ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR PROPOSED INSTALLATION OF MACHINERY AND EQUIPMENT FOR STEEL PROCESSING PLANT IN AN EXISTING GODOWN BY DURABLE AFRICA INVESTMENTS LIMITED, ON PLOT NO. THIKA MUNICIPALITY BLOCK 18/1969, LOCATED INKIANJAU SUB-LOCATION, MAKONGENI LOCATION, THIKAWEST SUB-COUNTY, KIAMBU COUNTY

GPS: -1.0568695,37.0739768

BY

DURABLE AFRICA INVESTMENTS

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THIKA

ENVIRONMENTAL AND SOCIAL IMPACT STUDY REPORT-DURABLE INVESTMENTS LIMITED

An Environmental and Social Impact Assessment 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.

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CERTIFICATION

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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, legal notice No. 31 of 2019.

Signature ..... Date 23/12/2022 .....

DURABLE AFRICA INVESTMENT LIMITED

Proponent

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ACKNOWLEDGEMENT

First and foremost, we would like to thank **DURABLE AFRICA INVESTMENTS LIMITED** for giving the Consultants the opportunity to conduct this an Environmental and Social Impact Assessment for the proposed installation of machinery and equipment for a Steel Processing Plant.

We further thank every person who immensely assisted in logistics, provision of data, and providing 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 I mpact assessors is highly appreciated. We are also indebted to the n e i g h b o u r s 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 Report contains 143 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.

Overview and Background

This comprehensive environmental impact assessment was commissioned by **DURABLE AFRICA INVESTMENTS 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 comprehensive project report 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 expected products from the proposed facility will be reinforcement **bars, steel nails, wire rods and wire mesh.**

Project Location, Objective and Scope

The primary objective of the proposed project is to install equipment and machinery for a **Steel Processing Plant** on Plot L.R. No. **THIKA MUNICIPALITY BLOCK 18/1969, LOCATED in KIANJAU SUB-LOCATION, MAKONGENI LOCATION, THIKA WEST**. Presently, the project site is developed with an existing Godown and the proposed development consists 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 **0.1713 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.

Project Cost and Components.

The proposed development project is estimated to cost **Ksh 9,500,000.** The main design components of the project include, but not limited to the following:

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

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 billets;fuel that will be used will Electricity, water will be the main coolant. Expected products will be reinforcement bars, steel nails, wire rods and

wire mesh among others.

Plant's Expected Waste

Some of the expected waste will include slags, dusts, mill scales, steel scrap, damaged furnace lining insulating materials, usedoil, usedgreaseandeffluentfrom sanitaryfacilities andwaste water.

For this development to take place, an Environmental Impact Assessment (EIA) 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 EIA has been carried out to determine the current environmental status of the site and toassess the impacts that are likely to arise from the implementation of the project. From the assessment, it has been established that some of the basic approvals for the project have beenobtained from relevant authorities.

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.

Project Location

Theprojectwillbesitedonthe pieceoflanddefinedas**L.R.No.THIKA MUNICIPALITY BLOCK 18/1969** owned by the proponent **-DURABLE AFRICA INVESTMENTS LTD-** and the proposed construction and installation of equipment and machinery for a steel processing plant is in tandem with other already existing developments in the areas. The site is located off the Kiandutu-Kiganjo road accessed through an access road on the front side of the site in **KIANJAU SUB-LOCATION, MAKONGENI LOCATION, THIKA WEST**. Other factories and industries neighbouring the proposedproject site include Three Spot Holding's LPG Storage and Filling Plant, and Blue Nile Rolling Mills.

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 is 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. Inmost cases, scrap with allow amount 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.

Summary of Steel Rolling

Rolling is deformation process in which work thickness is reduced by compressive forces exerted by two opposing rolls.

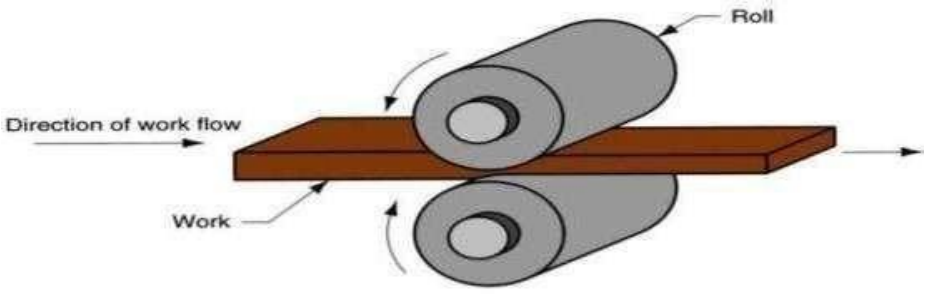

Fig 1. An illustration of rolling process

The rotating rolls perform two main functions:

• Pull the work into the gap between them by friction between work-part and rolls

• Simultaneously squeeze the work to reduce cross section.

Types of Rolling

Rolling by geometry of work

- Flat rolling-used to reduce thickness of a rectangular cross-section
- Shape rolling-a square cross-section is formed into a shape such as an I-beam

Rolling by temperature of work

- Hot Rolling- This is the most common due to the large amount of deformation Required
- Cold rolling- This one produces finished sheet and plate stock

Hot Rolling

Hot rolling is a metal working process that occurs above the re-crystallization temperature of the material. After the grains deform during processing, they re-crystallize, which maintains an equated micro structure and prevents the metal from work hardening. The starting material is usually large pieces of metal, like semi-finished casting products, such as slabs, blooms, and billets. If these products came from a continuous casting operation the products are usually fed directly into the rolling mills at the proper temperature. In smaller operations, the material starts at room temperature and must be heated. This is done in a gas- or oil-fired soaking pit for larger work-pieces; for smaller work-pieces, induction heating is used. As the material is worked, the temperature must be monitored to make sure it remains above the crystallization temperature. To maintain a safety factor a finishing temperature is defined above the recrystallization temperature; this is usually 50 to 100 °C (90 to 180 °F) above the recrystallization temperature. If thetemperature does drop below this temperature the material must be re-heated before more hot-rolling.

The proposed project will incorporate the above described process to process the intended products.

Economic Importance of Steel

Globally, steel consumption has been steadily increasing over time. World iron and steel production has continued to show large increase for the last decade, due to rapidly increasing steel demand in China, India, Kenya 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 ofwire products such as building steel bars, 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.

Economic Importance of Construction Industry

The construction industry plays a very important role in the economy. Indeed, construction index is one of the indicators of overall economic performance. Construction plays an important role in the economy, in that it is an

intensive activity that utilizes both skilled and unskilled labour.It also makes use of locally available materials both from the formal industry (cement, timber) and informal/Jua Kali industry (fabrications). For that matter it creates a lot of forward and backward linkages.It also means that money spent in a construction project circulates in the local economy. Further, the proponent will contribute to the county government revenue base through payment of rates and taxes.

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 analysed 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 supportfor development of local communitythrough company CSR programme
- Improvement of local economic
- 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
- Additionalstrain to the available existing natural resourceswithin 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 include:

- Ensuring construction work is undertaken during the day
- Erectionofatemporarybarrierofironsheetstocondonetheareafromunauthorizedtrespassers.
- Collection andappropriate disposalof solid wastefrom 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 forleakages
- Prioritizing the upgrade of equipment and installation of existing facilities of a network after adefined age.
- Careful sitting 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 leveling 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.

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 significantnegative Environmental and Social Impacts. In addition, the EIA team has developed an Environmental and Social Management Plan, which should be adopted in order to ensure that the mitigation process is successful and ensure environmental safeguards are appropriately implemented.

Table 1: 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, buildingline, land coverage, land ratio and zoning plan. • Careful layout and orientation of structures to respect windand sun direction
	• Adequate provision of green and open space planted withgrass, shrub and tree cover • Minimum use of reflective building material and finishes for roof, walls and pavements • The flow ofstorm watertobeharmonized with neighborhood and directed to well-designed drainage channels
Waste generation	• Contract a NEMA licensed waste handler and dispose offsiteat county designated dumpsite. • Develop appropriate and adequate waste collection measures and facilities. • Provide for waste segregation into organics, metals, and plastics at source for efficient management. • Maintain waste disposal records. • Manage materials responsibly to recover, reuse, andrecycle 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 withpermits. • MaintainafirstAid kitonsite and train theworkers onitsuse • 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 toschedule.

	• Switch off machines when not in use. • Use standard fuel and lubricants • Ensure water sprinkling on bare surface including accessroads to arrest dustemission. • 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 aphase out program as per schedule by Montreal protocol and in accordancetocontrolsubstancesregulations • 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 excessivedust. • 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 machinestoproduce l e s s n o i s e . • Construction and installation work undertaken during dayhours • 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 amongothers. Ensure the construction site is secured by appropriate noise attenuators
Occupational health and safety	• Ensure that work sites (especially excavation works), especially have proper protection with clear marking of safety borders and signals and fence off all dangerousareas. • 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 appropriateuse 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 projectsite. • 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 harassmentintheemployee Codeof 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 deliveringand collectingmaterialsfrom 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 C- 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).
Potential Negative Impact.	**Mitigation Measures**
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 odor, 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 issuesand concerns. • Enhance a health and safety policy and emergency response proceduresand informall staff in the processing plant • Conduct regular fire drills, fire training and general awareness and ensure fire-fighting equipment areserviceable.
	• 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 availablewater 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

	solartopowerthelightingsystem ofplant and domesticorstaff quarters. • Excavation and construction machines will be in serviceable condition to reduce consumption of fuel • The proponent will ensureinstallationofgeneratorsand 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 neighbours 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 noiseand vibration regulations (legal notice No. 61 of 2009) • All noisy plant machinery will be housed in soundproof buildings. • Roller bearing to be used ensure that the noise levels do notgo beyond 85 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 offuel. • Use of approved fuel tanks and monitor fuel quantities to detect leakages. • To prevent any leaks from getting into the environment, thetanks should be properly treated. • A layer of clay should be used to encase the tanks during installation. • The underground tanks must satisfy the national standardsand 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 deliveringand collectingmaterialsfrom 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 neighbours 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 compensationandemployment; 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.
Labour Influx	• The Proponentshould prepareInflux Management Plan • The Proponent should prepare Labour 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 wastesresponsibly • Rehabilitate the degraded soil and natural flora. • Recycle, reuse or recover demolition materials where appropriate • Use of covered transport vehicles to avoid waste gettingbeing blown off

Conclusion

This EIA Study 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 aspresented inthis Report.

After assessing the project impacts, the EIA 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

CGK –County Government of Kiambu

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

EPRA – Energy and Petroleum Regulatory Authority 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

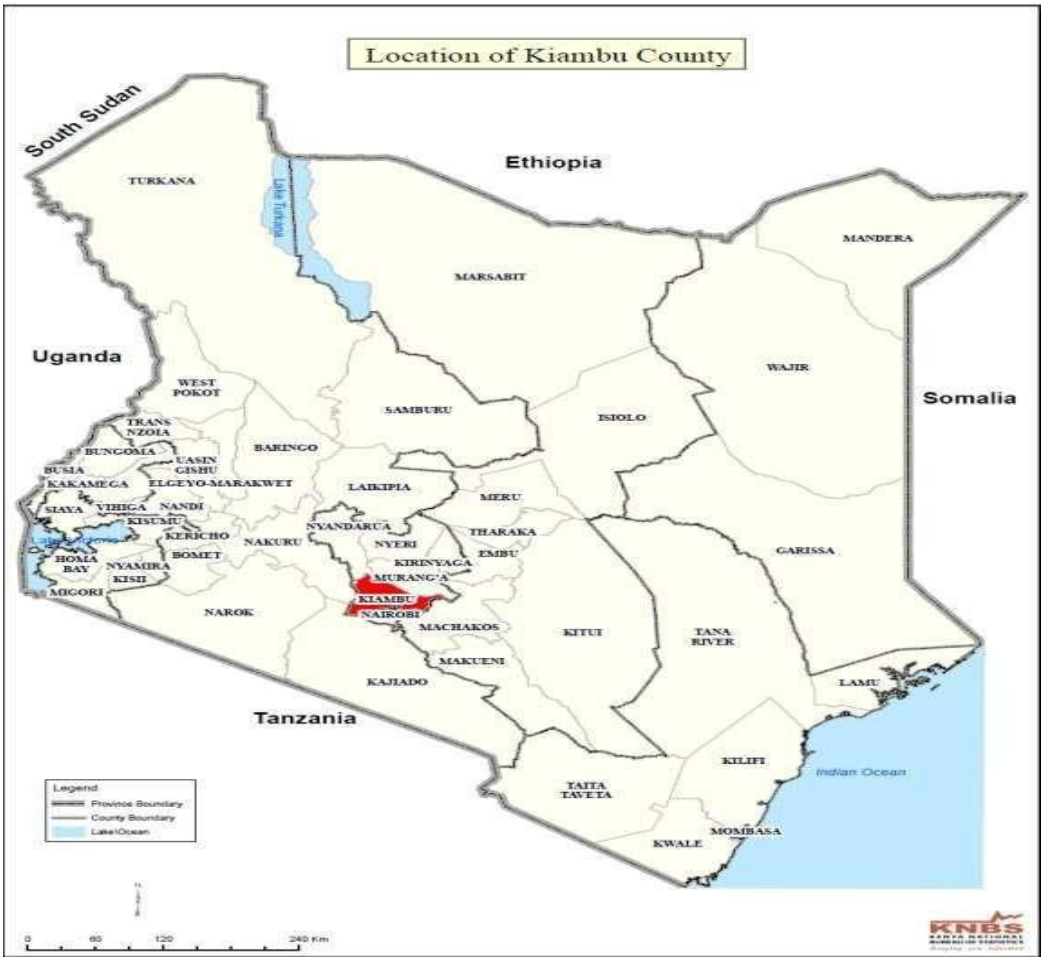
1.0 INTRODUCTION

1.1 Kiambu County

Kiambu County is one of the 47 counties in the Republic of Kenya. It is located in the central region and covers a total area of 2,543.5 Km2 with 476.3 Km2 under forest cover according to the 2009 Kenya Population and Housing Census. Kiambu County borders Nairobi and Kiambu Counties to the South, Machakos to the East, Murang'a to the North and North East, Nyandarua to the North West, and Nakuru to the West as indicated in Map

1. The county lies between **Latitude:** -1° 10' 0.60" S and **Longitude:** 36° 49' 11.39" E

Figure 1 show the location of the county in Kenya. Figure 1: Location of the County in Kenya.



1.2 DURABLE AFRICA INVESTMENTS LIMITED

The proponent, DURABLE AFRICA INVESTMENTS LIMITED is a locally incorporated private company under the Companies Act, 2015. It proposes to establish Steel processing plant within an existing Godown for manufacturing, processing as well as recycling of steel products to produce r**einforcement bars, steel nails, wire rods and wire mesh** to be sold locally and alsofor export. The project will be in Kiambu County, Thika West Sub – county, Kianjau Sub- location defined by coordinates -1.0568695, 37.0739768.

1.3 Origins and development of EIA

The first EIA legislation was formerly established in the United States of America in 1969 (NEPA 1970), in Europe the 1985 European Community directive on EIA (Directive 85/337) introduced broadly uniform requirements for EIA for all member states (CEC, 1985). In Australia, the Commonwealth EIA system was established in 1974 under the Environmental Protection (Impact of Proposal) Act (Wood 2003, Ellott and Thomas, 2009). The United Kingdom enacted a formal legislation on EIA in 1988 (Glasson et.al 2012). China formerly enacted its first EIA legislation in 1979 (Moorman and Ge 2007). In Africa and the Middle East, Israel and Algeria pioneered in enactment and implementation of EIA legislations in 1982, 2003 and 1983, 1990 respectively(Economic Commission for Africa, (2005) Almagi et.al (2007). In East Africa Uganda pioneered in enacting EIA legislation in 1998, Kenya EIA legislation was enacted in 2000, and implemented in 2003 (Morara et.al 2011).

1.4 Rationale of the EIA Study

This Environmental and Impact Assessment Project Report has been prepared following a request by the proponent, to the consultant, to develop an Environmental and Impact Assessment Project Report and an Environmental and Social Management Plan (ESMP) for the proposed construction and installation of Steel Processing Plant and other associated facilities.and Impact Assessment (EIA) is a formal process used to predict how development or construction project will affect natural resources such as water, air, land, Socio-economic and biophysical resources.

Environmental Impact Assessment studies have mostly beenapplied to individual projects and have led to various offshoot techniques, such as health impact assessments, social impact assessments, cumulative impacts assessments, risk assessments and strategic environmental assessments (environmental assessments of proposed policies, programs,and plans). In most cases, social and economic impacts are assessed as part of the environmentalimpact statements. In other cases, they are considered separately. An EIA usually involves a sequence of steps:

(I) Screening to decide if a project requires assessment and to what level of detail;

(II) Scoping to ensure the EIA focuses on key issues and to determine, where more detailedinformation is needed

(III) Description of existing environmental baseline conditions

(IV) Preliminaryassessment to identify key impacts, their magnitude, significance, and importance;

(V) Evaluation of Alternatives to the project;

(VI) Implementing the main EIA study, which involves detailed investigations to predict impacts, assess their consequences, or both.

1.5 The purposes of EIA

The most fundamental aim of an EIA is it acts as an aid to decision-making. For the decision maker, for example, NEMA and other relevant government agencies, it provides a systematic examination of the environmental implications of a proposed action, and sometimes alternatives, before a decision is taken. The EIA process has a potential, not always taken up, to be a basis for negotiation between the developer, public interest groups and the planning regulator. This can lead to outcome that balances well the interests of the development action and the environment.

Secondly, developers may see the EIA process as another set of hurdles to jump before they can proceed with their various activities; the process can be seen as yet another costly and time- consuming activity in the development consent process. However, EIA can be of great benefit to them, since it can provide a framework for considering location and design issues and environmental issues in parallel. It can be an aid to the formulation of development actions, indicating areas where a project can be modified to minimize or eliminate all together its adverse impacts on theenvironment. The consideration of environmental impacts early in the planning life of a development can lead to more environmentally sensitive development; to improved relations between the developer, the planning authority and the local communities; to a smoother development consent process, and sometimes to a worthwhile financial return on the extra expenditure incurred.

1.6 Need for EIA

The metal products sub-sector, which falls under the manufacturing sector plays a vital role in the country's economy especially with the industrialization strategy, and just like other development activities, it has some adverse impacts to the environment. To ensure sustainable development, it is important to take into consideration the possible environmental impacts associated with this project to ensure a safe and healthy environment at all stages of the project operations. Environmental impact assessment (EIA) is one of the tools used by planners to achieve this goal. Although the project is of a relatively low magnitude, the proponent in an endeavor to comply with legal requirements recognized the need to prepare an EIA project report to entrench environmental considerations in the project development and enhance environmental conservation.

1.7 Project Justification

The project is necessitated by the emerging high demand for steel products in the country and regionally. With the current economic growth in Kenya, (6.7 % in 2022), 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 a low density development and therefore suitable for such project hence there will be no land use conflict. Further, it will stimulate economic and social development of Thika and Kiambu County as 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 include 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 promotionof manufacturing sector.

1.8 Project Objectives

The objectives of the project are as follows;

I. To install machinery and equipment for a Steel Processing Plant with water reticulation and power connection to mains and 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.

Specifically, the EIA study is expected to among others:

I. Evaluate and assess the baseline information (physical, biological and socio-economic environment) within the project area of influence.
II. Conduct inclusive and participatory public consultation, engagement and participation during the study
III. Screen the project and its components against all potential significant adverse impacts on the environment, socio-economic well-being of the local population, as well as the requirements on health and safety.
IV. Ensure sustainable development and good environmental practice by ensuring that natural resources are used wisely in the project to ensure inter and intra generational equity. This will ensure ecologically sound and sustainable project.
V. Identify, prevent, avoid or offset any negative impacts that may emanate from theproject thus preventing losses or any disadvantages to any stakeholders.
VI. Identify potential environmental impacts, both direct and indirect.
VII. Categorize measure and propose appropriate mitigation measures for identified adverse impacts of the project.
VIII. Assess the compliance of the project with policy and legal frameworks as stipulated in EMCA 2015 and any other relevant laws of the republic of Kenya.
IX. Develop a comprehensive Environmental and Social Management and Monitoring Plan (ESMMP), indicatingthekeyactionitemsandplansthatwillbe required inorder toensurecompliance duringconstruction andoperation phasesof the project

1.9 Project Cost

The proposed project is estimated to cost an approximate of **KES 9,500,000** Kenya shillings **Nine Million Five Thousands shillings** itemized in section 3-3 project budget in the body of the EIA report.

2.0 EIA METHODOLOGY ANDAPPROACH

The following methodology was used in this project report for the proposed installation of machinery and equipment for a steel manufacturing plant.

(a) Screening

Projects listed in the first and second Schedule as being high risk in EMCA Amendment Act 2015 and Legal Notice No. 31 of 2019, must submit an Environmental and Social Impact Study Report to the Authority. The current project is listed as a high risk project and therefore requires the submission of an ESIA study report for consideration.

(b) Data collection

The team of Experts employed various approaches in collecting data and information forassessing the impacts of the proposed project. The following techniques were used:

i. Primary data review

Primary data was reviewed to get first hand opinion of the individual residents and establishment/facilities around the project location. This was achieved by use of public participation questionnaires that were distributed around the project location for voluntary

Completion by members of the community. Copies of the duly filled out questionnaires and acover letter from the areas Chief is appended to this report

Two Public forums/barazas were organized by the local administration to discuss issues of concern to the community surrounding the proposed project sites.

ii. Secondary data review

Secondary data sources were sought to describe the baseline conditions of the proposed sitelocation in terms of the bio-physical and socio-economic environment, more sore studies showing comparison of the baseline conditions over time.

iii. Site visit and survey

Site visiting by the consultancy team of Architect, Engineer, OSH Expert and the EIA team to assess the proposed location of the project was done in predetermination of the site‟s suitability economically and environmentally. This is in consideration of the regulatory and legislative requirements and standards. This

involves land ownership and size, current land use pattern,proximity to neighbouring developments, nature of neighbouring developments around the proposed site.

Site visiting also provided the EIA team with opportunity to observe substantial changes in the bio-physical and socio-economic environment by comparison to sources documenting the samein the past years.

Baseline air quality and noise surveys were also conducted the results of which are contained in this study report.

(b) Reporting

This report was prepared in accordance with the EIA terms of reference and in line with the guidelines specified in the Environmental (Impact Assessment and Audit) Regulations of 2003for preparation of ESIA study reports.

(c) Assessment of significance of impacts

The first stage of impact assessment is identification of environmental activities, aspects and impacts. The significance of the impacts is then assessed by rating each variable numerically according to defined criteria as outlined in **Table 2**.

The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the **consequence** of the impact and when summed can obtain a maximum value ofthe impact. The frequency of the activity and the frequency of the impact together comprise the

Likelihood of the impact occurring and can obtain a maximum value of 10.

The values for likelihood and consequence of the impact are then read off a significancerating matrix (**Table 3**), and it is determined whether mitigation is necessary using **Table 4**. Thedefinitions used in the impact assessment are given below:

*An **activity*** is a distinct process or task undertaken by an organization for which a responsibilitycan be assigned. Activities also include facilities or components of infrastructure that are owned by an organization.

*An **environmental aspect*** is an element of an organization's activities, products and services which can

interact with the environment. The interaction of an aspect with the environment may result in an impact.

Environmental impacts are the consequences of these aspects on environmental resources orreceptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality.

Receptors can comprise, but are not limited to, people or human-made structures or systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as aquifers, flora and palaeontology. In the case where the impactis on human health or well-being, this should be stated. Similarly,where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.

Resources include components of the biophysical environment.

Frequency of activity refers to how often the proposed activity will take place.

Frequency of impact refers to the frequency with which a stressor (aspect) will impact on thereceptor.

Severity refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.

Spatial scope refers to the geographical scale of the impact.***Duration*** refers to the length of timeover which the stressor will cause a change in the resource or receptor.

Table 2: Criteria for assessing significance of impacts

Magnitude of Impact	**Rating**
Negligible	1
Minor	2
Marginal	3
Significant	4
Catastrophic	5
Spatial Scope/Geographic Extent of	**Rating**
Activity specific	1
Site specific	2
Local area (within 5km of the project site)	3
Regional	4
National	5
Duration of Impact	**Rating**
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure/permanent	5

Likelihood

Frequency/duration of activity	Rating
Annually or less	1
6 monthly/temporary	2
Monthly/infrequent	3
Weekly/life of operation	4
Daily/permanent	5

Frequency of impact	Rating
Almost never/Impossible	1
Very seldom/highly unlikely	2
Infrequent/unlikely seldom	3
Often/regularly/likely/possible	4
Daily/highly likely/definitely	5

Table 3: Significance Rating Matrix

Likelihood (Frequency of Activity + Frequency of Impact)	Consequence (Magnitude + Geographic extent + Duration of the impact)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 4: Positive/negative mitigation ratings and associated color codes

Significance rating	Value	Color Code	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150		Propose mitigation measures	Maintain current management
High	100-120		Propose mitigation measures	Maintain current management
Medium high	77-105		Propose mitigation measures	Maintain current management
Low medium	52-75		Maintain current management	Improve current management
Low	25-50		Maintain current management	Improve current management
Very low	4-24		Maintain current management	Improve current management

3-0 ENVIRONMENTAL BASELINE INFORMATION

3-1 Physical and Bio-physical Environment

3-1.1 Climatic Conditions

Kiambu County is an area with temperatures varying with altitude between 30° C maximum and 14° minimum. The climate of the area is generally coo l throughout the year. The coolest period is between July and August while the hottest months are from November to April. Rainfall in the district is bi-modal, generally occurringin the months of March to May and October to December. The area receives unreliable rains with a mean annual rainfall of 1100mm. T he evaporation/evapo-transpiration is estimated to be between 1,450 and 2,200mm per annum.

3-1.2 Topography and Elevation

The general area is characterized by topography both with steep and gentle slopes, valleys and flat topography. The proposed project site is at the undulating base of a very steep hill. The elevation of thearea is approximately 1690m ASL. The subject proposed site has moderate to steep gradient at various points and the general area in the environs is in some places characterized by both steep and gentle gradients and level in others.

3-1.3 Geology and Soils

Kiambu County has an underlying rock of tuff and trachyte and soils vary in depth, red soils. The soils in the area classified as luvisol and are developed on undifferentiated tertiary volcanic and basicigneous rocks. They are well drained, shallow, dark reddish brown from ashes, pumice from volcanoes, and sediments mainly from crystalline basement rocks (Saggerson, 1991). The soils depth varies at various different points of the site with some areas being deep and others shallow.

3-1.4 Fauna

The site is situated within an area zoned for commercial, residential and agricultural land use where humanactivities have altered the natural habitat for wildlife over the years. Consequently, there are no major animals in the environs except may be birds, insects, and small rodents. Therefore, there is no fauna threatened by the proposed project. The area has some chunks of land undeveloped and bushy some with young trees while others has old mature and large trees.

3.1.4 Flora

The general area is planted with vegetation (trees) mostly along the roads, plot boundaries and in designated gardens within the respective plot boundaries. The proposed site had bushes but no trees as at the time of the study. Even for trees within other plots in the neighborhood, none of which were not of any ecological or economic significance. The soils and climate are favorable for vegetation growth and may be rain-fed agriculture to an extent but most suitably irrigation agriculture due to unreliable rainfall patterns largely due to climate change.

3.1.5 Hydrogeology

The hydrogeological features of the entire County, consist of an almost closed basin with internal drainage situated on the eastern rim of the main escarpment of the East Africa Rift Valley. There are some rivers and streams flowing within the county most of which are seasonal and there are also some low lying areas with depressions which are sometimes swampy. The proposed project site and its environs have gentle slopes which would help greatly in surface drainage.There are no rivers or water bodies in the area.

3.1.6 Water Resources

The area has piped water and there are seasonal streams whose water may not be used for human consumption without treatment. Water supply is adequate mainly supplied by the ThikaWater and Sewerage Company through a piped network. Boreholes drilled within the area indicate that there are sufficient volumes of underground water.

3.1.7 Sensitive Ecosystems and Places of Cultural Importance

There are no sensitive ecosystems or places of cultural importance in the environs.

3.1.8 Socio-economic Environment

The main economic activity is commercial activities and investment projects, subsistence and large-scale farming, livestock and small scale bee keeping so their main source of income is saleof the farm produce including coffee, livestock, milk and honey. Social amenities such as hospitals and schools are easily available in the locality mainly found in surrounding market centers and towns. The main road serving the area is Kiambu Road which is tar surfaced but the immediate access is earth but improved with quarry chips though worn out and in need of repair. Others social infrastructure like schools, religious places, shopping areas etc.) are within reasonable reach though not conveniently available for all. Water is not connected to the site from the piped network.

There are mains electricity serving the neighborhood. There are surface run-off drainage structures in the area but surface runoff drains naturally in line with the prevailing topography. As at the time ofthe

study, the area was covered by the mobile service providers.

The proposed project site is within an area predominantly agricultural and residential/commercial and therefore almost every other plot in the neighbourhood is utilized for agriculture, residential or commercial related activities.

The location is well accessible via good roads from several routes and in close proximity to the Nairobi City Center, Kiambu Town, Kikuyu, and Limuru. The general area has several pockets of commercial centers primarily to serve the residents.

All social amenities (hospitals, schools, religious places, shopping areas etc.) are within easy reach. Major urban infrastructures (water, electricity, roads, and mobile telephony) are availableand shall be connected to the proposed project site via an 11KVA. Esther

All emergency facilities (fire brigade, ambulances etc.) are within easy reach from the various providers. The area is currently an average density residential area. There are no sites of cultural, historic or traditional significance in the immediate neighborhood. The area is within theCounty Government of Kiambu‟s jurisdiction and therefore served by the CGK‟s infrastructure and is also bound by the CGK's by-laws

3.1.9 Waste disposal

Waste disposal services by licensed waste disposers are available in the major commercial andresidential centers.

In few cases non organic waste such as product wrappings/packaging‟s and containers are seenburnt or thrown around. The proponent will seek the services of a licensed waste disposer for collection and disposal of wastes generated during construction, operation and decommissioning.

- **Location and Demography**

The project area is located at Kianjau, Thika West Sub-county, Kiambu County. Kiambu is a county in the former Central Province of Kenya. Its capital is Kiambu and its largest town

is Thika. The county is adjacent to the northern border of Nairobi County and has a population of2,417, 735 of which 1,187, 146 were male and 1,230,454 were female. In Kiambu, the intersex population was 135 (KNBS: 2019 Population and Housing Census). The county is 40% rural and60% urban owing to Nairobi's consistent growth Northwards. Kikuyu are the dominant tribe in the county.

Existing Godown for the Installation of Machinery and Equipment for the proposed steel processing plant

Site Location Map (-1.0568695, 37.0739768)

Access Roads to Proposed Site and Electricity Connection to the proposed site

3.0PROJECT DESCRIPTION, ACTIVITIES AND BUDGET

5.0 Project Description

The project is focused on constructing and installing a Steel Processing Plant. The actual design components of the project include:

- An Administration block.
- Weighbridge
- Security office
- Parking lot
- Septic tank and sock pit
- Washrooms
- 2 pinch rolls
- Flying shear
- Tmt roll
- DC Pannel
- Water tanks
- Oil tank
- Intermediate
- Furnace
- Transfarm
- Mill
- Associated piping work
- Entrance and exit
- Site landscaping

5-0.1 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 theinductivity 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 andif 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) meltcycle, 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 powerisbeing applied, suchaswhen the initial charge isbeing added, whenslagisbeing removed, when a temperature dip or analysis sample is being taken, waiting for an analysis result, andtapping 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 40minutes, 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 processwhich requires 10 tons of liquid steel to be tapped perheatand the heatcycle is such that it canonly 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-tokeep the slag hot and fluid. The inductionfurnace 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 (Fig 1) are (i) radiation loss from the furnace top, (ii) conduction losses from the refractory lining, (iii) heat losses in the coolingwaterofthecoil,(iv) heatcarriedbythe 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 tothecoolingwater andbyradiation fromtheshellandtheexposedmetalsurface atthe 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.

5-0.2 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 a heat are important forcontrolling 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 workingpersonnel. 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 is 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 a 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, acarburizer (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 furnacewithin 65 % to 70 % of the actual melt cycle.

The initial materials are required to be charged in the furnace as quickly as possible and ofsufficient 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 metre. 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 toglowing cherry red colour within just one or two minutes increasing the oxidation. The oxidesofiron increasetheamountofslagformed. Allofthisoxidationproducesahighly reactive FeOslag.

Cleanliness of the scrap is very important since dirty or contaminated scrap tends to deposit a slaglayer on the furnace refractory. This occurs at, or just below, the liquid level in the crucible andrestricts 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 Cenergy 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 physicalcharacteristics. 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 overallheatloss, and(iv) improves the product qualityconsistency.

The role of carburizer during steel-making in the induction furnace is to remove oxygen from thesponge 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 steel making 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 rangeof 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 scrapis more desirable in order tohavebetter recovery of carbon. Use of veryfine particle size of thecarburizer 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 theferroalloysdepends ontheir specification(size,grading, andcomposition).

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.

5-0.3 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 need 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 heatcycle. As soon as thefirst lot of scrap is charged in the furnace, power is switched onandcurrent 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 depend s prim arily on tw o th in g s 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 enablepower 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 maximumkilowatts 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 inmedium 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 moltenpool 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 ontop 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 itsviscosity 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 theremoval 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 ofhigher amountof sponge iron in the charge, there is a needfor 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 oil occurs at slag metal interface by the reaction $3\,FeO + 2C = 3\,Fe + CO + CO2$. Carbon content in the liquid bath is tobe 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 $C = 1.67\,[100 - \%\,M - \{(\%\,Slag/100) \times \%\,Fe\}]$. Here, M is degree of metallizationand Fe is amount of iron in the slag.

5-0.4 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 becompleted, 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 bedecided taking intoaccount, 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 amountofferro-alloys and carburizer(if required) is put in theladle bottomand 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.

5.0.5 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 steel making 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. Theoperator 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 hasbeen moved forward up to the coil. If this condition leads to a blockage of the windings and therelease 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 thrownoutontothefurnace 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 othermaterials 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 intime.
- 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 orhollow 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 areto be told to remain at a safedistance.
- The minimum PPEs required by the personnel at the furnace operating floor are safetyhelmet, 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 otherimpurities.
- Any oil which has leaked out is to be picked up and the spot is covered with sand. The leakis 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, thebridge can be melted with the furnace at low power and in the tilted position and thefurnace 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 howlong 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 switchedoff.
- If work is to be carried out with the furnace in the tilted position, the furnace is required tobe 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

5-1.1 Existing Development in the Neighborhood

The neighborhood where the proposed project site is located is already characterized with medium residential, commercial, industrial and institutional developments and mixed use. The proposed development would hence easily blend with the existing character and development trends of the neighborhood and the wider Thika area.

5-1.2 Construction and Installation of 1 No of Steel Processing Plant

The project proposes the construction and Installation of 1 Steel Processing Plant and other support services, associated

facilities and amenities. The attendant site and approved plant‟s plans for the proposed development have been attached in Appendix 1.

5-1.3 Driveway, Walkway and Parking Spaces

A paved driveway and walkway is to be constructed to give motor vehicle traffic and pedestrians a proper surface on which to move. The proposed development will have adequate car parking. The improved sub-grade will be made up of compacted quarry stone chippings; the sub-base is of 150 mm thick hand-packed hard quarry stone; and the road surface will be 50 mm thick standard paving blocks.

5-1.4 Utilities and Services

i) Water Supply

The proposed development will be connected to an already available borehole 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 liters. 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 resident mainly relies 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 neighbouring premises.

iv) Solid Waste Disposal

The proposed development will generate solid waste. The proponent will engage a NEMA Licensed private contractor to collect the waste. It is further recommended that the compound has point designated for storage of solid waste before collection.

v) Electricity Supply

Electricity is to be connected to the proposed development from the main national electricity grid by Kenya Power and Lighting Company through an 11KVA circuit breaker.

VI) Telecommunication.

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

5-1.5 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 Kiambu. A green belt should be created within the site to providea habitat for birds and small mammals.

5.0 PROJECT ACTIVITIES

5-2.1 Overview

The activities of the proposed project include –

- Site preparation and clearance of existingvegetation
- 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.

5-2.2 Site Preparation

i) Fencing

The exact site location will be secured by hoarding along local access road.

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 orexplosives.

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.

5-2.3 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 Kiambu. 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.

5-2.4 Construction of the Steel Processing Plant

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

5-2.5 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 theprovisionsoftheengineer.

5-2.6 Internal /Utility Services

i) Plumbing System Water Supply

The internal water supply is 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 waste-water 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.

ii) 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.

5-2.7 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 available 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 engineer‟s 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 mmwide and 600 mm deep and with steel grating cover. The drain will discharge onto anopen main storm water drain along the local access road which will be harmonized withdesign drainage of neighboring premises. The storm water can be used for irrigation of lawns and flower gardens within the plant‟s compound. Alternatively harvest roofwater 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 County government of Kiambu and/or 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 manureand/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 provideaesthetically 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 becarted away. Similarly, any tools and equipment still on site will be removed.

5-3.1 Construction Procedure

5-3:1.1 Appointment of Contractor

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

5-3 :1.2 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 convey 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 toe sand 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 are 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 fire-fighting 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

5-4 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 formal '**Notice of Completion'**. The project will then be handed over to the proponent.

5-5 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.

5-6 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:

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

5-7 PROJECT BUDGET

5-7.1 Overview

The total project cost is estimated at **Ksh. 9,500,000**

5-7.2 Capital Investment Costs

The main capital investment costs relate to:

- 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.

5-7.3 Professional Fees and Labour Costs

The project involves lawyers, town/physical planners, environmental experts, architects, engineers, quantity surveyors etc. It is estimated that 30% of the project development cost will be allotted for labor charges. Labour force of **30** casual workers and **8** permanent staff will also be employed. The total professional fees and labour costs is estimated at **Ksh. 2,850,000**

5-7.4 Cost of Materials

Cost of purchase and installation of the steel plant system is estimated to take 70% of the total development cost. This can be therefore approximated at about **Ksh. 6,650,000**

5-7.5 Project Time Schedule

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

5-7.6 Financing

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

5-8 PROJECT MATERIAL AND PRODUCTS

5-8.1 Project Material and Inputs

The raw material that will be used in the production of hot rolled steel products is billets. A billet is a length of metal that has a round or square cross-section, with an area less than 36 square inch (230 cm^2). The billets that will be used at the RSD will be imported.

7.3.1.2 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 coolantfor the mill will oils and lubricants will lubricate the plant and equipment. In summary, the mainmaterial 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 (EPs) panels
- Sand
- Cement
- Crushed stone
- Gravel
- Soil
- Timber
- Steel (reinforcement, casement, wiring, pipeetc)
- Glass
- PVC material (tiles pipes, conduits andfittings)
- Concrete tiles and paving blocks
- Paint
- Plant material – grass, tree seedlings etc.
- Water

5-8.2 Project Products

The main products that will be generated from steel processing will be hot steel product namely angles, zed section, tee section, flat bars. 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)

6-1 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) 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:

6-1.1 The 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 environmentand 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 ofKenya;
- Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of thecommunities;
- Encourage public participation in the management, protection and conservation of the environment;
- Protect genetic resources and biologicaldiversity;

- 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.

6-1.2 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 integrated 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 andurbancouncils:

- 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 withreference 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 foran 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 necessaryto 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
- Suchplansdisclose a contravention of the physicalplanning(Buildingand 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 sub-plots

- 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 orcomfort 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 sub-plot 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 impactassessment report. The above provision compares well to Section 29 (a), which confers upon localauthorities 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 areawith 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.

6-1.3 The Environmental Management and Coordination Amendment Act 2015, CAP 387.

The Environmental Management and Coordination Act (EMCA) 2015 CAP 387, and its attendant Environmental (Impact Assessment and Audit) Regulations of 2003 amended 2016, provides for the establishment of an appropriate legal and institutional framework for the management of environment in Kenya. The Act introduces two important aspects of urban environmental management, which are directly related to the proposed project: environmental impact assessment (EIA) and environmental audit (EA). Section 58 (I) has underscored that any person being a proponent ofa project shall before financing, commencing or proceeding with s u b m i t a n EIA Study report to the National Environmental Management Authority (NEMA) of Kenya.

Section 68 (I) gives NEMA the mandate for carrying out all environmental audits of all activities that are likely to have significant impacts on the environment. It authorizes environmental inspectors, as appointed by NEMA to enter in any premise and determine how far the activities carried out conform to statements in

EIA study. 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 thereport.

Relevance to project

The proponent in preparing this EIA Study 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.

6-1.4 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 waste-water 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 o r c o n d i t i o n 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.

6-1.5 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 anyperson to use or possess or control for use for trade a weighing or measuring instrument notconstructed 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.

6-1.6 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 theresults 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 andbylaws. Thisisthe primarylaw governing thedevelopment ofcounties andthereby willbekeyduring implementation ofthe project. Theproponent 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 Kiambu. The proponent hasobtained the necessary approvals bythe relevant county departments.

Relevance to project

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

6-1.7 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 hisworkplace, 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 occupiers must carry out risk assessment and section 4 requires that theproponentsendsacopyto the occupational health and safety officer in thearea. Section 13 (a) to (g) also stipulates the duties of the employee in efforts to ensure that he/her safetyand healthisguaranteeattheplaceofwork. Section 21 givestheprocedureand 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 useenforced.

6-1.8 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 legislationwith regard to the above Act at

the proposed premises.

6-1.9 The Building Code, 2009

In recognition of the role of local authorities as lead planning agencies, the adoptive by-lawcompels 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 notcorrectly drawn or do not provide sufficient information that complies with the by-law. Anydeveloper, who intends to erect a building, must give the concerned local authority a notice ofinspection, 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 shalltherefore occupy a building whose certificate of completion has not been issued by the localauthority. 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. Theproponent 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.

6-1.10 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 ofother 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 acommon 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.

6-1.11 The Way Leave Act

The areas zoned for communication lines, sewer lines, power lines, water pipes etc. are known asway 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.

6-1.12 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 tohave anyadverse impact on thequalityorquantityofthewater withoutan EIAlicense issued.

Relevance to project

The proponent will ensure water connection from the Thika Water and Sewerage Company"s water supply line, 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.

6-1.13 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 waste-water disposal. Section 12 (1) requires that every in local authority, a person operating a sewerage system or owner or operator of any trade orindustrial undertaking obtain an effluent discharge license as stipulated under the EMCA, 1999 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 waste-water into public sewer or aquatic ecosystem is required to obtain a discharge license and regularly monitors qualify ofeffluent. The proponent will not discharge any waste water into the environment and will endeavour 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 endeavour to seek services of NEMA licensed operator when necessary.

6-1.14 The Traffic Act (CAP 403)

Theactitprohibitsobstructionoftraffic, eitherbypersonsorfacilitiesconstructed insuch 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 mobilevehicles.

Relevance to project

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

6.1.15 Sessional Paper No 9 of 2012 on National Industrialization Policy Framework forKenya

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 there from. 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, Kiambu, 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 industryin 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 thecountry,
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 coke.

NB: whenever any of the laws contradict each other on matters of environmental conservationThe EMCA act CAP 387 prevails.

OTHER POLICY DOCUMENTS AND INTERNATIONAL TREATIES

6-1.16 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 politicalinvolvement.

6-1.17 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 underscoredthat 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 beprovided. 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.

6-1.18 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 sustainabledevelopment 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 integrateenvironmental 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.

6-1.19 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.

6-1.20 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 proposedhousingdevelopers to invest in shelter and hence requires use of steel.

6-1.21 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.

6-1.22 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.

6-2 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:6-2.1 County government of Kiambu.

This is the principle lead agency in all matters pertaining to planning within the Kiambu 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 resourcesfor economic, social, ecological and other functions across a county; The Physical Planning Act (Cap 286) 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 Kiambu being no exception, the power to prohibit or control the use and development

6-2.2 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 requiredto coordinate and supervise the various environmental management activities being undertaken bystatutory organs with a view to promoting their integration into development policies, programmes, 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 programmes; 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.

6-2.3 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 developmentplans
- 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.

6-2.4 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 in the Petroleum Sub-sectorisas 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

6-2.5 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(ImpactAssessment and Audit)Regulations,2003,whichstatesthat:

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

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

6-3 Conclusion

The institutions guided by relevant policies and legislation 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.

7.0 PUBLIC CONSULTATION AND PARTICIPATION

7.1 Legal Requirement

During the field survey for the proposed installation of machinery and equipment for the development of a Steel Processing plant, public consultation (PC) 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 EIAs 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 decommissionphase.

7.2 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 comprehensive EIA project reporton the proposed projectsite, the project team and experts visited the site and assessed the suitability of the site to the proposed project. The consultancy team and EIA expert also visited the community and held stakeholder consultative meeting with more than **20** community members and neighbours about the proposed project. The minutes of the meeting together with photos and attendance list are provided in this report as annexed at the end of the EIA final study report.

Further consultation was done through the use of 3**0** semi structured questionnaires that wererandomly given to the area residents around the nearest neighborhood 0.5-2km away. Therespondents were mainly residents and investors who had resided in the area for a period of between **2 months-15 years**. 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: -

- Theproposeddevelopmentwillprovide steelproductstothe countyand countryat large.
- The proposed development would create employment opportunities to the local community.
- There will be improved aesthetic and development in the area
- The alreadyexistingbusinesseswillhave a boost from workersintheproposed projectsite.
- 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 theproblems 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 thesite.
- 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.

7.3 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 voicetheir 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 channeledandwillensure timely responses to each query.

This will allow for trust to be built amongst the stakeholders and prevent the culmination of smallissues 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 toall 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:

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

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 beenidentified for the project, as can be seen below: -

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
- Sexualexploitationandabuse byproject workers against community members
- Violence against children
- Gender-based violence
- Issues related to workers‟ organization.
- Labour Accommodation
- Health and Safety issues
- Extended working hours

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 andprotection
- 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.

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 befounded 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 theoutcome 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 haverelatively 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 mutuallyreinforcing. 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 andseriousness 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 its 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 understandablemanner. 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 clientand stakeholder groups. In certain circumstances, the client may consider providing funding for such third-party advice or facilitation in away that is acceptable to alparties and does not compromise the integrityoftheprocess

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 suchas 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 beenresponding to the grievances it hasreceived.

Table 0-1: Sample Grievance Recording Form

GRIEVANCE REGISTRATION	
CASE No.	**DATE**
Name	
Department/Contractor Name	
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)	

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.

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.

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.

Maintaining a Grievance Register

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

This grievance register shall be updated at each stage of the grievance redress. Once thegrievance 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.

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 redress shall be suggested. As part ofthis acknowledgement a tentative timeline for the redress 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.

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 siteinvestigation 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, itshould 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 adequateresponse shall be given to the grievant along with a suggested alternative resolution to thegrievance. If at any stage, the grievant is not satisfied with the solution, s/he may choose to ask foran escalation of the grievance to the next level.

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.

EXTERNAL GRIEVANCE MECHANISM

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

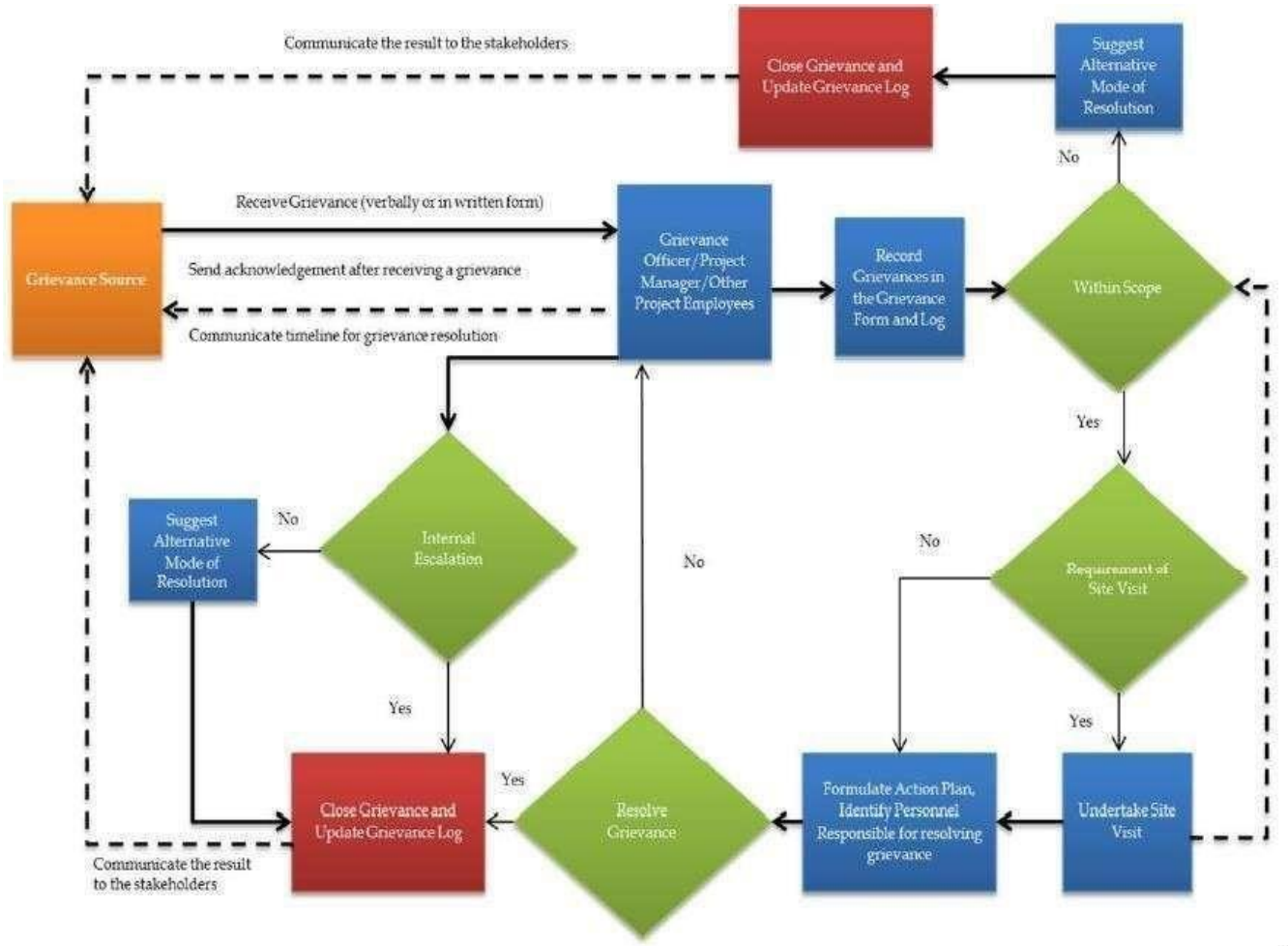


Figure 0-4: GRM steps

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.

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

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 anddiscussion. On the basis of these reports, a Grievance Redressal Report will be prepared.

8.0 IMPACT IDENTIFICATION, ANALYSIS AND MITIGATION.

8-1 Overview

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

8.1.1 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 periodof 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 bythe 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 synthesise significance of the impact as shown in impact significance assessment criteria that is used to generate the risk assessment matrix.

8.1.1.1 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.

8.1.1.2 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 in

Sensitivity	Definition (considers duration of the impact, spatial extent, reversibility, and ability of comply withlegislation)
High	Vulnerable receptor (human or ecological) with little or no capacity to absorbproposed 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

Generic Criteria for Determining Sensitivity

8-2 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 Table 6-1.

8-3 Impacts During Construction Process

The proposeddevelopmentislikelyto havethefollowingimpactsduringtheconstructionphase:-

8-3.1 Positive Impacts

It is estimated that **30%** of the project cost will be reflected in employment of professional services and labour. 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 willbe of a benefit from both social and economic perspectives. From economic perspective, abundant unskilled labour will be used in economic production, on the other hand, from social perspective, the labourers 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 labourers, semi- skilled and skilled labour, professionals such as town planners, architects and structural engineersamong 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.

Table 6-1: Detailed Impact Matrix for the Proposed Steel Processing Plant Development

Potential Impacts	Positive Impacts			Negative Impacts		
	Insignificant [1] (Negligible)	Moderate [2] (Mild)	Significant3 (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 break						
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 exhaustfrom the furnace flue gas						

[1] Insignificant stands for impacts that are too small or unimportant to be worth consideration
[2] Moderate stands for impacts that are average in amount, intensity and degree
[3] Significant stands for sufficiently great impacts that are noteworthy and important to be worth of attention

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						
Workers 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						

8-3.2 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. There is 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.

Table 3-3. Ambient Air Quality Tolerance Limits

Pollutant	**Time Weighted Average**			
		IndustrialArea	**Residential, Rural & Other Area**	**Controlled Areas**
Sulphur oxides (SOX);	Annual Average	80 ug/m^3	60 ug/m^3	15 ug/m^3
	24 hours	125 ug/m^3	80 ug/m^3	30 ug/m^3
	Annual Average		0.019 ppm/50ug/m^3	
	Month Average			
	24 Hours		0.048ppm /125ug/m^3	
Pollutant	**Time Weighted Average**			
		IndustrialArea	**Residential, Rural & Other Area**	**Controlled Areas**

	Instant Peak		500 ug/m^3	
	Instant Peak (10 min)		0.191 ppm	
Oxides of Nitrogen (NOX);	Annual Average	80 ug/m^3	60 ug/m^3	15 ug/m^3
	24 hours	150 ug/m^3	80 ug/m^3	30 ug/m^3
	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/m^3	0.05 ppm	
	Month Average		0.08 ppm	
	24 Hours	100 ug/m^3	0.1 ppm	
	One Hour		0.2 ppm	
[redacted]	Instant Peak		0.5 ppm	
Suspended Particulate Matter	Annual Average	360 ug/m^3	140 ug/m^3	70 ug/m^3
	24 hours	500 ug/m^3	200 ug/m^3	100 ug/m^3
	Annual Average		100 ug/m^3	
	24 hours		180 ug/m^3	
Respirable Particulate	Annual Average	70 ug/m^3	50 ug/m^3	50 ug/m^3
	24 hours	150 ug/Nm^3	100 ug/Nm^3	75 ug/Nm^3
PM2.5	Annual Average	35 ug/m^3		
	24 hours	75 ug/m^3		
Lead (Pb)	Annual Average	1.0 ug/Nm^3	0.75 ug/Nm^3	0.50 ug/m^3
	24 hours	1.5 ug/m^3	1.00 ug/m^3	0.75 ug/m^3
	Month Average		2.5	
Carbon monoxide (CO)/ carbon dioxide (CO2)	8 hours	5.0 mg/m^3	2.0 mg/m^3	1.0 mg/m^3
	1 hour	10.0 mg/m^3	4.0 mg/m^3	2.0 mg/m^3
Hydrogen sulphide	24 hours	150ug/m^3		
	instant Peak	700ppb		
Total VOC	24 hours	600 ug/m^3		
Ozone	1-Hour	200 ug/m^3	0.12 ppm	
	8 hour (instant Peak)	120 ug/m^3	1.25 ppm	

Source-NEMA

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 micro-climate 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 micro- organisms. 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 (honey sucker) 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 not 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. Measuresfor dust reduction and control will be necessary.

8-3.3 Potential Mitigation Measures

Anticipated Impacts	Potential Mitigation Measures
Noise Generation and Disturbances.	• Construction work should be carried out during the specified time i.e. from0730 hrs to 1700hrs; noise generated during the day is not quite disturbingas 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 labour is recommended in the construction phase, to reduce the noise emitted by constructionmachinery. • 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 run-off/storm water to reduce its impact on loose soil by e.g. roof or rainwaterharvesting • Control construction activities especially during rainy/ wetconditions • 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 tobeutilized for levelling low-lyingareas 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 been closed to mitigate effects of wind. • Workers should be trained to understand the hazards that may be generated in such workenvironments. • 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 Healthand 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 andother 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 Rule12 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 DOSH. • Appropriate abstracts should be displayed at strategic location including, the Workplaces Act, and Building Operations and Works of Engineering Construction (BOWEC), Rules, 1984.

8-4 Impacts during Operational Phase

8-5 8-4.1 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 Kiambu will also be revised upwards owing to the capitalappreciation 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, crapdealers and associated activities.

iv.) Optimal Use of Land

The Steel plant development leads to optimal use of land. Considering the scarcity of serviced land in the area theprojectenhances the returnson the limited land space in the area.

v) 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.

v) Improved Aesthetics

Some of the developments in Kianjau area 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.

8-4.2 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 a swell 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.
- Healthrisks appear to have little, if any, short term effectand it may be that ill-health does notoccur 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 contact 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, e.g. from hand-held tools leading to hand arm vibration syndromeand 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 selectedaccording 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 enclosingthe 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 arenecessary 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 th e 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.

II. Increased Population without Commensurate Services

The neighborhood where the proposed project is located is already characterized by high-density development. The proposed development will further lead to an increased demand on commensurate services and facilities in Thika Wes sub-county. If population in the neighborhood is not provided with appropriate services and facilities, thenpressureonexistingfacilitiesisboundtoincrease.

ii) 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. Theamount of runoff will increase slightlydueto loweredinfiltration of rainwater into the soil. The surfacewaterfrom theplant is likelyto

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 properlyconstructed 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.

iii) Traffic Congestion

The plant will to some extent 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.

iv) 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, andland use, ground coverof the surrounding site, climaticconditions and distance of the receiver from the sound source. Noise and vibrations from steel processing activities can have adverse effectsif notwellmanaged. Despite the lowpotential of the vibration and noise on human health, it isnecessarytonote that, the workerswillbeatgreater risk ofexposureatthe 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

Inundertaking the construction activities described above, the Contractor will complywith the following national regulatory air quality standards and WBG noise level guidelines, whichever is stringent. Regular monitoring to determine compliance will bedoneby the proponent and corrective/ mitigationmeasures appliedwhere 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. Indoors 2. Outdoors	 35 40		 25 25	
Mixed Residential (inclusive of Entertainment and commercial places)	55		45	
Commercial	70		70	
Silent arena	30		25	

Source-NEMA

Noise Levels for Construction Sites

Facility	Maximum Noise level limits dB(A)		Time Frame
	Day	Night	
Health facilities, Educational Centres 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	

Source-NEMA

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

Source-NEMA

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

- **I.** Factory/Workshops 85 dB (A)
- **II.** Offices 50 dB (A)
- **III.** 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	1,000
120	10,000

Source-NEMA

Baseline Noise Survey Results from the Proposed Site

Noise level survey was conducted at the proposed site to stablish the baseline noise levels and the results are as below. It is important to note that the levels are within the ranges recommended by NEMA.

1. POINT A Main Gate area	37.073178 S-01.05643	47	44	45	43	46.6	43.4	45.0	44.3	47.2		43	47.2	45.05556
2. POINT B Near exit gate	37.07388 S-01.05627	66.9	65.3	51.1	50.7	48.7	46.6	46.3	58.4	6.7		6.7	66.9	48.96667
3. POINT C	37.07410 S-01.05594	48.8	43.3	62.4	43.1	41.5	45.6	44.0	44.2	41.5		41.5	62.4	46.04444
4. POINT D	37.07415 S-01.05597	49.7	46.3	48.1	55.1	48.7	50.0	48.3	49.2	54.7		46.3	55.1	50.01111
5. POINT E	37.07420 S-01.05600	56.7	42.5	43.0	42.7	47.3	43.4	44.4	45.6	47.1		42.5	56.7	45.85556
6. POINT F	37.07432 S-01.05605	63.6	48.9	50.7	50.7	64.4	44.7	62.6	47.5	45.4		44.7	64.4	53.16667
7. POINT G School side	37.07431 S-01.05608	49.0	43.7	44.3	59.6	43.9	47.0	49.9	48.7	45.6		43.7	59.6	47.96667
8. POINT H	37.07424 S-01.05623	50.6	49.6	54.6	51.3	57.4	50.8	48.7	47.0	55.4489		47	57.4	51.71654
9. POINT I	37.07413 S-01.05663	51.2	60.2	53.4	50.3	57.4	50.7	53.1	52.3	50.4		50.3	60.2	53.22222
10. POINT J Near the church-main road	37.07407 S-01.05657	43.4	42.7	49.0	41.2	46.7	43.1	46.7	57.7	44.3		41.2	57.7	46.08889

11. POINT K Near main gate	37.07387 S-01.05648	49.6	57.4	56.7	47.4	44.7	48.7	44.6	48.6	47.7		44.6	57.4	49.48889

v) Increased Pressure on Infrastructure and Facilities

The neighbourhood 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. The site is connected to main power and water from a neighbors borehole water supply. During construction water stress is a likely impact due to increased demand but the contractor will be required to obtain water from outside the premises and truck it to the construction site. 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.

vi. **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 ofattracting disease vectors such as rats, flies, and cockroaches if not well managed.

viii.) 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.

Vix.) 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 bereported.

Vx). 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). Additionalsources 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/m^3
	24 hours	70 ug/m^3
Oxides of Nitrogen (NOX);	Annual Average	80 ug/m^3
	24 hours	150 ug/m^3
Sulphur oxides (SOX);	Annual Average	50 ug/m^3
	24 hours	125 ug/m^3
Hydrogen Sulphide	24 hours	50 ug/m3
Lead (Pb)	Annual/24 hours	0.5 – 2.0ug/m^3
Ammonia	24 hours	100 ug/m^3

Source – NEMA

The EIA experts further collected baseline air-quality data from various points at the the proposed site and the results are as presented in the table below. It is worth noting that the baseline results do not deviate significantly from those recommended by NEMA.

Location	GPS	Air Quality Parameters	
		PM µg/m^3 (2.5)	Air Quality Index (AQI)
1. POINT A Main gate entrance	37.073178 S- 01.05643	19	55
2. POINT B Near exit gate	37.07388 S-01.05627	17	53
3. POINT C	37.07410 S- 01.05594	19	57
4. POINT D	37.07415 S- 01.05597	16	53
5. POINT E	37.07420 S- 01.05600	17	53
6. POINT F	37.07432 S- 01.05605	21	61
7. POINT G School Side	37.07431 S- 01.05608	17	53
8. POINT H	37.07424 S-01.05623	17	53

8-4.3 Potential Mitigation Measures at the operation Phase

The Anticipated Impact	Potential Mitigation Measure
Increased Water Demand	• Encouragewaterreuse/recyclingmostlyduringoperationphase. • 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. • Ensurewaterconservationbyclosedlooprecyclingofwastewater • Use of treated waste-waterin 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 minimizedust generated by the trucks. • Provision of workers with personal protective equipment and clothingsuch as dust masks. • Fencing off the site from members of the public- this will reduce unnecessaryexposuretodustandotherhealthandsafetyrisks. • Use bag filter as for pollutiondevice.
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 activitiescan bescheduled or limited to certain timesof 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 whenworks are likely to be started and completed. The signs should bepositioned in a way to be easily viewed by the public and mostlymotorists. • The traffic along connecting routes should be controlled especially during construction phase and mostly when large trucks are turning intothe site, say for delivery ofmaterials.
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 Kiambu CountyGovernment. • 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 ReductionRules, 2007 are in place.
Power/Energy demand	• Ensureconnectionwiththe Kenya Powerand Lighting company • Power usage will be closely monitored to avoid wastage • Switch of machines when not in use • Ensureuseofhighqualityequipmentthatguaranteesefficiency
Emissions	• Regular servicing of machines • Switching off engines when not in use • Use unleaded fuel • Provide PPE to machine operators • Workers education and awareness
Occupational injuries and accidents	• Workers hired during the operational phase tofirst be trained on the appropriate useofthe providedpersonal 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 trainedfirst aiderswith fullyequipped first aid station

8-6 Impacts during Decommissioning Phase

8-5.1 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 limitedto:

- 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)
- Paint

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

8-5.2 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 regulatedmaterials.

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 structuralassembly 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 dustbyeither manuallydisassembling 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 ofdevelopment 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 withtheparticular aim ofpreserving theitems 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 fromanynuisance inform ofnoise anddust, and from falling objects. Thecontractor 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 attemptshallbe made to limit the quantityof materials removed from site or sent to landfillthrough 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 possibleminimize the projects overall environmental impact through reuse and recycling.
- Take particular care when decommissioning the fuel storage tanks to avoid soil contamination withoils and other petrochemicals.
- Use appropriate vehicles (covered) to transport demolition waste according to waste management regulations.

Table 6-2: 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 becovered and licensed as per the EMCA waste management regulations. • Carefulscreeningtocontainandarrestdemolitionrelateddustwillbeadopted • Exposed demolition debris of e.g. dustandsand, will be enclosed, covered, and watered daily before transported to disposalsite. • Demolition activitieswill besuspendedwhen wind speedexceeds 25 mph. • Windbreakerswill be installed at the windward side of the construction site. • Allworkersonthe sitewillbe requiredtowearprotective clothingwhile onduty	• Project proponent • NEMA inspectors • County government ofKiambu
Noise pollution by demolition activities.	• Explosives will not be used during the exercise • Portable barriers willbeinstalled toshield compressors and other smallstationery equipment where applicable. • Useofequipment designed withnoise control elements willbeadopted where necessary. • Trucks used during demolition exercise on site shall be routed away from noise sensitive areas in the neighbourhood, where feasible.	• Project proponent • County government of Kiambu • NEMA inspectors

	• Sound barriers are to be installed for pile driving activities. • Idling time for pick-up trucks and other small equipment will be minimized to limitedtime. • Use of very noisy equipment will be limited to daytime only. • All workers operating in noisy areas or operating noisy equipment will be providedwith earpieces to protect against extreme noise. • Special care to be considered when excavating out the fuel storage tanks to avoid sol contamination with petro-chemicals • The demolition exercise will be limited at day time only	
Proliferation of uncollected demolition debris and related wastes	• Private contractor will be engaged to collect demolition debris/wastes • Alldebris/wastes tobecollected regularlytocontrolair pollution and injuryetc • Receptacles will be provided for storage of light demolition products e.g. timber, plastics tiles etc • Refusecollectionvehicleswillbecoveredtopreventscatterofwastesbywind. • 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.	• Proponent • County government of Kiambu • NEMA inspectors
Workers accidents during demolition process.	• All workers will be sensitized before the exercise begins, on how to control accidents related to the demolition exercise • Acomprehensive contingency plan will be prepared before demolition begins, on accident response.	• Project proponent • County government of Kiambu

	• Practice one command approach for relying instructions. • Adherence to safety procedures will be enforced at all stages of the exercise • All workers, pursuant to labour laws, shall beaccordingly 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 accidentsdue to poor visibility	• County Public Health Officer • Ministry of Labour • NEMA inspectors

8-7 Other Potential Negative Impacts and Mitigation Measures

The potential negative impacts and possible mitigation measures for the proposed Steel Processingplant development are summarized below – Table 6:3:

Table 8-3: Other Potential Negative Impacts and Mitigation Measures

Potential Negative Environmental Impacts	Mitigation Measures
1. Architectural Incompatibility leadingto distortion of neighbourhood aesthetic image	1-1 Harmonize building scale with existing development in neighbourhood. 1-2 Harmonize detail, material and finishes for roofs and walls with existing development in the neighbourhood and use earth colorsthat blendwiththeenvironment.
2. 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 surfacerun-off	2-1 Development restricted to the approved density – building line, plot coverage and plot ratio accordingtozoningscheme. 2-2 Careful layout and orientation of buildings to respect wind and sun direction. 2-3 Adequate provision of green and open space planted with grass, shrub and tree cover. 2-4 Minimum use of reflective building material and finishes for roof, wall and pavement
3. Pollution and health Hazards - Dust and other construction waste - Noise generation from construction activities.	3-1 Damping down of site e.g. sprinkling water to dusty areas on construction site. 3-2 Containment of noisy operation, including locating noiseoperations away from sensitive neighbours 3-3 Limit construction work to day hours only. Construction worktotake3-4 shortest time possible.

			Use manual labour as much as possible Vehicles felling construction materials move in low speed. Bulk storage ofmaterials
4	Increasedloadingof Infrastructure services - Increased vehicular and/or pedestrian traffic - Increased demand on water, sanitation services etc. - Liquid waste management	4-1 4-2 4-4 4-6	Have clear exit/entry on the local access road including providing deceleration and acceleration lanes Encourage rainwater harvesting. Provisionofincreasedwater storage capacity Use of solar powerforhotwater system use Useofa septic tankduringthe operation phase (when the Steel processing plant is in operation) Install efficient water saving fittings
5	Worker accidents and health infection	5-1 5-2 5-3 5-4 5-6	Employ skilled and trained workers, educated on construction site safety procedures. Also provide workers with protective clothing and other personal protective equipment (PPEs). Prepare clearwork 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 hessiancloth tocoverthebuilding to avoid injury from flying or falling objects Providefirst Aidkitsforemergency

		5-7	Provide andmaintainfirefighting equipment and designate fireassembly points.
		5-8	Notifying neigbours about construction to raise awareness andput up signs such as "work in progress"
		5-9	Provide sanitary facilities for workers during construction
6	Increased social conflict	6-1	Encourage formation of community policing and neighbourhood association.
		6-2	Condone the site with iron sheet during construction
		6-3	Employ laborers of 18 years and above only
	7 Solid and Liquid Wastes	7-1	Segregate waste and provide waste holding units at Strategic locations.
		7-2	Recycle and recover some of the debrissuchastocoverearth surfaces.
		7-3	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. Below are the waste management options with the order of priority.

9.0 MITIGATION,PREVENTIONANDPROJECTALTERNATIVES.

9-0.1 OCCUPATIONAL HEALTH, SAFETY AND ACCIDENT PREVENTION PLAN.

9-0.2 Site Organization

To ensure health and safety conditions and prevent accidents on site, efforts will be made to have a clearsite organization plan. These include:

- Developing a clear site organization plan and construction schedule
- Delivery and storage of material at appropriate locations and times
- Right size of staff/workers with clear work schedule and appropriate dress gear
- Control staff and vehicle movement on site and keep out unwanted persons
- Site office with safety kit i.e. first aid and fire extinguisher
- Site toilet, could be a mobile toilet
- Adequate water supply for both construction work, operation and worker use.

9-0.3 Project Team

In order to ensure proper and appropriate organization of activities during plan, design and construction of the project, there must be appropriate project team. These include

- Plant installation experts /Mechanical engineers
- Town / physicalplanner
- Environmental Impact Assessment Expert
- Project Architect
- Structural / CivilEngineer
- Service Engineers
- Quantity Surveyor
- Land Surveyor

9-0.4 Enforcement of Standards and Legal Requirement

The project must ensure that appropriate standards and legal requirements are met. These include:

- That building work is in accordance to county government approved drawings and plans
- That building operations to meet the building code specifications
- That requirements of the Factory Workers Act are followed
- That requirements of the Public Health Act are followed
- That requirements as outlined in the Environmental Action Plan are observed.

9-0.5 Activities of Workers

The following activities by workers are clearly identified and must be closely monitored and organized to ensure health, safety and accident standards on site:

- Excavation using pick axes and shovels
- Fiting of the plant system andequipment
- Pushing of wheel barrows
- Watering of roads and walk surfaces
- Hand packing of stones on road surface
- Lifting and laying of building material – stone, concrete etc.
- Plastering of walls and ceiling
- Bending, cutting and laying ofreinforcement steel
- Other general building work activities.

9-0.6 Activities by Machinery and Light Equipment

The activities of machinery and plant must also be properly organized and monitored in order to ensure health and safety conditions and prevent accidents. The machinery and plant to be used on site include –

- Compacting machine
- Vibrators
- Concrete mixer
- Small size hoist machine
- Goods truck
- Tipper
- Machinery or equipment installed for operation

9-0.7 Insurance

The project proponent andbuilding contractor will take appropriate insurance coverforthevarious project activities and personnel and/or workers.

9-1 PROJECT ALTERNATIVES

91.1 Overview

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

9-1.2 Appraisal of Alternative Development Options

i) 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 approvalapplication

fees to the County government of Kiambu; professional fees to EIA lead experts and physical

planners. The option would similarly make thejobs that the project envisioned tocreate tobeforgone. The cost of labour alone is estimated at Ksh **10**m going by the BOS Estimate. 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.

ii) Relocation Option

Theother option available for the project implementation is for theproponent to relocate it toan alternative site either within kianjaus neighbourhood. At the moment, the proponent doesnot 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 theproponent.

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. The cost of labour and professional fees alone is estimated at **Ksh. 7,500,000**. Additional costs will arise from the design and approval of the architectural and structural drawings for the new site. In addition, she 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.

iii) 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 userto allow for such development. However, the field survey revealed that the property isin high proximity toother existing developments. Thelight 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 current site is zoned for the land use of the nature of theproposed project.

iv) Preferred Development Option

All the alternative options analyzed have implications, which make thecurrent 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 ThikaWestSub-county.
- There are several developed Steel processing plant in the neighborhood whose construction the County government of Kiambu approved. The area is a high density zone.

- The proposed development will therefore blend easily with the current development trend in kianjau and its environs.

9-2 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 solarpanels, 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 willminimize expenditure on electricity bills. The structures shouldbe 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.

10-1 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 seeks to improve and protect environmental quality for both urban and rural residents through segregating activities, which are environmentally incompatible. Environmental planning and management integrates 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 8-1 has addressed theidentified potential negative impacts and mitigation measures of the proposed Steel processing plantdevelopment on **plot L.R. No. THIKA MUNICIPALITY BLOCK 18/1969, in Kisaju area, Kiambu East sub-county.**

10-2 Environmental Monitoring and Evaluation

Environmental monitoring and evaluation are essential in project‟s lifespan as they are conducted toestablish 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.

Inthecontext ofthe proposed project, design hasmade provisions foran 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
- Workers accidents safety and health infections during construction process

- Proliferation of uncollected wastes both solid and liquid
- Aesthetics degradation
- Fire out-breaks

Table 8-1: Environmental Management Plan Matrixforthe Proposed Developmentofa Steel Processing Plant

CONSTRUCTION PHASE					
Environmental Impacts	**Proposed MitigationMeasures**	**Responsibility forMitigation**	**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 reflectivebuildingmaterialsand finishes for roof, walls and paving. • Harmonize site drainage design withneighbouringpremises	• County government of Kiambu • Project proponent • NEMA inspectors	Periodic 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. • 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.	• Project proponent/contractor • Ministry of Health: county public health officer • NEMA inspectors • Ministry of Labour • County government of Kiambu	Periodic Activities	Periodic and surprise checks	12,000 per month over the construction period

	• 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 vehicleswillberestrictedtonot more than 15 mph • 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 spaceand stabilize soils. • Exposed stockpiles of e.g. dust and sand, will beenclosed, covered, andwatered daily, or treated with non-toxic soil binders. • Excavation and grading activities will be suspended when wind speed exceeds 25mph. • Windbreakers will be installed at the windward side of the construction site. • All workers on the site will be required to wearprotective clothing while on duty.				

	• Regular servicing of vehicles.				
Architectural Incompatibility leading to distortion of neighbourhood aesthetic image	• Harmonize building scale with existing development in neighbourhood. • Allow for green and open spaces • Harmonize detail, material and finishes for roofs and walls with existing development in the neighbourhood and use colors that blend with the environment.	• Contractor • NEMA • County government of Kiambu	Routine activities	Periodic checks	Inclusive in the project budget
Noise pollution by construction activities.	• Portable barriers will be installedto shield compressors and other small stationery equipment where applicable. • Encourage use of manual labour where appropriate • Use of equipment designed with noise control elementswill be adopted where necessary. • Trucks used at construction site shallbe routed away from noise sensitive areas in the neighbourhood, wherefeasible. • Sound barriers are to be installedfor pile drivingactivities. • Idling time for pick-up trucks and other small equipment will be minimized to limited time.	• Project proponent/contractor • County government of Kiambu • County Public Health Officer • Ministry of Labour • Workers • NEMA inspectors	Routine Activities	Periodic and surprise checks	Inclusive in the project budget

	• Use of very noisy equipment will be limited to daytime only. • Allworkersoperatinginnoisy areas or operating noisy equipment will be provided with earmuffs to protect against extreme noise. • Construction works to be carried out during daytimeonly.				
Workers accidents during construction process.	• All workers will be sensitized before construction begins, on howto 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. • All workers, pursuant to labour 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 belimited to daytime only	• Project proponent/contractor • County government of Kiambu • County Public Health Officer • Ministry of Labour • Workers • NEMA inspectors	Routine Activities	Periodic checks	Inclusive in the project budget

	• Provide guard rails • Signs to alert people of possible falling objects • Usehessian cloth tocoverthe walls • Train workers on use of machines				
Inadequate human waste disposal by workers during construction process	• Asprovidedfor bythe Building Code, a temporary or mobile latrine will beprovided on site to beused byconstruction workers	• Project proponent • Contractor • County government of Kiambu • 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. • 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	• Proponent • County government of Kiambu • NEMA	Periodic activities	Periodic checks	Inclusive in the project cost

	• Condone the site with iron sheet (preferably colored to blend with environment) duringconstruction • Reseedbareareaswith appropriate grass species				
Increased surface run off leading to flooding, from paved grounds and expansive roofs.	• Surfacerunoffandroofwaterwillbe harvested and stored in underground reservoir for re-use. • Storm water managementplanthat minimizes impervious area increases infiltration by use of recharge areas, and use of retention, and/or retention with graduated outlet control structures, will be used. • Maintain internal and immediate external drainage systems clear all the times • Dig channels for water runoff into underground water reservoirs. • Compactloose soils andapply binding materials. • Undertake roof catchment harvesting to reduce volumes of storm water. • Stone pitching	• Contractor/proponent • County government of Kiambu • NEMA inspectors	Periodic and routine Activities	Periodic checks	Inclusive in the project cost
Pollution and health Hazards	• Damping down of site e.g. sprinkling water to dusty areas on construction site.	• Proponent • County government of Kiambu	Periodic activities	Periodic checks	Inclusive in the project cost

	• Containment of noisy operation, including locating noiseoperations away from sensitive neighbours • Limit construction work to day hours only. Construction work to take shortest time possible. • Use manual labour as much as possible • Vehicles felling construction materials moveinlowspeed • Proper and standard fuel storage tanks installed	• NEMA			
OPERATION PHASE					
Environmental Impacts	**Proposed Mitigation Measures**	**Responsibility forMitigation**	**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 Kiambu • 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 andcollection hours by service vehicles will belimited to off-peak hours and customer vehicles.	• Developer/proponent • County government of Kiambu	Periodic Activities	Periodic checks	Inclusive in the project budget

	• 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 • 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.	• Kiambu water and Sewerage Company-Water line • NEMA inspectors			
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 aroundthe project site. • Adhere to public health Act provisions	• County government of Kiambu • Physical Planning Department • Neighbourhood 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 tankand water pipes are located to avoid reticulation break down andease of locating water infrastructure lines	• Developer/Management • NEMA inspectors • County government of Kiambu	Periodic Activities	Periodic checks	Inclusive in the project cost
High water usage	• Install water meters • Install good taps that provide good conservation measures • Utilize storm water for irrigating of lawns and flower beds and tree planting • Regular inspectionof pipes to detect leaks • Recycle water during processing • Maintain internal and external drainage systems clear all the times • Provide Roof catchment harvesting	• Contractor/proponent	Periodic activities	Periodic checks	Inclusive in the project cost
High water demand	• Provide water storage tanks for useincaseofwaterrationing • Provide for rain water /roof catchment harvesting	• Contractor/proponent	Periodic activities	Periodic checks	Inclusive in the project cost

Fire Accidents	• Installafirehydrantpreferably near the main entrances • Train the workers in firefighting and subject them to frequent fire drills and designated fire assembly point • Place sand filled buckets in strategic places • Encourage to handle and store flammable materialsafely • Clear label fire exists points • Provide and regularly service the firefighting equipment • Ensure block electric wiring is doneby qualified electrician who is licensed by Kenyapower • All windows should be fitted with openable grills	• Proponent • County government of Kiambu • NEMA	Periodic activities	Periodic checks	Inclusive in the project cost

Proliferation of uncollected solid waste.	• Segregate solidwaste at source • A NEMA licensed private contractor will be engaged to collect solidwastegenerated. • Wastes to be collected regularlyto control air pollution and vermin/insects etc. • Receptacles will be provided for waste storage prior tocollection. • Resource recovery will be encouraged once the project takesoff soastoshrinkwastestream and recovernon-recyclables. • 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 beinfull protective attire. • Re use some of the waste	• Proponent • Hiredprivatecontractor • County government of Kiambu • County Public Health Officer • NEMA inspectors	Routine Activities	Periodic and surprise checks	Inclusive in project cost.
Increased loading of Infrastructure services	• Establish a collection schedule for clients picking steel products. • Provideretailshopsoutsidethe plants compound. Preferably in the neighbouring towns and business	• Proponent • County government of Kiambu	Periodic activities	Periodic checks	Inclusive in the project cost

	centres 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 rainwaterharvesting. • Provision of increased water storage capacity • Use of a septic tank during the operation phase (whenthe plant is operational)	• National government Ministry of Interior and Ministry ofEducation • NEMA			
Increased social conflict	• Encourage formation of community policing and neighbourhoodassociation (Nyumba Kumi). • Condone the site with iron sheet during construction and the sheets should be colored to blend with environment.	• Proponent • County government of Kiambu • NEMA	Periodic activities	Periodic checks	Inclusive in the project cost
Traffic congestion	• Notify the motorists about the development once implementationis 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 bepositioned in a wayto be easily viewedbythe publicandmostly motorists.	• Developer /proponent	Periodic activities	Routinely	Inclusive in the project cost

	• The traffic along connecting routes should be controlled especially during the construction phase andmostly when large trucks are entering into the site, say for delivery of materials. • Clients vehicles to collect products in off peakhours andduring daytime only. • Liaise with local traffic police for traffic control if need be.				
DECOMMISSIONING PHASE					
Environmental Impacts	**Proposed Mitigation Measures**	**Responsibility forMitigation**	**Means for Monitoring**	**Frequency for Monitoring**	**Estimated Cost (Kshs)**

Workers accidents and hazards when handling hazardouswastes.	• Adequate collection and storageof 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 inaccordance with section 5 of the waste management regulations • All employees will be required to wear protective clothing when handlinghazardouswastes. • Train workers onadvisable safety measures.	• Project proponent/contractor • County government of Kiambu • County Public Health Officer • Ministry of Labour • Workers • NEMA inspectors	Routine Activities	Periodic and surprise checks	Inclusive in the project budget

	• All workers will be adequately insured against unforeseen accidents. • Provide PPEs and enforce their use				
Demolition/deconstruction	• Ensurematerials after demolition are in a form that allows recycling and reusing • 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 licenced by NEMA	• County government of Kiambu • Contractor/proponent • NEMA Inspectors		Periodic checks	Inclusive in the project cost

	and appropriately covered during transportation.				

10-3 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; Durable Africa Investments 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.
- Thepolicies will enable management put in place measuresand structures that will care for the safety, health and welfare of all workers on site and the neighboring communityresidents.
- The policies will provide a framework for management to plan for, and put in place, monitoring programmes that will ensure conservation and protection of the environment, appropriate waste management and disposal.
- The policies will provide a framework for Corrugated Sheets 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 localcommunity.

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

11 RECOMMENDATIONS

11-1 Overview

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 theproponenthas incurredasubstantialamountofmoneyintheprojectuptodesignstage.

Further delay of the project is denying all stakeholders the anticipated benefits of the investment. While, redesigning or relocation of time willlead to loss of time andmoneythat 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. 35,000,000/- to the area and nationaleconomy. The project will create employment and improve income earnings in the area. The projectwill boost the demand for Steel products and associated services in Kiambu county and Kenya.

11-1.1 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 Plot L.R. THIKA MUNICIPALITY BLOCK 18/1969, off the Thika Garisa Road, along the Kiandutu Kiganjo Road in Kianjau area, Thika West Sub-county, Kiambu County.

- That County government of Kiambu does support this application for Environmental Impact Assessment License in respect to the proposed Steel processing plant project on Plot L.R. THIKA MUNICIPALITY BLOCK 18/1969.

- That the Project Report here now presented is sufficient and meets the requirements of the Environmental (Impact Assessment and Audit) Regulations 2003.

12 REFERENCES

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14. Kenya, Republic of (2002) The National Poverty Eradication Plan (NPEP)
15. Kenya, Republic of (2000) The Poverty Reduction Strategy Paper (PRSP)
16. National industrialization policy framework for Kenya
17. United Nations (1987) The Rio Declaration on Environment and Development
18. United Nations (2000) The World Commission on Environment and Development

APPENDIX

Title Deed and Proponent Identity Documents

Architectural Drawings and Designs

Site Plan

Returns from Stakeholder Consultation

Environmental Experts Practicing License