which are mainly movements by the trucks.
- There will be air pollution arising from dust particles emitted during site preparation and construction and operation phase.
- The project will require huge water volumes which might lead to water shortage
- Accidents resulting from falls in the open grounds during or after the project operations are complete

The respondents gave the following as possible mitigation measures to reduce or prevent the problems and impacts:

- The proposed project site should be well fenced around and signs indicating a construction going on mounted to condone the area from unauthorized trespassers.
- Collection and appropriate disposal of solid waste and construction debris from the construction works and materials.
- The site should be watered to prevent too much dust during construction and transportation by trucks.
- Use of less noisy machines and equipment; there should be no blasting.
- The workers should be provided with personal protective gear during the operations.
- Ensure that the site development operations are carried out during the day.
- Enhanced monitoring and control of vehicular movement
- Put bumps on the roads to avoid accidents.
- No use of vibrant explosives at the site.
- Ensuring construction work is undertaken during the day
- Training and awareness of construction workers and staff on safety precautions.

- Transport and storage of materials in bulk to avoid making of many trips
- Water harvesting and solar power utilization
- Adequate and properly designed waste/grey water treatment and disposal system

Overall, the respondents recommended the implementation of the project.

5.3 Grievance Redress Management (GRM).

Grievance redress Mechanism (GRM) is a critical component of effective ESMP implementation. The purpose of GRM is to provide a forum to the internal and external stakeholders to voice their concerns, queries and issues with the project. Such a mechanism would provide the stakeholders with one project personnel or one channel through which their queries will be channeled and will ensure timely responses to each query.

This will allow for trust to be built amongst the stakeholders and prevent the culmination of small issues into major community unrest. The GRM will be accessible and understandable for all stakeholders in the project and for the entire project life. The GRM will be communicated to all relevant stakeholders and will also be applicable for any contractor that will occupy and/or use land during the construction and operations phase.

This section contains the following:

i. Grievance definition and categories and GRM principles;
ii. The process of receiving, documenting, addressing and closing grievances

5.3.1 Grievance definition and categories

As stated earlier, a grievance is a concern or complaint raised by an individual or a group within communities affected by company operations. Both concerns and complaints can result from either real or perceived impacts of a company's operations, and may be filed in the same manner and handled with the same procedure.

Grievances may take the form of specific complaints for actual damages or injury, general concerns about project activities, incidents and impacts or perceived impacts. Based on the understanding of the project area and the stakeholders, an indicative list of the types of grievances have been identified for the project, as can be seen below: -

i. **Internal Grievances:** Grievances from Employees (including both direct and indirect employees, including local workers and migrant workers through contractors):
    - Complaints pertaining to amount of wage, salary, other remuneration or benefits as per Company's Human Resource policy;

- Timely disbursement of remuneration;
- Gender discrimination;
- Sexual harassment
- Sexual exploitation and abuse by project workers against community members
- Violence against children
- Gender-based violence
- Issues related to workers' organization.
- Labour Accommodation
- Health and Safety issues
- Extended working hours

ii. **External Grievances:** Grievances from community members:

- Issues related to sexual exploitation and abuse
- Issues related to gender-based violence at the community-level
- Issues related to child labour and protection
- Issues related to transportation and traffic;
- Increase in environment pollution;
- Impact on community health;
- Disturbances to locals due to influx of migrant workers in the area;
- Issues arising out of sharing of employment and business opportunity;
- Concerns over the impact on local cultures and customs; and

The list of grievances will be regularly updated as and when the new one arises.

5.3.2 Internal Grievance Mechanism – Project GRM

During consultations, it was revealed that the proponent will require a Community Liaison Officer (CLO) who will serve to meet all community liaison responsibilities. The officer will be tasked with the responsibility of ensuring the effectiveness in implementation of the grievance mechanism. The grievance mechanism will be advertised and announced to affected stakeholders so that they are aware of their rights to submit comments and how to go about it. The grievance mechanism will be founded on the following principles:

Responsibilities will be adequately assigned: A responsible person or team will be constituted and mandated to organize the resolution of grievances. This will enable the system run without undue impediments.

The process will be accorded due importance: It is important for affected communities and other stakeholder groups seeking to have their complaints resolved, to perceive the grievance management process as transparent and fair. The proponent grievance management process will enhance outcomes and give people satisfaction that their complaints have been heard, even if the outcome is less than optimal.

The grievance procedures will be readily understandable, accessible and culturally appropriated by the local population. From the outset, clarification will be made on who is expected to use this procedure. The people will be assured that there will be neither costs nor retribution associated with lodging a grievance. The entire process (from how a complaint is received and reviewed, through to how decisions are made and what possibilities may exist for appeal) will be made as transparent as possible through good communication

The Mechanism will be scaled as needed for the Project: The proponent grievance mechanisms will be designed to fit the context and needs of the project. As much as possible, it will have relatively simple means of addressing complaints, such as through community meetings, community liaison personnel and suggestion boxes allowing for anonymity. It may also need a more formalized process and mechanism, and a higher level of dedicated resources for receiving, recording, tracking, and resolving complaints. The grievance mechanisms will not be taken as a substitute for community engagement process or vice-versa. The two are complementary and will be made mutually reinforcing. Not all grievances shall be handled in the same way. Proponent will consider creating different levels of redress within the grievance mechanism that correspond to the scale and seriousness of the complaint.

The process will be documented and publicized: The process will be put in writing and publicized. Proponent recognizes that the GRM cannot be effective if nobody knows about it. Thus, the grievance procedures will be put into writing, publicized, and explained to relevant stakeholder groups. The people will be informed on where to go and whom to talk to if they have a complaint, and understand what the process will be for handling it. As with all information, it will be provided in a format and language readily understandable to the local population and/or communicated orally where it's established that literacy levels are low. It will not be overly complicated to use nor will it require legal counsel to complete.

Independent third parties will be brought in where needed: Proponent recognizes that sometimes ensuring "fairness of process" for affected individuals or groups require certain measures to level the playing field of perceived power. Thus, at a minimum, the host communities will need to have access to information. Proponent will facilitate this by providing project-related information in a timely and understandable manner. In cases where significant imbalances in knowledge, power, and influence exist, it may wish to

reach out to other partners to assist in the process. In terms of advocacy, an NGO might be brought in to assist local communities and advocate on their behalf.

Where mediation is desired, academic or other local institutions may be sought out to play an "honest broker" role in mediating between the client and stakeholder groups. In certain circumstances, the client may consider providing funding for such third-party advice or facilitation in a way that is acceptable to all parties and does not compromise the integrity of the process

The process will be made accessible: Projects that make it easy for people to raise concerns and feel confident that these will be heard and acted upon can reap the benefits of both a good reputation and better community relations. One of the best ways to achieve this is to localize your points of contact. Hire people with the right skills, training, and disposition for community liaison work and get them into the field as quickly as possible. Maintaining a regular presence in the local communities greatly helps to personalize the relationship with the company/farm and engender trust. Talking with a familiar face who comes to the village regularly, or lives nearby, creates an informal atmosphere in which grievances can be aired and sorted out, or referred up the chain of command. This is usually more convenient and less intimidating to people than having to travel distances to the company offices during business hours to file a formal complaint.

Response time will be defined and transparency upheld: Proponent will publicly commit to a certain time frame in which all recorded complaints will be responded to and ensure this response time is enforced. This will help allay frustration by letting people know when they can expect to be contacted by Proponent personnel and/or receive a response to their complaint. Combining this with a transparent process by which stakeholders can understand how decisions are reached will inspire confidence in the Proponent system. During critical times such as construction, will be immediate responses to time-sensitive complaints. A related issue is making sure that the community liaison officer has the authority to resolve basic complaints herself, as well as a direct reporting line to senior managers if the issue is more serious or costly to address.

Good record-keeping and feedback: A log book will be kept where necessary, and a sophisticated database will be maintained where required. Written records of all complaints will be kept as this is critical for effective grievance management. The record shall contain the name of the individual or organization; the date and nature of the complaint; any follow-up actions taken; the final result; and how and when this decision was communicated to the complainant. Overly personal data such as national identity and phone numbers will be optional and kept confidential unless required to disclose to authorities. In addition to informing the complainant of the outcome (in writing where appropriate), as part of the broader community

engagement process Proponent will report back periodically to communities and other stakeholder groups as to how the company has been responding to the grievances it has received.

There will be a separate reporting mechanism for GBV, SEA and SH cases that are discrete and anonymous. The liaison officer will be the focal point and will establish the system to handle these complaints that will include reference to confidentiality, safety and survivor-centered approach. All registration of the data will be confidential and anonymized.

Access to legal remedies will not be impeded: If the project is unable to resolve a complaint, it may be appropriate to enable complainants to have recourse to external experts. These may include public defenders, legal advisors or NGOs. The client may find that it can work in collaboration with these third parties and affected communities to find successful resolution of the issues. However, this is not always possible, and situations may arise where complainants will choose to pursue legal recourse. In this case, the proponent will not impede access to these mechanisms.

5.3.3 Publicizing and Disclosure of the GRM

The GRM will be disclosed to the stakeholders through written and verbal communication. The mediums to be used for this purpose are staff meetings, written communication and one-to-one meetings. Each worker and employee shall be made aware of the GRM in place at the time of joining, as part of the induction process.

5.3.4 Receiving and Recording Grievances

As part of the GRM, the grievances from the stakeholders or their representatives may be communicated verbally (in person to the respective supervisor or over a telephonic conversation) or in written form (in the form given below). All grievances communicated in any of these mediums shall be recognized and recorded by the supervisor as and when it is expressed.

The project should also put in place suggestion/ complaint boxes at strategic locations across the facility. These suggestion/complaint boxes will be opened at least every week. The employees and workers may drop their grievances in these boxes as well in keeping with the format attached.

In case of any worker or employee needs to file an anonymous complaint, s/he shall be allowed to do so by not filling the name, department, signature and contact information.

5.3.5 Maintaining a Grievance Register

Each grievance thus received, shall be recorded in a grievance register. The format for the grievance register shall be provided.

This grievance register shall be updated at each stage of the grievance redressal. Once the grievance is recorded in the register, a preliminary analysis shall be undertaken by the grievance officer (preferably HR representative) to ensure that the grievance is within the scope of the GRM.

5.3.6 Acknowledgement of Grievance

Once the grievance is received, a grievance number shall be allocated and communicated to the grievant. This communication shall also serve as an acknowledgement of the grievance. In case the grievance is assessed to be out of the scope of the GRM, a communication towards the same shall be made to the grievant, and an alternative mode of redressal shall be suggested.

As part of this acknowledgement a tentative timeline for the redressal of the grievances shall be identified, in keeping with the process below. This acknowledgement shall be provided on the same day as the grievance is received.

5.3.7 Resolution and Closure Allocation of Responsibility

Once the grievance is received and recorded, based on the subject and issue, the Grievance Officer shall identify the department, contractor or personnel responsible for resolving the grievance.

The Grievance Officer and concerned department shall then undertake an enquiry into the facts and figures relating to the grievance. This shall be aimed at establishing and analyzing the cause of the grievance and subsequently identifying suitable mitigation measures for the same. The analysis of the cause will involve studying various aspects of the grievance such as the employees past history, frequency of the occurrence, management practices, etc.

As part of this investigation, the grievance officer may also undertake confidential discussions with the concerned parties to develop a more detailed understanding of the issue at hand. The site investigation shall be completed in no more than 10 working days of receiving the grievance.

Resolution, Escalation and Closure Based on the understanding thus developed, the grievance officer, in consultation with the concerned departments, shall identify a suitable resolution to the issue.

This resolution shall be accordingly communicated to the grievant within 10 working days of completing the site investigation. In case the issue is beyond the purview of the grievance officer, it should be escalated to the department head or proponent.

A communication regarding the same shall be provided to the grievant. The developer shall in turn endeavor to resolve the grievance within 10 working days of the escalation.

The proponent shall endeavor to resolve the grievance within 10 working days. If, however the proponent is not able to identify an adequate resolution for the grievance, then an adequate response shall be given to

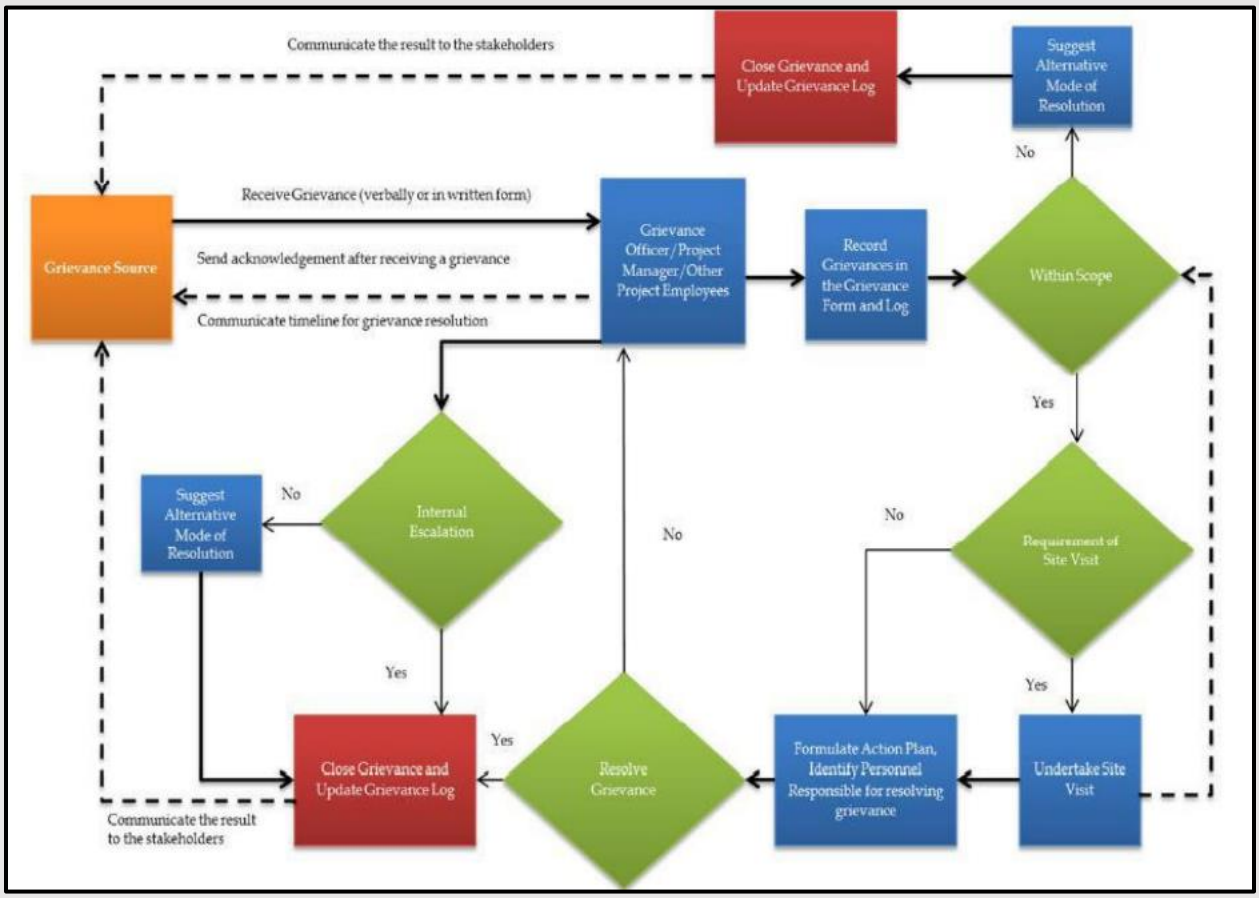
the grievant along with a suggested alternative resolution to the grievance. If at any stage, the grievant is not satisfied with the solution, s/he may choose to ask for an escalation of the grievance to the next level.

5.3.8 Update of Records

The records of the grievance register shall be updated every working week with the present status of the grievance. Once the grievance is resolved, and the same has been communicated to the grievant, the grievance shall be closed in the grievance register. The grievance register should also provide an understanding of the manner in which the grievance was resolved. These instances shall then serve as references for any future grievances of similar nature. In case of anonymous complaints, a summary of the grievance and resolution shall be posted on the notice boards and other relevant public places.

5.4 External Grievance Mechanism

The process to be followed for the redressal of the external stakeholder grievances is summarized below.



5.4.1 Publicizing and Disclosure of the GRM

The GRM will be disclosed to the stakeholders through written and verbal communication. The mediums to be used for this purpose are public meetings, group discussions, and provisioning of the GRM in the manner outlined in the previous section. The GRM disclosure will be done along with the disclosure of other management plans.

5.4.2 Monitoring of the GRM Implementation

It is important to monitor GRM to ensure that the grievances are addressed and resolved. The monitoring of the GRM implementation will be undertaken on a monthly basis by the proponent team. Monitoring will include:

- Auditing the implementation of the GRM;
- Monitoring the formal and informal consultation activities conducted with the stakeholder groups with respect to GRM;
- Tracking feedback received from engagement activities
- Recording and tracking commitments made to communities; and
- Assessing the efficacy of the engagement activities in terms of the desired outcomes and the participation of the stakeholder groups

5.4.3 Reporting of the GRM

The performance of the GRM will be reviewed on a quarterly basis during the implementation period. For the purpose of review, the quarterly reports will be considered for analysis and discussion. On the basis of these reports, a Grievance Redressal Report will be prepared.

Sample Grievance Recording Form

GRIEVANCE REGISTRATION	
CASE No.	**DATE**
Name	
Department/Contractor	
Phone number	
Details of grievance	
Name of Person Recording Grievance	
Designation of Person Recording Grievance	
Proposed Date of Response to Grievance	
Signature of Recording Person	Signature of Complainant
GRIEVANCE REDRESS RESPONSE	
Date of Redress	
Decision of GO (Give full details)	

CHAPTER SIX

6.0 PROJECT ALTERNATIVES

6.1 Overview

A careful assessment affirms that most of the potential negative impacts in the project can be mitigated with significant level of success.

6.2 Appraisal of Alternative Development Options

6.2.1 No Development Option

The nil intervention describes a situation in which the proponent does not undertake the proposed steel processing plant development. In terms of environmental considerations this is the best option, however, this option would imply economic loss to the proponent, local and national economics. The project site is currently underutilized while there is substantial steel products demand in the area and beyond.

In case the authorities such as NEMA settle for no development intervention, the owner would lose in terms of financial commitments already made in design and planning of the project. This includes approval application fees to the County government of Machakos; professional fees to EIA lead experts and physical planners. The option would similarly make the jobs that the project envisioned to create to be forgone. The county and national government will also lose the tax income that the project would generate if implemented. Needless to add that the project will increase supply of Steel products and associated facilities in the area, its disapproval would further constrain the government's objective to provide access to steel products.

6.2.2 Relocation Option

The other option available for the project implementation is for the proponent to relocate it to an alternative site. At the moment, the proponent does not have an alternative site. This implies that he has to buy another piece of land elsewhere. Looking for land of the similar size and market location and completing official transactions might take over one year, with no guarantee that the land would be available, and if such land is available, its cost might be beyond affordable for the proponent.

The proponent will have to restart the planning, design, and approval of the project afresh. The proponent will need to re-engage professionals like EIA lead/audit experts and physical planners to assess the viability of the new site. Additional costs will arise from the design and approval of the architectural and structural drawings for the new site. In addition, the proponents will have to send a planning brief to the county government, place a public notice on site and in the local daily newspaper. By the time the proposal is approved by authorities, economic parameters such as cost of building materials and equipment would have changed. This would lead to a situation like zero option and the project may no longer be viable leading to

eventual abandonment. The stand-off will discourage local and international investors from investing in Steel processing or the metal sub-sector, manufacturing sector and/or construction industry.

6.2.3 Exploration of Alternative Land uses

The developer could explore other uses for the site such as commercial, institutional, recreational, and/or light industry. If studies establish that these are better suited to the site in functional and economic sense, then the developer could apply for change/extension of user to allow for such development. However, the field survey revealed that the property is in high proximity to other existing developments. The light industry may lack complementary linkages in the neighborhood. Considering the foregoing coupled with the necessary procedural requirements for effecting such change, this option does not offer significant advantages over the current proposal. The proponent has already applied and obtained a change of use approval for the proposed Industrial use (steel mill)

6.2.4 Preferred Development Option

All the alternative options analyzed have implications, which make the current design option proposed by the proponent to be more viable. It is concluded that:

- The alternatives are likely to reduce the returns to investment that the proponent would have realized if the current proposed design were to be approved
- The alternatives are likely to reduce the amount of Steel processing plants that the proponent is willing to supply in Katani area of Mavoko sub-county.
- Prime land in Katani area is scarce and costly. Because of this, the proposed project may not be relocated to an alternative site within Mavoko Subcounty.
- There are several developed Steel processing plants in the neighborhood whose construction the County government of Machakos approved.
- The proposed development will therefore blend easily with the current development trend in Mavoko area and its neighborhood.

6.2.5 Alternative source of power.

i. Main Electricity.

The site is already supplied with power from the main Kenya power grid. This is the preferred option by the proponent since it will require only internal working and approvals from Kenya Power Company. The option is cheap on the short term but expensive in the long run due to the recurrent electricity bills during operation phase.

ii. Solar Power

The project area has a high potential for solar energy since the location has about 6 to 7 sunshine hours in a day. Solar power is therefore recommended for green energy but initial cost of installation of solar panels, batteries and other accessories is prohibitive. This study recommends that the proponent considers a combination of both mains and solar power be used especially mains for the bulk energy supply and solar for water heating. Solar energy will minimize expenditure on electricity bills. The structures should be built to enhance use of natural lighting during the day. Using solar power for the whole project would be the most preferred option environmentally but, the capital outlay will be large beyond the means of the proponent. Besides the energy requirement for the plant are huge and may not be generated by solar power installations.

CHAPTER SEVEN

7.0 IMPACT IDENTIFICATION, ANALYSIS AND MITIGATION.

7.1 Overview

Construction of the proposed Steel Processing and storage Plant is likely to present several environmental impacts. These can be either positive or negative.

7.1.1 Impact identification and predication

The type, scale and location of the proposed project guided the scope of the impact identification. The direct and indirect project-related impacts on the environment and local community and residual impacts were considered during the assessment of impacts. The extent of impact covers the project site, specific project activity at particular period and potentially affected areas beyond the project site. Duration in which the impact takes place is also considered in the evaluation of the impact. The period can be specific to the period of certain activities or could be related to the occupancy period of the project development. Thus, in terms of duration an impact can be viewed as a short, medium, long-term impact or permanent. Impact can affect biodiversity partially or completely. For instance, only small part of habitat, ecological processes or small population of species can be destroyed by the impact. Thus, magnitude of an impact was evaluated as proportion of the environmental entity affected. The probability of the impact to happen was derived from the frequency of the activity and frequency of impacts. The four characteristics described above were used to synthesize significance of the impact as shown in impact significance assessment criteria that is used to generate the risk assessment matrix.

7.1.2 Magnitude

The assessment of magnitude will be undertaken in two steps. Firstly, the key issues associated with the Project have been categorized as beneficial or adverse. Secondly, the magnitude of potential impacts has been categorized as major, moderate, minor, or negligible based on consideration of the parameters such as:

- Duration of the impact – ranging from temporary with no detectable impact to continuing beyond decommissioning;
- Spatial extent of the impact – for instance, within the site, boundary to regional, national, and international;
- Reversibility – ranging from no change to permanent requiring significant intervention to return to baseline;
- Likelihood – ranging from unlikely to occur to occurring regularly under typical conditions; and

- Compliance with legal standards and established professional criteria - ranging from meets or exceeds minimum standards or international guidance to substantially exceed national standards and limits / international guidance.

7.1.3 Sensitivity

Sensitivity is generally site specific and criteria have been developed from baseline information gathered. The sensitivity of a receptor will be determined based on review of the population (including proximity/numbers/vulnerability) and presence of features on the site or the surrounding area. Generic criteria for determining sensitivity of receptors are outlined below:

Generic Criteria for Determining Sensitivity

Sensitivity	**Definition (considers duration of the impact, spatial extent, reversibility, and ability of comply with legislation)**
High	Vulnerable receptor (human or ecological) with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.
Medium	Vulnerable receptor (human or ecological) with limited capacity to absorb proposed changes or limited opportunities for mitigation.
Low	Vulnerable receptor (human or ecological) with some capacity to absorb proposed changes or moderate opportunities for mitigation
Negligible	Vulnerable receptor (human or ecological) with good capacity to absorb proposed changes or and good opportunities for mitigation

7.2 Anticipated Environmental Impacts

During the field survey, key environmental problems relating to the proposed Steel Processing Plant development were identified. They were obtained by making physical observations at the project site as well as existing land use in the neighborhood. The magnitude of each impact is described as significant (major), moderate (minor) or insignificant. Generally, insignificant impacts have no obvious long-term consequences (positive or negative), and are regarded as being inconsequential.

But those with long-term repercussions are classified as significant. Using an impact matrix, the anticipated environmental impacts for the proposed project has been presented in this chapter.

7.3 Impacts during Construction Process.

The proposed development is likely to have the following impacts during the construction phase: -

7.3.1 Positive Impacts

During the construction period, the informal sector will benefit from the operations of the Steel Processing Plant development. This will involve kiosk owners who will be selling food to workers on site. This is envisioned to promote "jua kali" entrepreneurs in the local area. Second, there will be employment opportunities especially to casual workers. Employment opportunities will be of a benefit from both social and economic perspectives. From economic perspective, abundant unskilled labor will be used in economic production, on the other hand, from social perspective, the laborer's will be engaged in productive employment other than remaining idle, hence avoiding social vices such as drug abuse and robberies among others. Apart from casual laborer's, semi-skilled and skilled labor, professionals such as town planners, architects and structural engineers among others are also expected to obtain gainful employment during the period of construction.

There will be gains in the local and national economy through consumption of locally available materials including concrete tiles, concrete, timber and cement and the expected revenue to accrue from the taxes and other rates from the proponent.

Detailed Impact Matrix for the Proposed Steel Processing Plant Development

Potential Impacts	**Positive impacts**			**Negative Impacts**		
	Insignificant (Negligible)	Moderate (Mild)	Significant (Major)	Insignificant (Negligible)	Moderate (Mild)	Significant (Major)
Creation of employment opportunities			■			
Increased tax revenue to national and county governments			■			
Improved aesthetics	■					
Optimal use of land in the area			■			
Increased availability and accessibility of Steel products		■				
Fire out breaks					■	
Architectural distortion of the neighborhood				■		

Proliferation of uncollected solid and hazardous/toxic wastes						
Inadequate disposal of waste during construction phase						
Modification of micro-climate and disruption of vegetation						
Increased development without commensurate services						
Air pollution generated by dust during construction and exhaust from the furnace flue gas						
Noise pollution generated by construction activities and generator during operation phase						
Soil erosion during excavations resulting in loose soil structure						
Social vices due to concentration of people						
Worker's accidents during construction						
Increased run-off leading to flooding arising from paved ground and expansive roofs						
Pressure on infrastructure and services, e.g., traffic related conflicts, water, power and sanitation,						
Mushrooming of food kiosks						
Pollution of underground water systems by septic tank and storage tanks						
Bulk scrap storage issues i.e., oil leaks and water contamination						
Insecurity						

7.3.2 Negative Impacts

i. Potential Workers Accidents During Construction

There is possibility for workers' accident during construction phase. This can be fatal or lead to serious injuries if the proponent has not developed a comprehensive accident control and management plan prior beginning construction. Also, possibility of visitors or intruder accidents.

ii. Air Pollution

There is likely to be pollution in terms of noise and dust during the project's construction phase. This is likely to be from construction vehicles serviced/attended at the project site during excavation and vehicles accessing the site while felling construction material. Particulate matter (PM) may be generated in each of the process steps, and may contain varying concentrations of mineral oxides, metals (e.g., arsenic, cadmium, mercury, lead, nickel, chromium, zinc, manganese), and metal oxides. Sources include smelting and refining activities (BF, BOF, EAF) and heating furnaces (depending of type of fuels used); mechanical actions (e.g., Scarfing and grinding); and handling of materials (e.g., raw materials, additive, recycled and waste materials, and by-products). Additional sources of particulate matter (PM) emissions include coal storage, conveying, charging, coking, pushing, and quenching.

Air Quality Emission Standards

In undertaking the construction activities described above, the Contractor will comply with the following national regulatory air quality standards and WBG/WHO Air Emission and Ambient Air Quality guidelines, whichever is stringent. Regular monitoring to determine compliance will be done by the Supervision Consultant and corrective/ mitigation measures applied where necessary.

Ambient Air Quality Tolerance Limits

Pollutant	**Time Weighted Average**			
		Industrial Area	**Residential, Rural & Other Area**	**Controlled Areas**
Sulphur oxides (SOX);	Annual Average	80 ug/m3	60 ug/m3	15 ug/m3
	24 hours	125 ug/m3	80 ug/m3	30 ug/m3
	Annual Average		0.019 ppm/50ug/m3	
	Month Average			
	24 Hours		0.048ppm/125ug/m3	
Pollutant	**Time Weighted Average**			

		Industrial Area	**Residential, Rural & Other Area**	**Controlled Areas**
	Instant Peak		500 ug/m3	
	Instant Peak (10 min)		0.191 ppm	
Oxides of Nitrogen (NOX);	Annual Average	80 ug/m3	60 ug/m3	15 ug/m3
	24 hours	150 ug/m3	80 ug/m3	30 ug/m3
	Annual Average		0.2 ppm	
	Month Average		0.3 ppm	
	24 Hours		0.4 ppm	
	One Hour		0.8 ppm	
	instant Peak		*1.4 ppm*	
Nitrogen Dioxide	Annual Average	*150 ug/m3*	*0.05 ppm*	
	Month Average		*0.08 ppm*	
	24 Hours	*100 ug/m3*	*0.1 ppm*	
	One Hour		*0.2 ppm*	
	Instant Peak		*0.5 ppm*	
Suspended Particulate Matter	Annual Average	*360 ug/m3*	*140 ug/m3*	70 ug/m3
	24 hours	*500 ug/m3*	*200 ug/m3*	100 ug/m3
	Annual Average		*100 ug/m3*	
	24 hours		*180 ug/m3*	
Respirable Particulate	Annual Average	*70 ug/m3*	*50 ug/m3*	50 ug/m3
	24 hours	*150 ug/Nm3*	*100 ug/Nm3*	75 ug/Nm3
PM2.5	*Annual Average*	*35 ug/m3*		
	24 hours	*75 ug/m3*		
Lead (Pb)	*Annual Average*	*1.0 ug/Nm3*	*0.75 ug/Nm3*	0.50 ug/m3
	24 hours	*1.5 ug/m3*	*1.00 ug/m3*	0.75 ug/m3
	Month Average		*2.5*	
Carbon monoxide (CO)/ carbon dioxide (CO2)	*8 hours*	*5.0 mg/m3*	*2.0 mg/m3*	1.0 mg/m3
	1 hour	*10.0 mg/m3*	*4.0 mg/m3*	2.0 mg/m3
Hydrogen sulphide	*24 hours*	*150ug/m3*		
	instant Peak	*700ppb*		
Total VOC	*24 hours*	*600 ug/m3*		
Ozone	*1-Hour*	*200 ug/m3*	*0.12 ppm*	

	8 hours (instant Peak)	*120 ug/m3*	*1.25 ppm*	

iii. Disruption of Existing Vegetation

The construction process will involve clearing of existing vegetation cover. In the long-term, this is likely to change the microclimate of the area and aesthetics.

iv. Soil Disruption

Since the proposed project will involve extensive paving, construction and hard landscaping, this is likely to increase the volume and rate of storm water resulting to flooding and siltation. Excavation of the existing black cotton soil can also tamper with the natural soil types and structure in the area and associated microorganisms. The loose soil and any quarry spoil may increase soil erosion on site.

v. Inadequate Disposal of Human Waste

Lack of a toilet at the construction site is likely to encourage poor disposal of human waste, especially by the construction workers. This is foreseen as a major public health concern. It is therefore advised that the developer/proponent considers developing a pit latrine on site for the workers before the commencement of project development or provide a mobile toilet in order to maintain acceptable sanitation standards.

vi. Dust

Dust is one of the most visible invasive and potential irritating impact associated with construction activities. During site setting activities production of large amount of dust is inevitable during blasting, processing and transporting. Site conditions that affect the impacts of dust generated during extraction of aggregate and dimension of stone include rock properties, the direction of prevailing winds, size of the operations and proximity to populated areas. Dust concentrations, deposition rates and potential impacts tend to decrease rapidly away from source. Fine dust particles pose serious health problems since these are suspended as fine particles in the atmosphere and are easily inhaled. In view of this a carefully implemented dust control plan should be put in place to reduce the dust generated and safeguard the health of workers and local community. The impact on dust generated from the proposed project is likely to be minimal due to the fact that it is located away from the proximity of human population. In addition, other activities such as crushing and grinding will be done at a different area within the already acquired parcel of land. Measures for dust reduction and control will be necessary.

Anticipated Impacts	**Potential mitigation measures**
Noise Generation and Disturbances.	• Construction work should be carried out during the specified time i.e., from 0730 hrs to 1700hrs; noise generated during the day is not quite disturbing as compared to it being generated at night hours as noise threshold are higher during the day • Sensitize construction vehicles' drivers and machinery operators to switch off engines of vehicles when not in use. • Workers should be provided with relevant personal protective equipment (PPE)/ materials such as earmuffs and earplugs; when operating noisy machinery and when in noisy environment. These provide a physical barrier that reduces inner ear noise levels and prevent hearing loss from occurring. • Suppressors or silencers on equipment or noise shields; for instance, corrugated iron sheet structures. • Machineries should be maintained regularly to reduce noise resulting from friction. • Provision of billboards at the construction site notifying of the construction activity and timings. • Manual labor is recommended in the construction phase, to reduce the noise emitted by construction machinery. • Annual noise measurements should be conducted as required under the Noise Prevention and Control Rules 2005 and Noise and Vibration Regulations of 2006. • Steam injectors to be provided with silencers
Soil erosion and vegetation loss	• Provision of soil conservation structures on erosion prone areas to control occurrence of soil movement. • Avoid unnecessary movement of soil materials from the site.

	• Good management of the runoff/storm water to reduce its impact on loose soil by e.g. roof or rainwater harvesting • Control construction activities especially during rainy / wet conditions • Landscaping: Re-surface open areas on completion of the project and introduce appropriate vegetation where applicable and create a green belt within the project site. • Provide appropriate drainage systems to manage surface runoff. • Loose soil to be utilized for levelling low-lying areas inside the plant.
Air Pollution	• Provide appropriate Personal Protective Equipment (PPEs) such as nose masks to the affected workers on site during construction phase. • Regular and prompt maintenance of construction machinery and equipment. This will minimize generation of noxious gases and other suspended particulate matter • Control of areas generating dust particles. Such areas should be regularly cleaned or sprinkled with water to reduce dust. The areas can be enclosed to mitigate effects of wind. • Workers should be trained to understand the hazards that may be generated in such work environments. • Workers should be encouraged to go for regular health check-ups to ascertain their health standards • Consider use of bags filters or electrostatic precipitators • Provide stacks (exhaust) & pipes) at appropriate stack heights during operation phase.
Occupational Health and Safety	• Capacity building and training of staff/workers with respect to Occupational Health, Safety and Environment. Provide safety measures for personnel, Personal Protective equipment (PPE) - safety gear as per Health and Safety and Welfare – Special Provisions and Rules

	Regulations; conduct medical examination of workers as required by the Medical Examinations Rules of 2005 under the Occupational Safety and Health Act, 2007, for occupations covered under Schedule II of the act. Construction works fall under this schedule II and therefore all workers should undergo the medical examinations. • A first aid kit should be provided within the site and should be fully equipped (as per Rule 2 of the First Aid Rules, 1977) at all times and managed by qualified and trained first aider(s). • The contractor/proponent should initiate and develop effective Emergency Response Plans-ERPs to cater for various eventualities such as fire outbreaks, oil spills and other incidences that are likely to occur. • Proper documented possible action plans (ERPs) need to be put in place in case of any incidences occurring. • Where the workforce exceeds 20, the contractor should facilitate formation of a Safety and Health Committee, in accordance with the Health and Safety Committees Rules, 2004. The safety and health committee should be adequately trained on Occupational Safety and Health in line with Rule 12 of the Health and Safety Committee Rules, 2004 and be appraised on their functions as stipulated under Sec. 6 of the Health and Safety Committee Rules, 2004. • The contractor should obtain a certificate of registration of Building or Construction from DOHSS. • Appropriate abstracts should be displayed at strategic location including, the Workplaces Act, and Building Operations and Works of Engineering Construction (BOWEC), Rules, 1984

7.4 Impacts during Operational Phase

7.4.1 Positive impacts

i. Employment Generation

The project will result in the generation of employment opportunities during operational phase. This will involve steel processing experts, plant manager, supervisors, support staff, security personnel, solid waste management staff, among others.

ii. Increase in Revenue

There will be a positive gain for the revenue system. Land value of the said plot will be revised upwards. Rates paid to the County government of Machakos will also be revised upwards owing to the capital appreciation of the property upon development. Government revenue collection will increase through payment of VAT and other rates, licenses and taxes including PAYE from staff.

iii. Individual Investment

Economically, the project will be an investment to the proponent. The proposed project once complete can also be used as a collateral asset.

iv. Improved Local economy

As noted earlier in this report, steel plays a pivotal role in economic growth and development. The establishment of the plant in this area will serve to improve accessibility of steel products to developers thus boosting the economy of the area, county and country at large. Trial down effect to transporters, crap dealers and associated activities.

v. Optimal Use of Land

The Steel plant development leads to optimal use of land. Considering the scarcity of serviced land in Mavoko area and Machakos County as a whole the project enhances the returns on the limited land space in the area.

vi. Increase in available Steel products

The project will add to the depressed supply of steel products in the area and county, thus complementing the government’s initiative of providing access to quality and standard steel products to all.

vii. Improved Aesthetics

Some of the developments in Katani area of Mavoko Subcounty are old and are built with low quality materials. The proposed project adds to improved aesthetics of the local area. This will attract new residents into the neighborhood and with modern building structures that are well planned.

7.4.2 Negative Impacts

i. Occupational health Risks

The occupational health risks associated with steel processing activities are many. The OSHA (2007) places a duty on employers to ensure the health as well as the safety of their employees. Yet across industry, each year many more people become ill as a result of their work than are killed or injured in industrial accidents. Most diseases caused by work do not kill, but can involve years of pain, suffering and discomfort for those affected. It has long been recognized that health risks have not received the same attention as safety risks. Cole (1996) gives several reasons for this. These are:

- The health risk may not be understood or well defined and the cause/effect relationship not established.
- Health risks tend not to attract widespread publicity or demand the same urgent attention as safety risks.
- Health risks appear to have little, if any, short term effect and it may be that ill-health does not occur for many years after exposure.
- Health risks may be more difficult to address, resulting in attention being directed to risks where control is more visible and likely to attract tangible benefits
- Comprehensive data on the occupational ill-health may simply not exist in many cases and in practice, the true extent of occupationally related ill-health may be unknown.

Health problems may not be as obvious as a safety failure such as a structural collapse, machinery accident or a fire and explosion. Most people may never see cases of occupational ill health whilst at work. They may miss the connection between the effect and its causes, so it is even more important to adopt a proactive approach to managing health risks. Risks to health from work activities include:

- Skin contacts with irritant substances, leading to dermatitis etc;
- Inhalation of respiratory sensitizers, triggering immune responses such as asthma
- Badly designed workstations requiring awkward body postures or repetitive movements result in upper limb disorders, repetitive strain injury and other musculoskeletal conditions;
- Noise levels which are too high, causing deafness and conditions such as tinnitus;

- Too much vibration, eg from hand-held tools leading to hand arm vibration syndrome and circulatory problems;

There are a number of specific health and safety Regulations that deal with specific health hazards in the country as discussed earlier in the report. Occupational health is about protecting the physical and mental health of workers and ensuring their continual welfare in their working environment. In addition to preventing ill health, other important aspects of occupational health include:

- Ensuring fitness and physical capability to perform a job safely;
- Health education and promotion;
- Providing medical services including health surveillance;
- Rehabilitation after illness or injury.

If the assessment of risk shows that further action is necessary, then control measures should be selected according to the hierarchy of risk control, namely;

Hierarchy of Risk Control

i. **Elimination of the risk.** This can be achieved through redesigning the activity or equipment to eliminate the release of the hazard;
ii. **Reduction of the risk at source through engineering controls.** This can be achieved by enclosing the activity or equipment to capture and/or absorb the hazard, dilute the hazard or release it into a safer place;
iii. **Minimizing the risk through procedural controls.** This involves implementing systems and procedures so that work is carried out in a particular way that limits exposure to the hazard.
iv. Use of appropriate personal protective equipment (PPE).

The use of PPE is the last resort for the control of the exposure of employees to hazards. This is because PPE only protects the wearer and then only if worn properly. Situations where the use of PPE may be necessary are:

- Where adequate control of exposure cannot be achieved by elimination, reduction at source or minimization through administrative controls.
- As a ‘stop-gap; measure, where a risk assessment indicates that further control measures are necessary and until those further measures have been introduced and are deemed effective.

Having introduced new control measures it is essential that they are adequately used by employees, and so systems should be put in place to ensure that such measures are used effectively. This is a responsibility of

both the employer and employee and can be achieved by ensuring that the workforce receive adequate instruction and training through:

- Working procedures, codes of practice or other procedural controls;
- Educating the workforce on the hazards and risks involved in their work and how control measures will protect their health.
- Effective supervision.

Employees must use these control measures in compliance with any such instruction and training. Systems should be put in place to ensure that the effectiveness of all the risk reducing control measures does not decrease over time. Any engineering controls should be subject to regular checking and maintenance. The frequency of this should be determined by the risk assessment and based on the engineering reliability of the control measures and the consequences of their failure with respect to exposure.

The anticipated health impacts of the proposed development are discussed under various sub-headings below.

A. Increased Population without Commensurate Services

The proposed development will further lead to an increased demand on commensurate services and facilities in Katani area of Mavoko sub-county. If population in the neighborhood is not provided with appropriate services and facilities, then pressure on existing facilities is bound to increase.

B. Surface Water Drainage and run-off.

The plant will have an impervious surface thus reducing water infiltration into the ground due to increased paved areas. This implies that surface runoff from the site will increase. The amount of runoff will increase slightly due to lowered infiltration of rain water into the soil. The surface water from the plant is likely to contain oils and greases if drainage system is not well designed. The design should ensure that all water from service area and other section of the plant where spills are anticipated passes through properly constructed oil interceptor. If this is done, the impact of surface run-off from the plant on the environment will be minimized and provision of rain water harvesting structures to reduce the storm water. Channelizing excess storm water runoff efficiently such that no area in the downstream for transport of the produced products from the plant.

C. Traffic Congestion

The plant will to some extents have effect on traffic flow along the feeder roads as vehicles will slow down as they approach the plant. The impact will be minimized by providing ample parking space at the plant.

However, the impact cannot be fully eliminated. In addition, acceleration and deceleration lanes shall be constructed from the main road.

D. Noise Pollution

The proposed project is like to cause noise pollution as it is adverse due to noise emanating from rotary and vibrating machinery and steam injectors. The impacts of noise are highly dependent on sound source, the topography, and land use, ground cover of the surrounding site, climatic conditions and distance of the receiver from the sound source. Noise and vibrations from steel processing activities can have adverse effects if not well managed. Despite the low potential of the vibration and noise on human health, it is necessary to note that, the workers will be at greater risk of exposure at the site. Consequently, appropriate measures should be taken to protect them. To achieve this noble objective, the following proponent must fully comply with the following: -

- The Occupational Safety and Health Act, 2007
- The Factories and Other Places of Work (Noise Reduction) Rules, 2005
- The Environmental Management and Coordination (Noise and excessive vibrations) (control) regulations, 2009.
- The Public Health Act Cap 242

National Noise Emission Guidelines

In undertaking the construction activities described above, the Contractor will comply with the following national regulatory air quality standards and WBG noise level guidelines, whichever is stringent. Regular monitoring to determine compliance will be done by the proponent and corrective/ mitigation measures applied where necessary.

National Noise Guidelines

Zone		Maximum Noise level limits dB (A)		**Time Frame**
		Day	Night	
Places of worship	30		25	Day time: 6.01a.m-8. 00p.m Night time: 8.01p.m -6. 00p.m
Residential: 1. Indoor 2. Outdoors	 35 40		 25 25	
Mixed Residential (Inclusive of	55		45	

Entertainment and commercial places)				
Commercial	70		70	
Silent arena	30		25	

Noise Levels for Construction Sites

Facility	**Maximum Noise level limits dB (A)**		**Time Frame**
	Day	**Night**	
Health facilities, Educational Centers and homes of disabled	60	35	Day time: 6.01am- 10.00pm Night time: 10.01pm – 6.00am
Residential	60	35	
Industrial	85	65	
Commercial	75	50	

Noise levels from a factory or a workshop (Continuous or Intermittent Noise)

dB(A)	**Daily**	**Weekly**
85	8 hours	40 hours
88	4 hours	20 hours
91	2 hours	10 hours
94	1 minute	5 hours
97	30 minutes	2.5 hours
100	15 minutes	1.25 hours
103	7.5	37.5 minutes
106	3.75	18.75 minutes
109	1.875 minutes	9.375 minutes

N/B: NOISE LEVELS SHOULD NOT EXCEED A LEVEL OF:

1. Factory/Workshops 85 dB (A)
2. Offices 50 dB (A)
3. Factory/Workshop Compound 75 dB (A)

Maximum Permissible Noise level for Impact or Impulsive Noise

Sound Level dB(A) Max	Permitted impulses per day
140	100
130	1000
120	10,000

Source-NEMA

E. Increased Pressure on Infrastructure and Facilities

The neighborhood is already established by high industrial and commercial density development. These have intensified land use, hence leading to high demand for infrastructure and services. Utilities will be used by more people especially electricity and water resources. During construction water stress is a likely impact due to increased demand. The proponent proposes to drill a borehole on site to provide water during the construction and operational phase. The proposed construction development is likely to increase pressure on existing infrastructure such as roads. This would be due to increased human and vehicular traffic along the fronting access road.

F. Proliferation of Solid Waste.

The proposed development is likely to contribute to an increased generation of solid waste. It would be of adverse impact if the solid waste generated is stockpiled in the open for years This has a potential of attracting disease vectors such as rats, flies, and cockroaches if not well managed.

G. Pollution of Underground Water by Foul Water from Septic Tank

Each proposed development is connected to a septic tank and soak pit. If this is not well designed and regularly inspected, pollution of underground water system is likely to be experienced. Surface runoff in cases of pollution might result into surface water or streams pollution.

H. Fire-Out Break

Fire is one of the common hazards within steel processing plants. If its preparedness, management and mitigation are not well planned, then chances of loss of lives/injuries and properties are likely to be reported.

I. Air pollution from production processes.

The production process is likely to contribute to emissions of heat, dust, SO2, NO2, CO and vapor. Particulate matter (PM) may be generated in each of the process steps, and may contain varying concentrations of mineral oxides, metals (e.g., arsenic, cadmium, mercury, lead, nickel, chromium, zinc,

manganese), and metal oxides. Sources include smelting and refining activities (BF, BOF, EAF) and heating furnaces (depending of type of fuels used); mechanical actions (e.g., scarfing and grinding); and handling of materials (e.g., raw materials, additive, recycled and waste materials, and by-products). Additional sources of particulate matter (PM) emissions include coal storage, conveying, charging, coking, pushing, and quenching

THE NATIONAL AIR QUALITY STANDARDS FOR GENERAL POLLUTANTS

Pollutant	**Time Weighted Average**	**Property Boundary**
Particulate matter (PM)	Annual average	50 ug/m3
	24 hours	70 ug/m3
Oxides of Nitrogen (NOX);	Annual average	80 ug/m3
	24 hours	150 ug/m3
Sulphur oxides (SOX);	Annual average	50 ug/m3
	24 hours	125 ug/m3
Hydrogen Sulphide	24hours	50 ug/m3
Lead (Pb)	Annual/24 hours	0.5 – 2.0ug/m3
Ammonia	24 hours	100 ug/m3

Potential Mitigation Measures at the operation Phase.

The Anticipated Impact	**Potential Mitigation Measure**
Increased Water Demand	• Encourage water reuse/recycling mostly during operation phase. • Provide notices and information signs i.e., 'keep/leave the tap closed', etc. This will awaken the civic consciousness of stakeholders with regards to water usage and management. • Install water-conserving taps that turn-off automatically when water is not in use. • Ensure water conservation by closed loop recycling of waste water • Use of treated wastewater in various non production uses • Ensure rainwater harvesting to curb shortage.
Air pollution from production processes e.g., Dust	• Use covered conveyance systems for dry raw materials • Tall stacks for better dispersal of airborne pollutants.

	• Sprinkle water on roads passing through populated areas to minimize dust generated by the trucks. • Provision of workers with personal protective equipment and clothing such as dust masks. • Fencing off the site from members of the public- this will reduce unnecessary exposure to dust and other health and safety risks. • Use bag filter as for pollution device.
Noise pollution	• House noise prone equipment in separate enclosures • Ensure Procurement of low noise prone equipment • Encourage vibration dampening • Use of dynamically balanced of rotating parts Limit processing activities to normal working hours i.e 0800Hrs -1700Hrs. Noisy operations activities can be scheduled or limited to certain times of the day. • Workers should be provided with Personal Protective Equipment (PPEs) such as ear muffs. • Workers should be regularly health screened. • Installation of silencers on noise machines and equipment including trucks • Mounting compressors or generators on anti-shocks to reduce vibrations
Solid Generation and Management	• Maximize processing of solid waste either by reuse within the plant or selling to other gainful use • Avoid contamination of ground water by use of impervious liner in storage yard
Traffic Density	• Notify the motorists about the development once implementation is started. It is important that warning/informative signs (billboards) 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.

	• The traffic along connecting routes should be controlled especially during construction phase and mostly when large trucks are turning into the site, say for delivery of materials.
Fire Outbreaks and Risks	• Install an automatic fire alarm system for the entire project mostly on operation. • Install firefighting equipment, heat and smoke detectors, static water storage tanks for firefighting as approved by the Machakos County Government. • All fire control and fighting facilities to be installed as per the requirements stipulated in the approved plans. • The occupier to ensure that the requirements of the Fire Risk Reduction Rules, 2007 are in place.
Power/Energy demand	• Ensure connection with the kenya power and lighting company • Power usage will be closely monitored to avoid wastage • Switch of machines when not in use • Ensure use of high-quality equipment that guarantees efficiency
Emissions	• Regular servicing of machines • Switching off engines when not in use • Use unleaded fuel • Provide PPE to machine operators • Worker's education and awareness
Occupational injuries and accidents	• Workers hired during the operational phase to first be trained on the appropriate use of the provided personal protective equipment. • Project proponent to ensure all operational phase workers and visitors to the project site also use the provided personal protective equipment provided appropriately. • The project proponent to ensure that tools and equipment provided for use during the operational phase are well serviced and maintained. • The project proponent to ensure that among the operational phase workers are trained first aiders with fully equipped first aid station

7.5 Impacts during Decommissioning Phase.

7.5.1 Commissioning of New Buildings

During the commissioning phase, a clean-up of the site shall be undertaken the wastes that were used in construction process, if not collected and safely disposed of are likely to pose environmental problems. These wastes include, but not limited to:

- Sand
- Cement
- Crushed stone
- Gravel
- Soil
- Concrete tiles and paving blocks
- Timber
- Steel plant parts (reinforcement, casement, wiring, pipe etc)
- Glass
- PVC material (pipes, conduits and fittings)

The above wastes will be adequately cleared and disposed of at the site approved by the County government of Machakos.

7.5.2 Decommissioning at the end of Project Lifespan

If at the end of the project life span the buildings or its parts are to be demolished, then decommissioning stage will have to address two primary issues related to environmental impacts of demolishing old buildings:

- Minimizing waste disposal through re-use and recycling and
- Properly handling hazardous and regulated materials.

In addressing the first issue deconstruction of the old buildings is usually undertaken. Deconstruction is the manual dismantling of a building/its parts so materials can be salvaged for reuse. Deconstruction can range from the soft stripping of non-structural elements such as cabinets and plumbing to the full structural disassembly of the buildings. The deconstruction process is the opposite of the construction process; the last thing to go on is the first thing to come off. Of necessity, most deconstruction projects employ all three options reuse, recycling and disposal but reuse is often made the priority. Usually, when deciding whether to deconstruct or not, the first simple rule to remember is: Deconstruct no building before its time.

Preservation should be the first choice when deciding what to do with old buildings. With increased mechanization, however, recycling and disposal of Construction & Development debris has become more appealing than dismantling for reuse. Current building methods and materials, such as use of composite materials, laminates and adhesives, also favor recycling or disposal.

During deconstruction, necessary precautions will be undertaken such as:

- Mitigating against noise and dust by either manually disassembling the major portions of the items used during construction for example hoardings. The demolition requiring the use of heavy equipment will, however, be accomplished while wetting down the structures with water to reduce dust propagation. Wetting will also be done so as not to create runoff that could migrate from the site.
- All demolition debris will be handled with care to avoid material being blown by the wind from the proposed site of development to the surrounding environment. All debris should be packaged and transported to appropriate disposal site following established county government and public health waste management procedures.
- All demolition work shall be carefully executed with the particular aim of preserving the items being removed. All materials, components and fittings arising from the demolitions shall become the property of the contractor as a way of reducing the disposal cost.
- The method of demolition used shall be in line with all laws and by-laws governing such activities. In particular, the contractor will be required to protect the adjacent properties, users / workers and the public from any nuisance in form of noise and dust, and from falling objects. The contractor shall also take all necessary measures to prevent any damage or loss to third party.
- Before embarking on demolition, the contractor shall give all the necessary notices as required by law.
- An attempt shall be made to limit the quantity of materials removed from site or sent to landfill through reuse of the debris in the construction and landscaping stage.
- Re-sell or reuse reclaimed materials to reduce the cost of new materials and where possible minimize the projects overall environmental impact through reuse and recycling.
- Take particular care when decommissioning the fuel storage tanks to avoid soil contamination with oils and other petrochemicals.
- Use appropriate vehicles (covered) to transport demolition waste according to waste management regulations

Anticipated Environmental Impacts and Mitigation Measures at the demolition stage of the project Life Cycle

Environmental Impacts	Proposed Mitigation Measures	Responsibility for Mitigation
Air pollution by dust generated during demolition process.	• The demolition exercise will be limited at day time only • All personnel working on the project will be trained prior to commencing the demolition exercise on methods for minimizing negative impacts on air quality. • Construction vehicle drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon and minimize idling of engines. • All active demolition areas will be watered at least twice a day to reduce dust. • All trucks hauling demolition debris/wastes shall be covered and licensed as per the EMCA waste management regulations. • Careful screening to contain and arrest demolition related dust will be adopted • Exposed demolition debris of e.g., dust and sand, will be enclosed, covered, and watered daily before transported to disposal site. • Demolition activities will be suspended when wind speed exceeds 25 mph. • Windbreakers will be installed at the windward side of the construction site.	• Project proponent • NEMA inspectors • County government of Machakos

	• All workers on the site will be required to wear protective clothing while on duty	
Noise pollution by demolition activities.	• Explosives will not be used during the exercise • Portable barriers will be installed to shield compressors and other small stationery equipment where applicable. • Use of equipment designed with noise control elements will be adopted where necessary. • Trucks used during demolition exercise on site shall be routed away from noise sensitive areas in the neighborhood, where feasible. • Sound barriers are to be installed for pile driving activities. • Idling time for pick-up trucks and other small equipment will be minimized to limited time. • Use of very noisy equipment will be limited to daytime only. • All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise. • Special care to be considered when excavating out the fuel storage tanks to avoid soil contamination with petro-chemicals • The demolition exercise will be limited at day time only	• Project proponent • NEMA inspectors • County government of Machakos
Proliferation of uncollected demolition debris and related wastes	• Private contractor will be engaged to collect demolition debris/wastes	• Project proponent • NEMA inspectors County government of Machakos

	• All debris/wastes to be collected regularly to control air pollution and injury etc • Receptacles will be provided for storage of light demolition products e.g., timber, plastics tiles etc • Refuse collection vehicles will be covered to prevent scatter of wastes by wind. • Engage services of NEMA to collect demolition debris to avoid illegal final dumping at unauthorized site. • All persons involved in refuse collection shall be in full protective attire.	
Worker's accidents during demolition process.	• All workers will be sensitized before the exercise begins, on how to control accidents related to the demolition exercise • A comprehensive contingency plan will be prepared before demolition begins, on accident response. • Practice one command approach for relying instructions. • Adherence to safety procedures will be enforced at all stages of the exercise • All workers, pursuant to labor laws, shall be accordingly insured against accidents. • All workers will be instructed to wear Personal protective equipment (PPEs) during demolition, including helmets and this enforced. • Demolition work will be limited to daytime only to avoid workers accidents due to poor visibility	• County Public Health Officer • Ministry of Labor • NEMA inspectors

7.6 Other Potential Negative Impacts and Mitigation Measures

The potential negative impacts and possible mitigation measures for the proposed Steel Processing plant development is summarized below:

Other Potential Negative Impacts and Mitigation Measures

Potential Negative Environmental Impacts	**Mitigation Measures**
Architectural Incompatibility leading to distortion of neighborhood aesthetic image	• Harmonize building scale with existing development in neighborhood. • Harmonize detail, material and finishes for roofs and walls with existing development in the neighborhood and use earth colors that blend with the environment.
Disruption of existing natural environment and modification of micro-climate: • Increased development density • Increased glare/solar reflection • Reduced natural ground cover • Obstruction of ventilating wind • Increased surface run-off	• Development restricted to the approved density – building line, plot coverage and plot ratio according to zoning scheme. • Careful layout and orientation of buildings to respect wind and sun direction. • Adequate provision of green and open space planted with grass, shrub and tree cover. • Minimum use of reflective building material and finishes for roof, wall and pavement
Pollution and health Hazards • Dust and other construction waste • Noise generation from construction activities.	• Damping down of site e.g., sprinkling water to dusty areas on construction site. • Containment of noisy operation, including locating noise operations away from sensitive neighborhoods • Limit construction work to day hours only. Construction work to take shortest time possible • Use manual labor as much as possible

	• Vehicles felling construction materials move in low speed. • Bulk storage of materials
Increased loading of Infrastructure services • Increased vehicular and/or pedestrian traffic • Increased demand on water, sanitation services etc. • Liquid waste management	• Have clear exit/entry on the local access road including providing deceleration and acceleration lanes • Encourage rainwater harvesting. • Provision of increased water storage capacity • Use of solar power for hot water system use • Use of a septic tank during the operation phase (when the Steel processing plant is in operation) • Install efficient water saving fittings
Worker accidents and health infection	• Employ skilled and trained workers, educated on construction site safety procedures. Also provide workers with protective clothing and other personal protective equipment (PPEs). • Prepare clear work schedule and the organization plan and place them on site for inspection. • Have adequate worker insurance cover • Enforce occupational health and safety standards by providing hessian cloth to cover the building to avoid injury from flying or falling objects • Provide first Aid kits for emergency • Provide and maintain firefighting equipment and designate fire assembly points.

	• Notifying neighbors about construction to raise awareness and put-up signs such as "work in progress" • Provide sanitary facilities for workers during construction
Increased social conflict	• Encourage formation of community policing and neighborhood association. • Condone the site with iron sheet during construction • Employ laborers of 18 years and above only
Solid and Liquid Wastes	• Segregate waste and provide waste holding units at Strategic locations. • Recycle and recover some of the debris such as to cover earth surfaces. • Debris and other inert materials (wood, steel bars, nails, papers, glass etc) be recycled offsite or in approved dumpsites.

Adoption of best practice in waste management is recommended where waste reduction and mitigation hierarchy strategy in embraced. Avoidance of waste as much as possible is the beginning point followed by 4Rs (Reduce, Re-use, Recover, Recycle. It is only the residual waste that needs to be treated and disposed.

CHAPTER EIGHT

8.0 ENVIRONMENTAL MANAGEMENT PLAN

8.1 Introduction.

Integrating environmental issues into construction management, such as those related to development of Steel processing plant is that it increases efficiency while enhancing the companies' financial and environmental management. These issues, which are normally of financial concern at company level, are costs, product quality, investments, level of productivity and planning.

Environmental planning and management as a concept seek to improve and protect environmental quality for both urban and rural residents through segregating activities, which are environmentally incompatible.

Environmental planning and management integrate urban structure land use, social systems, regulatory law, environmental awareness and ethics.

Environmental and Social Management Plan (ESMP) for development projects such as the proposed Steel processing plant development is aimed at providing a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition, ESMP assigns responsibilities for action to various actors, and provides time frame within which mitigation measures can be done and the cost.

ESMP is a vital output for an environmental impact assessment as it provides a checklist for project monitoring and evaluation and as a basis for environmental audit. A number of mitigation measures have already been incorporated into the project design. The ESMP outlined in table below has addressed the identified potential negative impacts and mitigation measures of the proposed Steel processing plant development on amalgamated L.R. No. Mavoko Town Block 2/22616 and 26177 situated in Katani area of Mavoko subcounty within the jurisdiction of Machakos County.

8.2 Environmental Monitoring and Evaluation

Environmental monitoring and evaluation are essential in project's lifespan as they are conducted to establish if the project implementation has complied with the set environmental management standards as articulated in the Environmental Management and Coordination Act (EMCA) CAP 387, and its attendant Environmental (Impact Assessment and Audit) Regulations, 2003 amended 2016.

In the context of the proposed project, design has made provisions for an elaborate operational monitoring framework for the following among others:

- Disruption of natural environment and modification of microclimate
- Air and noise pollution

- Increased heat generation
- Oil spills and leaks
- Proliferation of kiosks
- Worker's accidents safety and health infections during construction process
- Proliferation of uncollected wastes both solid and liquid
- Aesthetics degradation
- Fire out-breaks

Environmental Management Plan Matrix for the Proposed Development of a Steel Processing Plant.

CONSTRUCTION PHASE					
Environmental Impacts	**Proposed Mitigation Measures**	**Responsibility for Mitigation**	**Means for Monitoring**	**Frequency for Monitoring**	**Estimated Cost (Kshs)**
Modification of Micro-Climate	• Careful layout and orientation of the plant and buildings to respect microclimate: wind and sun direction. • The project will use minimum reflective building materials and finishes for roof, walls and paving. • Harmonize site drainage design with neighboring developments	• County government of Machakos • Project proponent • NEMA inspectors	Periodic Activities	Activities Periodic checks	Inclusive in development cost
Air pollution during construction process.	• All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. • Construction vehicle drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the evening and minimize idling of engines.	• Project proponent/contractor • Ministry of Health: county public health officer • NEMA inspectors • Ministry of Labor • County government of Machakos	Periodic activities	Periodic and surprise checks	30,000 per month over the construction period

	• All active construction areas will be watered at least twice a week to reduce dust. • All trucks hauling soil, sand and other loose materials shall be covered. • All paved access roads will be swept daily. This includes all paved parking areas and staging areas at construction site. • Traffic speed of construction/other vehicles will be restricted to not more than 10 Kph • Provide all workers with PPEs and enforce their use • Careful screening of construction site to contain and arrest construction-related dust. • Vegetation will be replanted in disturbed areas as soon as possible to create green space and stabilize soils. • Exposed stockpiles of e.g., dust and sand, will be enclosed, covered, and watered daily, or treated with non-toxic soil binders.				

	• Excavation and grading activities will be suspended when wind speed exceeds 25 mph. • Windbreakers will be installed at the windward side of the construction site. • All workers on the site will be required to wear protective clothing while on duty • Regular servicing of vehicles.				
Architectural Incompatibility leading to distortion of Neighborhood aesthetic image	• Harmonize building scale with existing development in the neighborhood. • Allow for green and open spaces • Harmonize detail, material and finishes for roofs and walls with existing development in the neighborhood and use colors that blend with the environment.	• Contractor • NEMA • County government of Machakos	Routine activities	Periodic checks	Inclusive in the project budget
Noise pollution by construction activities.	• Portable barriers will be installed to shield compressors and other small stationery equipment where applicable. • Encourage use of manual labor where appropriate • Use of equipment designed with noise control elements will be adopted where necessary.	• Project proponent/contractor • County government of Machakos • County Public Health Officer • Ministry of Labor • Workers • NEMA inspector	Routine activities	Periodic and surprise checks	Inclusive in the project budget

	• Trucks used at construction site shall be routed away from noise sensitive areas in the neighborhood, where feasible. • Sound barriers are to be installed for pile driving activities. • Idling time for pick-up trucks and other small equipment will be minimized to limited time • Use of very noisy equipment will be limited to daytime only. • All workers operating in noisy areas or operating noisy equipment will be provided with earmuffs to protect against extreme noise. • Construction works to be carried out during daytime only.				
Worker's accidents during construction process.	• All workers will be sensitized before construction begins, on how to control accidents related to construction. • A comprehensive contingency plan will be prepared before construction begins, on accident response. • Accordingly, adherence to safety procedures will be enforced.	• Project proponent/contractor • County government of Machakos • County Public Health Officer • Ministry of Labor • Workers • NEMA inspectors	Routine activities	Periodic checks	Inclusive in the project budget

	• All workers, pursuant to labor laws, shall be insured against accidents. • All workers will be instructed to wear protective clothing during construction, including helmets. This would be enforced to ensure compliance. • Construction work will be limited to daytime only • Provide guard rails • Signs to alert people of possible falling objects • Use hessian cloth to cover the walls • Train workers on use of machines				
Inadequate human waste disposal by workers during construction process	• As provided for by the Building Code, a temporary or mobile latrine will be provided on site to be used by construction workers	• Project proponent • Contractor • County government of Machakos • Ministry of Health • Ministry of Labor • NEMA inspectors	Periodic activities	Periodic checks	Inclusive in the project cost
Disruption of existing natural environment and modification of micro-climate	• Development restricted to the approved density building line, plot coverage and plot ratio.	• Contractor/proponent • County government of Machakos	Periodic and routine Activities	Periodic checks	Inclusive in the project cost

	• Careful layout and orientation of buildings to respect wind and sun direction. • Adequate provision of green and open space planted with grass, shrub and tree cover. • Minimum use of reflective building material and finishes for roof, wall and pavement • Condone the site with iron sheet (preferably colored to blend with environment) during construction • Reseed bare areas with appropriate grass species	• NEMA inspectors			
Pollution and health Hazards	• Damping down of site e.g., sprinkling water to dusty areas on construction site. • Containment of noisy operation, including locating noise operations away from sensitive neighbors • Limit construction work to day hours only. Construction work to take shortest time possible. • Use manual labor as much as possible	• Proponent • County government of Machakos • NEMA	Periodic activities	Periodic checks	Inclusive in the project cost

	• Vehicles felling construction materials move in low speed • Proper and standard fuel storage tanks installed				
OPERATION PHASE					
Environmental Impacts	**Proposed Mitigation Measures**	**Responsibility for Mitigation**	**Means for Monitoring**	**Frequency For Monitoring**	**Estimated Cost (Kshs)**
Increased development density likely to adversely affect ecological carrying capacity.	• The proposed development will strictly adhere to the conditions attached to its approval such as zoning guidelines that include plot/ground coverage and floor index/plot ratio.	• Proponent • County government of Machakos • NEMA inspectors	Periodic Activities	Periodic checks	Inclusive in development cost
Pressure on infrastructure and services, i.e., traffic related conflicts, water, power and sanitation.	• Delivery and collection hours by service vehicles will be limited to off-peak hours and customer vehicles. • Service deceleration line will be provided at the entry point. • Adequate roof catchment and underground water storage tanks will be provided. • Expansion of the capacity of water and sewer lines to accommodate the increased demand in the area	• Developer/proponent • County government of Machakos • NEMA inspectors	Periodic Activities	Periodic checks	Inclusive in the project budget

	• Standby generator will be installed to ensure uninterrupted power supply • Use energy saving appliances • Use solar energy for heating water • Detect leaks early enough and fix immediately to conserve water.				
Mushrooming of food kiosks	• Kiosks will be provided on site, with adequate sanitation, during construction process. • Pursuant to the Physical Planning Act (Cap.286), development control is to be enforced around the project site. • Adhere to public health Act provisions	• County government of Machakos • Physical Planning Department • Neighborhood association • County Public Health Officer/Ministry of Health • NEMA inspectors	Periodic activities	Periodic and surprise checks	Inclusive in the project cost
Water supply and septic tank/storm water breakdown.	• Regular inspection and maintenance of water system and septic tank • Before construction begins, it will be determined where septic tank and water pipes are located to avoid reticulation break down and ease of locating water infrastructure lines	• Developer/Management • NEMA inspectors • County government of Machakos	Periodic Activities	Periodic checks	Inclusive in the project cost
High water usage	• Install water meters	• Contractor/proponent	Periodic activities	Periodic checks	Inclusive in the project cost

	• Install good taps that provide good conservation measures • Utilize storm water for irrigating of lawns and flower beds and tree planting • Regular inspection of pipes to detect leaks • Recycle water during processing • Maintain internal and external drainage systems clear all the times • Provide Roof catchment harvesting				
High water demand	• Provide water storage tanks for use in case of water rationing • Provide for rain water /roof catchment harvesting	• Developer/Management • NEMA inspectors • County government of Machakos	Periodic activities	Periodic checks	Inclusive in the project cost
Fire Accidents	• Provide water storage tanks for use in case of water rationing • Provide for rain water /roof catchment harvesting • Install a fire hydrant preferably near the main entrances • Train the workers in firefighting and subject them to frequent fire drills and designated fire assembly point	• Developer/Management • NEMA inspectors • County government of Machakos	Periodic activities	Periodic checks	Inclusive in the project cost

	• Place sand filled buckets in strategic places • Encourage to handle and store flammable material safely • Clear label fire exists points • Provide and regularly service the firefighting equipment • Ensure block electric wiring is done by qualified electrician who is licensed by Kenya power • All windows should be fitted with openable grills				
Proliferation of uncollected solid waste.	• Segregate solid waste at source • A NEMA licensed private contractor will be engaged to collect solid waste generated. • Wastes to be collected regularly to control air pollution and vermin/insects etc. • Receptacles will be provided for waste storage prior to collection. • Resource recovery will be encouraged once the project takes off so as to shrink waste stream and recover non-recyclables.	• Proponent • Hired private contractor • County government of Kajiado • County Public Health Officer • NEMA inspectors	Routine activities	Periodic and surprise checks	Inclusive in project cost.

	• Refuse collection vehicles will be covered to prevent scatter of wastes by wind. • Wastes will be collected by a licensed operator to avoid illegal final dumping at unauthorized sites. • All persons involved in refuse collection shall be in full protective attire. • Re use some of the waste				
Increased loading of Infrastructure services	• Establish a collection schedule for clients picking steel products. • Provide retail shops outside the plants compound. Preferably in the neighboring towns and business centers to avoid overcrowding at the plants compound and vicinity. • Have clear exit/entry on the local access road including providing deceleration and acceleration lanes • Encourage rainwater harvesting. • Provision of increased water storage capacity • Use of a septic tank during the operation phase (when the plant is operational)	• Proponent • County government of Machakos • National government • Ministry of Interior and Ministry of Education • NEMA	Routine activities	Periodic checks	Inclusive in project cost.

Increased social conflict	• Encourage formation of community policing and neighborhood association (Nyumba Kumi). • Condone the site with iron sheet during construction and the sheets should be colored to blend with environment.	• Proponent • County government of Machakos • NEMA	Routine activities	Periodic checks	Inclusive in project cost.
Traffic congestion	• Notify the motorists about the development once implementation is started. It is important that warning/informative signs (billboards) 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. • The traffic along connecting routes should be controlled especially during the construction phase and mostly when large trucks are entering into the site, say for delivery of materials. • Clients' vehicles to collect products in off peak hours and during day time only.	• Proponent/contractor	Routine activities	Periodic checks	Inclusive in project cost.

	• Liaise with local traffic police for traffic control if need be.				
DECOMMISIONING PHASE					
Environmental Impacts	**Proposed Mitigation Measures**	**Responsibility for Mitigation**	**Means for Monitoring**	**Frequency for Monitoring**	**Estimated Cost (Kshs**
Worker's accidents and hazards when handling hazardous wastes.	• Adequate collection and storage of waste will be provided and ensured on site, and safe transportation to, and display methods at designated areas. • All receptacles for storing hazardous wastes shall be labelled and adequately covered in accordance with section 5 of the waste management regulations • All employees will be required to wear protective clothing when handling hazardous wastes. • Train workers on advisable safety measures. • All workers will be adequately insured against unforeseen accidents. • Provide PPEs and enforce their use	• Project proponent/contractor • County government of Machakos • County Public Health Officer • Ministry of Labour • Workers • NEMA inspectors	Routine activities	Periodic checks	Inclusive in project cost.
Demolition/deconstruction	• Ensure materials after demolition are in a form that allows recycling and reusing	• County government of Machakos		Periodic checks	Inclusive in the project

	• Dispose waste through appropriate disposal methods using best available practices. • Put up dust screens around surrounding buildings to trap dust and particulates • Carry out demolition activities during the day only when permissible noise levels are high • Acquire NEMA license for activities beyond the allowable thresholds e.g., if explosives are to be used. • Special care be taken when dismantling the fuel storage tank to minimize soil and ground water contamination with oil leaks and other petrochemicals. • All vehicles carrying demolition waste should be licensed by NEMA and appropriately covered during transportation.	• Contractor/proponent • NEMA Inspectors			cost

8.3 Policies to be developed and documented by the proponent to guide project implementation

Implementation of the proposed project will require careful and sound environmental planning to ensure that all issues and concerns raised by all stakeholders are fully addressed and that all potential negative impacts are appropriately mitigated to ensure environmental sustainability. To achieve this; **RAINHAM STEEL PLANT LIMITED** who is the project proponent will establish and develop policies to guide the implementation of the proposed project. The policies once developed will be vital in the following ways among others:

- The policies will enable management to develop and maintain sound relations with construction workers and the neighboring community.
- The policies will enable management put in place measures and structures that will care for the safety, health and welfare of all workers on site and the neighboring community residents.
- The policies will provide a framework for management to plan for, and put in place, monitoring programs that will ensure conservation and protection of the environment, appropriate waste management and disposal.
- The policies will provide a framework for **RAINHAM STEEL PLANT LIMITED** to assume its corporate social responsibility for its activities with regard to conservation of the environment as well as for the well-being of the local community.

The following policies will need to be developed and documented by the project proponent: -

- Environmental and sustainability policy
- Occupational Health and safety policy
- Stakeholder engagement and involvement policy
- Training and development policy
- Risk Management policy

CHAPTER NINE

9.0 CONCLUSION AND RECOMMENDATIONS

9.1 Conclusion

From the foregoing analysis, the social, economic and environmental rating for this project is highly positive. Evaluation of alternatives has already shown that options are limited and costly. Already the proponent has incurred a substantial amount of money in the project up to design stage.

Further delay of the project is denying all stakeholders the anticipated benefits of the investment. While, redesigning or relocation of time will lead to loss of time and money that is already tied in the preliminary costs of the project. The project does not pose any serious and negative environmental impacts. Adequate mitigation measures have been proposed to address any of the negative impacts arising from the project.

The proposed project will inject approximately Ksh. 500,000,000/- to the area and national economy. The project will create employment and improve income earnings in the area. The project will boost the demand for Steel products and associated services in Machakos county and Kenya as a whole.

9.2 Recommendations

- That National Environmental Management Authority do consider, approve and grant required Environmental Impact Assessment License to the proponent in respect to the proposed Steel processing plant project on amalgamated Plot L.R. No. Mavoko Town Block 2/26177 and 22616 off Katani Road, in Katani area of Mavoko subcounty of Machakos County.
- That County government of Machakos do support this application for Environmental Impact Assessment License in respect to the proposed Steel processing plant project on amalgamated Plot L.R. No. Mavoko Town Block 2/26177 and 22616 off Katani Road, in Katani area of Mavoko subcounty of Machakos County.
- That the Project Report here now presented is sufficient and meets the requirements of the Environmental (Impact Assessment and Audit) Regulations 2003.

CHAPTER TEN

10.0 REFERENCES

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