

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT REPORT

PROPONENT



CROWN PAINTS KENYA PLC
P.O BOX 78848 – 00507
NAIROBI.

PROPOSED CONSTRUCTION AND OPERATION OF EMULSION BINDER AND PLASTIC INJECTION MOULDING PLANT.

LOCATED ON LR. NO. 12648/81 KINANIE LOCATION, KINANIE DIVISION, MAVOKO SUB-
COUNTY, MACHAKOS COUNTY
GPS Coordinates -1.507274, 37.067968.



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REPORT CERTIFICATION

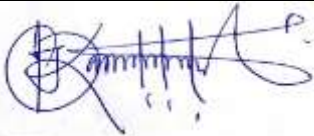
This Environmental and Social Impact Assessment report has been prepared by a team of Experts from Greenlite Consultants Limited an EIA Firm of Expert of NEMA Reg. No. 11123 and current practicing license No. NEMA/ENVIS/ELi/Foo66 having been commissioned by Crown Paints Kenya PLC, the Proponent, in accordance with the requirements of the Environmental Management and Coordination Act (EMCA) 2015 and the Environmental Impact Assessment and Audit Regulations of 2003 and submitted to the National Environment Management Authority (NEMA) for approval consideration.

We the undersigned do confirm that the particulars of this EIA Study Report for the proposed Emulsion binder and plastic injection moulding plant within Kinanie location, Kinanie division, Athi river sub-county, Machakos county are correct to the best of our knowledge.

PROPONENT:

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DATE	13 / 07 / 2026

CERTIFICATION BY THE EIA CONSULTANTS

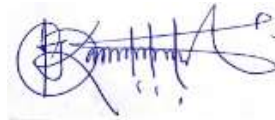
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DISCLAIMER:

This project report has been prepared in accordance with the terms and conditions of agreement in respect to the provision of consultancy services as per the Environmental Management and Coordination Act (EMCA) 2015, and the Environmental Impact Assessment and Environmental Audit Regulations of 2003 and subject to terms and conditions of the National Environment Management Authority (NEMA).

QUALIFICATION STATEMENT.

The following multi – disciplinary team of Experts among others participated in undertaking and harnessing this Environmental and Social Impact Assessment and developing a competent report for submission to the proponent and to the authority for approval consideration.

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LIST OF ACRONYMS

Acronym	Full Term
ALARP	As Low As Reasonably Practicable
BAU	Business As Usual
BESS	Battery Energy Storage System
CCRA	Climate Change Risk & Vulnerability Assessment
CIDP	County Integrated Development Plan
DOSH	Directorate of Occupational Safety and Health
EA	Environmental Audit
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act, 1999
EMP	Environmental Management Plan
EPRA	Energy and Petroleum Regulatory Authority
ESCP	Environmental and Social Commitment Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ETP	Effluent Treatment Plant
GHG	Greenhouse Gas
GWP	Global Warming Potential
HAZOP	Hazard and Operability Study
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IPL	Independent Protection Layer
KPLC	Kenya Power and Lighting Company
LOPA	Layer of Protection Analysis
M ³	Cubic Metres
MWh	Megawatt Hour
NDC	Nationally Determined Contribution
NEMA	National Environment Management Authority
OSHA	Occupational Safety and Health Act, 2007
OND	October-November-December (Short Rains)
P&ID	Piping and Instrumentation Diagram
PM ₁₀	Particulate Matter <10 microns
PSV	Pressure Safety Valve
PV	Photovoltaic
RWH	Rainwater Harvesting
SGR	Standard Gauge Railway
SIL	Safety Integrity Level
SOP	Standard Operating Procedure
tCO _{2e}	Tonnes of Carbon Dioxide Equivalent
TOR	Terms of Reference
VAM	Vinyl Acetate Monomer
VFD	Variable Frequency Drive
VMG	Vulnerable and Marginalized Group
VOC	Volatile Organic Compound
WHO	World Health Organization
WRMA	Water Resources Management Authority

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EXECUTIVE SUMMARY

The Proponent

The Proponent of the proposed Emulsion binder and plastic injection moulding plant is the Crown Paints Kenya PLC. Crown Paints Kenya PLC is the leading paint manufacturer in East Africa, established in 1958 and listed on the Nairobi Securities Exchange. The company produces over 3 million litres of paint monthly and offers a wide range of decorative, automotive, and industrial coating solutions.

The Proposed Project

The company is desirous of producing its own plastic containers and emulsion binder polymer. The foregoing facts have informed the decision to construct factory facilities to satiate the derived demand. The proposed development comprises of Plastic injection block and Emulsion binder plant on twin plots at Lukenya. Both blocks comprise of a subbasement, ground and mezzanines floors. An administration block and general warehouse blocks are also proposed.

The company intends to use the produced Emulsion Binder in the manufacture of Emulsion Paints in their existing paint factories in Kenya. Emulsion Binder and water are the key ingredients used in manufacture of Emulsion Paints. The company will use the produced plastic containers from the Plastic Injection moulding Plant for packaging of paints within their factories.

The Project scope.

The objective is to Construct on parcel 12648/81, 3blocks to house Emulsion plant, plastic injection molding plant and warehouse. The following are the main components of the proposed project with their and approximate floor areas;

Emulsion polymer plant block.	
Ground floor	2400 sqm
Mezzanines	1400 sqm
Plastic injection plant block	
Ground floor	1400 sqm
Mezzanines	600 sqm
Warehouse	4000 sqm
Total	9800 sqm

Besides the above constructed areas, the project is designed to have green areas of approximately 3000 sqm which will not only beautify the compound but also boost the overall environmental sustainability of the project.

General Project Form.

The proposed development comprises of two main blocks:

- Plastic Injection;
- Emulsion Binder;
- Warehouse

General Construction:

Substructures:

The substructures are of Reinforced concrete foundations and structural steel columns and beams

Superstructures:

The buildings envelope and roof are of structural steel frame clad with galvanized pre-painted sheeting interspaced with polycarbonate lighting sheets.

Floors

The ground floors are of reinforced concrete slab. Upper mezzanine floors are of steel chequered plate on steel beams and columns.

Planned execution:

A competent contractor shall be engaged. All prescribed licenses and permits shall be procured.

Approvals:

The proponent has already acquired change of use approval and development construction permit from the Machakos County Government.

[Project Cost and Statutory fees](#)

Project Cost	
System Description	Cost (Ksh.)
Project cost	355,000,000.00
Statutory fees	
0.1 % of the total Project Cost	355,000.00

The indicated statutory fees will be paid to the authority during submission of this EIA Report.

Activities of the Project

The major project activities include but not limited to:

- Site clearance and preparation
- Excavation and appropriate disposal of excavated soil
- Laying of foundation slab and walling
- Construction of the proposed buildings, plastering and painting
- Storm water and drainage systems construction
- Connection to utilities electricity, water and waste water management systems,
- Cleaning and removal of construction waste and Landscaping
- Government inspection/occupation certificate and completion of works issued
- Operation activities which include production of Emulsion binder and plastic containers.

Project Location and Land Ownership.

The proposed development is located in LR. No. 12648/81 Kinanie Location, Kinanie Division, Mavoko Sub-County, Machakos County approximately one kilometer off Mombasa Road and 40 km from Nairobi city. The site is within other industrial developments. It has an east west slope of 1 in 60 meters. Dominant wind directions are southeast to north west.

Site Characteristics

Land reference Nos	IR 12648/81
Size	9.5 acres
Tenure	Lease hold
Registered owner	CPK PLC
Existing structure	None
Topography	Slope east west 1 in 60
Substrata	Cotton soil av 1m: light murram and pozzolana
Neighborhood	Industrial

ESIA Rationale and Background

Environmental and Social Impact Assessment is a tool for environmental conservation and has been identified as a key component in new project implementation. According to section 58 of the Environmental Management and Coordination Act (EMCA) No.8 (Amendment) 2015 second schedule 9 (1), and Environmental (Impact Assessment and Audit) regulation, 2003, new projects

must undergo Environmental Impact Assessment. The report of the same must be submitted to National Environment Management Authority (NEMA) for approval and issuance of relevant licenses.

In accordance with the 2nd Schedule of the Environmental Management and Coordination Act (No. 8 of 1999) contained in Kenya Gazette Supplement No. 62, Legal Notice 31, the proposed project requires a full study Environmental and social Impact Assessment owing to its nature, magnitude and sensitivity. It falls under the category of high-risk projects.

Scope Objective and Criteria of the Environmental Impact Assessment EIA)

The broad objective of this study was to carry out detailed Environmental and Social Impact Assessment of the proposed project to ensure that any negative impacts resulting from the proposed project implementation are adequately addressed and mitigated thereof.

The scope of the assessment covered literature review, project description, description of the baseline environment, description of the environmental legislative and regulatory framework, undertaking stakeholder's engagement and public consultation, identification of impacts, proposing mitigation measures, analysis of project alternatives as well as development of an environmental and social management plan. The output of this work was a full study Environmental and Social Impact Assessment Report.

The Environmental Management and Coordination Act (Amendment) 2015 Cap 387 and its subsequent regulations have been used to guide the methodology and provide the framework for this study. The consultant prepared the study report in accordance with the outline contained in Part IV, Section 18 (1) of the above regulations.

Study Methodology

Based on the magnitude of the proposed Project, the ecological and biophysical aspects of the area, an Environmental and Social Impact Assessment (ESIA) was undertaken to determine the impacts of the project. The general steps followed in Environmental and Social Impact Assessment were as follows:

- Environmental screening, in which the project was identified as among those requiring Environmental Impact Assessment under schedule 2 of EMCA, Cap 387.
- Environmental scoping that identified the key issues to be addressed in the ESIA study report.
- Desktop studies to gather any relevant secondary data and information on the impacts of the project on the environment and possible mitigation measures by making use similar reports for other infrastructural projects that have been undertaken before.

- Public participation by conducting interviews, discussions and public meetings with key stakeholders including members of the community adjacent to the project site to obtain their views on the impacts of the project and possible mitigation measures. This is as per the Kenyan Constitution, EMCA Cap 387, and Multilateral Environmental and Social Impact Guidelines.
- EISA full study report preparation, publication and submission.
- Integration of recommendations of the ESIA study report into the design and implementation of the proposed project.

The consultant, on behalf of the proponent conducted the EIA by incorporating but not limited to the following terms of reference:

- Project description
- Proposed location of the project.
- Description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.
- Environmental effects of the project including the social and cultural effects, and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- EMP proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures.
- Consideration of the viable project alternatives

Table 3 : Permits and Surveys required for the Construction and Operations phases

Relevant Surveys / Studies		
Survey	Consultant	Current status
Feasibility Study report	Consulting firm	Undertaken
Ambient Air Quality Report	Licensed Lab	Undertaken
Noise level measurements	EHS / EIA Expert	Undertaken
Geotechnical survey Report	Geologist	Undertaken
Socio – economic Survey	Sociologist	Undertaken
Gender Assessment Report	Gender Specialist	Undertaken
Ecological Survey	Ecologist	Undertaken
Relevant Permits / Licenses		

Permit	Issuing Agency	Current status
Change of Use Approval	County Government	Acquired
Approval or building plans	County Government	Acquired
ESIA Certificate of approval	NEMA	To be acquired via this ESIA
Environmental Audit	NEMA	To be done once operational, annually
Registration of workplaces	DOSH	To be acquired towards construction phase.
Single Business Permit	County Government	To be acquired towards construction phase.

Impacts and Mitigation Measures

The proposed project is envisaged to generate direct and indirect impacts of which some are positive while others are negative. The potential Impacts are derived from the proposed project activities, the baseline information as well as the discussions with the community and stakeholders during the public participation exercises.

The positive impacts associated with the proposed development are both short term and long term and include the following:

Long term Positive Impacts;

1. Creation of direct and indirect employment opportunities during operational phase
2. Skills transfer and capacity building in polymer manufacturing and process safety
3. Creation of industrial support ecosystem for complementary enterprises along Mombasa Road corridor
4. Revenue generation for National Government through corporate tax, VAT, PAYE, and import duty
5. Revenue generation for Machakos County Government through land rates, permits, and license fees
6. Increased export potential and foreign exchange savings through import substitution
7. Productive utilization of idle industrial-zoned land in line with Vision 2030
8. Catalyst for infrastructure upgrade including tarmacking of access road and stormwater drainage
9. Enhanced industrial symbiosis and circular economy practices in Kinanie area
10. Climate mitigation through 300kWp Solar PV installation
11. Provision of model for responsible industrialization balancing manufacturing and ecological protection

Short term positive impacts

- Expanded opportunities for small scale businesses in the area

- Creation of job opportunities during construction and implementation phases.
- Market for raw materials

A summary of key negative impacts associated with the proposed project and their mitigation measures are listed in table 0-1 below

Table 2: A summary of negative impacts and mitigation measures Possible

Possible Impact	Mitigation Measures
Biodiversity Loss	• Rehabilitation and revegetation of excavated areas after construction • Site clearance and cutting of trees to be restricted to project site only • Minimum disturbances to soil cover and also care will be taken not to damage adjoining vegetation. • Trees cut to be compensated at the minimum ration of a 1:2. Planting locations could be either onsite or in the neighbouring Karura forest.
Air emissions/ greenhouse gases	• Vehicles to be used during the construction phase are to be kept in good working condition and should not be the source of excessive fumes • The backup genset onsite to also be well maintained and kept off unless when genuinely needed during power black outs.
Dust pollution	• Dust and air pollution due to dust when excavated material is stock piled, should be limited by means of wetting (particularly in dry season), covering with foil or working in small sections so that the trenches are backfilled with excavated soil within shortest possible period (maximum 2-3 days). • Settled areas within project access routes will be identified and maximum speeds of project vehicles will be established within these areas. iv. Speed limit of 15km per hour will be posted and enforced to reduce airborne fugitive dust caused by vehicular traffic. • Construction materials will be delivered in bulk to avoid repetitive movements of delivery vehicles • Construction materials and stockpiled soils will be covered if they are a source of fugitive dust. • Transportation of materials will be done in such a manner that they do not fly or fall off the vehicle by covering or wetting friable materials.
Generation of solid waste	• A site management plan should be prepared by the proponent prior to construction activities. • This should include designation of appropriate waste storage areas, collection and removal schedule.

	• Re-useable inorganic waste should be stockpiled away from drainage features and used for infilling where necessary. • Unused construction waste, such as damaged pipes, form work and other construction material, must be disposed at appropriate dumpsite.
Noise Pollution	• Road traffic movements shall be scheduled to normal working hours (08H00 –17H00) • Servicing of all construction vehicles and machinery must be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced • Maintenance of vehicles, equipment and machinery will be regular and up to the satisfaction of the Resident Engineer to keep noise levels at the minimum • Temporary noise pollution due to construction works will be controlled by ensuring proper maintenance of equipment and vehicles • Idling of temporary trucks or other equipment will not be permitted during periods of loading / unloading or when they are not in active use. This practice will be enforced especially near residential and sensitive areas.
Impacts on Drainage and flooding	• Installation of adequate and sizeable culverts along the storm drain adjacent the highway and beneath the acceleration and deceleration lanes. • Ensuring that no materials or waste are dumped along the traditional drainage routes within the project area of influence. • Install Permeable Pavers to allow water to soak into the ground rather than running off.
Health and Safety Risks	• Capacity building of the workers and staff; to create awareness towards potential risks and recommended preventive measures through training. This will ensure that health and safety measures are followed. • Conduction of regular drills on fire prevention and control will be encouraged to ensure proper preparedness for fire control. • Comprehensive firefighting equipment should be provided after completion of the project. This should be installed or provided at strategic points. The fire extinguishers should be serviced accordingly i.e. after every six months to ensure effective and efficient performance when required.
Soil Contamination/ pollution	• Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refuelling will be carried out in such a way that spillage of fuels and lubricants does not further contaminate the ground • Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (approved by NEMA)
HIV/AIDs risks	• Contractor to engage approved service provider by National Aids Control Council (NACC) to raise awareness on HIV/ AIDs to workers

Occupational Health and Safety Hazards	• Contractor to develop and safe operating procedures to the workers: this will involve creating detailed written instructions and guidelines that outline the specific steps, precautions, and best practices to be followed when carrying out a particular task or operation. • Safety Training of workers: Provide comprehensive safety training to workers on a regular basis. Ensure workers are aware of potential hazards and understand safety protocols. • Provide and enforce the use of appropriate PPE, including helmets, gloves, safety boots, and high-visibility vests.
Grievances	• Formation of a project grievance redress mechanism to address all project related grievances • Inform local residents about ongoing construction activities and potential hazards. Address community concerns and establish open lines of communication
Sexual Exploitation and Abuse	• Develop and execute a SEA action plan with an Accountability and Response Framework, in line with international guidelines. • Prevention of SEA: Incorporate SEA prevention measures into Codes of Conduct and maintain ongoing staff sensitization. • Response to SEA: establish procedures for survivor-centred referral and assistance, staff reporting mechanisms, and case oversight, investigation, and disciplinary processes. • Engage the community with confidential complaints mechanisms and PSEA awareness-raising, using community-based IEC materials and outreach. • Management and Coordination: Integrate SEA considerations into job descriptions, employment contracts, and performance appraisals; establish policies related to SEA and whistle blower protection; provide training for project management; manage a coordination mechanism for case oversight, investigations, and disciplinary actions; designate trained PSEA focal points and community liaison officers.
Gender Based Violence and Sexual Harassment	• Implement a clear human resources policy against sexual harassment in alignment with national law. • Integrate provisions related to sexual harassment into the employee Code of Conduct (COC) • Appoint human resources personnel responsible for managing reports of sexual harassment according to policy. • Ensure that the Contractor's employees, sub-contractors, sub-consultants, and relevant personnel sign and adhere to a Code of Conduct containing provisions for protection against sexual exploitation and abuse.

	• Implement provisions that prevent gender-based violence at the community level, including effective community engagement and consultation, especially involving women and girls. • Review project components known to heighten GBV risk at the community level, such as compensation Projects and employment opportunities for women.
Economic displacement	• In case any economic activity be interfered with especially along the road reserve, the affected individuals will be properly notified so that they can plan their relocation with ease.

Table 4 A summary of negative impacts and mitigation measures Possible

Conclusion

It is evident that the construction and operation of the proposed emulsion polymer manufacturing plant will generate significant positive impacts for the proponent, the local community in Mavoko Sub-County, and Kenya's industrial sector.

The project will create direct jobs during operation, promote skills transfer in chemical manufacturing and process safety, and generate revenue for both National and Machakos County Governments. It will put idle industrial-zoned land to productive use in line with Vision 2030, catalyze infrastructure upgrades including tarmacking of the access road, and reduce forex expenditure through import substitution of emulsion polymers. The retention of grassland and 300kWp Solar PV ensures the plant is a low-carbon, climate-compatible industrial investment.

The identified negative impacts, most significant during construction, are largely reversible and can be reduced to low residual levels through the proposed mitigation measures. Key issues include fire/explosion risk, effluent management, habitat loss, dust/noise, and water demand. Occupational safety, health, and environment (OSHE) remains a priority across both phases.

The project design has integrated mitigation measures to ensure full compliance with EMCA 1999, Climate Change Act 2016, OSHA 2007, Water Act 2016, and NEMA/EIA Regulations. Sustainable Environmental Management shall be implemented, ensuring efficient use of water, energy, and raw materials.

Considering the substantial socio-economic benefits and that no major unmitigable impacts were identified, the ESIA concludes that the project is environmentally, socially, and economically viable. The proponent and contractors shall strictly implement the Environmental and Social Management and Monitoring Plan (ESMMP) and adhere to all NEMA license conditions.

1: INTRODUCTION

1.1 Background and Rationale

The Proponent of the proposed Emulsion binder and plastic injection moulding plant is the Crown Paints Kenya PLC. Crown Paints Kenya PLC is the leading paint manufacturer in East Africa, established in 1958 and listed on the Nairobi Securities Exchange. The company produces over 3 million litres of paint monthly and offers a wide range of decorative, automotive, and industrial coating solutions.

The proponent is desirous of producing its own plastic containers and emulsion binder polymer. The foregoing facts have informed the decision to construct factory facilities to satiate the derived demand. The proposed development comprises of Plastic injection block and Emulsion binder plant on twin plots at Lukenya. Both blocks comprise of a subbasement, ground and mezzanines floors. An administration block and general warehouse blocks are also proposed.

The company intends to use the produced Emulsion Binder in the manufacture of Emulsion Paints in their existing paint factories in Kenya. Emulsion Binder and water are the key ingredients used in manufacture of Emulsion Paints. The company will use the produced plastic containers from the Plastic Injection moulding Plant for packaging of paints within their factories.

1.2 Nature of the Proposed Project

The objective is to Construct on parcel 12648/81, 3blocks to house Emulsion plant, plastic injection molding plant and warehouse. The following are the main components of the proposed project with their and approximate floor areas;

Emulsion polymer plant block.	
Ground floor	2400 sqm
Mezzanines	1400 sqm
Plastic injection plant block	
Ground floor	1400 sqm
Mezzanines	600 sqm
Warehouse	4000 sqm
Total	9800 sqm

Table 5 Project description

1.3 Objectives of the Project

The main objective of the proposed project is construction and operation of an Emulsion binder and plastic injection moulding plant. This will help the company to produce its own plastic containers and emulsion binder polymer. The foregoing facts have informed the decision to construct factory facilities to satiate the derived demand.

The company intends to use the produced Emulsion Binder in the manufacture of Emulsion Paints in their existing paint factories in Kenya. Emulsion Binder and water are the key ingredients used in manufacture of Emulsion Paints. The company will use the produced plastic containers from the Plastic Injection moulding Plant for packaging of paints within their factories.

Specific objectives include;

- Production of emulsion binder for use in the existing paint factories,
- Production of plastic containers for packaging of paints within the existing factories,
- Reduction of operation and production costs of paints,
- Use of locally available raw materials in the paints production process,
- Act as an income generating venture for the proponent,
- Open up the area to similar and complementing developments,
- Put into a profitable commercial use the already idle parcel of land.

1.4 Scope objective and criteria of the Environmental Impact Assessment (EIA)

1.4.1 Objective of the Assessment

The broad objective of the study was to carry out detailed Environmental and Social Impact Assessment for the proposed project.

The specific objectives included:

- Identify and assess the anticipated Environmental and Social Impacts of the proposed project
- Identify and analyse alternatives to the proposed project
- Propose and recommend cost effective mitigation measures against negative impacts and enhancement measures for positive impacts to be undertaken during and after the implementation of the proposed projects;

- Verify compliance with national environmental regulations and policies, international policies, and industry best practice and standards.
- Generate baseline data for monitoring and evaluation of how well the mitigation measures have been implemented during the project life cycle;
- Seek the views of affected persons in consultation with the proponent and NEMA;
- Prepare an Environmental and Social Management Plan (ESMP); and,
- Prepare a full study Environmental and Social Impact Assessment Report Assessment.

1.4.2 Scope

The scope for the assessment work included:

Literature Review

The Consultant was to undertake a detailed desktop study on the available literature on the proposed project and its potential impacts. Literature available to the client was provided to the Consultant which served as a starting point for gathering Environmental and Social information pertaining the project.

Description of the Baseline Environment

The Consultant was to collect, analyse and present the baseline information pertaining to the environmental and social situation on the ground, with an emphasis on the downstream environment, namely:

- The Physical Environment
- The Biological Environment
- The Social and Cultural Environment

Detailed Description of the Proposed Project

The Consultant was to describe the proposed project, its geographic location, general layout of facilities, raw materials, products and by-products, wastes to be generated and project alternatives.

Carry out Stakeholders Participation and Consultations

The Consultant was to carry out a detailed stakeholders consultation exercise to collect the views and opinions of stakeholders and the affected population. The consultant would organize forums for public participation (barazas) to enable interested and affected parties to present their concerns and opinions regarding the proposed project. The views of the public would be captured then noted in the ESIA Report. Key Stakeholders were also to be consulted and their views and concerns captured and reported.

Identify Potential Environmental Impacts

The Consultant was to analyse and describe all potential impacts on the environment for the project, environmental, ecological and social impacts, both positive and negative. The impacts were to be further identified according to effective time span, that is, short, medium and long-term.

Occupational Safety & Health Concerns

The Consultant was to analyse and describe all occupational health and safety concerns likely to arise as a result of construction and operations of the proposed facility. Recommendations on corrective and remedial measures to be implemented would then be made under the Environmental and Social Management Plan.

Propose Mitigation Measures for the Identified Negative Impacts

The Consultant was to come up with mitigation measures for the negative impacts that could result from the proposed project.

Development of Environmental and Social Management Plan

The Consultant was to develop a comprehensive Environmental and Social Management Plan (ESMP) which would recommend a set of mitigation, monitoring and institutional measures to eliminate, minimize or reduce to acceptable levels of adverse environmental impacts and/or maximize socio-economic benefits. It would also have cost estimates for implementation of the proposed measures as well as their institutional and financial support.

Development of Environmental and Social Monitoring Plan

The Consultant would give specific descriptions and technical details of monitoring measures, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, and definition of thresholds that would signal the need for corrective actions as well as deliver monitoring and reporting procedures.

Environmental and Social Impact Assessment Report

The main output for this exercise - the Environmental and Social Impact Assessment (ESIA) Report. The study report would be in English Language, presented in a manner that is clear and acceptable to all parties.

1.4.3 Terms of Reference (TOR) for the EIA Process

The Environmental Impact Assessment included the necessary specialized assessments to determine the environmental impacts relating to the biophysical, health and safety and socio-economic aspects and to determine the issues of concerns from the relevant authorities and

interested and/or affected parties. The appropriate measures to ensure co-existence of the proposed development with other social and economic activities in the area are provided as part of the Environmental Management Action Plan.

The consultants on behalf of the proponent conducted the assessment by committing themselves to the following terms of reference among others: -

- Proposed location of the proposed project.
- Description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.
- Objectives of the project.
- Technology, procedures and processes to be used in the implementation of the project.
- Materials to be used in the construction and implementation of the project.
- Products, by-products and wastes generated by the project.
- Description of the potentially affected environment.
- Environmental effects of the project including the social and cultural effects, and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- Alternative location, technologies and processes available and reasons for preferring the chosen technology and processes.
- Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies.
- EMP proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures.
- Provision of an Action Plan for the prevention and management of foreseeable accidents and hazardous activities caused by carrying out activities or major industrial and other development activities.
- Measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies.
- Identification of gaps in knowledge and uncertainties which were encountered in compiling the information.
- Economic and social analysis of the project.
- Indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures; and

- Other such matters as the National Environment Management Authority (NEMA) may require.

1.4.4 Methodology outline

The general steps followed in Environmental and Social Impact Assessment were as follows:

- Environmental screening, in which the project was identified as among those requiring Environmental Impact Assessment under schedule 2 of EMCA, Cap 387.
- Environmental scoping that identified the key issues to be addressed in the ESIA study report.
- Desktop studies to gather any relevant secondary data and information on the impacts of the project on the environment and possible mitigation measures by making use similar reports for other infrastructural projects that have been undertaken before.
- Public participation by conducting interviews, discussions and public meetings with key stakeholders including members of the community adjacent to the project site to obtain their views on the impacts of the project and possible mitigation measures. This is as per the Kenyan Constitution, EMCA Cap 387, and Multilateral Environmental and Social Impact Guidelines.
- EISA full study report preparation, publication and submission.
- Integration of recommendations of the ESIA study report into the design and implementation of the proposed project.

1.4.5 Data collection procedures

First, the Consultant undertook environmental screening and scoping to narrow down into the most critical issues requiring attention in the assessment. The data collection was carried out through questionnaires/standard interview schedules, use of checklists, observations and photography, site visits, consultative meetings and desktop environmental studies, where necessary in the manner specified in Part V (section 31-41) of the Environmental (Impact Assessment and Audit) Regulations, 2003.

1.4.6 EIA organization and structure

The EIA was carried out to full completion within a period of eight weeks from the date of undertaking. The Firm's Team leader and lead environmentalist coordinated the day-to-day functions and any related institutional support matters. Otherwise, all formal communications were directed to NEMA through the proponent.

1.4.7 Reporting and documentation

The EIA Report with the findings was compiled in accordance with the guidelines issued by NEMA for such works and was prepared and submitted by the proponent for consideration and approval. The Consultant ensured constant briefing of the client during the exercise.

1.4.8 Responsibilities and undertaking

The Consultant undertook to meet all logistical costs relating to the assignment, including those of production of the report and any other relevant material. The consultant arranged for own transport and travels during the exercise. On the site, the proponent provided all the information required by the consultant.

The output from the consultants includes the following: -

- A Full Study Environmental and Social Impact Assessment report comprising of an executive summary, study approach, project description, baseline conditions, anticipated impacts and proposed mitigation measures, analysis of alternatives, conclusion and recommendations.
- An Environmental and Social Management Plan Outline which also forms part of the report recommendations.

2: PROJECT DESCRIPTION, DESIGN AND ACTIVITIES

2.1 Project Design

The proponent has proposed to undertake construction, Installation and operations of emulsion binder and plastic injection molding plant within Lukenya area of Machakos County, off Mombasa Road on L.R No. 12648/81 and GPS Coordinates; -1.506489, 37.067915. The proponent intends to construct the Godowns where the installation of the emulsion binder and plastic injection molding machines will be done. The proponent will then purchase the right operating machines for installation and use within the Godowns. Once the proponent gets the relevant approvals, installation of the machinery component will take place followed by the operation phase

The ESIA report is based on information and consultations with the proponent, the Architects and details contained in the Architectural plans and Drawings of the proposed development. The proposed project components and design will involve the following:

- Plastic injection block, Emulsion paint binder plant and a warehouse
- The godowns will have a ground floor and two mezzanine floors – these floors will be used for installation of machines and production purposes
- The roof plan will be covered with iron sheets
- Development utilities (water, drainage, electricity etc).
- Construction of an internal water reticulation system as a waste collection centre which will be connected to a waste water treatment plant

The following are the main components of the proposed project with their and approximate floor areas;

Emulsion polymer plant block.	
Ground floor	2400 sqm
Mezzanines	1400 sqm
Plastic injection plant block	
Ground floor	1400 sqm
Mezzanines	600 sqm
Warehouse	4000 sqm
Total	9800 sqm

Besides the above constructed areas, the project is designed to have green areas of approximately 3000 sqm which will not only beautify the compound but also boost the overall environmental sustainability of the project.

General Project Form.

The proposed development comprises of two main blocks:

- Plastic Injection;
- Emulsion Binder;
- Warehouse

General Construction:

Substructures:

The substructures are of Reinforced concrete foundations and structural steel columns and beams

Superstructures:

The buildings envelope and roof are of structural steel frame clad with galvanized pre-painted sheeting interspaced with polycarbonate lighting sheets.

Floors

The ground floors are of reinforced concrete slab. Upper mezzanine floors are of steel chequered plate on steel beams and columns.

Planned execution:

A competent contractor shall be engaged. All prescribed licenses and permits shall be procured.

Approvals:

The proponent has already acquired change of use approval and development construction permit from the Machakos County Government.

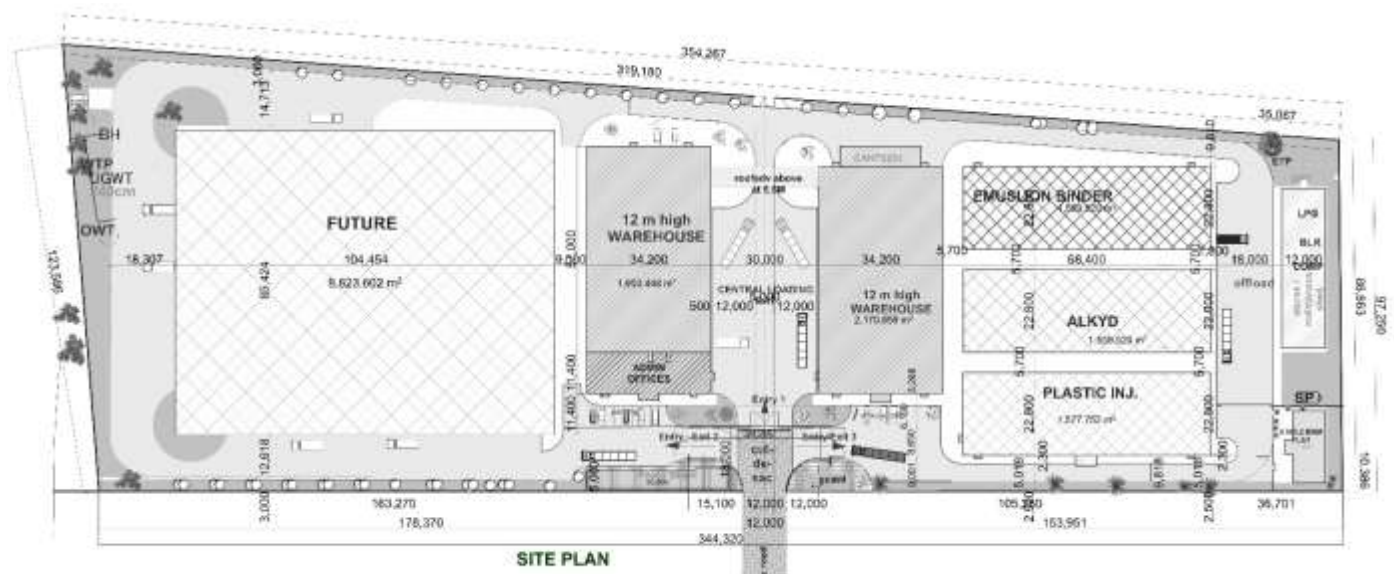
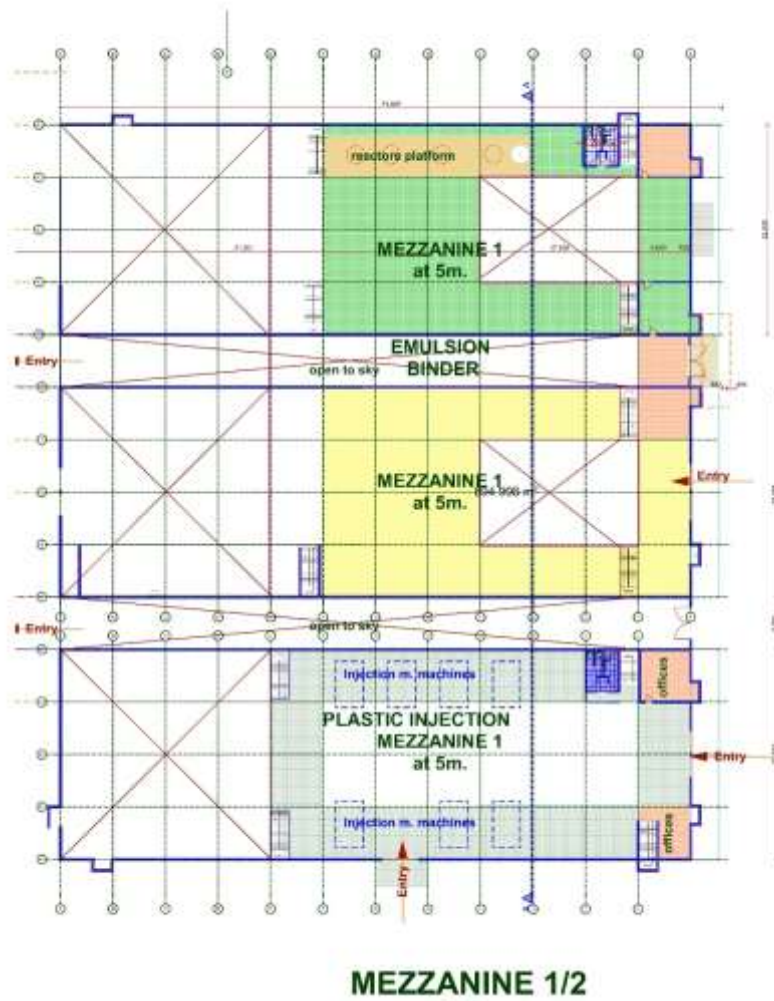
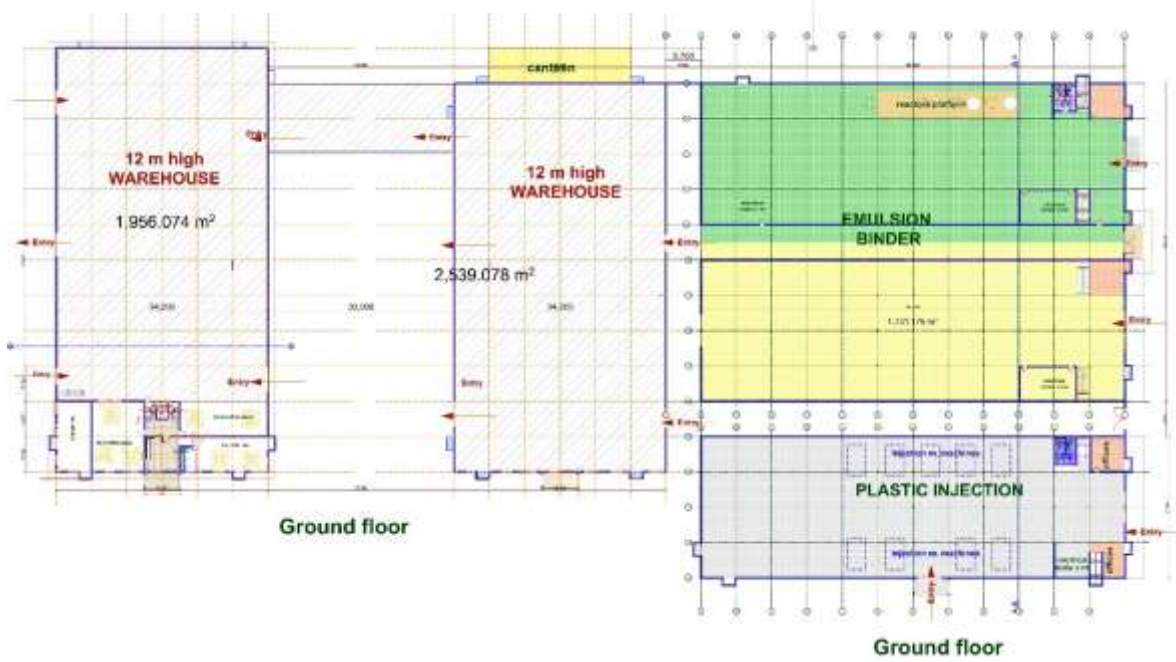


Plate: Site Layout



Pictorial presentation of the proposed development layout

2.2 Emulsion binder manufacturing process and the machinery component

The main raw materials for Emulsion Paint Binder production will include; the primary monomers which are methyl methacrylate, butyl acrylate, styrene and vinyl acetate. We will also have water and surfactants and initiators and functional additives which will include potassium persulfate that will be used to trigger the polymerization process, and functional monomers like itaconic and methacrylic acid.

Emulsion paint binders will be produced through Emulsion polymerization. The machine components to be used will include; reactor vessels, agitation system, dosing and feeding systems, reaction loop among others. It's a multi-step process that turns liquid monomers into stable polymer particles suspended in water

2.2.1 Step 1: Preparation of the Pre-Emulsion

This stage will involve mixing of the primary monomers e.g., methyl methacrylate, butyl acrylate, water, and surfactants to create a stable pre-emulsion of monomer droplets. The role of Surfactants in this stage will be to lower the interfacial tension, allowing hydrophobic monomers to be finely dispersed in the water, setting the stage for particle nucleation.

2.2.2 Step 2: Polymerization Reaction

Some portion of the pre-emulsion and an initiator e.g. potassium persulfate will be added to a heated reactor. The initiator will trigger the reaction. The remaining pre-emulsion will then be fed in over time (a semi-batch process) to ensure controlled growth and consistent particle size. The process will typically be carried out at 50–100°C, often under pressure. Some processes may use a multi-stage approach to create particles with different polymer layers for specific properties.

2.2.3 Step 3: Colloidal Stabilization

The goal in this stage will be to create a stable dispersion. This will be achieved through electrostatic repulsion or steric stabilization (surfactant/ polymer chains creating a physical barrier). Monomers like methacrylic acid or itaconic acid will be added to build charges into the polymer backbone, enhancing stability. The balance of surfactants and monomers is key as poor balance leads to flocculation, sedimentation, and film defects.

2.2.4 Step 4: Post-Processing and Formulation

The pH will or may be adjusted with amines or ammonia to solubilize acid groups and improve stability.

The final latex will then be filtered to remove any coagulum. The binder will then be mixed with pigments, additives, and solvents to create the final paint.

2.3 Plastic Injection Moulding Process

The raw materials for this process are plastic pellets (resin) and additives such as Polypropylene master batches. Plastic injection molding is a high-precision manufacturing process where molten plastic is forcefully injected into a closed mold, then cooled to form a solid part.

The process is automated and repeats in a continuous loop:

- ✓ Clamping: The two halves of the mold are securely closed by the clamping unit to withstand the high injection pressure.
- ✓ Injection: Plastic pellets will be melted in the injection unit, and the molten polymer will be forced through a nozzle into the mold cavity. Pressure will often be maintained afterward to prevent shrinkage.
- ✓ Cooling: The plastic cools and solidifies into the final shape. This often accounts for the longest portion of the cycle time, as uneven cooling can cause warping.
- ✓ Ejection: The mold then opens, and ejector pins push the finished part out. The mold closes, and the cycle begins again.

The waste mold will then be crushed and used again in the moulding process thus reducing the waste generated during this process

2.4 Hazard and operability (HAZOP) study and layer of protection analysis (LOPA)

This section is prepared to satisfy the requirement for a detailed Hazard and Operability (HAZOP) study and Layer of Protection Analysis (LOPA) to identify and address potential hazards in the emulsion production and plastic injection moulding processes.

2.4.1 Objective and Scope

The HAZOP/LOPA study covers the following process nodes;

- (i) Pre-Emulsion Preparation,
- (ii) Polymerization Reactor,
- (iii) Colloidal Stabilization and Post-Processing/Formulation, and
- (iv) Plastic Injection Moulding (clamping, injection, cooling, ejection).

The primary hazardous materials of concern are the flammable/reactive monomers (methyl methacrylate, butyl acrylate, styrene, vinyl acetate), the initiator (potassium persulfate, an oxidiser), and molten plastic under pressure.

2.4.2 Methodology

The study applies the standard HAZOP guide-word methodology (IEC 61882) — examining each process node against the guide words No/Not, More, Less, As Well As, Part Of, Reverse, and Other Than — to systematically identify deviations from design intent, their causes, consequences, existing safeguards, and recommended actions.

Scenarios judged to warrant independent protection layers are then carried forward into a Layer of Protection Analysis (LOPA) following CCPS methodology, to verify that the combination of Independent Protection Layers (IPLs) reduces risk to a tolerable frequency.

2.4.3 HAZOP Worksheet Summary

Node	Guide Word / Deviation	Possible Causes	Consequences	Existing/Proposed Safeguards	Recommendation
Pre-Emulsion Preparation	More flow (excess monomer feed to mixing tank)	Dosing pump failure; operator/valve error	Overfilling; potential spill/release of flammable monomer and vapour	High-level alarm; bunded mixing area	Install high-high level interlock tripping feed pump; secondary containment sized to full tank volume
Pre-Emulsion Preparation	Loss of agitation	Agitator motor failure; power loss	Poor dispersion; monomer phase separation; localised hot spots if combined with later heating	Motor run-status indication	Add agitator-fail alarm interlocked to prevent initiator dosing until agitation confirmed
Polymerisation Reactor	More temperature (runaway exotherm)	Initiator over-dosing; cooling failure; blocked reflux condenser	Runaway polymerisation reaction; overpressure; potential vessel rupture, fire/explosion, toxic monomer release	Temperature indication; operator monitoring	Install independent high-temperature trip with automatic initiator feed isolation and emergency cooling/quench; pressure relief device sized for two-phase runaway scenario
Polymerisation Reactor	No/Less cooling	Cooling water pump failure; valve mal-position; fouled heat exchanger	Temperature rise as above	Cooling water flow indication	Redundant cooling water supply or emergency quench dosing system; flow-fail alarm
Polymerisation Reactor	Other than intended (wrong initiator quantity/charge)	Human error in batch charging; mislabelled containers	Uncontrolled reaction rate; potential runaway	Batch sheet/manual verification	Implement double-check/permit-to-charge procedure; consider automated dosing with interlock against batch recipe
Post-Processing/Formulation	More pressure (filtration system blockage)	Coagulum build-up blocking filter	Overpressure of filtration line; potential rupture/spray of hot latex	Pressure gauge	Install pressure relief valve on filtration line; scheduled filter inspection/cleaning regime
Plastic Injection Moulding — Clamping	Less clamping force	Hydraulic system fault; worn seals	Mould separation under injection pressure; ejection of molten plastic	Machine interlock (standard OEM safety)	Verify OEM safety interlock is functional and tested; include in preventive maintenance schedule

Node	Guide Word / Deviation	Possible Causes	Consequences	Existing/Proposed Safeguards	Recommendation
Plastic Injection Moulding — Injection	More pressure/temperature (barrel overheating)	Heater band control failure; blocked nozzle	Material degradation releasing fumes; potential barrel over-pressurisation	Temperature controller with alarm (typical OEM feature)	Confirm independent high-temperature cutout separate from the process controller; provide local exhaust ventilation at the nozzle/mould area
Plastic Injection Moulding — Cooling/Ejection	No ejection (part sticking)	Mould design fault; insufficient cooling time	Operator manual intervention increasing exposure to hot mould/moving parts	Machine guarding (standard OEM feature)	Reinforce lock-out/tag-out procedure before manual intervention; interlock guard doors

2.4.4 Layer of Protection Analysis (LOPA) — Priority Scenarios

The following scenarios were carried forward from the HAZOP as warranting quantified LOPA, given their potential consequence severity (fire, explosion or toxic release).

Scenario	Consequence Severity	Initiating Event Frequency (indicative)	Independent Protection Layers (IPLs) Credited	Residual Risk Gap	Additional Safeguard Required
Reactor runaway exotherm due to cooling failure combined with continued initiator feed	Major (potential vessel overpressure, fire/explosion, toxic release)	TO BE CONFIRMED	1) Basic Process Control System (BPCS) temperature control; 2) Independent high-temperature alarm with operator response; 3) Relief device	Gap identified — BPCS and alarm alone do not meet typical tolerable frequency target for major consequence	Install a Safety Instrumented Function (SIF) providing automatic emergency cooling/initiator isolation on high-high temperature, independent of the BPCS
Overfilling of monomer feed/mixing tank leading to spill and vapour release near ignition sources	Serious (fire potential; environmental release)	[TO BE CONFIRMED]	1) Level indication; 2) Bunded/contained area	Gap identified — no independent high-level trip currently credited	Install independent high-high level switch interlocked to isolate the feed pump; ensure area electrical classification (ATEX/Ex-rated) is verified for the bunded zone
Loss of containment of flammable solvent/monomer storage near LPG storage, escalating to fire	Major (fire/explosion escalation)	[TO BE CONFIRMED]	1) 50m firebreak (Section 3.8.3.11); 2) Fire water retention pond; 3) Manual fire response	Gap identified — reliance on manual response and passive separation only	Install automatic fire/gas detection with alarm annunciation; confirm firebreak and bund separation distances meet a recognised process safety standard (e.g., NFPA 30) rather than the ecological buffer distance alone

2.4.5 Summary of Recommendations for Design/EMP Integration

- Independent high-high temperature trip with automatic emergency cooling/initiator isolation on the polymerization reactor.
- Independent high-high level interlock on monomer feed/mixing tanks, with secondary containment sized to full tank volume.
- Automatic fire and gas detection for flammable material storage areas, supplementing the existing firebreak and fire-water pond.
- Confirmation of electrical area classification (hazardous area/Ex-rating) for zones handling flammable monomers and solvents.
- Formal preventive maintenance and interlock-testing schedule for all safety-critical instrumentation identified above.

These recommendations are carried forward into the Integrated ESMP Matrix

2.5 Project Activities

The building will be constructed based on applicable building standards of Kenya. Other building standards will be incorporated. The constructions will as well incorporate environmental guidelines, health and safety measures. (Detailed structural plans are provided in the architectural drawings in the Annex).

2.5.1 Construction Inputs

The project inputs include the following:

- Construction raw materials i.e. sand, cements stones, crushed rock (gravel/ ballast), ceramic, steel metals, roofing materials-tiles, painting materials among others. All these will be obtained from licensed dealers and especially those that have complied with the environmental management guidelines and policies.
- Construction machines will include trucks, concrete mixers, and other relevant construction tools and equipment. These will be used for the transportation of materials and clearing of the resulting construction debris. Most of the machinery will use petroleum products to provide energy.
- A construction labour force of both skilled and non-skilled workers.
- Water for construction purposes. It will be supplied from an already existing borehole in the area. Power from the main grid or provided by generators.
- Security to take care of the site during construction period.

2.5.2 Description of the Project's Construction Activities

2.5.2.1 Re-construction Investigations

The implementation of the project's design and construction phase will start with investigation of the site biological and physical resources in order to minimize any unforeseen adverse impacts during the project cycle.

2.5.2.2 Sourcing and Transportation of Building Materials

Building materials will be transported to the site from their extraction, manufacture, or storage sites using transport trucks. The building materials to be used in construction of the project will be sourced from Athiriver. Greater emphasis will be laid on procurement of building materials from within the local area, which will make both economic and environmental sense as it will reduce negative impacts of transportation of the materials to the project site through reduced distance of travel by the materials transport vehicles.

2.5.2.3 Storage of Materials

Building materials will be stored on site. Bulky materials such as rough stones, ballast, sand and steel will be carefully piled on site. To avoid piling large quantities of materials on site, the proponent will order bulky materials such as sand, gravel and stones in bits. Materials such as cement, paints and glasses among others will be stored in temporary storage structures which will be constructed within the project site for this purpose.

2.5.2.4 Excavation and Foundation Works

Excavation will be carried out to prepare the site for construction of foundations, pavements and drainage systems. This will involve the use of heavy earthmoving machinery such as tractors and bulldozers.

2.5.2.5 Masonry, Concrete Work and Related Activities

The construction of the building walls, foundations, floors, pavements, drainage systems, perimeter fence and parking area among other components of the project will involve a lot of masonry work and related activities. General masonry and related activities will include stone shaping, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces. These activities are known to be labour intensive and will supplement by machinery such as concrete mixers.

2.5.2.6 Structural Steel Works

The building will be reinforced with structural steel for stability. Structural steel works will involve steel cutting, welding and erection.

2.5.2.7 Roofing and Sheet Metal Works

Roofing activities will include sheet metal cutting, raising the roofing materials such as tiles and structural timber to the roof and fastening the roofing materials to the roof.

2.5.2.8 Electrical Work

Electrical work during construction of the premises will include installation of electrical gadgets and appliances including electrical cables, lighting apparatus, sockets etc. In addition, there will be other activities involving the use of electricity such as welding and metal cutting.

2.5.2.9 Plumbing

Installation of pipe-work for water supply and distribution will be carried out within the development and associated facilities. In addition, pipe-work will be done to connect sewage from the premises to the waste water treatment system, and for drainage of storm water from the rooftop into the peripheral Mavoko Sub- County storm water drainage system. Plumbing activities will include metal and plastic cutting, the use of adhesives, metal grinding and wall drilling among others.

2.5.2.10 Landscaping

To improve the aesthetic value or visual quality of the site once construction ceases, landscaping will be carried out by the proponent. This will include establishment of flower gardens and lush grass lawns and will involve replenishment of the topsoil. It is noteworthy that the proponent will use plant species that are available locally preferably indigenous ones for landscaping.

2.5.3 Description of the Project's Operational Activities

2.5.3.1 Residence

Occupancy will thus be accompanied by several domestic activities such as cooking, cleaning, use of vehicles, manufacturing activities and office related activities. In addition, there will be production of domestic and sanitary wastes.

2.5.3.2 Solid Waste and Waste Water Management

The proponent will provide facilities for handling solid waste generated within the facility. These will include dust bins for temporarily holding waste within the premises before final disposal at the town's designated dumping site.

Sewage generated from the building will be discharged in to a waste treatment plant which is which will be constructed at the proposed site proposed site

2.5.3.3 Cleaning

The proponent will be responsible for regular washing and cleaning of the pavements and offices. Cleaning operations will involve the use of substantial amounts of water, disinfectants and detergents.

2.5.3.4 General Repairs and Maintenance

The offices and associated facilities will be repaired and maintained regularly during the operational phase of the project. Such activities will include repair of building walls and floors, repair and maintenance of the parking area, repairs and maintenance of electrical gadgets and equipment, repairs of leaking water pipes, painting, maintenance of flower gardens and grass lawns, and replacement of worn out materials among others.

2.5.4. Description of the Project's Decommissioning Activities

2.5.4.1 Demolition Works

Upon decommissioning, the project components including buildings, pavements, drainage systems, parking areas and perimeter fence will be demolished. This will produce a lot of solid waste, which will be reused for other construction works or if not reusable, disposed off appropriately by a licensed waste disposal company.

2.5.4.2 Dismantling of Equipment and Fixtures

All equipment including electrical installations, furniture, partitions, pipe-work and sinks among others will be dismantled and removed from the site on decommissioning of the project. Priority will be given to reuse of these equipment in other projects. This will be achieved through resale of the equipment to other building owners or contractors or donation of these equipment to schools, churches and charitable institutions.

2.5.4.3 Site Restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored through replenishment of the top soil and re-vegetation using indigenous plant species.

2.6 Project Budget

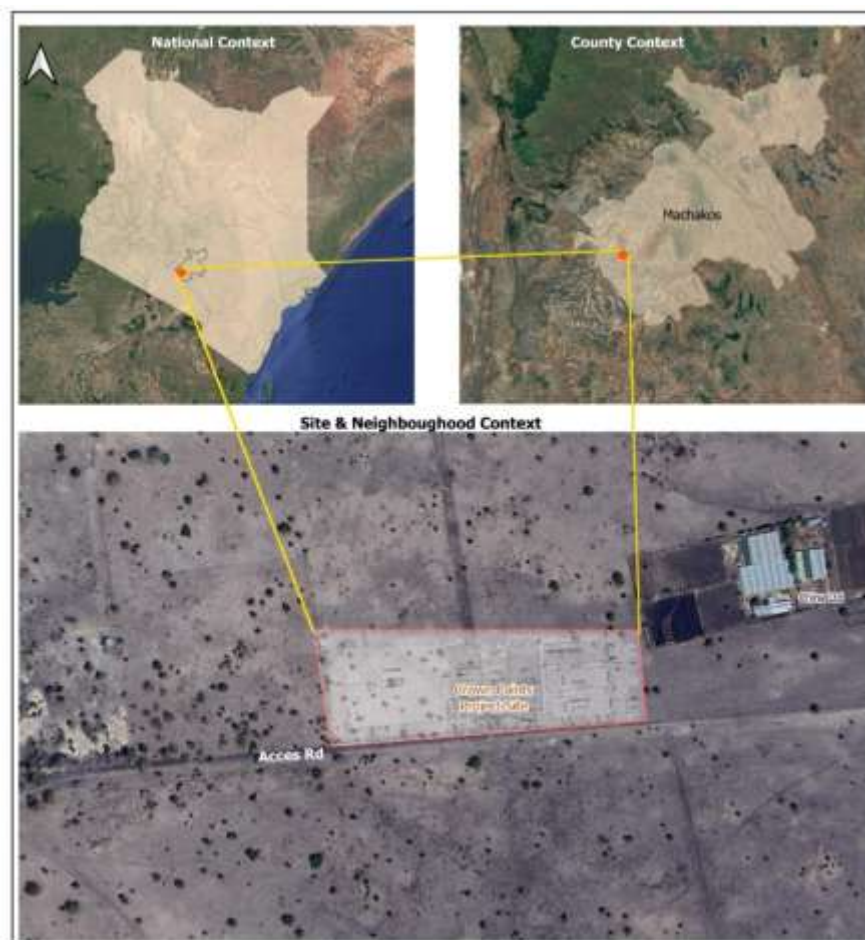
The proposed project under study is estimated not to exceed a budget of approximately Ksh 355,000,000.00

3: BASELINE DESCRIPTION

3.1 INTRODUCTION

The proposed development is located in LR. No. 12648/81 Kinanie Location, Kinanie Division, Mavoko Sub-County, Machakos County approximately one kilometer off Mombasa Road and 40 km from Nairobi city. The site is within other industrial developments. It has an east-west slope of 1 in 60 meters. Dominant wind directions are southeast to north west.

The project site is a neighbor to various facilities and developments which are majorly commercial premises and factories. Other associated developments include a road network, electricity supply and other infrastructure. The proposed site neighbors Rongai Steel co. Limited, Batchu Limited among other factories. The site is off Mombasa Road.



Site Location

3.2 OVERVIEW OF MACHAKOS COUNTY.

Machakos County is a key county in Kenya's Lower Eastern region, serving as a strategic economic and logistics hub within the greater Nairobi Metropolitan Region. It is the 10th most populous county with approximately 1.4 million residents (KNBS 2019), and covers 6,208 km², making it significantly larger than Nairobi City County but with lower population density. Often called the "Gateway to Ukambani", Machakos is renowned for its mix of Athi-Kapiti plains, Kyanzavi Hills, and Lukenya escarpment, supporting rangeland livelihoods, commercial agriculture, and emerging industrial zones.

Machakos County borders Nairobi City County to the west, Kiambu County to the northwest, Murang'a and Kirinyaga Counties to the north, Kitui County to the east, Makueni County to the south, and Kajiado County to the southwest. The county lies between longitudes 36°45' and 37°45' East, and latitudes 0°45' and 1°45' South. As one of the five counties forming the Nairobi Metropolitan Region alongside Nairobi, Kiambu, Kajiado, and Murang'a, Machakos is a critical node for trade, manufacturing, logistics, and regional integration, anchored by major transport corridors including Mombasa Road, the Nairobi–Mombasa SGR, and the Eastern Bypass/Northern Bypass network.

3.3 Climate and rainfall

3.3.1 Introduction

The larger Machakos County experiences a semi-arid to sub-humid climate classified under Agro-Ecological Zones IV and V. The county's climate is strongly influenced by altitude, which ranges from 1,000m in the Athi-Kapiti plains to 2,100m in the Kyanzavi and Iveti Hills. Mean annual rainfall varies from 500mm in the lower plains to 1,300mm in the higher zones. The county has a bimodal rainfall pattern with long rains from March–May and short rains from October–December. Temperatures range from 12°C minimum to 28°C maximum, with hotter, drier conditions prevailing in the Athi-Kapiti ecosystem where the proposed site is located

The project area, Kinanie, falls within the lower Athi-Kapiti plains at approximately 1,550m ASL. The area is characterized by:

- Rainfall: 500–700mm per annum, with high inter-annual variability. Long rains (Mar–May): 200–300mm. Short rains (Oct–Dec): 250–350mm. Dry spells frequent Jan–Feb and Jun–Sep.

- Temperature: Mean annual 20–22°C. Hot months: Jan–Mar and Sept–Oct reaching 28–30°C. Cool months: Jun–Aug with lows of 12–14°C.
- Evaporation: High potential evapotranspiration of 1,800–2,200mm/year, creating a persistent moisture deficit. Rainfall only meets 30–40% of PET.
- Wind: Predominantly easterlies. Strongest Jun–Aug. Wind erosion risk on bare ground.

3.3. 2 Site-Specific Climate Conditions & Risks

Based on the field assessment, the approximately 40% intact *Balanites Themeda* grassland is climate-sensitive due to:

1. Drought & Heat Stress

The *Themeda triandra* grassland is dormant July–Sept and Feb–Mar. Extended dry periods cause loss of perennial grass cover, increasing vulnerability to *Parthenium hysterophorus* invasion. Mature *Balanites aegyptiaca* rely on groundwater <8m deep. Construction-related compaction or altered drainage threatens this groundwater access.

2. Rainfall Variability & Flash Flooding

Short rains Oct–Dec are intense but short. Bare murrum and construction areas adjacent to the site generate high runoff. Without swales, runoff causes:

- Waterlogging and root rot of *Balanites*,
- Siltation of grassland,
- Seed dispersal of *Parthenium hysterophorus* into Zone 1.

3. Wind & Dust

Warehouse construction to the south generates dust during dry months Jun–Oct. Dust deposition reduces photosynthesis in *Themeda* and *Aspilia mossambicensis*, weakening native grassland competitiveness against *Parthenium*.

4. Fire Risk

Dry grassland carries high fire risk Aug–Oct before short rains. *Balanites aegyptiaca* bark is fire-sensitive; mature trees are killed by grass fires. *Parthenium* invasion increases fuel load and fire intensity.

3.3.3 Climate Change Implications for the Site

The Machakos CIDP 2023-2027 and Kenya's NDC project increased temperatures of 1.0–1.5°C by 2030 and more erratic rainfall for the Athi-Kapiti region. For the proposed project site this means:

- Longer dry spells will increase *Parthenium* competitive advantage over *Themeda*.
- More intense storms will increase runoff from adjacent warehouse, requiring upgraded drainage.
- Zone 1 *Balanites Themeda* core is a critical climate resilience asset: carbon storage, erosion control, and local cooling.

3.3.4 Climate Adaptation & Mitigation Recommendations

Climate Risk	Site Impact	Mitigation Measure
Drought	Loss of vegetation cover. vegetation water stress	10m no-development buffer. Protect groundwater recharge. Reseed with <i>Cenchrus ciliaris</i> .
Flash floods	Waterlogging, siltation, Parthenium seed spread	Construct 30cm swale + berm at Zone 1 edge before Oct rains. Silt traps on warehouse drainage
Dust	Reduced photosynthesis. Grassland degradation	5m <i>Cenchrus ciliaris</i> windbreak between warehouse and Zone 1. Wet murrum during construction
Fire	Loss of <i>Balanites</i> . Increased <i>Parthenium</i>	5m bare firebreak around Zone 1 by end-Aug. Prescribed burn 30% of grassland Sept with County permit
Heat	Increased evapotranspiration. Livestock stress	Retain 100% of <i>Balanites</i> canopy for shade. No clearing of Acacia trees

3.4 Geology and Soils

3.4.1 Geology

The project site lies within the Athi-Kapiti volcanic plains, part of the broader Nairobi volcanic complex formed during East African Rift development. The area is underlain by mid-Miocene to Upper Pleistocene volcanic rocks, predominantly Kapiti Phonolite (dated ~13 Ma), that overlie older Neo-Proterozoic metamorphic basement rocks.

Site-Specific Geology

LR. No. 12648/81 is situated on weathered phonolitic lava flows and associated tuffs derived from fissure eruptions west of Nairobi in the Kikuyu-Limuru area. The surface geology comprises:

1. Kapiti Phonolite: Dark, fine-grained volcanic rock forming the resistant substrate beneath the *Balanites-Themedra* grassland. Low permeability contributes to surface runoff toward the warehouse site.
2. Weathered Tuffs & Pyroclastics: Occur as interbeds and in the deep red friable soils. These fragmentary deposits, from Pleistocene volcanic activity, form the parent material for the site's fertile but erosion-prone topsoil.
3. Erosion Surface: The volcanics rest on a late-Cretaceous erosion surface that was peneplained before Miocene lava extrusion.

Implications for the project site.

1. Shallow soils: Weathered tuffs produce thin, well-drained soils. Highly susceptible to erosion if grass cover is lost — increasing *Parthenium* invasion risk.
2. Groundwater: Phonolite is fractured, allowing deep groundwater storage that sustains *Balanites aegyptiaca* during drought. Construction compaction or dewatering will damage this source.
3. Runoff: Low permeability of phonolite means high surface runoff from the warehouse site into Zone 1 during Oct–Dec short rains. Swales required.
4. Construction risk: No major fault lines mapped on-site, but weathered tuff is unstable when wet — foundation design must account for shrink-swell potential.

The site's volcanic geology supports valuable grassland but creates high erosion and runoff risk under industrial pressure. Retention of topsoil and natural drainage is critical.

3.4.2 Soils

Soil Type & Characteristics

The project site is characterized by deep red friable soils derived from weathered phonolitic tuffs and pyroclastics. These soils are well-drained, porous, and moderately fertile, typical of the Athi-Kapiti plains. In intact grassland, the topsoil supports high native grass cover and good root penetration.

Drainage and Management Issues

1. Natural drainage: Good in undisturbed grassland areas due to grass root structure and gentle slope.
2. Disturbance impacts: Adjacent warehouse construction and murram extraction have exposed subsoil and compacted surfaces. These areas show poor infiltration, high runoff, and dust generation.
3. Erosion risk: The red soils are highly erodible when bare. Stormwater runoff has caused siltation. Low-lying areas near the south boundary experience seasonal waterlogging during rains.
4. Construction suitability: Weathered tuff subsoil has shrink-swell potential when wet. Foundations require geotechnical assessment. The topsoil is not suitable for fill due to high organic content.

While the native soils are ecologically valuable and stable under grass cover, construction disturbance has created drainage failure and erosion risk. Retention of topsoil and installation of swales/silt traps is key to prevent loss of vegetation.

3.5 Water resources

Machakos County's primary water resources include surface water from earth Dams, Nol-Turesh pipeline, and seasonal rivers draining the county, supplemented by groundwater from Athi-Kapiti aquifers. The county faces a persistent water deficit due to semi-arid climate, increasing industrial/agricultural demand, aging infrastructure, and climate shocks. Key challenges include illegal abstraction, catchment degradation, and inadequate funding for maintenance and expansion.

3.5.1 Surface Water

The project site vicinity contains active hydrological features. A seasonal river with highly sensitive riparian vegetation flows 250m north and 400m west of the site boundary. Three water pans are present; one ephemeral pan 300m northwest, and two larger pans 500–600m south within the adjacent Conservancy. These pans are critical dry-season water sources for wildlife and livestock in Mavoko Sub-

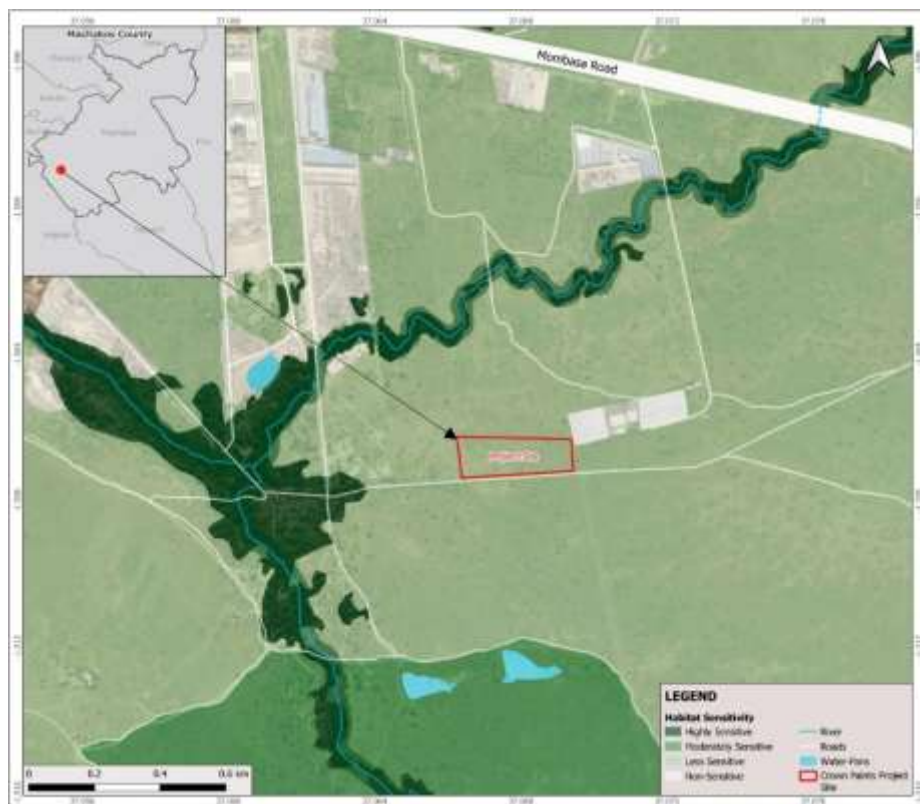
County. Another major river in the region, the Athi River is ~4km south. This river is heavily impacted by industrial effluent and municipal waste from Nairobi upstream.

3.5.2 Drainage & Flood Risk

The Project Site sits on Grassland with natural drainage northeast toward the riparian corridor. The Built-up industrial area immediately west has created bare land and compacted surfaces that generate high runoff. Stormwater from these warehouses flows east toward the river. During heavy rains this could create flood risk + siltation into the riparian zone.

3.5.3 Groundwater

The site overlies fractured Kapiti Phonolite, with shallow groundwater <8m supporting vegetation. The aquifer is hydraulically connected to the river and water pans. Contamination from industrial runoff or borehole over-abstraction can degrade both groundwater and surface systems. This therefore calls for a comprehensive waste water management system for the proposed project.



Map : Habitat sensitivity map showing stream, water pans and riparian vegetation within the project site vicinity.

3.6 AMBIENT AIR QUALITY

As part of this Environmental and Social Impact Assessment (ESIA), baseline ambient air quality assessment to establish the current environmental conditions before the actualization of the Proposed Construction and operation of emulsion binder and plastic injection moulding plant was carried out. The assessment was carried out on 9th June 2026 by Airsense Environmental Lab Ltd, a NEMA licensed laboratory and involved measurement of concentration of PM_{2.5}, PM₁₀, SO_x, NO_x, CO, CO₂ and TVOCs.

The air samples for each pollutant were picked from five predetermined points at the project area so as to identify any potential exceedances early on so that corrective measures can be implemented to mitigate pollution levels. The standards used to evaluate the measured values are derived from EMCA (Air Quality) Regulations, 2024 and the WHO ambient air quality standards.

Environmental Management and Co-ordination Act Air Quality Limits.

The limits included in the first schedule of the Air Quality regulations are shown in the Table 1 overleaf below:

Table 4: EMCA Air Quality Limits

EMCA Ambient Air Quality Tolerance Limits		
Pollutant	TWA	Residential Rural & other Areas µg/m ³)
PM ₁₀	24 hours**	50
PM _{2.5}	24 hours	75
Sulfur Dioxide (SO ₂)	24 hours**	125
Nitrogen Dioxide (NO ₂)	24 hours	100
Volatile organic carbon (VOC)	24 hours	600
Carbon Monoxide CO	24 hours**	5
Carbon Dioxide CO ₂	24 hours	5

World Health Organization, Air Quality Guidelines

The World Health Organization (WHO) Air Quality Guidelines (AQG) are intended for worldwide use but have been developed to support actions to achieve air quality that protects public health in different contexts. The International Finance Corporation (IFC), Environmental, Health and Safety Guidelines also refer to WHO standards for ambient air quality. The guidelines are in table below.

Table 5 : WHO Air Quality Guidelines

Pollutant	Time Weighted Average	Air Quality Guideline
Sulphur Oxides, Sox	24-Hr Mean	20µg/m ³
Nitrogen Dioxide, NOx	Annual Mean	40µg/m ³
Respirable Particulate Matter (<10µm)	24-Hr Mean	50 µg/m ³
PM _{2.5}	24-Hr Mean	25 µg/m ³

In addition to guideline values, interim targets are given for each pollutant. These are proposed as incremental steps in a progressive reduction of air pollution and are intended for use in areas where pollution is high. These targets aim to promote a shift from high air pollutant concentrations, which have acute and serious health consequences, to lower air pollutant concentrations. If these targets were to be achieved, one could expect significant reductions in risks for acute and chronic health effects from air pollution. Progress towards the guideline values should, however, be the ultimate objective of air quality management and health risk reduction in all areas.

3.6.1 Air Quality measurements Methodology

Persium Pods are advanced, low-cost air quality sensors designed for outdoor and indoor environmental monitoring. They measure up to 12 major pollutants — including gases like NO₂, SO₂, O₃, CO, H₂S, TVOCs as well as particulate matter (PM₁, PM_{2.5}, PM₁₀) — and also record atmospheric parameters such as temperature, humidity, and pressure. They have built-in wind sensors, enabling source apportionment and analysis of pollution dispersion.

Persium Pods can transmit data via multiple connectivity options (e.g, WiFi, 3G/4G LTE, LoRa WAN, GSM), and some models are solar powered for flexible and wide deployment. The hardware is paired

with software tools, including dashboards, cloud storage, and visualization platforms. The systems support real-time data presentation, mapping (including heatmaps and wind isobars), and forecasting through machine learning, allowing users including governments, researchers, and planners — to monitor air quality, detect trends, and make informed policy or mitigation decisions.



Table 6: Description of the site – Linear (Identified) sampling points at the Junctions

Monitoring Point	Description of the sampling point	GPS Coordinates
Mp1 Boundary at the entry area of the proposed site	This point is located at the entry of the proposed site	1°30'23.02182" S 37°4'4.01178"E
Mp2 Boundary at North East of the proposed facility	This point is located at the corner at the North east side of the proposed facility	1°30'25.51752" S 37°4'10.53066"E
Mp3 Boundary at the Eastern side of the proposed site	This point is located at the eastern side of the proposed facility	1°30'26.88984' S 37°3'59.34378"E
Mp4 Boundary at the western side of the proposed site	This point is located at the western side of the proposed facility	1°30'26.87982" S 37°3'59.31864"E
Mp5 Boundary at the south west of the proposed site	This point is located at the South west side of the proposed facility	1°30'26.87982" S 37°3'59.31864"E



Plate 1: Air Quality Measurements. MP1 and MP2



Plate 2: Air Quality Measurements. MP3 and MP4

3.6.2 Particulate Dust

From the results analysis in tables 4 and 5, the five points sampled for both PM₁₀ and PM_{2.5} were within both the Environmental Management and Co-ordination (Air Quality), Regulations, 2024 and WHO ambient air quality standards.

Table 7 : PM₁₀ Analysis Results

Location	Time (hrs)	Concentration µg/m ³			WHO Air Quality Guidelines PM ₁₀	EMCA (Air Quality) Reg. 2014
		AVG	MAX	MIN		
MP1	24hrs	31.0	33.3	29.5	50 µg/m ³ 24hrs	50 µg/m ³ 24hrs
MP2	24hrs	14.7	15.2	13.9		
MP3	24hrs	12.6	13.7	11.3		
MP4	24hrs	16.5	17.9	15.4		
MP5	24hrs	11.1	16.9	9.1		

Table 8 : PM_{2.5} Analysis Results

Location	Time (hrs)	Concentration µg/m ³			WHO Air Quality Guidelines PM ₁₀	EMCA (Air Quality) Reg. 2014
		AVG	MAX	MIN		
MP1	24hrs	17.3	17.9	15.9	25 µg/m ³ 24hrs	75 µg/m ³ 24hrs
MP2	24hrs	3.2	3.9	2.9		
MP3	24hrs	4.4	5.2	3.7		
MP4	24hrs	11.1	17.1	6.2		
MP5	24hrs	4.4	7.8	4.1		

3.6.3 Oxides of Sulphur (SO₂) and Oxides of Nitrogen (NO₂)

From the results obtained, the five points sampled for SO₂ were within both the Environmental Management and Coordination Act (Air Quality) regulations, 2024 and WHO ambient air quality standards.

The levels of NO₂ results at all the measurement points were within both the Environmental Management and Coordination Act (Air Quality), Regulations, 2024 and WHO ambient air quality standards.

Table 9: NO₂ & SO₂ Analysis Results

Location	Time (hrs)	NO ₂ Concentration µg/m ³	SO ₂ Concentration µg/m ³	EMCA (Air Quality) Reg. 2014	WHO Air Quality Guidelines
MP1	24hrs	63	13.7	NO ₂ – 100 µg/m ³ SO ₂ – 125 µg/m ³	NO ₂ - 40 µg/m ³ SO ₂ -20 µg/m ³
MP2	24hrs	52	9.2		
MP3	24hrs	56	7.1		
MP4	24hrs	54	8.9		
MP3	24hrs	51	10.2		

3.6.4 VOCs

Total VOC levels were all within the Environmental Management and Coordination Act (Air Quality), Regulations, 2024, and the World Health Organization Air quality guidelines.

Table 10: VOC Analysis Results

Location	Time (hrs)	TOTAL VOC	EMCA (Air Quality) Reg. 2014
MP1	24hrs	<2.32	VOC – 600 µg/m ³
MP2	24hrs	<2.32	
MP3	24hrs	<2.32	
MP4	24hrs	<2.32	

3.6.5 Carbon Dioxide and Carbon Monoxide (CO₂ & CO)

The levels of both Carbon dioxide and carbon monoxide were within the Environmental Management and Co-ordination Act (Air Quality), Regulations, 2024 at all the measurement points assessed.

Table 11 : CO & CO₂ Analysis Results

Location	Time (hrs.)	CO Concentration mg/m ³	CO ₂ Concentration mg/m ³	EMCA (Air Quality) Reg. 2024
		AVG	AVG	
MP1	24hrs	4.1	4.2	5 mg/m ³
MP2	24hrs	3.1	3.9	
MP3	24hrs	3.7	3.3	
MP4	24hrs	3.2	3.1	
MP5	24hrs	3.6	3.2	

3.6.6 Sources of Emission

During the monitoring period, several notable emission sources were observed within and around the project area.

Firstly, motor vehicles operating within the proposed site, particularly those owned and operated by third-party companies, contribute significantly to air pollution. Emissions from internal combustion engines release pollutants such as carbon monoxide (CO) and particulate matter (PM) into the surrounding environment. In addition, idling of vehicles during loading and offloading activities increases localized concentrations of exhaust emissions.

Secondly, companies operating within the proposed facility act as potential point and non-point sources of pollution. Depending on the nature of their industrial or commercial activities, these companies may generate air emissions, noise pollution, wastewater effluents, solid waste, and fugitive dust.

These sources were identified as the dominant contributors to air quality conditions at the time of the assessment.

3.7 BASELINE NOISE MEASUREMENTS

3.7.1 Introduction

This section details noise level survey & mapping undertaken on 9th June 2026. Noise level measurements were taken from five predetermined points at the project area so as to identify the baseline noise levels which will inform project implementation and aid monitoring and future audits.

Noise measurements were performed at the stated areas in accordance with the South African standard SANS 10083:2004, Fifth Edition: "The Measurement and Assessment of Occupational Noise Exposure for Hearing Conservation Purposes". Further afield, A European directive (Directive 2003/10/EC of the European Parliament and the Council), published in 2003, describes the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise). Monitoring was done at a height of 1.5 meters from the ground and 1-meter way from the façade of the noise source. Measurements were carried out at various predetermined locations in the plant. A calibrator was used to check the sensitivity and accuracy of the meter immediately before, during measurement intervals and after the measurement period.

3.7.2 Scope of the Measurements

The noise measurements were taken at various points considered relevant for the ESIA. These points were;

- Northern side – at the main entrance to the site.
- Southern side – At the boundary with the access road
- Eastern side boundary
- Western side boundary
- Within the site

3.7.3 Objectives of the Survey

- To determine the current / typical noise levels within and around the project site.
- To see how the measurements, compare with the Limits

- To fulfil the requirements of the Environmental and Social Impact Assessment of the proposed emulsion binder and plastic injection plant.
- To recommend appropriate control measures if required.

3.7.4 Survey Methodology

Noise measurements were performed at the stated areas in accordance with the South African standard SANS 10083:2004, Fifth Edition: "The Measurement and Assessment of Occupational Noise Exposure for Hearing Conservation Purposes". Further afield, A European directive (Directive 2003/10/EC of the European Parliament and the Council), published in 2003, and describes the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise).

Monitoring was done at a height of 1.5 meters from the. The run time was averagely 5 minutes per point. Measurements were carried out at various predetermined locations around the site.

A calibrator was used to check the sensitivity and accuracy of the meter immediately before, during measurements intervals and after the measurement period.

3.7.5 Instrumentation

Noise levels were determined using the following:

- Sound level meter type SVAN 971 Serial No.73447 with Omni - directional microphone was used.
- This integrating sound level meter was calibrated using a multifunctional Acoustic calibrator type 4226 with a standard uncertainty of +/-0.025Db

3.7.6 Measurements Results

The measurement results are expressed as follows:

Table 12: Measurements Results

No	Point of measure	Measurement (dBA)	Code	OEL in dBA	Remarks
1	Northern side – Entrance	77.7		90	Below OEL

2	Southern boundary	66.3		90	Below OEL
3	Eastern boundary	66.9		90	Below OEL
4	Western Boundary	81.1		90	Below OEL
5	Within the site	66.5		90	Below OEL

Legend:

Noise rating	Colour code	Implication
Less than 85dB(A)		No further action required
More than 85dB(A) but less than 90dB(A)		Occupier must develop and implement an effective noise control and hearing conservation programme when within the vicinity of the noise area
More than 90dB(A)		No worker to be exposed to such noise levels. Further, the Occupier must develop and implement an effective noise control and hearing conservation programme

3.7.7 Discussion of Results

Pursuant to the Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005 which requires that where noise in a work place exceeds the continuous equilibrium of 85 dB(A), the occupier must develop and implement an effective noise control and hearing conservation program. The measurements revealed a normal working environment with no foreseeable adverse health effects that could arise due to noise exposure.

The measurements were within the occupational exposure limits – 8Hr Time Weighted Average. With regard to the hierarchy of hazard controls, noise risk factors would be controlled as follows:

Engineering controls

Machinery or plant in the workplace should be installed in such a way that the lowest possible noise is emitted when it is in operation. The occupier should also carry out regular inspection and maintenance of machines and installations to ensure that noise emission is prevented or controlled.

Administrative controls

The impact of high noise levels on workers will be minimized by limiting their exposure time. This can be achieved by rotating them.

Selection of Ear Protectors

The selection of proper ear protectors is key to ensuring that the protectors are effective in reducing noise impact. The following factors are considered in selecting a suitable ear protector:

- It must adequately attenuate noise levels to below 90dB (A) but not “over protect” an employee. Overprotection can lead to health and safety hazards such as worker not hearing safety warnings within the workplace.
- The attenuation values of different types of hearing protectors should be obtained by contacting the appropriate manufacturer of the type of PPE.

Ear protectors are available in two basic forms: earmuffs and earplugs. Either have an assigned Noise Reduction Rating (NRR) which gauges the adequacy of the hearing protector’s attenuation or rather the noise reducing capacity. The NRR was developed by USEPA (United States Environmental Protection Agency). The USEPA requires that the NRR be printed on the packaging of each hearing protector.

The NRR of a hearing protector will reduce the noise exposure by its rating. However, it is important to note that the calculation on reduction of noise exposure is true if only the original TWA exposure was arrived at with a noise measuring instrument in reading in the C scale. When A weighting is used as in this survey, a slight adjustment will be carried out: 7dB must first be subtracted from the hearing protector’s NRR; this number is then subtracted from the TWA exposure.

A good hearing protector should attenuate sound to between 75dB (A) to 80dB (A).

3.8 BIOLOGICAL ENVIRONMENT

3.8.1 Ecological Conditions

The project site, located in Kinanie along the Mombasa Road corridor and bordering active industrial development, is characterized by a fragile and rapidly changing ecology marked by intense industrial pressure, environmental degradation, and proximity to sensitive hydrological systems.

Habitat Status: The site is 40% intact *Balanites-Themedra* wooded grassland mapped as “Less Sensitive,” but it functions as a critical buffer between industrial bareland to the west and a Highly Sensitive riparian corridor 200m north + water pans 300–600m northwest/south.

Threats:

- Invasive species: Category 1 *Parthenium hysterophorus* at source/front/beachhead stages, vectored from adjacent construction. Class 1 toxic *Euphorbia heterochroma* on disturbed edges.
- Hydrological: Warehouse runoff crosses the site into the sensitive river, carrying silt and *Parthenium* seeds. No stormwater controls exist.
- Dust & Fragmentation: Bareland to the west generates dust that suppresses native grasses. The site is severed from larger habitat blocks by industrial walls.

Ecological Value: Despite pressure, the site retains 71% native species, protected *Balanites aegyptiaca*, and pollinator habitat for bees. It provides erosion control, carbon storage, and aquifer recharge for the Athi River sub-catchment. The Zone 1 core is the last filtration barrier protecting the riparian zone and Conservancy water pans downstream.

3.8.2 Biodiversity

The project area, located in Kinanie within the Athi-Kapiti ecosystem of Mavoko Sub-County, is part of a semi-arid rangeland ecosystem heavily influenced by industrial encroachment and proximity to sensitive riparian corridors. Biodiversity in this area is largely defined by edge effects from adjacent warehouse development and the hydrological linkages to the Highly Sensitive River 200m north and Conservancy water pans 500–600m south, as shown in the Habitat Sensitivity Map.

Flora

The ecosystem includes a blend of remnant Athi-Kapiti grassland and woodland species alongside invasive and naturalized flora driven by disturbance:

- Indigenous core: *Balanites aegyptiaca* (protected), *Themeda triandra*, *Acacia mellifera*, *Leonotis nepetifolia*, *Aspilia mossambicensis* — 17 native species, 71% of site flora.
- Invasives: Category 1 *Parthenium hysterophorus* at source/front/beachhead stages. Class 1 toxic *Euphorbia heterochroma*. *Lantana camara* and *Nicotiana glauca* on edges.
- Disturbance indicators: *Solanum incanum*, *Bidens pilosa* dominate degraded.

Fauna

The area supports grassland-adapted fauna, with diversity limited by fragmentation from industrial walls <30m south.

- Avifauna: Superb Starling, Speckled Mousebird, sunbirds utilize mature *Balanites* and *Acacia*. Riparian zone 200m north supports higher diversity.
- Invertebrates: *Acacia mellifera* and *Leonotis* are key bee forage. Pollinator habitat is a critical site service.
- Mammals/Reptiles: No evidence of medium-large mammals like duikers or monkeys due to lack of habitat connectivity. May support rodents, skinks, and agamas. Bush babies/genets unlikely.
- Water pan link: Conservancy water pans 500m south support seasonal waterbirds and amphibians, but are threatened by silt runoff from the Project Site.

Mapping of land use and habitat sensitivity shows that biodiversity within the project area of influence has reduced in both composition and density over time. The Land Cover Map confirms the site is Grassland surrounded by Built-up and Bareland, with the nearest intact habitat being the Riparian corridor and Conservancy to the south. Anthropogenic activities — illegal dumping, poor stormwater management from adjacent warehouses, murram extraction, and *Parthenium* introduction — are the major causes of reduced biodiversity.

3.8.3 Biodiversity survey

3.8.3.1 Introduction & Regulatory Context

This Biodiversity Assessment forms part of the Environmental and Social Impact Assessment for the proposed Emulsion Binder and Plastic Injection Moulding Plant by Crown Paints Kenya PLC. The project is located on 9.5 acres at LR. No. 12648/81, Kinanie Location, Mavoko Sub-County, Machakos County at GPS coordinates -1.507274, 37.067968. The development comprises a Plastic Injection Block, Emulsion Binder Plant, sub-basement, ground and mezzanine floors, administration block, and general warehouse blocks.

The assessment is prepared to meet requirements of the Environmental Management and Coordination Act (EMCA) 1999, Environmental Impact Assessment and Audit Regulations 2003, Wildlife Conservation and Management Act 2013, Air Quality Regulations 2014, Water Quality Regulations 2006, and the Plastic Pollution Regulations 2024 under NEMA.

The project falls within the Athi-Kapiti ecosystem, a known wildlife dispersal area for Nairobi National Park, ~15km NW of the site. The broader Kinanie area is ecologically sensitive due to its role in wildlife movement between NNP and Ol Donyo Sabuk ecosystem.

3.8.3.2 Methodology

Desktop Review

Secondary data was reviewed from: Kenya Wildlife Service (KWS), National Museums of Kenya (NMK), IUCN Red List, Kenya Forest Service (KFS), IBAT, and existing EIAs in Mavoko Sub-County. Satellite imagery from Google Earth 2026 was used for preliminary habitat mapping.

Field Survey

- Season: April and May 2026, dry season.
- Flora: 10m x 10m quadrats + walkover line transects. Species ID, cover %, conservation status recorded.
- Fauna: Direct observation, spoor/scat ID, point counts for birds 0600-1000hrs, key informant interviews.

- Area of Influence: 500m buffer assessed for ecological connectivity per NEMA guidelines.
- Limitation: Dry season surveys under-represent annual/perennial herbs, amphibians, and migratory birds. Wet season follow-up Nov-Dec 2026 recommended per Reg 16(1)(d) of EIA Regulations 2003.

3.8.3.3 Baseline Biodiversity Conditions

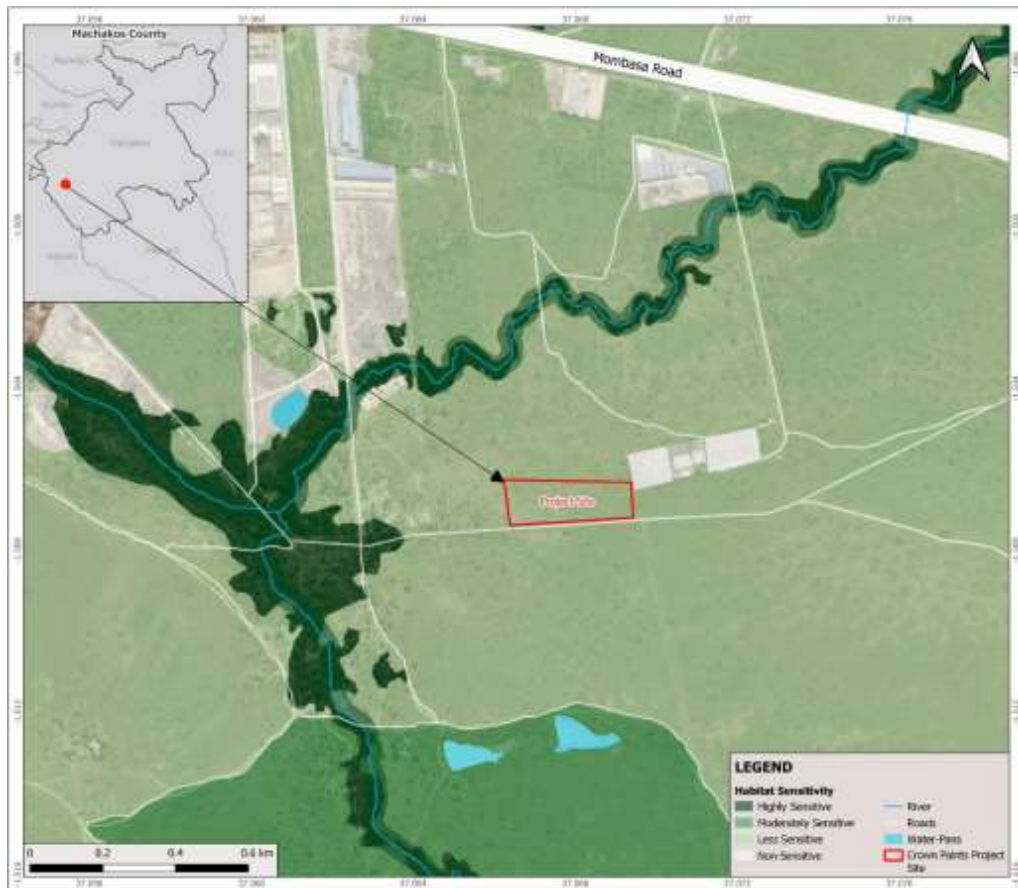
Ecological Setting

The site lies within Kenya's Somali-Masai Acacia-Commiphora deciduous bushland and thicket ecoregion. No gazetted forests, IBAs, or KBAs overlap the 9.5-acre plot. Closest water bodies: two water pans visible ~400m SE and ~600m S in satellite imagery, used by livestock and wildlife.

Table 13: Habitats

Habitat Type	Approx. Area	Condition	Key Characteristics
Open Acacia drepanolobium bushland	6.5 acres	Moderately degraded	Scattered Acacia spp., Balanites aegyptiaca, bare patches, overgrazing evident
Grassland patches	2.5 acres	Degraded	Themeda triandra, Cynodon spp., invasive Opuntia noted
Disturbed/bare ground	0.5 acres	High disturbance	Tracks, possible old structures

3.8.3.4 Habitat Sensitivity Map



Habitat Sensitivity Map

3.8.3.5 Flora diversity survey

Site Status: 70.8% native species cover. High conservation value *Balanites Themeda* wooded grassland present.

Critical Threats:

- Category 1 invasive *Parthenium hysterophorus* at source/front/beachhead stages.
- Industrial construction <30m from protected *Balanites aegyptiaca*
- Class 1 toxic *Euphorbia heterochroma* on disturbed edges.

3.8.3.6 Species List

Line transects were systematically established within the project area. Plants along each side of the established lines were identified and listed to generate plant diversity of the project area. No endangered or threatened plant was listed during the exercise. A detailed checklist of the identified floral diversity is attached below.

Table 14: Summary: Natives: 17 (71%) | Invasives: 3 (12%) | Naturalized: 4 (17%)

Botanical Name	Kikamba/Common	Status & Legal Notes	Management Action
<i>Balanites aegyptiaca</i>	Kilului / Desert date	Protected. KEFRI priority. Machakos County permit required to fell	Retain 100%. 10m buffer. Collect seed Dec-Jan
<i>Cissus quadrangularis</i>	Mukungugu / Veld grape	Medicinal. Non-toxic	Retain. Indicator of undisturbed site
<i>Searsia natalensis</i>	Muthigiya / Natal rhus	Non-toxic	Retain. Thicket habitat
<i>Themeda triandra</i>	Muthanga / Red oat grass	Non-toxic	Retain. No ploughing. Prescribed burn Sept
<i>Chloris gayana</i>	Kikuyu grass / Rhodes grass	Non-toxic	Retain. Reseed bare areas Oct
<i>Acacia drepanolobium</i>	Mwaitha / Whistling thorn	Non-toxic. Thorns	Retain. Core grassland tree
<i>Acacia tortilis</i>	Munga / Umbrella thorn	Non-toxic	Retain. Mature trees
<i>Grewia tembensis</i>	Muvu / Tembu	Non-toxic	Retain thickets
<i>Ziziphus mucronata</i>	Muthithi / Buffalo thorn	Non-toxic	Retain
<i>Acacia mellifera</i>	Muthiia / Hook thorn	Non-toxic. Aggressive encroacher	Thin 70%. Leave 10% for bees
<i>Leonotis nepetifolia</i>	Kivovoyo / Lion's ear	Non-toxic	Harvest seed Aug. Slash if fire risk
<i>Aspilia mossambicensis</i>	Muvya / Wild sunflower	Non-toxic	Retain. Burn 30% Sept. Reseed gaps
<i>Solanum incanum</i>	Mutongu / Sodom apple	Toxic to livestock. Unripe fruit	Slash before seed. Reseed grass
<i>Achyranthes aspera</i>	nan / Devil's horsewhip	Burs stick to animals	Slash before seed. Sign of disturbance
<i>Tagetes minuta</i>	Muvangi / Mexican marigold	Strong smell. Suppresses nematodes	Slash. Compost. Prevent monoculture
<i>Amaranthus cruentus</i>	Terere / Red amaranth	Edible. High oxalates if mature	Harvest young. Slash before seed
<i>Ocimum gratissimum</i>	Mukandu / African basil	Aromatic. Non-toxic	Retain patches. Coppices
<i>Bidens pilosa</i>	Munyu / Blackjack	Seeds stick. Edible young	Slash before seed. Feed to goats
<i>Gomphrena celosioides</i>	nan / Bachelor's button	Non-toxic	Uproot on paths. Tolerant of trampling
<i>Lantana camara</i>	Mucimoro / Lantana	Toxic to livestock. Liver failure	Cut stump + glyphosate. Uproot seedlings
<i>Nicotiana glauca</i>	Muthunuku / Tree tobacco	Toxic. Anabasine	Uproot. Wear gloves. Bag + burn
<i>Parthenium hysterophorus</i>	Gathuru / Congress weed	Causes asthma, dermatitis. Toxic to livestock	PPE mandatory. Uproot + bag + burn/solarize. 0% tolerance
<i>Euphorbia heterochroma</i>	Kithumba / Candelabra spurge	Class 1 TOXIC. Sap = blindness, burns. Death if ingested	Fence 2m + signage. NEVER cut/burn. Full PPE. Report to OSHA if workers present
<i>Commiphora africana</i>	Mutunguu / African myrrh	Non-toxic	Retain. Rare on site

Pictorial presentation of sampled plant species identified at the proposed site.



Plate 3: *Acacia-Commiphora*, *Balanites aegyptiaca* and *Nicotiana glauca*



Plate 4: *Leonotis nepetifolia*, *Searsia natalensis* and *Withania somnifera*



Plate 5: *Achyranthes aspera*, *Tagetes minuta* and *Grewia similis*



Plate 6: *Ocimum gratissimum*, *Acacia mellifera* and *Amaranthus cruentus*



Plate 7: *Acacia mellifera*, *Solanum incanum* and *Balanites aegyptiaca*



Plate 8: *Leonotis nepetifolia*, *Parthenium hysterophorus* and *Euphorbia heterochroma*

3.8.3.7 Fauna diversity survey

A combination of point counts and line transects were used to determine species diversity within the site and the project area of influence. Desktop study was also employed to help understand the fauna diversity of the project area. The biodiversity survey exercise, did not spot any key faunal species on site save for butterflies and passing birds which could not be identified.

Desktop studies indicate that the broader Athi-Kapiti ecosystem, including Kyanzavi Hills and residual Lukenya grasslands, historically supported diverse fauna including birds, small mammals, and reptiles. Common species in less-disturbed portions of Mavoko Sub-County include vervet monkeys, bush babies, brush-tailed porcupines, genets, and common duikers. The area is also known for grassland and woodland bird species such as the African Red-rumped Swallow, Superb Starling, and various sunbirds.

Site-Specific Conditions

The project site, LR. No. 12648/81 in Kinanie, is located adjacent to active industrial development and within 30m of a warehouse construction zone. The site has undergone significant edge disturbance from murram extraction, construction runoff, and invasive species introduction.

Current Faunal Status

While the site retains 40% high-quality *Balanites-Themedia* wooded grassland (Zone 1), which is structurally suitable for small fauna, direct observations and habitat assessment from 2026 indicate severely limited faunal presence due to:

1. Anthropogenic pressure: Active construction, dust, noise, and vehicle movement from the adjacent warehouse have displaced larger mammals. No evidence of monkeys, duikers, porcupines, or genets was recorded during the baseline survey.
2. Invasive species impact: Category 1 invasive *Parthenium hysterophorus* is established at three fronts and produces allelopathic chemicals known to suppress ground fauna and insect diversity. Toxic *Euphorbia heterochroma* further reduces habitat usability for mammals.
3. Habitat fragmentation: The site is bordered to the south by a concrete wall and industrial infrastructure, severing connectivity to larger habitat blocks.

Remaining Faunal Value

1. Avifauna: The mature *Balanites aegyptiaca* and *Acacia* trees in Zone 1 continue to support common grassland/woodland birds. Species likely present include Superb Starling, Speckled Mousebird, and sunbirds. *Leonotis nepetifolia* and *Aspilia mossambicensis* in Zones 3-4 provide nectar for pollinators during flowering periods. The site is unlikely to support African Red-rumped Swallow colonies due to lack of suitable nesting structures and high disturbance.
2. Small mammals/reptiles: The intact grassland may support small rodents, skinks, and agamas. Bush babies and genets are unlikely due to lack of dense, connected canopy and proximity to development. No burrows or scat of brush-tailed porcupine were observed.
3. Invertebrates: *Acacia mellifera* thickets in Zone 2 remain an important resource for honeybees. However, *Parthenium* pollen is known to contaminate honey and suppress native pollinator diversity.

Table 15: Likely fauna based on habitat type and regional data:

Scientific Name	Common Name	Taxon	IUCN Status	Kenya WCA 2013	Likelihood on Site*
<i>Equus quagga</i>	Plains Zebra	Mammal	NT	Protected	Seasonal/Dispersal
<i>Giraffa camelopardalis tippelskirchi</i>	Masai Giraffe	Mammal	EN	Vulnerable	Seasonal/Dispersal
<i>Connochaetes taurinus</i>	Blue Wildebeest	Mammal	LC	Protected	Seasonal/Dispersal
<i>Lepus capensis</i>	Cape Hare	Mammal	LC	Not Protected	Likely Resident
<i>Xerus erythropus</i>	Striped Ground Squirrel	Mammal	LC	Not Protected	Likely Resident
<i>Tockus erythrorhynchus</i>	Red-billed Hornbill	Bird	LC	Not Protected	Likely Resident
<i>Lamprotornis superbus</i>	Superb Starling	Bird	LC	Not Protected	Likely Resident
<i>Ardeotis kori</i>	Kori Bustard	Bird	NT	Protected	Possible
<i>Agama agama</i>	Rainbow Agama	Reptile	LC	Not Protected	Likely Resident
<i>Bitis arietans</i>	Puff Adder	Reptile	LC	Not Protected	Likely Resident
<i>Macrotermes sp.</i>	Termite	Insect	NE	Not Protected	Confirmed

3.8.3.8 Seven-Zone Management Map

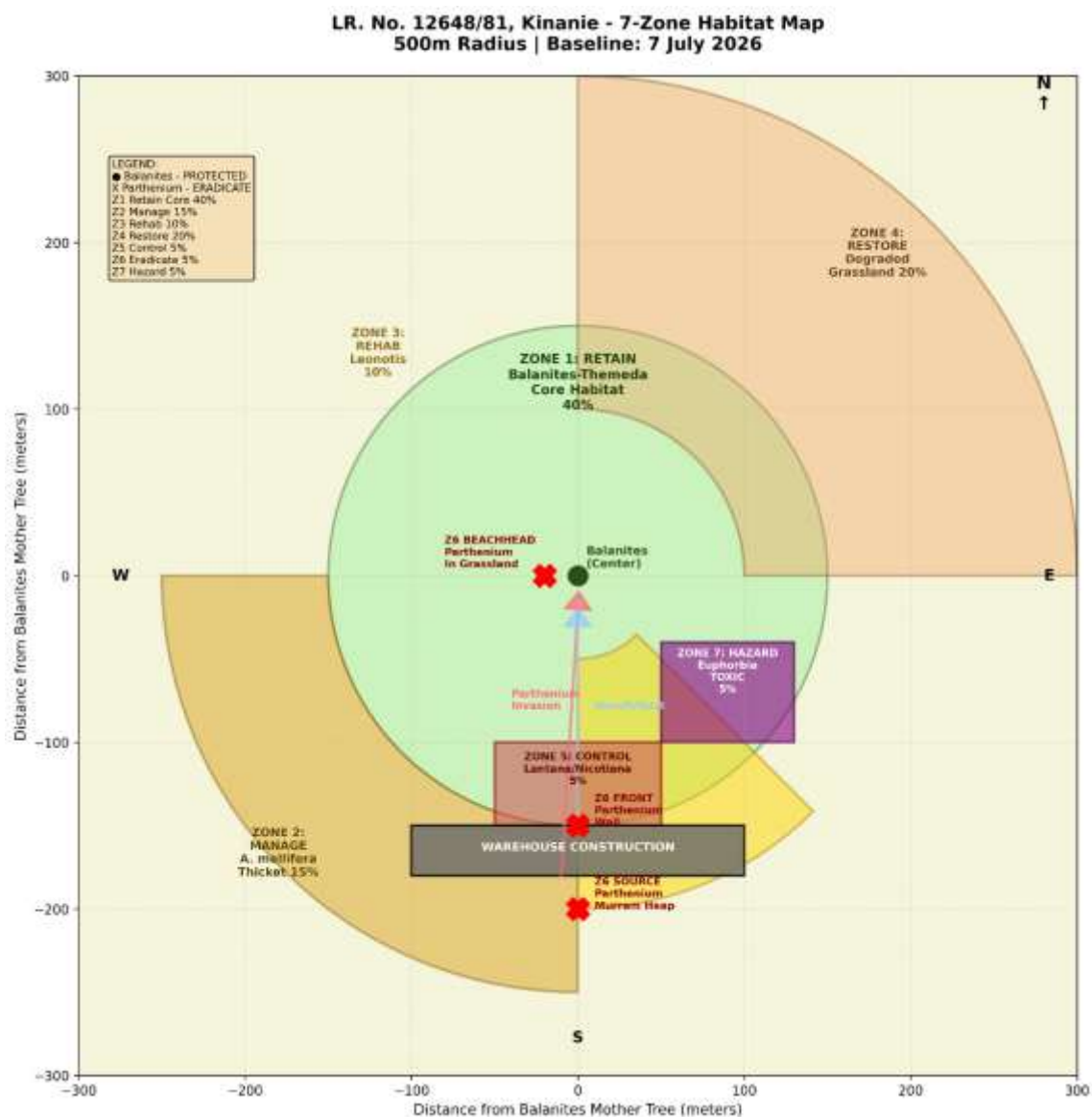


Table 16: Summary of the Map

Zone	Habitat	Area %
Zone 1: Retain — Core	Balanites + Themeda wooded grassland	40%
Zone 2: Manage	A. mellifera thickets	15%
Zone 3: Rehabilitate	Leonotis shrubland	10%
Zone 4: Restore	Solanum + Bidens + Aspilia grassland	20%
Zone 5: Control	Nicotiana + Lantana	5%
Zone 6: Eradicate	Parthenium hysterophorus	5%
Zone 7: Hazard	Euphorbia heterochroma	5%

3.8.3.9 Ecosystem Services

- Provisioning: Seasonal grazing by local community, medicinal plants like Aloe secundiflora.
- Regulating: Carbon in soils, limited due to degradation; dust control by vegetation.
- Cultural: No sacred groves reported on plot, but verify with elders during public consultation.

3.8.3.10 Impact Prediction & Significance

The proposed Emulsion Binder and Plastic Injection Moulding Plant introduces specific risks beyond standard construction impacts, including air emissions (VOCs), effluent, plastic pellet loss, and fire hazards.

Impact	Project Phase	Source
Habitat loss - 9.5 acres	Construction	Site clearance for factory, warehouse, admin block
Wildlife barrier effect	Construction / Operation	Perimeter wall, 24hr lighting, noise
Air emissions impact on flora	Operation	VOCs from emulsion plant, boiler stack, polymer fumes
Effluent risk to seasonal dams	Operation	Process water, washdown, stormwater
Plastic pellet/nurdle loss	Operation	Spills during loading/offloading
Fire/explosion risk	Operation	Solvents, polymers, LPG storage
Invasive species spread	Construction	Opuntia/Prosopis on machinery

3.8.3.11 Mitigation & Management Plan

Avoid

- 30m no-build buffer along southern boundary to protect drainage to the water pans on the neighboring land. Use for indigenous landscaping only.
- Wildlife gaps: 1m x 0.5m culverts every 100m in perimeter wall for small fauna. No razor wire at ground level.

Minimize

- Air emissions: RTO/carbon filters on emulsion reactor vents. Stack height per AQ Regulations dispersion modelling. Monthly leaf damage monitoring on boundary Acacia trees.

- Effluent: Zero Liquid Discharge target. All process water to ETP. Oily water separator + polymer traps before NEMA discharge point. Stormwater to have silt/polymer traps.
- Plastic pellet control: NEMA Plastic Pollution Regs 2024 compliance - closed loading bays, vacuum systems, pellet traps on all drains, daily yard sweeps. Report pellet loss in annual audit.
- Lighting: Full cut-off LED, 3000K max, downward facing only. No skyglow. Motion sensors for yard areas.
- Noise: <55dB day, <45dB night at boundary per NEMA Noise Regs. Acoustic barriers around injection moulding machines.
- Fire: 50m firebreak of bare/mineral soil around LPG + solvent storage. No vegetation within bund. Fire water retention pond separate from stormwater.

Restore

- Biodiversity offset: 9.5 acres lost. Propose 1:1 indigenous tree planting on 10 acres in degraded parts of Ol Donyo Sabuk or Mua Hills water tower. Partner with KFS.
- On-site landscaping: 30% of plot = green area. Species list: *Acacia drepanolobium*, *Balanites aegyptiaca*, *Themeda triandra*. No exotics.

3.9 Socio – economic Baseline

This section presents the socio-economic baseline conditions of the project area and its zone of influence to establish the human environment within which the proposed emulsion binder and plastic injection molding plant will be implemented. Understanding existing social and economic characteristics is critical for: Identifying sensitive receptors, predicting potential project impacts, designing appropriate mitigation measures, and enhancing positive socio-economic outcomes. Baseline data was obtained through site observations, stakeholder consultations, secondary literature including the Machakos County Integrated Development Plan (CIDP) 2023–2027, 2019 Kenya Population and Housing Census (KNBS), and specialized baseline assessments.

3.9.1 Settlement Patterns and Land Use

The Project area exhibits characteristics of a rapidly industrializing corridor, including largescale warehouse development, bareland from murram extraction, fragmented grassland, and mixed and often incompatible land uses.

Settlement Pattern in Kinanie reflects growing pressure on the Athi Kapiti plains due to industrial spillover from Nairobi and proximity to Mombasa Road. As shown in the Land Cover Map, the pattern is defined by:

- Built-up Industrial: Dense warehouse clusters to the west and east of site, with active construction <30m south. These are formal but have poor stormwater and waste management.
- Grassland: The Project Site and surrounding areas remain unfenced Themeda grassland, but are under immediate conversion threat. Mapped as “Less Sensitive” in the Habitat Sensitivity Map, yet it buffers the “Highly Sensitive” riparian corridor 200m north.
- Bareland: Large murram borrow pits west of site create dust sources and runoff nodes.
- Riparian & Conservancy: The river and water pans to the north/south are ecologically critical but unprotected from industrial runoff. The Conservancy to the south contains water pans but has no physical barrier to silt.
- Infrastructure: Access via murram roads. No municipal sewerage, piped water, or formal drainage. All industrial sites use septic/boreholes.

Land Use is predominantly industrial/warehousing, with remnant rangeland grazing, isolated community structures, and conservation in the southern Conservancy zone. Increased and unplanned industrial development has contributed to strain on natural systems, particularly in drainage, erosion control, and habitat connectivity.

3.9.2 Demographic Characteristics

According to the 2019 Kenya Population and Housing Census, Machakos County had a population of approximately 1.4 million persons, making it the 10th most populous county in Kenya. Mavoko Sub-County is the fastest growing sub-county due to industrialization along Mombasa Road and proximity to Nairobi.

The sub-county continues to experience high in-migration due to employment opportunities in warehousing, logistics, and manufacturing, driven by SGR, JKIA, and EPZ expansion.

According to the Machakos CIDP (2023–2027), the county continues to experience strong population growth, which has intensified demand for industrial land, infrastructure, utilities, and water, particularly in peri-urban zones such as Kinanie, Athi River, and Mlolongo. The population is predominantly youthful and economically active, creating strong demand for employment opportunities. High population in Kinanie has caused pressure on natural resources — specifically:

1. Water demand: Industrial borehole abstraction and water trucking are straining the shallow Athi-Kapiti aquifer that supports *Balanites aegyptiaca* and Conservancy water pans.

2. Land conversion: Labour in-migration drives grassland-to-warehouse conversion, with the Land Cover Map showing Built-up areas now directly abutting the Project Site.
3. Infrastructure gap: There is no municipal sewerage, piped water, or formal stormwater drainage serving the new industrial population. All developments rely on septic systems and boreholes, increasing contamination risk to the Highly Sensitive riparian corridor zoom north shown in your Habitat Sensitivity Map.

Site-Specific Demographics: LR. No. 12648/81 itself has no resident population. Adjacent land use is industrial labour + transient truck traffic, not households. The key demographic impact is indirect — industrial workers and developers create edge effects: dust, waste, *Parthenium* introduction, and stormwater runoff that degrades the remaining Zone 1 grassland and downstream water resources.

3.9.3 Economic Activities and Livelihoods

The local economy is industrial and logistics-oriented, driven by Mombasa Road and proximity to Nairobi/JKIA. Common livelihood activities observed within and around the project area include warehousing/logistics, transport services, truck stops and makeshift eateries, murram/ballast extraction, artisanal fabrication, and rental housing for industrial workers. Small-scale trading exists — Mpesa shops, kiosks, butcheries — but the dominant land use is large-scale industrial, not residential, as shown in the Land Cover Map with extensive Built-up and Bareland zones west and east of site.

Key economic drivers within 1km:

1. Industrial: Warehouses, go-downs and light manufacturing dominate. These provide formal jobs but generate stormwater, dust, and effluent impacts on adjacent grassland.
2. Extractive: Bareland patches indicate murram harvesting for construction — a major income source but causes habitat loss and *Parthenium* introduction.
3. Transport: Mombasa Road access supports trucking, fuel stations, and roadside food kiosks serving drivers.
4. Pastoralism/Agriculture: Remnant grassland supports limited grazing, but fragmentation by walls has reduced viability. The Conservancy to the south may support eco-tourism jobs, but water pans are threatened by silt from industrial runoff.
5. Informal services: Water vending, security, and construction casual labor serve the industrial sites.

Proximity to Nairobi and Mombasa Road gives the area access to national supply chains and income-generating opportunities, but it also means land speculation, high murram extraction, and conversion pressure on remaining rangeland. Unemployment remains a notable concern among youth in Mavoko Sub-County, consistent with broader county trends emphasizing the need for private-sector investment to stimulate job creation.

3.9.4 Water and Sanitation

Water Supply

No community water project or MAWASCO piped supply serves Kinanie. The area is not connected to municipal water. Water access within the project area of influence is characterized by private borehole drilling and water trucking serving industrial facilities.

As confirmed by the Habitat Sensitivity Map, the project site lies 200m south of a Highly Sensitive riparian corridor and 500–600m north of Conservancy water pans. These surface water sources are seasonal and vulnerable to industrial pollution. Most warehouses and factories within 1km, rely on boreholes abstracting from the shallow Athi-Kapiti aquifer.

Key challenges:

1. No municipal supply: MAWASCO network ends at Athi River town ~4km south. Kinanie is served only by private vendors.
2. Aquifer stress: Unregulated borehole drilling by industry risks lowering the water table, threatening the Zone 1 grassland and downstream Conservancy water pans.
3. Surface water contamination: No formal drainage. Stormwater from bareland and warehouse roofs flows untreated across the Project Site into the riparian zone, carrying pollutants.

Sanitation

The area has no municipal sewerage. All industrial and commercial facilities use septic tanks and soak pits. Due to shallow fractured phonolite, there is high risk of groundwater contamination reaching the same aquifer used for boreholes and the sensitive river 200m north.

3.9.5 Solid Waste Management

Solid waste management within Mavoko Sub-County is visibly constrained, with no county-managed collection system serving the Kinanie industrial zone. The Machakos CIDP 2023–2027 identifies improved waste management as a key priority due to rising industrial waste volumes, but implementation is concentrated in Athi River and Mlolongo towns. Kinanie relies on private contractors or illegal dumping.

Field observations indicate that solid waste is crudely disposed within the project area of influence:

1. Industrial waste: Construction debris, murram spoil, plastic packaging, and oil drums from warehouses. No formal transfer stations exist.
2. No disposal infrastructure: There are no county bins, collection points, or designated dumpsites within 1km. All waste is either burned, buried, or dumped in drainage channels and grassland edges.
3. Site-specific risk: The Project Site currently has minimal waste, but stormwater from adjacent warehouses carries plastics and debris across the site.
4. Hazardous waste: Industrial sites generate paint tins, chemical containers, and used oil — observed in Bareland areas. No hazardous waste handling protocol is evident.

3.9.6 Security and Social Stability

The security of the area reflects that of a peri-urban industrial corridor rather than a high-density residential settlement. It is closely linked to land use conflicts, transient labour populations, and inadequate infrastructure. Security dynamics in the area are influenced by: industrial encroachment on rangeland, youth unemployment, unplanned warehouse development, resource competition for water/murram, and proximity to Mombasa Road.

The presence of local governance structures, including the Kinanie Chief's and Assistant Chief's offices, reflects established administrative mechanisms at the location level. These offices play a critical role in: land dispute resolution, community mobilization for public participation, and security coordination with Machakos County Government and National Police Service during industrial expansion.

According to the Machakos County Integrated Development Plan 2023–2027, insecurity in Mavoko Sub-County has increased due to inadequate street lighting, poor murram access roads, illegal murram harvesting, and limited formal employment opportunities for local youth displaced by industrialization.

However, no major security hotspots were identified within the immediate project footprint during site visits and stakeholder engagements. The site has no resident population and is bordered by walled industrial plots, reducing petty crime risk.

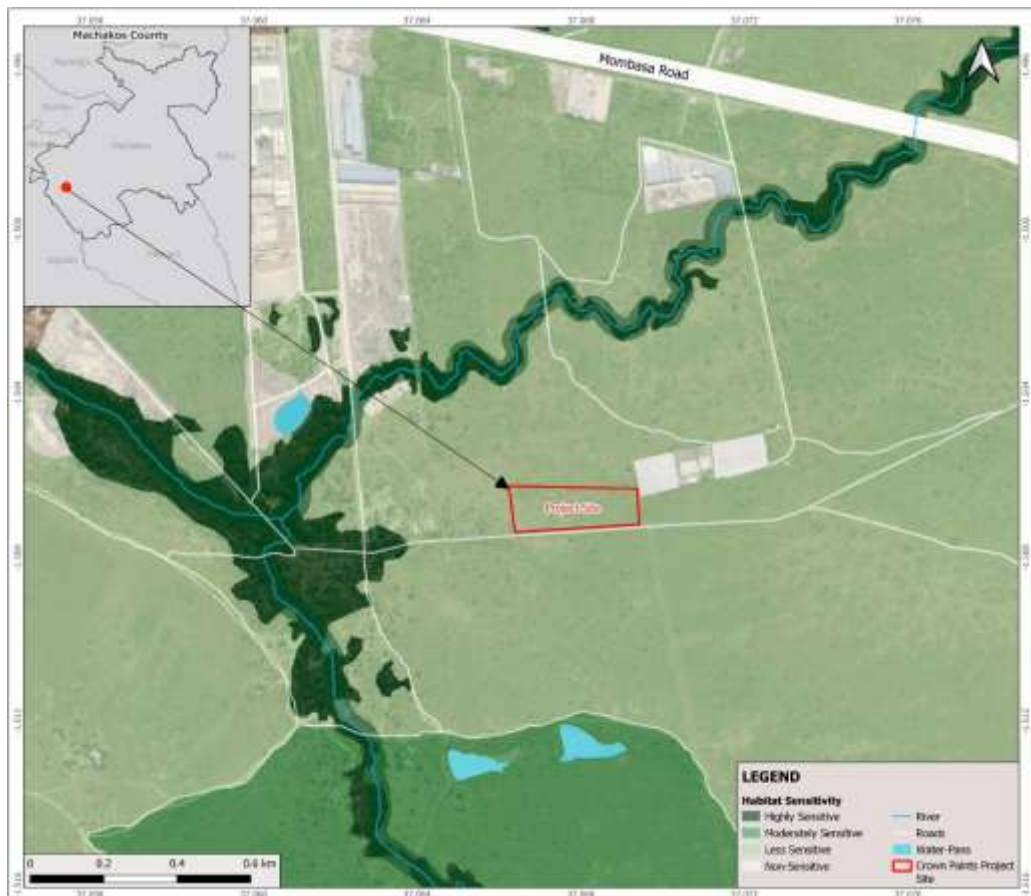
3.9.7 Health

Machakos County, as Kenya's 10th most populous county, relies on a mix of public and private health facilities anchored by Machakos Level 5 Hospital, Athi River Level 4 Hospital ~4km south, and private clinics serving the industrial corridor. Major referral institutions such as Kenyatta National Hospital remain critical for specialized care, but distance limits access for Mavoko residents.

Despite growing industrialization, Mavoko's health system faces challenges: public facilities experience understaffing and drug shortages, while private clinics are often unaffordable for industrial casual laborers. Access varies widely — Kinanie industrial zone has no public dispensary within 3km. The area faces a dual burden of disease: non-communicable diseases among industrial workers, plus environmental health risks from dust, chemical exposure, and water insecurity.

3.9.8 Road Network

The proposed project site is strategically located ~500m south of Mombasa Road (A109), approximately 2km east of the Athi River Interchange and 1.5km west of the Devki/Steel Structures junction.



Habitat map that also shows the roads within the area.

The area benefits from connectivity to major transport corridors including:

1. Mombasa Road (A109): Primary Nairobi–Mombasa highway. Provides national logistics access but is heavily congested with truck traffic.
2. Site Access Road: Unnamed murram road branching south from Mombasa Road, passing directly along the southern boundary of the Project Site. This is visible as the white road on your Habitat Sensitivity Map. Not tarmacked, no drainage, generates dust and channels stormwater.
3. Internal Industrial Roads: Network of murram access roads serving adjacent warehouses to the west and east. These are unplanned, no stormwater controls, and contribute silt runoff into the Highly Sensitive riparian corridor zoom north.

These roads enhance accessibility to Nairobi, JKIA, SGR Athi River Station, and Mombasa Port, supporting industrial and logistics expansion.

3.9.9 Electricity and Energy

Electricity coverage in Machakos County has expanded significantly due to national grid extensions and EPRA industrial power programs, improving access for warehouses, factories, and institutions along Mombasa Road. However, Kinanie remains under-served by last-mile connections.

The type of energy used is related to the socio-economic profile: industrial consumers rely on KPLC 3-phase and diesel generators, while casual labourers and informal settlements use charcoal, firewood, and paraffin due to high grid connection costs.

The site and adjacent warehouses are not connected to the grid at present. The Land Cover Map shows the Project Site as Grassland surrounded by Built-up industrial plots, all of which operate on private transformers or diesel generators due to unreliable supply.

Energy Supply Plan

For the proposed development, the Proponent will:

- Grid Connection: A dedicated transformer will be installed by Kenya Power and Lighting Company (KPLC). The Proponent has already submitted applications and is following up with KPLC Athi River Office.
- Construction Phase: The contractor will maintain a diesel generator set onsite to provide reliable temporary power pending grid connection.
- Operational Phase: Apart from KPLC, a backup diesel generator will be installed to ensure continuity of operations during frequent power outages in Mavoko. Generator exhausts must be fitted with silencers to reduce noise impact.

3.9.10 Vulnerable and Marginalized Groups

Kinanie, like many peri-urban industrial zones in Machakos County, hosts vulnerable groups whose exposure is tied to environmental degradation and economic displacement rather than informal settlement density. These populations face unique challenges that impact their social, economic, and health outcomes.

Some of the identified vulnerable and marginalized groups in the project area of influence include:

Casual Industrial Laborers and Migrant Workers

The warehouses and construction sites adjacent to the Project Site employ youth and adults from Machakos, Makueni, and Kitui counties on daily/casual terms. They face significant health and social challenges such as Exposure to material risks, Psycho-social risks and Economic vulnerability.

Pastoralist Households on Rangeland Margins

Remnant grassland around Kinanie supports isolated pastoralist families who graze small stock. These child-headed households, persons with disabilities, and older adults face challenges related to: Loss of grazing, Water insecurity, and Access to services.

Conservancy-Dependent Communities

Households adjacent to the Conservancy south of site rely on water pans for livestock, bee forage, and seasonal wild food. They are vulnerable to upstream pollution and ecological displacement.

3.9.11 Gender Issues

In Mavoko Sub-County, gender issues are shaped by industrial land use, pastoralist traditions, and migrant labour patterns rather than urban residential culture alone. Social values, literacy levels, and economic roles for men and women influence participation in decision-making, access to resources, and vulnerability to environmental impacts.

Key Gender Disparities Observed

1. Labour segregation: Industrial jobs in adjacent warehouses are male-dominated — loading, security, truck driving — while women occupy lower-paid casual roles in cleaning, food kiosks, and water vending.

2. Land & property rights: Perimeter walls and industrial buyouts have displaced pastoralist households where women traditionally managed small stock grazing eliminates women's access to fodder, wild vegetables, and bee forage — critical for household nutrition and income. Title deeds for industrial plots are held by men; women have no collateral for credit to start alternative businesses.
3. Water burden: Women and girls from nearby pastoralist homes walk to Conservancy water pans 500–600m south for domestic water. If siltation from industrial runoff degrades these pans, their time poverty and health risk from contaminated water will increase.

4: RELEVANT POLICY, LEGISLATIVE AND REGULATORY FRAMEWORK

4.1 Introduction

There is growing concern in Kenya and globally that many forms of development activities cause damage to the environment. Development activities have the potential to damage the natural resources upon which economies are based. A major national challenge today is how to maintain sustainable development without damaging the environment. Environmental Impact Assessment is a useful tool for protection of the environment from negative effects of developmental activities.

These legal obligations relating to EIA cover all proposed enterprises, including chemical manufacturing plants, factories, warehouses, power stations, quarries, mines and any ongoing projects specified under the Second Schedule of EMCA. There are other legislations to be complied with in the project and include those discussed below. These have been selectively reviewed to ensure that the project complies environmentally as required by the Constitution of Kenya, 2010.

4.2 The Constitution of Kenya, 2010

The Constitution of Kenya has taken on board various issues related to environmental management. Article 42 of the Bill of Rights provides that every Kenyan has the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures. Part 2 of Chapter 5 is dedicated to Environment and Natural Resources. Article 69 provides that the State shall ensure sustainable use of natural resources, increase national forest cover, encourage public participation in environmental management, and require environmental impact assessment, environmental audit and monitoring.

Relevance: This ESIA has ensured comprehensive public participation in compliance with constitutional requirements. The proponent has undertaken public participation through the NGAO offices to ensure members of public, especially those around the site, are well involved. The proponent and contractor will ensure environmental protection throughout the project cycle.

4.3 Relevant Policies

4.3.1 The Kenya Vision 2030

Kenya Vision 2030 is the country's development blueprint from 2008 to 2030. It aims to transform Kenya into a newly industrialized, middle-income country with annual growth of 10% by 2030. The Vision is based on three pillars: Economic, Social, and Political. It calls for promoting environmental conservation and pollution and waste management through appropriate economic incentives in development initiatives.

Relevance: The proposed emulsion polymer manufacturing plant is in line with Vision 2030 by contributing to industrialization, import substitution, and sustainable manufacturing.

4.3.2 Bottom-Up Economic Transformation Agenda (BETA)

The Fourth Medium Term Plan 2023–2027 runs on the theme: “Bottom-Up Economic Transformation Agenda for Inclusive Growth”, focusing on Agriculture; Micro, Small, and Medium Enterprise (MSME) Economy; Housing and Settlement; Healthcare; and Digital Superhighway and Creative Economy.

Relevance: The proposed plant embodies BETA by promoting local manufacturing, creating 150+ jobs, skills transfer in chemical engineering, and reducing forex expenditure through import substitution of emulsion polymers.

4.3.3 National Environment Policy, 2014

This Policy seeks to achieve a better quality of life for present and future generations by promoting sustainable management and use of the environment and natural resources. It establishes a framework for integrated planning, strengthens legal and institutional structures, and promotes investment in research and environmental management tools including EIAs and environmental audits.

Relevance: The undertaking of this Environmental Impact Assessment reflects the project’s adherence to the requirements set out in this policy.

4.3.4 National Land Policy, 2009

The National Land Policy, 2009 provides a framework for sustainable management and use of land resources in Kenya. It addresses land tenure insecurity, informal settlements, and land-related conflicts. The policy promotes economically viable, socially equitable and environmentally sustainable allocation and use of land.

Relevance: The proposed project site is within industrial-zoned private land owned by the proponent. The policy guides land use planning and environmental protection.

4.3.5 National Climate Change Action Plan (NCCAP, 2023–2027)

The NCCAP (2023–2027) is the third action plan under Kenya's climate policy framework and supports implementation of the Climate Change Act, 2023. It outlines priority climate actions to meet Kenya's NDCs under the Paris Agreement. Key pillars include climate adaptation and resilience building; climate change mitigation; mainstreaming climate change into planning; climate finance mobilization; and stakeholder engagement.

Relevance: The proposed project supports national priorities by enhancing climate resilience through 300kWp Solar PV, Zone 1 carbon sink retention, ZLD water system, and reducing emissions by 51% from business-as-usual.

4.4 Legal and Regulatory Framework

4.4.1 The Environmental Management and Coordination Act (EMCA), 2015

EMCA is the principal environmental legislation in Kenya, establishing a legal and institutional framework for environmental management. Part VI, Section 58 mandates that proponents of projects listed in the Second Schedule conduct EIA and submit the report to NEMA. Section 68 requires operators of existing projects to conduct environmental audits.

Some of the Subsidiary EMCA Cap. 387 legislations relating to this project include:

4.4.1.1 Environmental Impact Assessment and Audit Regulations, 2015

These regulations provide objectives and guidelines for carrying out EIA and EA. Regulation 4(1) prohibits project proponents implementing projects with negative environmental impacts without NEMA approval.

Relevance: This ESIA undertaking is in compliance with these regulations. The proponent and contractor are expected to undertake environmental audits annually from the first year of operation.

4.4.1.2 EMCA (Air Quality) Regulations, 2024

Introduced in 2024, these Regulations provide for prevention, control and abatement of air pollution. They apply to internal combustion engines, premises, processes, and works. The regulations introduce emission testing from mobile sources and stricter ambient air quality standards.

Relevance: The project shall ensure compliance by conducting regular maintenance of machinery, annual stack tests for VOCs and PM₁₀, and continuous fence line monitoring to ensure adherence to permissible limits.

4.4.1.3 EMCA (Waste Management) Regulations, 2024

These regulations provide a framework for handling, storage, transportation, segregation and destruction of waste. They provide procedures and standards for environmental governance in the waste management sector.

Relevance: The proponent and contractor will develop and implement a Waste Management Plan including segregation at source, recycling, and use of NEMA-licensed waste handlers for hazardous waste.

4.4.1.4 EMCA (Water Quality) Regulations, 2024

These regulations provide for prevention of water pollution and protection of water sources. They establish standards for wastewater management and water for different uses. Section 5 requires waste generators to collect, segregate and dispose waste properly.

Relevance: The proponent shall construct a Zero Liquid Discharge effluent treatment plant. During operation, the proponent will acquire effluent discharge licenses from NEMA annually and conduct quarterly monitoring.

4.4.1.5 EMCA (Noise and Excessive Vibration Pollution Control) Regulations, 2009

These regulations prohibit any person from making unreasonable noise which annoys, disturbs, or endangers comfort, health or safety. They stipulate permissible noise levels for different zones. For this project, Zone A (Silent) limits apply: 40 dB(A) day, 35 dB(A) night.

Relevance: Project work shall be planned to limit excessive noise and vibration. No works shall be conducted at night. Acoustic screens shall be installed at the Conservancy boundary.

4.4.2 Water Act, No. 43 of 2016

The Water Act 2016 is the primary legislation for regulation, management, and protection of Kenya's water resources. It establishes the Water Resources Authority (WRA), mandated to issue water permits, monitor compliance, protect catchment areas, and enforce pollution control. The Act prohibits obstruction or diversion of watercourses, discharge of waste into water resources, and unauthorized use of water.

Relevance: The proponent shall secure necessary permits from WRA before borehole drilling. No unauthorized discharges shall enter the seasonal river zoom north. Erosion control and stormwater management shall prevent water pollution.

4.4.3 Sustainable Waste Management Act, 2024

This Act establishes the legal and institutional framework for sustainable waste management to ensure the right to a clean and healthy environment. It promotes waste segregation into organic and non-organic fractions, and requires hazardous waste to be handled as prescribed by EMCA.

Relevance: Waste Management Plans shall be prepared to guide segregation, recycling, and disposal throughout the project lifecycle.

4.4.4 The Physical and Land Use Planning Act, 2019

This Act provides for preparation and implementation of physical development plans. Part IV requires developments to ensure orderly physical and land use development, optimal land use, environmental protection, public participation, and public safety.

Relevance: The proponent bears responsibility for securing all necessary approvals from Machakos County Government including change of user, building plan approval, and occupation certificate.

4.4.5 Workers Injury Benefit Act (WIBA), 2007

WIBA provides for compensation to employees for work-related injuries and occupational diseases. The Act is administered by the Director of Occupational Health and Safety Services.

Relevance: The proponent is committed to ensuring safety and welfare of all employees. All employees will be covered by appropriate insurance policy and provided with PPE. In event of accident, full compensation shall be facilitated as stipulated under WIBA.

4.4.6 The County Government Act, 2012

The County Government serves the entire County including: development of urban areas, refuse removal and solid waste disposal, storm water management, fire station services, trade licensing, control of air and noise pollution, and approval of building plans.

Relevance: Through adherence to the County Governments Act, the proposed project remains legally compliant and promotes collaborative governance with Machakos County.

4.4.7 Occupational Safety and Health Act, 2007 (OSHA)

OSHA applies to all workplaces and secures safety, health and welfare of persons at work. Section 19 requires occupiers of premises likely to emit poisonous substances to use best practicable means to prevent emissions. Section 16 prohibits improper activity that creates hazards.

Relevance: All Sections related to this project including provision of protective clothing, clean water, and insurance cover shall be observed. The ESMP provides guidelines for management of Health and Safety issues.

4.4.8 Climate Change Act, No. 11 of 2016 and Climate Change (Amendment) Regulations, 2024

The Climate Change Act 2016 strengthens Kenya's legal framework for addressing adverse effects of climate change and promoting climate-resilient development. The 2024 Regulations require facilities emitting >1,000 tCO₂e/yr to submit annual GHG inventories and demonstrate 4% annual reduction.

Relevance: The proposed project shall incorporate climate mitigation through 300kWp Solar PV, Zone 1 carbon sink, and energy efficiency. Annual GHG reporting to NEMA shall be undertaken.

4.4.9 HIV/AIDS Prevention and Control Act, 2006

The Act mandates public awareness through education and campaigns at workplaces. It provides guidelines for educating workers and providing incentives to combat HIV/AIDS.

Relevance: The proponent and contractor shall train workers on HIV/AIDS and provide VCT services and condoms throughout project lifecycle.

4.4.10 Environment and Land Court Act, 2011

The Environment and Land Court has jurisdiction to hear disputes relating to environment and land, including public, private and community land. The court has powers to deal with disputes relating to land administration and management.

Relevance: In case of any dispute related to land or environmental aspects of the proposed project, this court would hear the matter.

4.4.11 The Employment Act, 2007 (as amended 2022)

The Act establishes minimum terms and conditions of employment. It requires written contracts for jobs longer than three months, equal pay for equal work, 21 days annual leave, 90 days maternity and 2 weeks paternity leave, and fair termination procedures. Child labour is restricted.

Relevance: During construction, the contractor shall observe basic minimum conditions of employment and prevent child labour.

4.4.12 Land Act, 2012

The Land Act 2012 provides that land is classified as public, private, or community land. Individuals may acquire legal ownership through allocation, adjudication, compulsory acquisition, transfer, transmission, or leases. The National Land Commission is empowered to acquire land for public purposes with just and prompt compensation.

Relevance: The proposed project site is within private land owned by the proponent with valid title deed.

4.4.13 Public Health Act, Cap 242

The Public Health Act serves as a foundational legal framework governing public health in Kenya. It focuses on preventing activities that pose risks to human health, including unsanitary conditions, environmental pollution, and spread of communicable diseases.

Relevance: The implementing agencies will develop Sanitation and Hygiene Management Plans to minimize health-related risks.

4.4.14 The Sexual Offences Act, 2006

The Sexual Offences Act provides a legal framework for prevention, prosecution, and punishment of sexual offences including rape, defilement, sexual harassment, and exploitation. Employers have a duty to prevent sexual offences within project environments.

Relevance: The Act is relevant during construction where interactions between workers and community may expose vulnerable groups to risk of SH/SEA/GBV. Code of Conduct and GRM shall be implemented.

4.4.15 Kenya National Building Code, 2024

The Kenya National Building Code 2024, gazetted as Legal Notice No. 47, came into effect on March 1, 2025. It replaces the 1968 Building Order and introduces requirements for green building practices including energy efficiency, renewable energy, and waste management. It mandates regular building inspections and emphasizes professional obligations of licensed experts.

Relevance: Construction activities shall be undertaken in line with the National Building Code. The project pursues EDGE certification.

4.4.16 Trade Licensing Act, Cap 497

The Act prohibits any person from conducting business without a current license. The license must be displayed prominently on the premises.

Relevance: The contractor will acquire a site license. During operation, all businesses operating within the plant will procure trading licenses annually.

4.5 Relevant Institutional Framework

Several government and regulatory institutions are mandated to oversee environmental management, land use planning, water and sanitation services, housing, and public infrastructure. Key institutions include:

Institution	Mandate and Relevance
National Environment Management Authority (NEMA)	Principal agency for implementation and coordination of environmental matters. Mandate includes formulating policies, supervising EIAs and audits, enforcing environmental laws, monitoring state of environment, and issuing EIA licenses. Relevance: NEMA will review this ESIA and issue license. Annual environmental audits shall be submitted to NEMA.

National Construction Authority (NCA)	Regulatory body established under NCA Act No. 41 of 2011 to oversee construction industry by ensuring compliance with quality and safety standards. Relevance: NCA has pivotal role in ensuring quality construction standards and safety on construction sites.
Water Resources Authority (WRA)	Statutory body mandated to regulate use and management of water resources. Responsible for issuing water permits, monitoring compliance, protecting catchment areas, and enforcing pollution control. Relevance: WRA will issue borehole abstraction permit and effluent discharge license.
Machakos County Government	Principal devolved unit responsible for county services including refuse removal, storm water management, fire services, trade licensing, air and noise pollution control, and building plan approval. Relevance: County is key stakeholder for approvals including change of user, building plans, and occupation certificate.
Directorate of Occupational Safety and Health Services (DOSHS)	Under Ministry of Labour, administers OSHA 2007. Responsible for workplace registration, safety audits, and accident investigations. Relevance: DOSHS will register workplace and approve fire safety plans.
Energy and Petroleum Regulatory Authority (EPRA)	Regulates energy sector under Energy Act 2019. Responsible for licensing solar PV systems and energy audits. Relevance: EPRA will approve 300kWp Solar PV installation and receive energy audit reports.
National Land Commission (NLC)	Manages public land and oversees land use planning. Relevance: Ensures compliance with land use zoning for industrial development.
Department of Social Protection	Under Ministry of Labour and Social Protection, ensures social dimensions are addressed inclusively. Relevance: Safeguards welfare of vulnerable groups and ensures benefit-sharing mechanisms.

5: ANALYSIS OF PROJECT ALTERNATIVES

This chapter contains an analysis of alternatives in terms of project site, design, construction techniques and “no project alternative”.

5.1 Introduction

This section analyses the project alternatives in terms of project design, site location, technology, scale, and waste management options. The ESIA has been prepared based on the proposed site, design, materials, and technology to evaluate environmental effects. Alternatives are different ways to achieve the same purpose and need that the proposed project will achieve.

The analysis includes the proponent's final proposal with incorporation of legal guidelines and regulations as stipulated in EMCA 2015 and its subsidiary legislation, aimed at reducing environmental impacts to the maximum extent practicable. Appropriate Environmental Management Plans have been prepared as detailed in Chapter 7.

5.2 Project Location Alternative

The proponent is the registered owner of LR. No. 12648/81 measuring 4.2Ha and zoned for industrial use. The site was selected based on:

- (i) Proximity to Mombasa Road for raw material transport and product dispatch;
- (ii) Availability of industrial-zoned land of sufficient size;
- (iii) Distance from dense residential settlements;
- (iv) presence of existing infrastructure including power and access road; and
- (v) Relatively flat topography reducing earthworks.

Relocation to a different site is not a viable option as the proponent has no alternative industrial-zoned land. Relocating would incur additional costs for land acquisition, infrastructure development, and permitting delays. The current site has been optimized through the Habitat Sensitivity Map to confine development to Zones 3 and 4 while retaining Zone 1 as a natural buffer. Alternative sites within Machakos County were considered but rejected due to higher ecological sensitivity, lack of services, or proximity to water bodies.

5.3 No Project Alternative

The No Project alternative implies maintaining the status quo. From an extreme environmental perspective, this option ensures non-interference with existing conditions and avoids all construction and operational impacts identified in Chapter 7.

However, this option involves significant disadvantages:

- i. the proponent would not realize economic returns on land investment;

- ii. ~150 direct jobs and 300+ indirect jobs would not be created in Mavoko Sub-County;
- iii. Kenya would continue importing emulsion polymers, expending forex;
- iv. the 800m access road would remain untarmacked;
- v. 300kWp Solar PV and Zone 1 carbon sequestration benefits would not be realized; and
- vi. the site would remain idle, contrary to Vision 2030 industrialization goals.

The No Project Option is the least preferred from socio-economic and development perspectives, and fails to capitalize on the opportunity for climate-compatible industrial development.

5.4 The Proposed Development Alternative

Under the proposed development alternative, the project would be implemented as described in Chapter 2, with full integration of mitigation measures outlined in Chapter 7 and the ESMP in Chapter 9. NEMA would issue an EIA License subject to compliance with all environmental measures during construction and operation phases.

This alternative consists of the applicant's final proposal incorporating NEMA regulations and international best practice to reduce environmental impacts to ALARP. Key features include: clustering all infrastructure in Zones 3 and 4; full retention of Zone 1 as ecological buffer; Zero Liquid Discharge effluent treatment with 70% water recycle; 300kWp Solar PV + BESS; vapour recovery on VAM tanks; SIL-2 safety systems; and comprehensive monitoring. This is the preferred alternative as it balances economic benefits with environmental protection.

5.5 Analysis of Alternative Raw Materials and Technology

The proposed project will use emulsion polymerization technology, which is internationally accepted as Best Available Technique (BAT) for water-based polymer production. Alternative technologies considered include:

Solvent-based polymerization: Rejected due to high VOC emissions, fire risk, and non-compliance with EMCA Air Quality Regulations 2024.

Bulk polymerization: Rejected due to poor heat control and product quality issues.

Suspension polymerization: Rejected as unsuitable for emulsion binders for paint.

Emulsion polymerization was selected as it uses water as the continuous phase, minimizing VOC emissions, reducing fire risk, and enabling ZLD water management. Equipment will prioritize energy and water efficiency including VFDs on motors, steam condensate recovery, and heat integration. All materials and equipment shall meet Kenya Bureau of Standards (KEBS) requirements.

5.6 Waste Water Management Alternatives

The plant will generate 40m³/day of process effluent with COD ~2,000 mg/L. Several treatment alternatives were evaluated:

5.6.1 Alternative One - Stabilization Ponds/Lagoons

This involves a series of ponds allowing biological processes before discharge. Ponds require large land area, are exposed to weather, and produce odour. While low cost, they risk groundwater contamination and are unacceptable adjacent to the "Highly Sensitive" riparian corridor zoom north. This option is rejected due to land requirements, odour nuisance to Swara Plains Conservancy, and pollution risk.

5.6.2 Alternative Two - Constructed Wetland

Constructed wetlands use plants as filters and are simple with low capital cost. However, they require extensive space, long establishment time, and studies on plant species to avoid weed invasion. Given the limited site area and need for immediate compliance, this is not suitable as primary treatment for industrial effluent.

5.6.3 Alternative Three - Connection to Public Sewer

The Kinanie area is not served by a municipal sewer line. EPZA sewer is 3km away and lacks capacity for industrial effluent. This option is not viable and would not meet ZLD requirements.

5.6.4 Alternative Four - Zero Liquid Discharge ETP with RO (Selected)

This involves primary, secondary, and tertiary treatment followed by Reverse Osmosis and evaporation. It achieves 70% water recycle and zero discharge to the environment. Though capital intensive, it is the only option that meets EMCA Water Quality Regulations 2024 and protects the "Highly Sensitive" riparian corridor. Given the ecological sensitivity of the site and regulatory requirements, this is the selected alternative. RO brine will be evaporated in lined solar ponds with salt disposal to NEMA-licensed facility.

5.7 Solid Waste Management Alternatives

The project will generate solid wastes including off-spec emulsion, ETP sludge, packaging, and office waste. An integrated solid waste management system based on the waste hierarchy is proposed:

1. Reduction at source: Accurate material budgeting and process optimization to minimize off-spec product.
2. Reuse/Recycling: Off-spec emulsion reworked where possible. Packaging returned to suppliers. Metal/plastic recycled.
3. Treatment: ETP sludge dewatered and sent to NEMA-licensed hazardous waste facility. No on-site incineration.
4. Disposal: Only non-recyclable, non-hazardous waste to sanitary landfill via licensed handler.

Sanitary landfilling is the last option. The proponent shall maintain waste manifests per EMCA Waste Management Regulations 2024.

5.8 Water Supply Alternatives

Water is a scarce resource in Machakos County. The plant requires 80m³/day. The following options were evaluated:

5.8.1 Alternative One - Rain Water Harvesting

Rain water from roofs and paved areas can be harvested during wet seasons. With 12,000m³ storage, this can provide ~60 days supply. However, it cannot be the sole source due to seasonal variability. All buildings shall have gutters and RWH systems installed.

5.8.2 Alternative Two - Borehole with RWH and Recycle (Selected)

This involves a borehole sited >100m from the river per WRMA requirements, combined with 12,000m³ RWH and 70% process water recycle from the ZLD ETP. This integrated approach reduces freshwater demand to <30m³/day and ensures supply security. Connection to EPZA water is retained as emergency backup. This is the selected option as it meets Water Act 2016 requirements and minimizes impact on the Athi-Kapiti aquifer.

5.8.3 Alternative Three - Municipal Supply Only

EPZA supply is unreliable and insufficient for industrial demand. This option is rejected due to supply insecurity.

5.9 Conclusion

The proposed development alternative with ZLD ETP, Solar PV, Grassland retention, and integrated water management represents the best practicable environmental option. It meets regulatory requirements while delivering significant socio-economic benefits with residual impacts reduced to Low except water demand which remains Medium.

6: PUBLIC PARTICIPATION AND STAKEHOLDER ENGAGEMENT

Public participation enables evaluation of the public and neighbours' views. It is an important part of the ESIA process as it helps identify various concerns which should be addressed at the initial stages of project implementation processes.

Public consultation barazas were organised through the office of the Senior chief Kinanie location of Machakos County. The public barazas were held at the proposed project site on 20th May 2026, 28th May 2026 and 3rd June 2026. Once the dates and venues of the meetings were confirmed, public notices were printed and posted in strategic public places within the vicinity of the site of project area at least seven days before the days for the 3 meetings. Also, announcement of the notice was made over the radio with a nationwide coverage at least once a week for two consecutive weeks. Additionally, a public notice about the proposed project was published for 2 successive weeks in a newspaper that has a nationwide circulation.

Table 17: Schedule of the 3 public consultation meetings

Venue	Date	No. of attendees	Chairman
Proposed site	20 th May 2026	29	Senior chief Mr. Musinga
Proposed site	28 th May 2026	29	Senior chief Mr. Musinga
Proposed site	3 rd June 2026	23	Senior chief Mr. Musinga





Plate 9: view of a posted public notice at the proposed site

For the subject project, Questionnaires were used to collect the views of the immediate neighbors. During the three meetings with the neighbours, project affected persons, the area chief chaired the meetings which were conducted during the day, briefed about the projects the important of the EIA process as well as the importance of the public participation exercise. Public Consultation was aimed at ensuring a comprehensive participation process to ensure that all the concerns of the neighbors were heard and incorporated in the execution of the proposed project.

All the neighbours indicated that they had no problem with the project in the area so long as the proposed works are contained within the designated boundaries and timeframe. The people consulted generally welcomed the proposed project as it is in an industrial area saying it will have positive impacts that include (but not limited to):

Creation of employment opportunities

It is expected that the project will create employment opportunities for unskilled, semi-skilled and skilled labor. Skilled labor will include professions such as welding and machine operation, while semi-skilled labor will include drivers, mechanics and watchmen, among others. Unskilled labor will be required mostly for casual labor services or permanent manual works.

Local labor will also be required during the operations phase. Most of the jobs will be related to highly mechanical skills, electrical skills as well as maintenance and surveillance. The community requested the local youths to be considered for employment opportunities mostly during the construction activities and operation phases

General Economic Growth

The total economic transactions in the project area will significantly improve. The quantity of economic activities will increase in both volume and diversification due to the development of the proposed project in the area. This will translate to direct fiscal revenue through the payment of taxes. The project will also lead to growth of the

national economy through increased fiscal revenue through the payment of taxes by people employed either directly or indirectly by the project, and also by companies that service the project directly/indirectly.

Increased business market

It's expected that the proposed plant will source the raw materials from the local market. There was optimism that the proposed project will increase businesses through the buying of raw materials for use. i.e. construction materials

Noise generation

The people expressed concern over possibility of noise generation within the project and surrounding areas mostly at the installation and operation phase. Appropriate measures will however be put in place to curb noise emissions. The proponent should therefore put in place appropriate measures to curb noise nuisance.

Environmental health and safety issues

The people interviewed expressed concern over the safety of workers' during installation and operation phases and over the possibility of the proponent not having provision for access to first Aid kits, PPE, sanitary facilities and drinking water within the plant. Smoke emission from the material transporting vehicles, accidents from such vehicles as well as environmental degradation. Additional mitigation measures presented within the EMP will be fully implemented to ensure use of PPE and provision of First Aid kits for workers safety. Occupational health and safety of the workers and the general public especially during operation phase should be keenly observed.

The local community requested the developer to consider offering the CSR projects like community water as the locals walk for long distances looking for water, painting the chiefs office and some schools among others All the issues raised and many other foreseeable impacts have been adequately addressed in the report and in the EMP section.





Plate 10: . View of public participation meetinngs

7.0 POTENTIAL ENVIRONMENTAL IMPACTS

7.1 Introduction

This chapter outlines the potential negative and positive impacts that will be associated with the development. The impacts will be related to activities mainly during construction, installation and operational phase. In addition, closure and decommissioning phase impacts of the project are also highlighted.

The impacts of the development during each its life cycle stages/phase (construction, installation, operation and decommissioning) can be categorized into: impacts on the biophysical environment; health and safety impacts; and socio-economic impacts.

7.2 Negative Environmental Impacts of Construction & installation Activities

7.2.1 Extraction and Use of Building Materials

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

7.2.2 Dust Emissions

During construction and installation, the project will generate substantial quantities of dust at the construction site and its surrounding. The sources of dust emissions will include levelling works, and to a small extent, transport vehicles delivering building materials. Emission of large quantities of dust may lead to significant impacts on construction & installation workers and the local residents, which will be accentuated during dry weather conditions.

7.2.3 Exhaust Emissions

The trucks used to transport various building materials from their sources to the project site will contribute to increases in emissions of CO₂, NO_x and fine particulates along the way as a result of diesel combustion. Such emissions can lead to several environmental impacts including global warming and health impacts. Because large quantities of building materials are required, some of which are sourced outside Athiriver. Such emissions can be enormous and may affect a wider geographical area. The impacts of such emissions can be greater in areas where the materials are sourced and at the

construction site as a result of running vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas.

7.2.4 Noise and Vibration

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

7.2.5 Risks of Accidents and Injuries to Workers

Because of the intensive engineering , construction and installation activities including erection and fastening of roofing materials, metal grinding and cutting, concrete work, steel erection and welding among others, construction and installation workers will be exposed to risks of accidents and injuries. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others.

7.2.6 Increased Soil Erosion

Clearance of land and excavation works will lead to increased soil erosion at the project site and release of sediments into the drainage systems. Uncontrolled soil erosion can have adverse effects on the local water bodies.

7.2.7 Solid Waste Generation

More solid waste will be generated at the site during construction of the building and related infrastructure. Such waste will consist of metal cuttings, rejected materials, surplus materials, surplus spoil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. Such solid waste materials can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on human and animal health. This may be accentuated by the fact that some of the waste materials contain hazardous substances such as paints, cement, adhesives and cleaning solvents, while some of the waste materials including metal cuttings and plastic containers are not biodegradable and can have long-term and cumulative effects on the environment.

7.2.8 Energy Consumption

The project will consume fossil fuels (mainly diesel) to run transport vehicles and construction machinery. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability.

The project will also use electricity supplied by Power & Lighting Company (KPLC) Ltd. Electricity in Kenya is generated mainly through natural resources, namely, water and geothermal resources. In this regard, there will be need to use electricity sparingly since high consumption of electricity negatively impacts on these natural resources and their sustainability.

7.2.9 Water Use

The construction activities will require large quantities of water which will be supplied by a borehole that the proponent has drilled within the site. Water will mainly be used for concrete mixing, curing sanitary and washing purposes. Excessive water use may negatively impact on the water source and its sustainability.

7.3 Positive Environmental Impacts of Construction and installation Activities

7.3.1 Creation of Employment Opportunities

Several employment opportunities will be created for construction and installation workers during the construction and installation phase. This will be a significant impact since unemployment is currently quite high in Kenya.

7.3.2 Provision of Market for Supply of Building Materials

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

7.3.3 Increased Business Opportunities

The large number of staff required will provide ready market for various goods and services, leading to several business opportunities for small-scale traders such as food vendors around the construction site.

7.3.4 Optimal use of land

By constructing the proposed factory, land use will be optimized and value of adjoining property is likely to appreciate.

7.4 Negative Environmental Impacts of Operational Activities

7.4.1 Solid Waste Generation

Enormous amounts of solid waste will be generated during its operation phase. The bulk of the solid waste generated during the operation of the stage will consist of paper, plastic, glass, metal, textile and organic wastes. Such wastes can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on animal health. Some of these waste materials especially the plastic/polythene are not biodegradable may cause long-term injurious effects to the

environment. Even the biodegradable ones such as organic wastes may be injurious to the environment because as they decompose, they produce methane gas, a powerful greenhouse gas known to contribute to global warming.

7.4.2 Increased Storm Water Flow

The building roofs and pavements will lead to increased volume and velocity of storm water or run-off flowing across the area covered by the premise. This will lead to increased amounts of storm water entering the drainage systems, resulting in overflow and damage to such systems in addition to increased erosion or water logging in the neighbouring areas.

7.4.3 Increased Demand for Sanitation

The project involves the construction of a Godowns building. This will lead to increased demand for sanitation and sewage disposal.

7.4.4 Energy Consumption

During operation, the Godown units will use a lot of electrical energy mainly for commercial purposes including lighting, running of air conditioning equipment, running of refrigeration systems, pumping water, running of machines. Since electricity generation involves utilization of natural resources, excessive electricity consumption will strain the resources and negatively impact on their sustainability.

7.4.5 Water Use

The domestic activities during the operation phase of the project will involve the use of large quantities of water.

7.5 Positive Environmental Impacts of Operational Activities

7.5.1 Access of emulsion paint binders (raw materials for manufacturing of paints)

The project will produce emulsion binders which the proponent will use in manufacturing of paints in the already existing facilities (Kisumu/Nairobi). This will reduce the cost of importing the emulsion binders

7.5.2 Employment Opportunities

Some people will be employed as management agents, workers, care takers, cleaners, security personnel and technicians in the plant.

7.5.3 Revenue to National and Local Governments

Through payment of relevant taxes, rates and fees to the government and the local authority, the development will contribute towards the national and local revenue earnings.

7.5.4 Improved Security

Security will be ensured around the Godown buildings through distribution of suitable security lights and presence of 24-hour security guards. This will lead to improvement in the general security in the surrounding area.

7.6 Negative Environmental Impacts of Decommissioning Activities

7.6.1 Solid Waste

Demolition of the project buildings and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

7.6.2 Dust

Large quantities of dust will be generated during demolition works. This will affect demolition staff as well as the neighbours.

7.6.3 Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas.

7.7 Positive Environmental Impacts of Decommissioning Activities

7.7.1 Rehabilitation and improved visual of the area

Upon decommissioning the project, rehabilitation of the project site will be carried out to restore the site to its original status. This will include replacement of topsoil and re-vegetation which will lead to improved visual quality of the area.

7.7.2 Employment Opportunities

Several employment opportunities will be created for demolition staff.

8.0 IMPACTS MITIGATION AND MONITORING

8.1 Introduction

This chapter highlights the necessary mitigation measures that will be adopted to prevent or minimize significant negative environmental, health and safety impacts associated with the activities during its construction, operation and decommissioning phases. Allocation of responsibilities, time frame and estimated costs for implementation of these measures are presented in the environmental management programme (EMP)

8.2 Mitigation of Construction Phase Impacts

8.2.1 Efficient sourcing and Use of Raw Materials

The proponent will source building materials such as sand, ballast and hard core from registered quarry and sand mining firms, whose projects have undergone satisfactory environmental impact assessment/audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are considerably well mitigated.

To reduce the negative impacts on availability and sustainability of the materials, the proponent will only order for what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities. Moreover, the proponent will ensure that wastage, damage or loss (through run-off, wind, etc) of materials at the construction site is kept minimal, as these would lead to additional demand for and extraction or purchase materials.

In addition to the above measures, the proponent shall consider reuse of building materials and use of recycled building materials. This will lead to reduction in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites

8.2.2 Minimization of Vegetation Disturbance

Clearance of part of the vegetation at the project site to pave way for construction will be inevitable. However, the proponent will ensure proper demarcation of the project area to be affected by the construction works. This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project area and avoid spill over effects on the neighbouring areas.

In the same vein, there will be strict control of construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works.

Another important measure aimed at reducing disturbance of vegetation in the project area will be preservation of individual trees within the site. In addition, the proponent has committed to re-vegetation of some of the disturbed areas through implementation of a well designed landscaping programme. It is recommended that part of the topsoil excavated from the construction site be re-spread in areas to be landscaped to enhance plant health.

8.2.3 Minimization of Run-off and Soil Erosion

The proponent will put in place some measures aimed at minimizing soil erosion and associated sediment release from the project site during construction. These measures will include terracing and levelling the project site to reduce run-off velocity and increase infiltration of rain water into the soil. In addition, construction vehicles will be restricted to designated areas to avoid soil compaction within the project site, while any compacted areas will be ripped to reduce run-off.

8.2.4 Minimization of Construction Waste

It is recommended that demolition and construction waste be recycled or reused to ensure that materials that would otherwise be disposed off as waste are diverted for productive uses. In this regard, the proponent is committed to ensuring that construction materials left over at the end of construction will be used in other projects rather than being disposed off. In addition, damaged or wasted construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects. Such measures will involve the sale or donation of such recyclable/reusable materials to construction companies, local community groups, institutions and individual residents or home owners.

The proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal.

It is further recommended that the proponent should consider the use of recycled or refurbished construction materials. Purchasing and using once-used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste.

Additional recommendations for minimization of solid waste during construction of the project include:-

- i. Use of durable, long- lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time
- ii. Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements
- iii. Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials

- iv. Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste
- v. Use of construction materials containing recycled content when possible and in accordance with accepted standards.

8.2.5 Reduction of Dust Generation and Emission

Dust emission during construction will be minimized through strict enforcement of onsite speed controls as well as limiting unnecessary traffic within the project site. In addition, it is recommended that excavation works be carried out in wet weather; and traffic routes on site be sprinkled with water regularly to reduce amount of dust generated by the construction trucks.

8.2.6 Minimization of Exhaust Emissions

This will be achieved through proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road. In addition truck drivers will be sensitised to avoid unnecessary racing of vehicle engines at loading/offloading areas, and to switch off or keep vehicle engines at these points

8.2.7 Minimization of Noise and Vibration

Noise and vibration will be minimized in the project site and surrounding areas through sensitization of construction truck drivers to switch off vehicle engines while offloading materials. In addition, they will be instructed to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, residential areas and hospitals. In addition, construction machinery shall be kept in good condition to reduce noise generation. It is recommended that all generators and heavy duty equipment be insulated or placed in enclosures to minimize ambient noise levels.

8.2.8 Reduction of Risks of Accidents and Injuries to Workers

The proponent is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Health and Safety Act (Cap 514). In this regard, the proponent is committed to provision of appropriate personal protective equipment, training staff of occupational safety and health, first aid and fire safety training as well as ensuring a safe and healthy environment for construction workers as outlined in the EMP.

8.2.9 Reduction of Energy Consumption

The proponent shall ensure responsible electricity use at the construction site through sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used. In addition, proper planning of transportation of materials will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during construction and set targets for reduction of energy use.

8.2.10 Minimization of Water Use

The proponent shall ensure that water is used efficiently at the site by sensitising construction staff to avoid irresponsible water usage.

8.3 Mitigation of Operation Phase Impacts

8.3.1 Ensuring Efficient Solid Waste Management

The staff will be responsible for efficient management of solid waste generated by the project during its operation. In this regard, the owner will provide waste handling facilities such as waste bins and skips for temporarily holding waste generated at the site before its disposed off by a licensed waste handler. In addition, the owner will ensure that such disposed of regularly and appropriately. It is recommended that the proponent puts in place measures to ensure that the occupants of the building manage their waste efficiently through recycling, reuse and proper disposal procedures.

8.3.2 Minimization of Sewage Release

The proponent will ensure that there are adequate means for handling the large quantities of sewage generated at the building this will be through a waste treatment plant. It will also be important to ensure that sewage pipes are not blocked or damaged since such vices can lead to release of the effluent, resulting in land and water contamination. Such blockages or damages will be fixed expeditiously.

8.3.3 Ensure Efficient Energy Consumption

The proponent plans to install an energy-efficient lighting system. This will contribute immensely to energy saving during the operational phase of the project. In addition, occupants of the building will be sensitised to ensure energy efficiency in their domestic operations. To complement these measures, it will be important to monitor energy use during the operation of the Godowns and set targets for efficient energy use.

8.3.4 Ensure Efficient Water Use

The proponent will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff. In addition, the staff will be sensitized to use water efficiently.

8.3.5 Encroachment on privacy

There is need to address the issue of encroachment on privacy of those residing within the vicinity of the project. Although the height of the building shall be within the prevailing height, the other mitigation measure shall be planting of trees that will grow to the required height to prevent encroachment on privacy. More so the concrete wall shall be raised to appropriate height too.

9. CLIMATE RISK AND VULNERABILITY ASSESSMENT

9.1 Introduction

Climate change is one of the greatest threats facing the world in the 21st century, with severe consequences for ecosystems, human health, and industrial operations if not addressed. Scientific consensus confirms that limiting global temperature rise to 1.5°C above pre-industrial levels is critical to avoid irreversible impacts. Climate change is already causing tangible impacts in Kenya including erratic rainfall, rising temperatures, prolonged droughts, and flash flooding, which threaten water security, energy systems, and infrastructure resilience.

Kenya is a signatory to the Paris Agreement and has committed to reducing GHG emissions by 32% by 2030 under its updated Nationally Determined Contribution (NDC). The Climate Change Act 2016 and Climate Change (Amendment) Regulations 2024 require all major projects to undertake climate risk assessments and demonstrate alignment with national adaptation and mitigation goals. This chapter assesses climate risks to the proposed emulsion polymer plant and outlines mitigation and adaptation measures integrated into project design.

9.2 Kenya Climate & Project Site Context

Kenya's climate is highly diverse, influenced by altitude and proximity to the Indian Ocean. The project site in Kinanie, Machakos County lies within the Athi-Kapiti Plains at ~1,600m altitude, characterized by semi-arid conditions. Mean annual temperature is 20–24°C, with annual precipitation of 600–800mm in a bimodal regime: long rains (March–May) and short rains (October–December).

The site is located 200m south of a seasonal river feeding the Athi River system and 300–600m north of the Swara Plains Conservancy. The area is classified as Agro-Ecological Zone IV — semi-arid with high climate variability. Baseline studies confirm increasing temperature trends and declining reliability of rainfall in Machakos County over the past 30 years.

9.2.1 Projected Climate Changes for Athi-Kapiti Plains

Kenya is projected to experience rising temperatures and more unpredictable rainfall. For Machakos County under RCP6.0:

- Temperature: Increase of 1.3°C by 2030, 1.6°C by 2050, and 2.2°C by 2080 relative to 2000
- Very Hot Days (>35°C): Increase from 15 days/year currently to 51 days/year by 2080
- Precipitation: High uncertainty. Models project -5% to +15% change in annual rainfall, with increased intensity of heavy rainfall events
- Heavy Rainfall Days: Increase from 7 to 9 days/year by 2080, raising flash flood risk

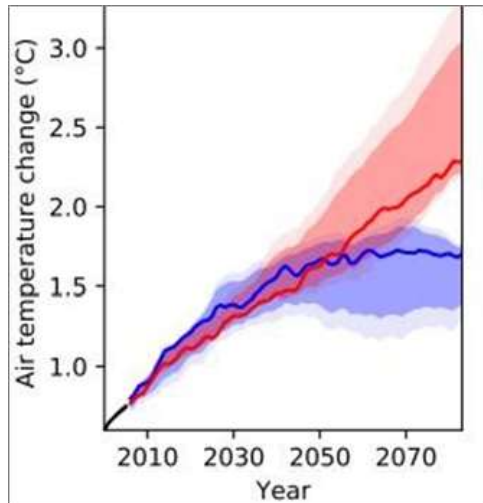


Figure 1: Air temperature projections for Kenya for different GHG emissions scenarios

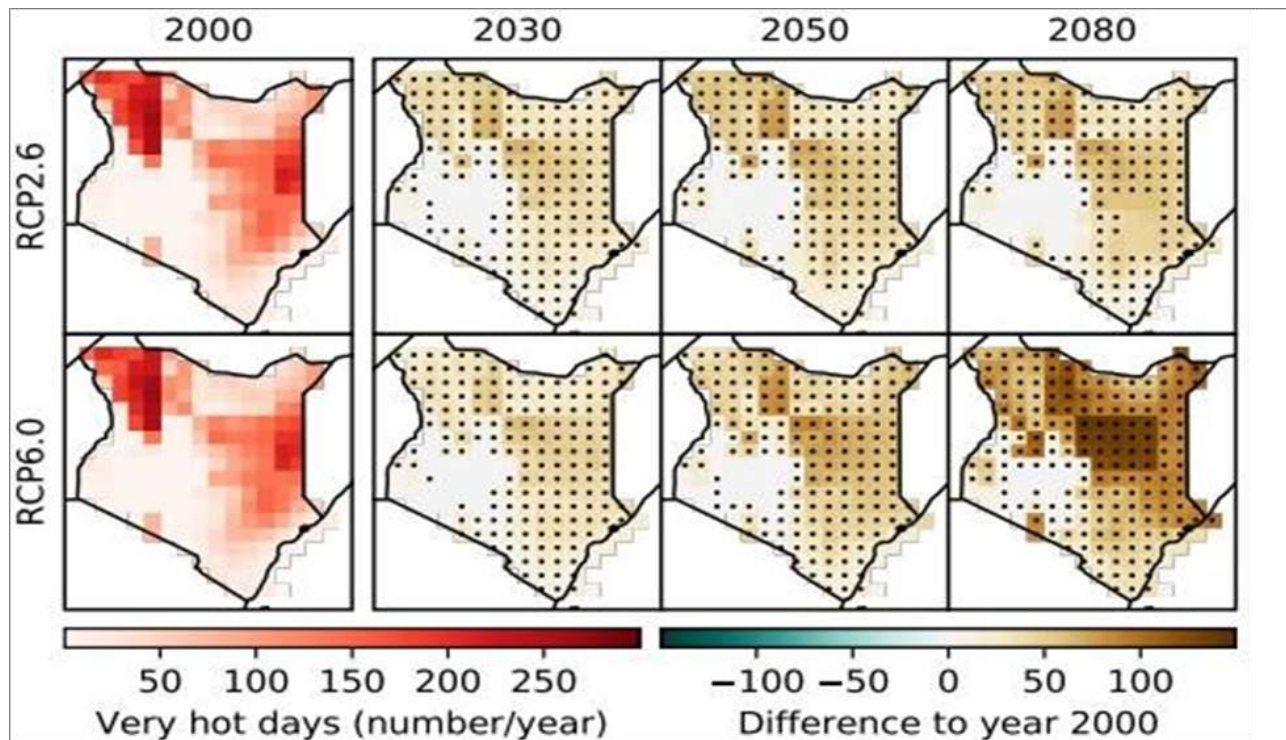


Figure 2: Projections of the annual number of very hot days (daily maximum temperature above 35 °C) for Kenya for different GHG emissions scenarios

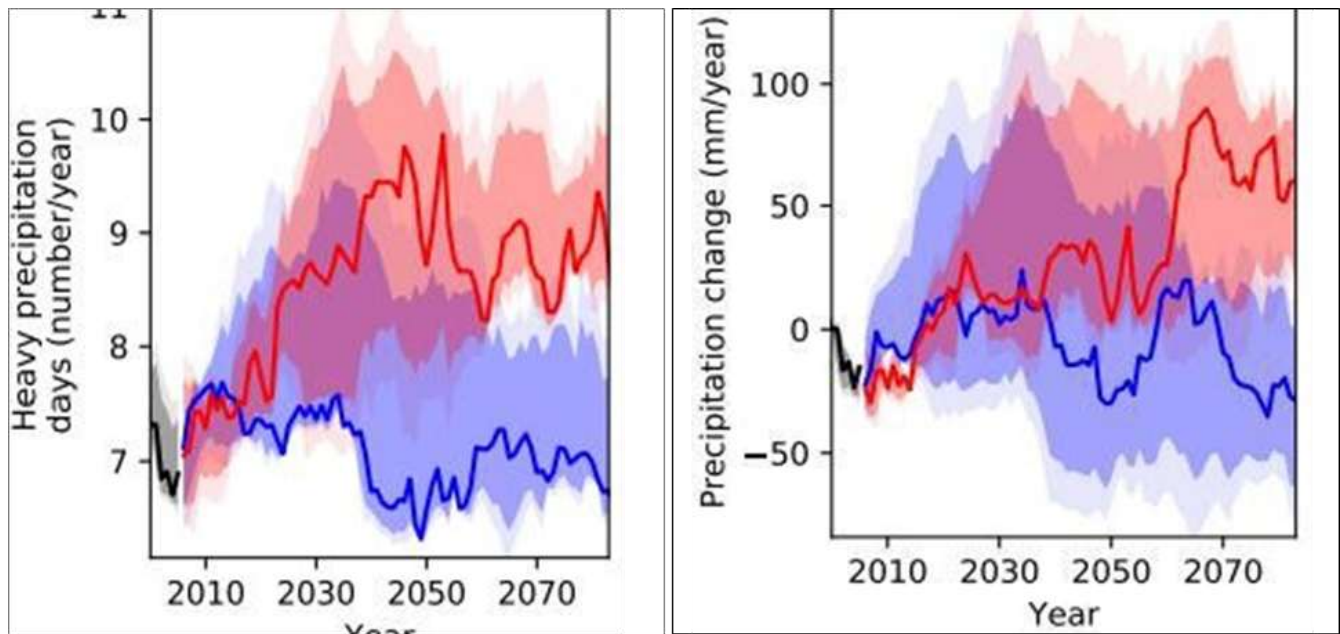


Figure 3: Projections of the number of days with heavy precipitation over Kenya for different GHG emissions scenarios, relative to the year 2000 in certain regions.

9.3 Climate Change Impacts to Key Sectors Relevant to Project

9.3.1 Water Resources

Per capita water availability in Athi River Basin is projected to decline by 63% by 2080 due to population growth and evaporation. The Athi-Kapiti aquifer is already stressed. Increased drought frequency threatens borehole yields and surface water reliability, directly impacting plant operations requiring 80m³/day.

9.3.2 Infrastructure

Extreme weather will damage transport infrastructure. Mombasa Road and the 800m murram access road are vulnerable to flooding and heat-induced asphalt degradation. Power infrastructure faces disruption from storms. This threatens raw material supply and product dispatch.

9.3.3 Energy

Rising temperatures will increase cooling energy demand for reactors and warehouses by 15–20% by 2050. Grid reliability may decline due to hydropower variability. Diesel generator costs will rise with fuel price volatility.

9.3.4 Ecosystems

The adjacent Swara Plains Conservancy and riparian corridor zoom north are vulnerable to habitat transformation from temperature rise and altered rainfall. Zone 1 *Balanites Themeda* grassland on site provides critical ecosystem services as flood buffer and carbon sink that must be protected.

9.4 Climate Change Adaptation for the Emulsion Polymer Plant

Climate change can impact the proposed plant through: increased structural risk from floods/storms; higher cooling costs from extreme heat; water scarcity affecting process operations; and supply chain disruptions.

Direct Climate Impacts on Plant:

- Structural Damage & Maintenance: Flash floods from the seasonal river could inundate Zone 3/4. Extreme heat accelerates equipment degradation.
- Energy Consumption & Costs: Ambient temperatures $>35^{\circ}\text{C}$ increase reactor cooling load and warehouse AC demand by 20%.
- Water Security: Prolonged drought reduces borehole yield and rainwater harvesting potential.
- Reduced Asset Value: Plants without climate resilience may face higher insurance premiums and financing costs.
- Regulatory & Compliance Pressure: Climate Change Regulations 2024 mandate annual GHG reporting and 4% annual reduction for facilities $>1,000\text{ tCO}_2\text{e/yr}$.
- Supply Chain Disruptions: Floods on Mombasa Road delay VAM and additive deliveries.

Adaptation Strategies Integrated into Design:

- Flood Resilience: All critical infrastructure sited in Zone 3/4 above 1:100yr flood level. Detention pond sized for 1:25yr storm. Zone 1 retained as natural floodway.
- Water Security: $12,000\text{m}^3$ rainwater harvesting + 70% process water recycle. Borehole sited $>100\text{m}$ from river per WRMA requirements.
- Energy Resilience: 300kWp Solar PV + 500kWh BESS provides 40% of power. VFDs on all motors $>15\text{kW}$. Building orientation and insulation reduce cooling load.
- Heat Resilience: Reactors fitted with oversized cooling systems designed for 45°C ambient. Shade structures over VAM tank farm.

- Resilient Design: Flood-resistant materials for foundations. Elevated electrical switchgear. On-site renewable energy reduces grid dependence.
- Green Building Standards: Pursuing EDGE certification. Sustainable materials and designs to reduce operational carbon.

9.5 Greenhouse Gas (GHG) Emissions Assessment

9.5.1 Construction Phase GHG Emissions

Table 18 a: Estimated from vehicles, machinery, and worker transport using carbon calculation tools.

Description	Qty	Fuel Type	Consumption (L)	CO ₂ Emissions (t)
Diesel Heavy Equipment (Excavator, Loader)	2	Diesel	2,520	8.54
Diesel Medium Trucks (Material delivery)	4	Diesel	3,780	12.80
Diesel Generator (100kVA)	1	Diesel	1,800	6.10
Worker Transport (Bus)	2	Diesel	2,400	8.13
Total Construction Phase			10,500	35.57

9.5.2 Operation Phase GHG Emissions

Table 18 b: Annual emissions estimated at 1,230 tCO₂e/yr, triggering reporting under Climate Change Regulations 2024:

Source	Activity Data	CO ₂ e Emissions (t/yr)
Grid Electricity	1,200 MWh/yr @ 0.33 tCO ₂ e/MWh	396
Diesel Generator (backup)	20,000 L/yr	68
LPG (lab/kitchen)	5,000 kg/yr	15
VAM Fugitive Emissions	0.1% of 5,000t/yr	8
Wastewater Treatment	40m ³ /day	3
Employee Commuting	150 staff	90
Raw Material Transport	8,000 t/yr	650
Total Scope 1+2+3		1,230

Mitigation Measures:

Solar PV: 300kWp system avoids 288 tCO₂e/yr

Carbon Sink: Avoids 320 tCO₂e land-use change + 18 tCO₂e/yr sequestration

Energy Efficiency: VFDs, LED, steam recovery reduce 104 tCO₂e/yr

Total Mitigation: 630 tCO₂e/yr = 51% reduction

Net Emissions: 600 tCO₂e/yr

9.6 Table 19: Climate Risk Impact Matrix

Risk Category	Climate Risk	Likelihood (L)	Consequence (C)	Significance	Remarks / Mitigation Measures
Hydrology & Flooding	Increased rainfall intensity causing flash floods from seasonal river	3 – Possible	4 – Major damage to ETP, warehouses in Zone 4	High	Retain Zone 1 as floodway; size detention pond for 1:25yr storm; elevate critical equipment 0.5m above grade
Water Security	Prolonged drought reducing borehole yield & RWH	3 – Possible	4 – Plant shutdown due to water shortage	High	12,000m ³ RWH + 70% recycle; WRMA permit; diversify to EPZA water backup
Infrastructure Damage	Heat stress >35°C causing VAM tank overpressure & reactor cooling failure	3 – Possible	5 – Catastrophic fire/explosion	High	Oversized cooling systems; shade structures; SIL-2 interlocks; shade paint on tanks
Energy	Grid outages from storms; increased cooling demand	4 – Likely	3 – Production loss; higher costs	Medium	300kWp Solar + 500kWh BESS; Energy efficiency measures
Supply Chain	Mombasa Road flooding disrupting VAM delivery	3 – Possible	3 – Production stoppage	Medium	3-day VAM inventory; Alternative route via Namanga; Supplier contracts include climate clause
Regulatory	Non-compliance with GHG reporting/limits	2 – Unlikely	3 – NEMA fines; license revocation	Medium	Annual GHG inventory to NEMA. 4% annual reduction plan

9.7 Conclusion

The plant has High exposure to flooding, water scarcity, and heat risks. However, integrated adaptation measures including Zone 1 grassland retention, ZLD water system, Solar PV, and climate-resilient design reduce residual risk to Medium. The project aligns with Kenya's NDC and Climate Change Act 2016 through 51% GHG mitigation and nature-based adaptation.

10: ENVIRONMENTAL MANAGEMENT/MONITORING PLAN

10.1 Introduction

The proponent acknowledges the fact that the proposed project activities will have some impacts on the biophysical environment, health and safety of its employees and members of the public, and socio-economic well-being of the residents. Thus, the focus will be on reducing the negative impacts and maximizing the positive impacts associated with the project activities through a programme of continuous improvement.

An Environmental Management Plan has been developed to assist the proponent in mitigating and managing environmental impacts associated with the life cycle of the project. The EMP has been developed to provide a basis for an Environmental Management System (EMS; ISO 14001 principles) for the project. IFC Policy on Social and Environmental Sustainability including the IFC Performance Standards (PS) and the Environmental, Health & Safety (EHS) Guidelines which cover key areas of environmental and social impacts and issues that have been used in developing the EMP. It is noteworthy that key factors and processes may change through the life of the project and considerable provisions have been made for dynamism and flexibility of the EMP. As such, the EMP will be subject to a regular regime of periodic review. In general, monitoring the project will include the following:

Construction phase

- Monitor that occupational health and safety measures are carried out in accordance with IFC's General Environmental, Health and Safety Guidelines.
- Monitor those impacts from construction such as erosion and sedimentation, solid and sanitary waste disposal, hazardous materials (including fuels and lubricants) management, are being mitigated in accordance with IFC's General Environmental, Health and Safety Guidelines Erosion.
- If applicable, monitor that any cultural heritage that may be found or affected during construction is treated in accordance with IFC P.S. 8.
- Respond to and record community grievances.

- If applicable, monitor habitat and species impacts in accordance with IFC P.S. 6 and/or the Project's biodiversity management plan.
- If applicable, monitor that temporary worker housing is constructed and maintained in accordance with Workers' Accommodation: Processes and Standards: A Guidance Note by IFC

Operation and decommissioning phases

- Monitor for potential cumulative impacts.
- Ensure that restoration of any disturbance during construction and demolition has occurred.

The tables below are the core of this EMP for the construction, operational and decommissioning phases of the proposed project respectively. In general, the tables outline the potential safety, health and environmental risks associated with the project and detail all the necessary mitigation measures, their financial costs, as well as the people responsible for their implementation and monitoring. The EMP will be used as a checklist in future environmental audits.

10.2 Table 20: Construction Phase Environmental and Social Management Plan

Impact	Mitigation/Enhancement Measures	Responsibility	Timeframe	Performance Indicator	Monitoring Method	Estimated Cost (KES)
Loss of grassland / Biodiversity	• Demarcate and fence • Reseed degraded patches with <i>Themeda triandra</i>. • Eradicate <i>Parthenium hysterophorus</i> • Monthly ecological inspection	Proponent / Contractor / Ecologist	Pre-construction & throughout construction	Grassland intact; 0% encroachment; >80% grass cover	Site inspection; Drone survey; Photo record	1,200,000
Dust emissions from excavation & vehicles	• Water bowzers 2x daily on roads/stockpiles • Cover haulage trucks • 3m hoarding at Conservancy boundary • Limit vehicle speed to 20km/h • Suspend earthworks during high winds	Contractor / EHS Officer	Throughout construction	PM ₁₀ <80 µg/m ³ at boundary; No dust complaints	Monthly PM ₁₀ monitoring; Complaints register	800,000
Exhaust emissions (CO ₂ , NO _x , PM)	• Service vehicles monthly • No idling >3 mins • Maximize vehicle fill to reduce trips • Use low-sulphur diesel	Contractor	Throughout construction	All vehicles with service records; No black smoke	Vehicle inspection logs; Visual checks	300,000
Noise & vibration	• Work 7am–6pm weekdays only • Acoustic screens at south boundary • Silencers on all plant	Contractor / EHS Officer	Throughout construction	Noise <65 dB(A) at boundary; Zero noise complaints	Monthly noise surveys; Complaint's log	600,000

	• Notify Conservancy 48hrs before blasting					
Soil erosion & siltation of river	• Silt fences & geotextile barriers before earthworks • Sedimentation ponds for 1:10yr storm • No excavation in rainy season	Contractor / Civil Engineer	Pre-construction & during earthworks	TSS <30mg/L in runoff; No visible silt in river	Weekly TSS sampling; Visual inspection	1,500,000
Extraction of building materials	• Source from NEMA-approved quarries only • Accurate material budgeting • Reuse/recycle construction waste • Use recycled materials where possible	Proponent / Contractor	Procurement phase	100% materials from licensed sources; <5% wastage	Delivery notes; Waste records	Included in BOQ
Occupational accidents & injuries	• DOSH-approved Site Safety Plan • PPE: helmets, boots, harnesses, high-vis • Daily toolbox talks • First aid room + transport to Athi River L4 • Incident reporting system	Contractor / Safety Officer	Throughout construction	Zero fatalities; LTIFR <1.0; 100% PPE compliance	Safety inspections; Incident logs; Training records	2,000,000
Labour influx & social impacts	• Code of Conduct + GBV training for all workers. • Grievance Redress Mechanism • Priority hire from Mavoko (70%) • No labour camp on site	Proponent / Contractor / CLO	Pre-construction & throughout	Zero GBV cases; >70% local hire; <5 grievances/month	GBV register; HR records; GRM log	500,000

Solid waste generation	• Segregation at source: metal, wood, concrete, hazardous • Reuse excavated soil for landscaping • Recycle metal/wood • NEMA-licensed waste handler for disposal • No burning on site	Contractor / EHS Officer	Throughout construction	<10% waste to landfill; 100% hazardous waste tracked	Waste manifests; Site inspection	900,000
Energy consumption (diesel/electricity)	• Switch off equipment when not in use • Service generators monthly • Monitor fuel use weekly • Target 10% reduction from baseline	Contractor	Throughout construction	Fuel use <500L/week; Electricity <2000kWh/month	Fuel logs; KPLC bills	200,000
Water use & depletion	• Sensitize workers on water conservation • Fix leaks within 24hrs • Reuse curing water where possible • Monitor borehole levels monthly	Contractor / Proponent	Throughout construction	Water use <50m ³ /day; Borehole drawdown <2m	Water meter readings; Borehole log	300,000

10.3 Table 21: Operation Phase Environmental and Social Management Plan

Impact	Mitigation/Enhancement Measures	Responsibility	Timeframe	Performance Indicator	Monitoring Method	Estimated Cost (KES)
Fire/explosion risk - VAM & reactor	- HAZOP/LOPA + SIL-2 SIS on reactors - Deluge systems on VAM tanks - DOSH-approved ERP - Quarterly fire drills with County Fire Brigade	Proponent / Plant Manager / Safety Officer	Pre-commissioning & continuous	Zero fire incidents; SIL-2 verification; 100% drill compliance	Safety audits; Drill reports; DOSH inspections	5,000,000 annual
Effluent discharge to riparian corridor	- Zero Liquid Discharge ETP + RO 70% water recycle - No discharge to river/land - Solar evaporation ponds for brine - NEMA license + quarterly monitoring	Proponent / ETP Operator / Lab	Continuous	Zero discharge; BOD<30mg/L; COD<50mg/L in recycle; 100% compliance	Daily ETP logs; Quarterly NEMA sampling; WRA reports	8,000,000 annual
Air emissions - VOCs, PM ₁₀ , odour	- Vapour recovery on VAM tanks. - Thermal oxidizer for vents - Stack height per NEMA regs - Retain Zone 1 as buffer - Annual stack tests - Fence line VOC monitors	Proponent / EHS Officer	Continuous	VOC <20mg/Nm ³ ; PM ₁₀ <50µg/m ³ ; Zero odour complaints	Annual stack tests; Continuous VOC monitor; Complaint's log	3,500,000 annual
Water demand on Athi-Kapiti aquifer	12,000m³ rainwater harvesting 70% process water recycle - Borehole >100m from river - WRMA permit compliance - Annual water audit	Proponent / Water Officer	Continuous	Freshwater use <30m ³ /day; Aquifer drawdown <5m; RWH >60 days supply	Water meter logs; Borehole levels; WRA reports	2,000,000 annual

GHG emissions - 1,230 tCO ₂ e/yr	• 300kWp Solar PV + 500kWh BESS • Retain grassland carbon sink • VFDs on motors >15kW • LED lighting + steam recovery • Annual GHG inventory to NEMA	Proponent / Energy Manager	Continuous	<700 tCO ₂ e/yr net; 40% renewable energy; NEMA reporting	Energy meter data; GHG inventory; NEMA submission	1,500,000 annual
Solid waste - plastics, paper, organics	• Segregation at source • Recycling: plastics, paper, metal • Composting organics • NEMA-licensed handler for residuals • Waste minimization targets	Proponent / EHS Officer	Continuous	<20% to landfill; 100% hazardous waste tracked; Recycling >60%	Waste manifests; Recycling records	1,200,000 annual
Hazardous waste - sludge, off-spec	• Bunded 90-day hazardous waste store • NEMA-licensed transporter only • Waste tracking manifests • Explore waste-to-energy	Proponent / EHS Officer	Continuous	Zero spills; 100% manifest compliance; Store <90 days	Waste store inspection; Manifests	800,000 annual
Increased stormwater runoff	• Detention pond sized for 1:25yr storm • Permeable paving in parking • Roof water to RWH tanks • Zone 1 infiltration	Proponent / Maintenance	Continuous	No flooding; Discharge rate <pre-development	Rainfall / discharge logs; Visual inspection	500,000 annual
Increased traffic on Mombasa Rd	• Acceleration/deceleration lanes per KeNHA • Off-peak delivery 9am-4pm • Tarmac 800m access road • Staff bus from Athi River	Proponent / Logistics	Continuous	Zero traffic accidents; <20 trucks/day; 80% staff on bus	Traffic logs; Accident reports	1,000,000 annual

Energy consumption	• Energy-efficient lighting • ISO 50001 Energy Management System • Monthly monitoring + targets • Sensitize staff	Proponent / Energy Manager	Continuous	Energy use <0.5kWh/kg product; 10% annual reduction	Energy audits; KPLC bills	600,000 annual
Sanitation & sewage	• ETP handles domestic sewage • No septic tanks • Monthly pipe inspection	Proponent / Maintenance	Continuous	Zero overflows; BOD <30mg/L in treated water	Inspection logs; ETP data	Included in ETP cost
Employment & local economy	• Maintain 70% local hire policy • Skills training program • Local procurement >40% • CSR: support 2 schools annually	Proponent / HR / CLO	Continuous	150 direct jobs maintained; 30% women; 2 CSR projects/yr	HR records; Procurement data; CSR reports	2,500,000 annual
Plastic pellet/nurdle loss	• Closed loading bays, • vacuum systems, • pellet traps on drains, • daily yard sweeps	Proponent	Continuous		Daily sweep log; pellet loss reported in annual environmental audit	
Stack/point-source air emissions	• RTO/carbon filters on emulsion reactor vents; • stack height per dispersion modelling	Proponent	Continuous		Stack emission testing (annual); monthly leaf-damage monitoring	

10.4 Table 22: ESMP on Process Safety Hazards (HAZOP/LOPA)

Hazard	Mitigation Measure	Responsible Party	Timeframe	Monitoring Parameter	Estimated Cost
Reactor runaway exotherm	Independent high-high temperature trip with automatic emergency cooling/initiator isolation (SIF)	Process/Instrumentation Engineer	Prior to commissioning	SIF proof-test log (per assigned test interval); alarm response drill records	500,000
Overfilling of monomer feed/mixing tank	Independent high-high level interlock; secondary containment sized to full tank volume	Process Engineer	Prior to commissioning	Interlock functional test log; bund integrity inspection	500,000
Fire escalation from flammable storage to LPG storage	Automatic fire/gas detection; confirmation of separation distances to a recognised standard (e.g., NFPA 30)	Facility Safety Officer	Prior to commissioning	Fire detection system test log; fire drill records	750,000
Injection moulding barrel overheating	Independent high-temperature cutout separate from process controller; local exhaust ventilation	Maintenance Engineer	Prior to commissioning and ongoing	Preventive maintenance log; LEV airflow verification	250,000
Electrical ignition risk in flammable material handling areas	Verification/certification of hazardous area (Ex-rated) electrical classification	Electrical Engineer	Prior to commissioning	Area classification certificate; periodic electrical inspection	300,000

10.5 Table 23: ESMP on Climate Change Adaptation Measures

Climate Risk	Adaptation Measure	Responsible Party	Timeframe	Monitoring Parameter	Estimated Budget
Flash flooding / stormwater overload	Upgraded stormwater drainage design; electrical equipment raised above flood datum	Design Engineer / Facility Manager	Design stage; verify before commissioning	Post-storm inspection; drainage capacity review	2,000,000
Drought / reduced borehole yield	Rainwater harvesting from roof catchments; increased on-site water storage	Facility Manager	Design stage and ongoing	Borehole yield log; water storage level records	1,500,000
Rising ambient temperatures	Adequately rated cooling/HVAC systems; heat-stress work-rest protocols	Facility Manager / HSE Officer	Design stage and ongoing (seasonal, Jan–Mar, Sep–Oct)	HVAC performance checks; heat-related incident log	1,000,000
Dust/wind impacts on product quality and filtration	Windbreak vegetation buffer; filter maintenance schedule	Facility Manager / Environmental Officer	Ongoing, dry months (Jun–Oct)	Filter replacement log; windbreak establishment survey	500,000
Grassland fire risk to project storage areas	Maintain 50m firebreak; coordinate with County fire services	Facility Manager	Annually, by end-August	Firebreak inspection record; County fire service liaison log	500,000

10.6 Table 24: Decommissioning Phase Environmental and Social Management Plan

Impact	Mitigation/Enhancement Measures	Responsibility	Timeframe	Performance Indicator	Monitoring Method	Estimated Cost (KES)
Solid waste from demolition	• Inventory all materials pre-demolition • Maximize reuse/recycling: steel, concrete • NEMA-licensed handler for disposal • No burning on site • Hazardous waste to licensed facility	Proponent / Contractor	6 months pre-closure to completion	<30% to landfill; >70% recycled; 100% hazardous waste tracked	Waste inventory; Manifests; Completion audit	15,000,000
Soil contamination	• Phase I & II ESA before demolition • Excavate contaminated soil • Remediate to Intervention Values • Validation sampling	Proponent / Environmental Consultant	Pre-demolition	All parameters <DIV; NEMA clearance	Soil test reports; NEMA approval	8,000,000
Dust from demolition	• Water spraying during demolition • Cover haulage trucks • 3m hoarding • Suspend works in high winds	Contractor	During demolition	PM ₁₀ <80µg/m ³ ; No dust complaints	Dust monitoring; Complaints log	1,000,000
Noise & vibration	• Work 7am–6pm only • Notify neighbors 1 week prior • Acoustic barriers • Monitor at boundary	Contractor	During demolition	Noise <70 dB(A); Zero complaints	Noise surveys; Complaints log	500,000
Loss of employment	• Retrenchment plan per Employment Act 2007. Issue a 6 months notice. • Skills retraining program • Severance per law	Proponent / HR	6 months pre-closure	100% staff paid severance; 50% retrained	HR records; Training certificates	10,000,000
Site rehabilitation	• Remove all foundations to 1m depth • Replace topsoil • Re-vegetate with indigenous species • Remove all infrastructure • NEMA site closure certificate	Proponent / Contractor	Post-demolition	>80% vegetation cover in 2yrs; NEMA closure cert issued	Rehab audit; Vegetation survey; NEMA inspection	5,000,000

10.7 Table 25: Environmental and Social Monitoring Plan

The Proponent shall implement a comprehensive monitoring program to verify ESMP implementation and impact predictions. Monitoring shall be conducted by qualified EHS staff and independent consultants.

Parameter	Location	Frequency	Responsibility	Reporting
PM ₁₀ , PM _{2.5} , VOCs	Site boundary, Conservancy boundary	Monthly (construction); Quarterly (operation)	EHS Officer / Accredited Lab	Monthly to Proponent; Quarterly to NEMA
Noise dB(A)	Site boundary (4 points)	Monthly (construction); Bi-annual (operation)	EHS Officer	Monthly to Proponent; Annual to NEMA
Effluent: BOD, COD, TSS, pH, VAM	ETP outlet	Daily (internal); Quarterly (NEMA)	ETP Operator / Accredited Lab	Daily log; Quarterly to NEMA/WRA
Surface water: TSS, turbidity	Seasonal river u/s & d/s	Monthly (wet season)	Environmental Consultant	Quarterly to NEMA/WRA
Groundwater level & quality	Borehole + 2 monitoring wells	Quarterly	Hydrogeologist	Annual to WRA
GHG emissions	Whole facility	Annual	Energy Manager	Annual to NEMA by 31 Mar
Zone 1 vegetation	Zone 1 transects	Bi-annual	Ecologist	Annual to NEMA
Occupational H&S	Whole site	Continuous	Safety Officer	Monthly; Annual to DOSH
Grievances	Community	Continuous	CLO	Monthly to Proponent; Quarterly to NEMA

10.8 ESMP Implementation and Review

- The Proponent shall appoint a full-time EHS Manager responsible for ESMP implementation.
- The ESMP shall be reviewed annually and updated based on monitoring results, changes in operations, or new regulations.
- All contractors shall be contractually bound to comply with the ESMP.
- NEMA shall be notified of any major non-compliance within 24 hours.

11: CONCLUSION AND RECOMMENDATIONS

It is evident that the construction and operation of the proposed emulsion polymer manufacturing plant will generate significant positive impacts for the proponent, the local community in Mavoko Sub-County, and Kenya's industrial sector.

The project will create direct jobs during operation, promote skills transfer in chemical manufacturing and process safety, and generate revenue for both National and Machakos County Governments. It will put idle industrial-zoned land to productive use in line with Vision 2030, catalyze infrastructure upgrades including tarmacking of the access road, and reduce forex expenditure through import substitution of emulsion polymers. The retention of grassland and 300kWp Solar PV ensures the plant is a low-carbon, climate-compatible industrial investment.

The identified negative impacts, most significant during construction, are largely reversible and can be reduced to low residual levels through the proposed mitigation measures. Key issues include fire/explosion risk, effluent management, habitat loss, dust/noise, and water demand. Occupational safety, health, and environment (OSHE) remains a priority across both phases.

The project design has integrated mitigation measures to ensure full compliance with EMCA 1999, Climate Change Act 2016, OSHA 2007, Water Act 2016, and NEMA/EIA Regulations. Sustainable Environmental Management shall be implemented, ensuring efficient use of water, energy, and raw materials.

Considering the substantial socio-economic benefits and that no major unmitigable impacts were identified, the ESIA concludes that the project is environmentally, socially, and economically viable. The proponent and contractors shall strictly implement the Environmental and Social Management and Monitoring Plan (ESMMP) and adhere to all NEMA license conditions.

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APPENDICES

- Certificate of incorporation
- KRA PIN Certificate
- Land ownership – Title Deed
- Approved Architectural Drawings
- Geotechnical investigation report
- Ambient Air Quality Report
- Biodiversity Assessment Report
- Certified Bill of Quantity
- Duly Filled Public Participation Questionnaires
- PPC attendance lists and Minutes
- Evidence of Public notices for PPC meetings
- Letter to the NGAO Kinanie Location
- Experts practicing licenses.

No. C 6/93



CERTIFICATE OF CHANGE OF NAME

I hereby Certify, that—

CROWN PAINTS KENYA LIMITED.....

having, with the sanction of a Special Resolution of the said Company,
and with the approval of the REGISTRAR OF COMPANIES, changed
its name, is now called CROWN PAINTS KENYA PLC.....

and I have entered such new name on the Register accordingly.

Given under my hand at Nairobi this TWENTY SECOND day of

JUNE

Two Thousand and SEVENTEEN

Dy. 
Registrar of Companies

PIN Certificate

For General Tax Questions
Contact KRA Call Centre
Tel: +254 (020) 4999 999
Cell: +254(0711)099 999
Email: callcentre@kra.go.ke

Certificate Date : 21/02/2013

Personal Identification Number

P000593540R



This is to certify that taxpayer shown herein has been registered with Kenya Revenue Authority

Taxpayer Information

Taxpayer Name	Crown Paints Kenya Limited
Email Address	muriithi.david@crownpaints.co.ke

Registered Address

L.R. Number :	Building : CROWNBERGER K LTD
Street/Road : LIKONI ROAD	City/Town : NAIROBI EAST
County : Nairobi	District : Nairobi East District
Tax Area : Nairobi East	Station : LTO
P. O. Box : 78848	Postal Code : 00507

Tax Obligation(s) Registration Details

Sr. No.	Tax Obligation(s)	Effective From Date	Effective Till Date	Status
1	Income Tax - Company	08/01/1993	N.A.	Active
2	Income Tax - PAYE	15/12/2008	N.A.	Active
3	Value Added Tax (VAT)	12/02/2009	N.A.	Active

The above PIN must appear on all your tax invoices and correspondences with Kenya Revenue Authority. Your accounting end month is December unless a change has been approved by the Commissioner-Domestic Taxes Department. The status of Tax Obligation(s) with 'Dormant' status will automatically change to 'Active' on date mentioned in "Effective Till Date" or any transaction done during the period. This certificate shall remain in force till further updated.



NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT, Cap 387

Experts License - Firm of Experts

License No.:

NEMA/ENVIS/ELI/F0066

Application Reference No:

NEMA/ENVIS/EL/00304

M/S Greenlite Ventures Limited

(individual or firm) of (address) P.O.BOX 72925, 00200, City Square

is licensed to practice in the capacity of a **Firm of Experts** registration number **NEMA/ENVIS/ELI/F0066** in accordance with the provision of the Environmental Management and Coordination Act cap 387.

Issued Date: 22nd January 2026

Expiry Date: 31st December 2026

David Ongare

For DIRECTOR GENERAL
National Environment Management Authority

P.T.O.



ISO 9001 : 2015 Certified