ESIA REPORT

Environmental and Social Impact Assessment (ESIA)

MACCEM CEMENT GRINDING PLANT

Prepared by

INTEGEMS

Integrated Geo-information and Environmental Management Services

Integrated Geo-information and Environmental Management Services Limited

On Behalf of

MACCEM INDUSTRIES (SL) LTD

MACCEM Industries (SL) Limited

Prepared for

EPA-SL ENVIRONMENT PROTECTION AGENCY

Environment Protection Agency Sierra Leone

January 2025

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Prepared by

Integrated Geo-information and Environmental Management Services (INTEGEMS)

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Integrated Geo-information and Environmental Management Services

Prepared for

Environment Protection Agency-Sierra Leone (EPA-SL)

EPA-SL ENVIRONMENT PROTECTION AGENCY

MACCEM INDUSTRIES (SL) LTD

On behalf of

MACCEM Industries (SL) Limited

QUALITY ASSURANCE CHECK

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LIST OF ACRONYMS AND ABBREVIATIONS

ANMP	Air Quality and Noise Monitoring Point
BAT	Best Available Technique
CHC	Community Health Centres
CHP	Community Health Posts
DHMT	District Health Management Team
EDSA	Electricity Distribution and Supply Agency
EHS	Operational Policies and Environmental, Health and Safety
EIA	Environmental Impact Assessment
EPA-SL	Environmental Protection Agency-Sierra Leone
ESIA	Environmental and Social Impact Assessment
GDP	Gross Domestic Product
GIIP	Good International Industry Practice
GIS	Geographic Information System
GoSL	Government of Sierra Leone
GPS	Global Positioning System
GVWC	Guma Valley Water Company
IFC	International Finance Corporation
INTEGEMS	Integrated Geo-information and Environmental Management Services
INTEGEMS	Integrated Geo-information and Environmental Management Services Limited
MBSSE	Ministry of Basic and Senior Secondary Education
MCHP	Maternal Child Health Post s
MECC	Ministry of Environment and Climate Change
MLGCA	Ministry of Local Government and Community Affairs
MLGRD	Ministry of Local Government and Rural Development
MLSS	Ministry of Labour and Social Security
MRU	Manor River Union
MSW	Ministry of Social Welfare
MTHE	Ministry of Technical and Higher Education
NGO	Non-Government Organization
NWRMA	National Water Resources Management Agency
PHC	Population and Housing Census
PM	Particulate Matter

PPE	Personal Protective Equipment
SLRE	Sierra Leone River Estuary
SLSB	Sierra Leone Standard Bureau
UNEP	United Nations Environment Program
WARDC	Western Area Rural District Council
WBG	World Bank Group

1 INTRODUCTION

1.1 Background

MACCEM, a private company registered in Sierra Leone, is undertaking an industrial investment project, for the loose-bulk processing and bagging; and ultimately the full-scale Production of cement from raw materials. MACCEM is currently developing a Cement Grinding Plant in Hastings in the Western Area Rural District. The factory will manufacture cement using both local and imported raw materials with the primary aim of selling in the domestic market as substitutes for imports of finished products; and for exports to other countries in the Manor River Union (MRU) sub-region. The factory will be constructed and operated on a 10.9-acre piece of land between the Hastings Airstrip and the Jui-Masiaka Highway.

To commence construction and operation of the plant, MACCEM must conduct an ESIA in line with the Environmental Impact Assessment (EIA) procedures of the Environmental Protection Agency-Sierra Leone (EPA-SL). Accordingly, MACCEM has applied for an EIA License and has been instructed by the Agency to carry out an ESIA study in compliance with the provisions promulgated in the EPA Act of 2022.

To ensure that the proposed Project is implemented in an environmentally and socially sustainable manner, MACCEM has engaged the services of Integrated Geo-information and Environmental Management Services (INTEGEMS) Limited, an EPA Category A classified consultancy firm, to conduct an Environmental and Social Impact Assessment (ESIA) for the proposed Project activities. The study seeks to describe the environmental and socio-economic baseline of the Project area, identify potential adverse/beneficial project impacts and propose appropriate mitigation measures and management plans for the design, construction, operation and decommissioning phases of the Project.

The project now intends to seek funding from the World Bank International Financing Corporation (IFC) for expansion and is required to update the ESIA with respect to the project description and baseline, impact assessment and environmental and social management plan (ESMP).

In addition to meeting compliance with local Legislation, MACCEM, is required to adhere to the International Finance Corporation (IFC) Performance Standards and the World Bank Group Environmental, Health and Safety (EHS).

1.2 Project Proponent

MACCEM Industries (SL) Limited is a private company registered in Sierra Leone. Company is undertaking an industrial investment project, for the loose-bulk processing and bagging; and ultimately the full-scale Production of cement from raw materials.

1.3 Project Justification

Sierra Leone's economic transformation requires substantial improvement in the industrial sector, as highlighted by the African Development Bank's Economic Outlook 2017. The current imbalance in trade and unsustainable foreign exchange pressures necessitate a focus on production to reverse the trend and create jobs for the growing urban population. With its extensive experience in Sierra Leone and the cement industry, MACCEM recognizes that investments in Cement Grinding offer win-win scenarios for both the government and private investors. The project aims to contribute to the government's growth and poverty reduction goals while providing stability for long-term investment returns.

Moreover, the establishment of a Cement Grinding Plant aligns with Sierra Leone's national industrial policy objectives. It supports the goal of raising the production industry's contribution to Gross Domestic Product (GDP) and increasing the share of local content in manufactured products. The project also contributes to the volume of exports, which is crucial for economic development. By creating an investment-friendly environment and providing special facilities for large-scale industrial production, the government can demonstrate its commitment to the national policy document.

Furthermore, the project offers direct economic benefits, such as increased national output and job creation. Production growth has a positive correlation with GDP growth, and a thriving production sector can stimulate employment through both direct and indirect means. MACCEM's operations will generate direct employment opportunities, including management, technical, vocational, and support roles.

Indirect employment will arise from purchasing networks, distribution enterprises, and transportation and logistics services. Additionally, new enterprises will emerge in the quarry market segment, further boosting national production and output.

The project also brings significant tax revenues for the government through import taxes, levies, PAYE taxes, and social security taxes. These revenues will contribute to the country's fiscal stability and provide resources for further development. Moreover, the project has the potential to ease foreign exchange and exchange rate pressures, as it reduces the reliance on imported cement and promotes the utilization of domestic raw materials or imported raw materials for value addition.

Overall, establishing a Cement Grinding Plant of this nature aligns with Sierra Leone's economic growth objectives, creates employment opportunities, generates tax revenues, reduces import dependency, and supports the national industrial policy. It also catalyses attracting additional private investments and fostering economic development and diversification in the country.

1.4 EPA-SL Regulatory Requirements for the ESIA

In 2022, a new act was passed into law, which continues to emphasize the EPA-SL's goal of creating and enforcing a strict framework for environmental regulation in Sierra Leone. As such, it is mandated to coordinate, monitor, and evaluate the implementation of national environmental policies, programs, and projects, including issuing EIA licenses. Environmental protection, as stipulated within legislation and regulations, includes activities aimed at preserving a healthy and clean environment, improving ecological balance, preventing and mitigating adverse impacts of human and natural activities on the environment, and promoting rational and sustainable exploitation and utilisation of natural resources. Section 24(1) of the EPA Act (2022) states that an EIA is required for certain types of project activities while section 26 specifies the factors determining whether a project requires EIA which include:

- **The environmental impact on the community;**
- **The location of the Project;**
- **Whether the project transforms the locality;**
- **Whether the project has or is likely to have a substantial impact on the ecosystem of the locality;**
- **Whether the project results in the diminution of the aesthetic, recreational, scientific, historical, cultural or other environmental quality of the locality;**
- **Whether the project will endanger any species of flora or fauna or the habitat of the flora or fauna;**
- **The scale of the project;**
- **The extent of the degradation of the quality of the environment;**
- **Whether the project will increase demand for natural resources in the locality;**
- **The cumulative impact of the project together with other activities or Projects, on the environment.**

Figure 1-1 schematically outlines the EPA-SL EIA process for new developments in Sierra Leone.

1.5 Objectives and Scope of Work

The objective of the ESIA is to thoroughly evaluate the existing baseline environmental and socioeconomic conditions within the Project Area, as well as to identify and assess the potential impacts that may arise from the proposed activities.

The scope of work includes:

- **Inform the public about the Project;**
- **Identify the key stakeholders and take their concerns into account;**
- **Define practical and viable alternatives to the Project;**
- **Identify and assess the significant impacts that may emanate from the project**

1.6 ESIA Approach and Methodology

A formal approach and process was followed to identify, assess and document the potential effects that the Project will have on the biophysical, social, and economic environments so that the significance of

potential impacts can be taken into account when designing and developing the proposed Project. The process followed, through the basic tasks, is described below.

- **Literature Review:** The project team conducted a detailed review of documentation to obtain an adequate understanding of the significant elements and key sensitivities to be considered during the ESIA. Documents reviewed included for the broader national context, the regional are and the local context. This included project-related documents, relevant legislations, regulations, policies, international multilateral agreement, GIS datasets, and other relevant reports and online sources useful for the study. Information on the geology, hydrology, hydrogeology, topography, land use/land cover and other socio demographics of the area was obtained from various reports, databases and maps.
- **Field Investigation:** After the document review, the expert teams made joint visits to the project location to conduct fact-finding activities to understand the on-ground site status and to carry out a baseline assessment of environmental and social sensitivities related to the proposed activities. The team collected targeted primary data collection as follows:
  - **Biological and Physical Baseline: Site walkovers to conduct a detailed analysis of identified sensitive receptors and take any requisite parameter measurements and sampling.**
  - **Social Baseline: Consultations with the local communities and institutions, informal businesses, local administration and the regulatory authorities. These were done based on the list of stakeholders developed during the desktop document review.**
- **Stakeholder Engagement:** Stakeholder engagements is a requirement stipulated in the regulations and a critical component of the ESIA process for achieving transparent decision-making and can provide many benefits for the project. The Team undertook engagements with local communities. Feedback from stakeholder engagement, has been used to prepare the report. The engagement was done through Key informant interviews community meetings and focus group discussions.
- **Analysis of Alternatives: this** includes an examination of each technically feasible alternative to the source of impacts, including the non-project alternative, and documents the rationale for selecting the chosen alternative.
- **Defining Geographic Scope**

  The spatial extent of the ESIA comprises the geographical area potentially affected by the Project. Individual study areas were selected for each discipline, and these are illustrated and justified in the relevant chapters of this report. The following definitions were used to determine each individual ESIA study area:

  - **Areas and communities potentially impacted by the Project and its activities.**
  - **Areas and communities potentially impacted by cumulative impacts from further planned development of the Project or other sources of similar impacts in the geographical area and other Project-related developments.**
  - **Environmental and social issues associated with activities or facilities which are not part of the Project, but which may be directly or indirectly influenced by the Project, i.e., it exists solely because of the Project or could present a risk to the Project.**
- **Impact Assessment**: The potential project-related environmental and socio-economic impacts identified were based on likely interactions between Project activities and the sensitive receptors. The methodology to assess the impact significance is based on the assumption that the significance of an impact on resources or receptors is considered to result from an interaction between three factors:
  - **The nature and magnitude of the impact or change;**
  - **The number of resources or receptors affected; and**
  - **The environmental value (sensitivity) of those resources or receptors to the change**
- **Development of Environmental and Social Management Plans**

  Based on the findings of the environmental and social assessment process and the outcomes of stakeholder engagement, a programme of mitigation actions and management controls was prepared to address the Project's identified potential environmental and social impacts and

issues and other performance improvement measures. These are captured within a suite of Environmental and Social Management Plans (ESMPs), which cover all phases of the Project.

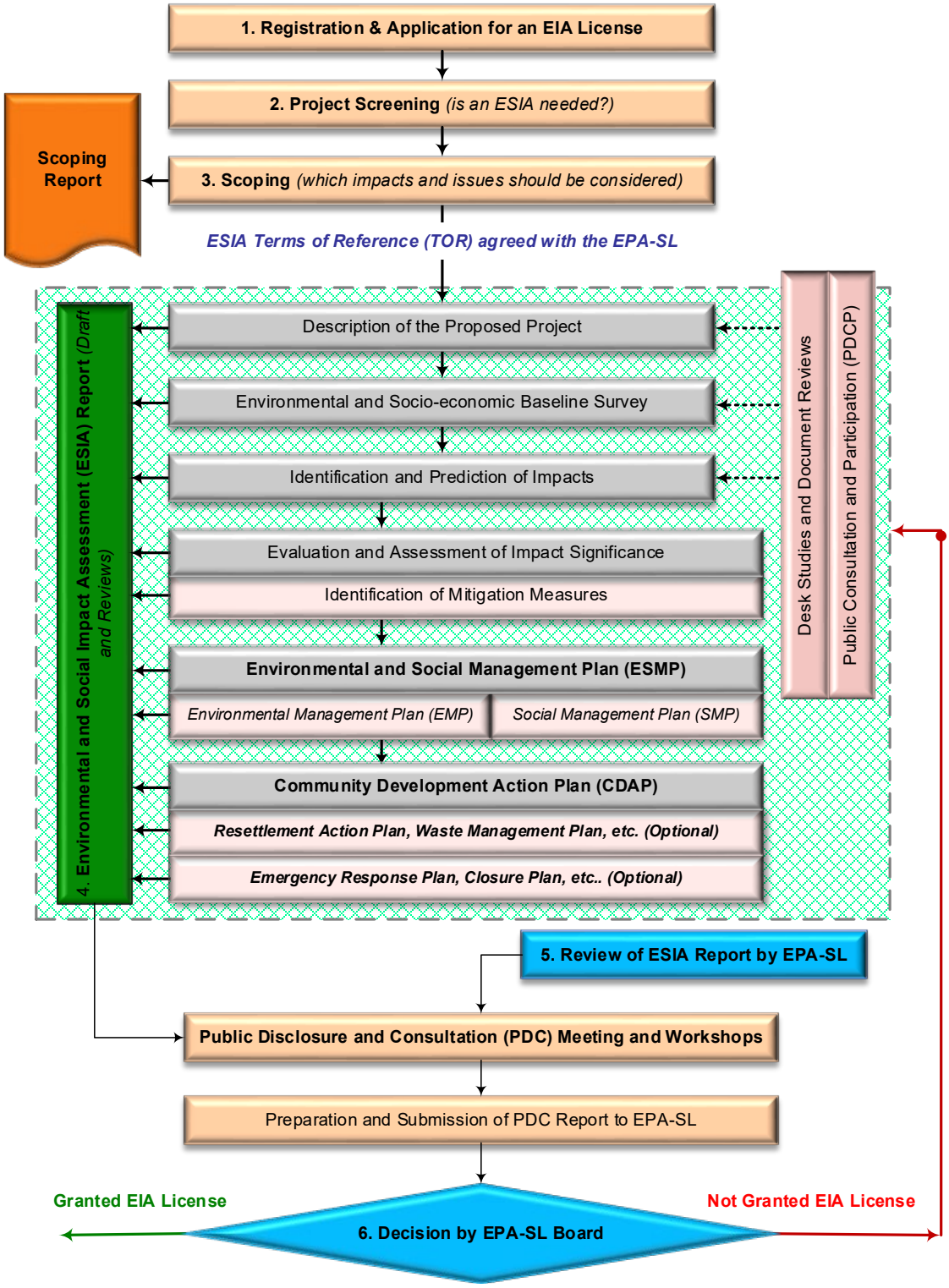
1.7 The ESIA Consultant

INTEGEMS is a leading consultancy firm that specializes in providing innovative solutions to environmental, socio-economic and natural resource management challenges. Our multidisciplinary approach combines state-of-the-art GIS and remote sensing technologies with research, environmental, and geo-information management expertise, enabling us to empower our clients with effective and efficient solutions.

INTEGEMS has experience across Sierra Leone and has developed a thorough understanding of national, regional and local legislative requirements and the environmental and socio-economic challenges faced by various programs, projects and organisations in the country. In collaboration with strategic partners, INTEGEMS has successfully designed and carried out several environmental and socio-economic baseline surveys and assessments in diverse communities in Sierra Leone.

We serve a diverse clientele, both domestic and international, across the public and private sectors. Our services encompass a broad range of technical expertise, including geo-information management, environmental management, aerial survey and drone mapping, disaster risk reduction and management, geological and mining consulting, web development maintenance and hosting, health information systems and research, and monitoring and evaluation services. with a focus on delivering high-quality, cost-effective, and value-based services, INTEGEMS is committed to helping our clients succeed in their ventures.

Figure 1-1: EPA-SL EIA Process



1.8 Structure of the Report

The structure of this report is as follows.

Table 1-1: The Structure of the Report

Section	Title	Content
Section 1:	**Introduction**	Introduces the background to the Project, the rationale for the Project, the ESIA process and the purpose and structure of the report.
Section 2:	**Legislative and Policy Framework**	Provides a summary of the relevant legislation as well as pertinent policy and planning documents including national laws, international guidelines and standards and multilateral agreements.
Section 3:	**Project Description**	Provides a description of the Project site conditions, key project components, proposed activities and reasonable alternatives that have been considered.
Section 4:	**Environmental and Social Baseline**	Describes the existing environmental and social conditions within the proposed project area and the immediate surroundings.
Section 5:	**Stakeholder Engagement and Public Participation**	Presents the stakeholder consultation and engagement process that has been conducted for the Project and includes a plan for consultation moving forward.
Section 8:	**Assessment of Environmental and Social Impacts**	Presents the potential significant environmental, social, health and impacts anticipated from the proposed project in relation. This chapter also presents mitigation measures to manage impacts across the life of the project.
Section 11:	**Conclusions**	Summarises the key findings of the Study
Section 12:	**References**	Presents the list of background documents that were utilized during the Study.
Section 13:	**Appendices**	Presents the list of appendices including the list of stakeholders, and photographs during the stakeholder engagement.

2 LEGISLATIVE AND POLICY FRAMEWORK

The Project must conform to several relevant legislative and policy frameworks, regulations, standards and guidelines in Sierra Leone as well as international standards, guidelines and good international industry best practices. This section provides a high-level overview of the relevant institutional and legislative framework for the proposed Project.

2.1 Relevant National Legislation

2.1.1 The Constitution of Sierra Leone

The Constitution is the overarching document that guides the operation of the state and informs and supersedes any piece of legislation. The constitution makes provisions for the state to harness all the natural resources of the nation to promote national prosperity and an efficient, dynamic and self-reliant economy.

The constitution also provides for the management and control of the national economy in such a manner as to secure the maximum welfare and freedom of every citizen based on social justice and equality of opportunity.

The Project's operations will be required to meet a variety of legislation that is backed by the Constitution.

2.1.2 Environment Protection Agency Act, 2022

The EPA-SL Act of 2022 is a law that repels the EPA-SL Act of 2008 which establishes the Environment Protection Agency - Sierra Leone (EPA-SL) as the lead agency responsible for the protection and management of the environment in Sierra Leone. The Act provides for the continuation of the EPA and outlines its functions, powers, and administrative provisions. It also establishes various committees, including the Multilateral Environmental Agreements Coordination Committee, the National Environmental Compliance and Enforcement Coordination Committee, and the Ward Environment and Chiefdom Environment Committee.

The EPA-SL Act of 2022 includes provisions related to environmental impact assessment, chemicals, toxic and hazardous substances, information, education, public awareness, and judicial proceedings. It also provides for the identification and demarcation of land on which trees may be cut or forest burned, the management, protection, and development of the marine and coastal environment, and the testing of emissions. Additionally, the Act includes provisions related to internal audits, incentives for good environmental behaviour, emergency measures, and general offences.

The Project meets the requirements for having the potential to cause harm to the environment and human health; and is, therefore, required to acquire an EIA License and comply with all the relevant sections of the EPA Act.

2.1.3 National Environmental Policy, 1994

The National Environmental Policy (1994) seeks to achieve sustainable development in Sierra Leone through the implementation of sound environmental management systems that will encourage productivity and harmony between man and his environment. It also promotes efforts that will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of nationals, and serves to enrich the understanding of ecological systems and natural resources which are important to the country.

2.1.4 Sierra Leone Local Content Policy, 2016

The Sierra Leone Local Content Policy, 2016 is a framework aimed at promoting the active participation of Sierra Leonean individuals, businesses, and institutions in the country's economic activities. It recognizes the importance of maximizing the benefits derived from natural resources and investment projects for the local population. The policy emphasizes the need to create an enabling environment and establish mechanisms for skills transfer, technology sharing, and knowledge development to empower Sierra Leoneans.

The policy highlights the preference for local goods and services in procurement processes, encouraging companies to prioritize the use of local suppliers, contractors, and consultants, provided they meet the required quality and cost standards. This approach aims to stimulate local economic growth, generate employment opportunities, and foster the development of local industries. Additionally, the Sierra Leone Local Content Policy emphasizes the significance of partnerships and collaborations between international investors and local stakeholders, promoting joint ventures, technology transfers, and knowledge-sharing arrangements to enhance the capabilities of Sierra Leonean businesses.

MACCEM is required to preferentially utilise Sierra Leonean goods and service providers for all purchases of equipment, supplies, goods and services, where goods and services are available at competitive prices and quality

2.1.5 Local Government Act, 2022

This Act deals with the establishment and operation of local councils around the country to enable meaningful decentralization and devolution of Government functions. It stipulates that a local council shall be the highest political authority in the locality and shall have legislative and executive powers to be exercised by this Act or any other enactment. It shall be responsible, generally for promoting the development of the locality and the welfare of the people in the locality with the resources at its disposal and with such resources and capacity as it can mobilize from the central government and its agencies, national and international organisations, and the private sector. The local council should initiate and maintain programmes for the development of basic infrastructure and provide works and services in the locality. A local council shall cause to be prepared a development plan which shall guide the development of the locality.

The project will operate within the jurisdiction of the Western Area Rural District Council (WARDC). Therefore, MACCEM should consider the local council within the area as a primary stakeholder that has a significant influence on its operations.

2.1.6 The Standards Decree, 1996

The Sierra Leone Standards Decree created by the Standards Act No. 2 of 1996 (National Provisional Ruling Council Decree, Repeal and Amendment Act No. 3 of 1996) came into force on the 18th December, 1996.

The Standards Decree, 1996. Being a Decree to provide for the standardization of commodities and products, to establish the Sierra Leone Standards Bureau. The Bureau became operational on the 24th January 2000 and carried along the functions of the erstwhile Weights and Measures administration of the Ministry of Trade and Industry.

The Weights and Measures Act No. 22 of 1961 was created to replace the Weights and Measures Ordinance that existed before Sierra Leone gained independence from the United Kingdom. Sierra Leone Standards Bureau is designated as: National Standards Body, National Certification Body and National Accreditation Body mandated to assess, confirm that a product conforms to applicable standards and to ensure that companies demonstrate their technical competence in line with national and international best practices. Also, they are there for Certification of products and Accreditation of conformity assessment bodies.

2.1.7 National Water Resources Management Agency Act, 2017

This Act establishes the National Water Resources Management Agency (NWRMA) in Sierra Leone as the central authority responsible for the sustainable management and regulation of the country's water resources. The Act aims to ensure the effective planning, development, utilization, and protection of water resources to support socio-economic development and environmental sustainability. The NWRMA is granted the power to oversee and coordinate water resources management activities, enforce regulations, and promote efficient water use across various sectors.

Under the Act, the NWRMA is empowered to develop a national water resources management plan, which serves as a comprehensive framework for guiding the sustainable use and allocation of water resources. The Agency is also responsible for issuing permits, licenses, and approvals related to water use, including abstraction, diversion, and discharge permits. Additionally, the NWRMA is tasked with monitoring water quality, assessing water availability, and conducting research and studies to inform decision-making and promote integrated water resources management practices. The Act emphasizes

the importance of public participation and stakeholder engagement in water resources management, encouraging collaboration among government agencies, local communities, and other relevant stakeholders to ensure the equitable and sustainable utilization of water resources in Sierra Leone.

Given that the project will likely be mechanically abstracting water for its operations, MACCEM is required to acquire a Water Use Permit as stipulated in Sections 28 and 29 of the Act.

2.1.8 Factories Act, 1974

This Act addresses worker health and safety issues associated with factories.

- **Part II Section 3(v) – "any premises in which mechanical power is used in connection with the making or repair of articles of metal or wood incidental to any business carried on by way of trade or for purposes of gain."**
- **Part II Section 3(vi) – "any premises in which articles are made or prepared incidentally to the carrying on of building operations or works of engineering construction, not being premises in which such operations or works are being carried on."**
- **Part II Section 3(vii) – "any premises in which such persons are regularly employed in or in connection with the generating of electrical energy for supply by way of trade, or for supply for any industrial or commercial undertaking or of any public building or public institution, or for supply to streets or other public places.**

The Factories Act also includes machine safety, safe working conditions, sanitary amenities, periodic inspections, factory registration, and guidelines for reporting injuries, accidents and industrial diseases

Occupational health and safety issues are extremely important for operations of the cement factory which will utilize a wide array of equipment. The project will employ a considerable number of workers the Act addresses the occupational health and safety applicable to employees.

2.1.9 National Lands Policy, 2015

The National Land Policy promotes the objectives of equal opportunity and sustainable social and economic development. The principles guiding the Land Policy include (1) protecting the common national or communal property held in trust for the people; (2) preserving existing rights of private ownership and (3) recognising the private sector as the engine of growth and development, subject to national land-use guidelines and rights of landowners and their descendants.

In specific terms, the objectives of this policy are to:

- **Ensure that every socio-economic activity is consistent with sound land use practices through sustainable land use planning in the long-term national interest;**
- **Ensure the payment, within a reasonable time of fair and adequate compensation for land acquired by the government;**
- **Provide laws that will protect citizen's right to land against the government;**
- **Instil order and discipline into the land market to curb the incidence of land encroachment, unauthorized development schemes, multiple or illegal land sales, falsification and multiple registrations of land documents, land speculation and other forms of land racketeering**

The provisions of this policy governing land acquisition and fair compensation will need to be considered for this Project.

2.2 Institutional Framework in Sierra Leone

The following key institutions (i.e., MDAs and local council) currently play an important role in environment and natural resources management in Sierra Leone and are relevant to the Project's environmental and social governance.

Table 2-1: Environmental Management Responsibilities of Key Institutions in Sierra Leone

Institution	Responsibilities
Ministry of Environment and Climate Change (MECC)	The Ministry of Environment and Climate Change in Sierra Leone is responsible for overseeing and coordinating matters related to environmental protection and management in the country. Its primary role is to provide policy direction, guidance, and support to promote sustainable development practices that safeguard the environment and natural resources. The Ministry has several functions and responsibilities, including formulating and implementing policies, projects, and programs on the environment, overseeing and coordinating the activities of government agencies and other departments on environmental matters, and enforcing regulations and standards related to environmental protection.
Environment Protection Agency – Sierra Leone (EPA-SL)	The broad mandate of EPA-SL is to implement the government's environmental policies, plans, and programs and to coordinate, monitor, regulate, supervise and advise on all issues of the environment in Sierra Leone and serve as a focal point for all international environmental matters. The functions of EPA-SL include advising the Minister of the Environment on environmental policy formulation; coordination of activities of relevant sectoral stakeholders in the implementation of national environmental policy; waste management, pollution prevention and control; promotion of research, the establishment of environmental standards and public education; and environmental compliance enforcement.
Ministry of Lands, Housing and Country Planning (MLHCP)	The MLHCP's central role is to ensure the sustainable management and utilization of the nation's lands and proper planning of the nation's land resources for the country's socio-economic growth and development. The MLHCP's policies and programmes are designed to contribute towards the realization of the national goals of wealth creation, revenue mobilization and employment generation within the framework of poverty reduction.
Western Area Rural District Council (WARDC)	The Local Councils are the highest political authority in the locality and have legislative and executive powers to be exercised in accordance with the Local Government Act 2022. The council is generally responsible for promoting development in the district and the welfare of the people with the available resources and with such resources and capacity as it can mobilise from the central government and its agencies, national and international organisations, and the private sector (GoSL, 2004).
Ministry of Local Government and Rural Development (MLGRD)	MLGRD is mandated to provide an effective link between national development priorities and local-level development initiatives and to uphold a democratic local government system reflecting a decentralized approach and facilitating the provision of efficient and effective delivery of quality services at the local level (MLGRD, 2021).
Ministry of Trade and Industry (MTI)	The MTI is mandated to develop policies and programmes to stimulate local and export trade as well as to enhance private sector investment, and industrial and economic growth. The Ministry envisages a private sector-led economy, which will ensure that the socio-economic needs of the citizens are met through private sector development, job and wealth creation (DEVEX, 2021).
Sierra Leone Standard Bureau (SLSB)	The Bureau has the mandate to conduct tests on products or materials to ensure compliance with standards designated by the ISO; undertake investigations where necessary into the quality of facilities, materials and products in Sierra Leone; compile an inventory on products

Institution	Responsibilities
	requiring standardisation; prepare and distribute standards samples (SLSB, 2015). The Bureau has also established environmental standards for air quality, noise and effluent management.
National Water Resources Management Agency (NWRMA)	The object for which the Agency is established is to regulate, utilize, protect, develop, conserve, control and generally manage water resources throughout Sierra Leone; propose comprehensive plans and strategies for the utilization, conservation, development and improvement of water resources; grant water rights and collect raw water charges; initiate, control and coordinate activities concerned with the development and utilization of water resources including the supervision and regulation of - (i) the Water Basin Management Boards; and (ii) Water Catchment Area Management Committees (GoSL, 2017).
Ministry of Social Welfare (MSW)	The Ministry's mission is to ensure that social development and the rights of all Sierra Leoneans are protected and promoted in general and that those socially marginalized, disadvantaged, and less privileged including the aged, the disabled, whether as groups, individuals, family units and the needy in our communities are equitably and adequately supported.
Ministry of Labour and Social Security (MLSS)	The Ministry develops and implements policies and programmes on employment creation, workplace harmony, safety and health at work and an all-inclusive social security system. To effectively contribute to the socio-economic development of Sierra Leone by developing and implementing policies, and legislation aimed at promoting social security and social protection, preventing accidents and diseases at workplaces, promoting sound labour and employment relations, enhancing vocational guidance and counselling of job seekers, promoting the dignity of employers and employees, and enhancing the collection and maintenance of vital labour statistics on the formal and informal sectors of the economy for human resource development, employment promotion, policy formulation and development (DEVEX, 2021).

2.3 International Standards and Guidelines

In addition to mandatory national laws, the project will be guided by some Good International Industry Practice (GIIP) policies, standards, and guidelines including the IFC Performance Standards, World Bank Safeguard Policies and World Bank Group Environmental, Health and Safety (EHS) Guidelines, Summaries of these standards and guidelines are presented in the sections below.

2.3.1 World Bank Group Environmental Health and Safety Guidelines

The Environmental, Health, and Safety (EHS) Guidelines, shown in Table 2, are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary.

Table 2-2: WBG EHS Guidelines

WB EHS Guidelines	*Summary*
General (Environmental)	This guideline applies to facilities or projects that: • generate emissions to air at any stage of the project life-cycle (Air Emissions and Ambient Air Quality);

WB EHS Guidelines	*Summary*
	• consume energy in process heating and cooling; process and auxiliary systems, such as motors, pumps and fans, compressed air systems and heating, ventilation and air conditioning systems (HVAC) and lighting systems (Energy Conservation); • discharge of process wastewater, wastewater from utility operations or stormwater to the environment (Wastewater and Ambient Water Quality); • promote the continuous reduction in water consumption and achieve savings in the water use (Water Conservation); • store or handle any quantity of hazardous materials, defined as materials that represent a risk to human health, property, or the environment due to their physical or chemical characteristics. (Hazardous Materials Management); • that generate, store, or handle any quantity of waste across a range of industry sectors (Waste Management); • addresses impact of noise beyond the property boundary of the facilities (Noise); and • management approaches for land contamination due to anthropogenic releases of hazardous materials, wastes, or oil, including naturally occurring substances (Contaminated Land). This sector complements the industry-specific environmental guidance presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines by providing information about common techniques for emissions management that may be applied to a range of industry sectors.
General (Occupational Health and Safety)	Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. This Guideline provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction activities. Companies should hire contractors that have the technical capability to manage the occupational health and safety issues of their employees, extending the application of the hazard management activities through formal procurement agreements. The Occupational Health and Safety issues focus on the following: • General Facility Design and Operation • Communication and Training • Physical Hazards • Chemical Hazards • Biological Hazards • Radiological Hazards • Personal Protective Equipment (PPE) • Special Hazard Environments • Monitoring

WB EHS Guidelines	*Summary*
General (Community Health and Safety)	This section addresses aspects of project activities taking place outside of the traditional project boundaries, but related to the project operations, as may be applicable on a project basis. These issues may arise at any stage of a project life cycle and can have an impact beyond the life of the project. These issues include: • Water Quality and Availability • Structural Safety of Project Infrastructure • Life and Fire Safety (L&FS) • Traffic Safety • Transport of Hazardous Materials • Disease Prevention • Emergency Preparedness and Response
General (Construction and Decommissioning)	This section provides additional, specific guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life cycle, or due to expansion or modification of existing project facilities. Cross-referencing is made to various other sections of the General EHS Guidelines.
Environmental, Health, and Safety Guidelines for Cement and Lime Production	These guidelines provide industry specific references and Good Industrial Industry Practices (GIIPs) for cement and lime Production and their applications as required by relative policies and standards.
Worker's Accommodation: Processes and Standards: A Guidance Note by IFC and the EBRD, 2009	This guidance notes, developed jointly by IFC and the European Bank for Reconstruction and Development (EBRD), looks at the provision of housing or accommodation for workers by employers and the issues that arise from the planning, construction and management of such facilities. This publication aims to provide practical guidance to IFC and EBRD specialists, consultants and clients on appropriate policies and standards relating to workers' accommodation.
International Labour Organization (ILO) Conventions, declared in 1998, and amended in 2022	The ILO Governing Body had initially identified eight "fundamental" Conventions, covering subjects that were considered to be fundamental principles and rights at work: freedom of association and the effective recognition of the right to collective bargaining; the elimination of all forms of forced or compulsory labour; the effective abolition of child labour; and the elimination of discrimination in respect of employment and occupation. These principles were also covered by the ILO Declaration on Fundamental Principles and Rights at Work (1998)
IFC Good Practice Handbook: Use of Security Forces: Assessing and Managing Risks and Impacts, 2017	The handbook provides practical, project-level guidance for companies to better understand and implement the requirements outlined in Performance Standard 4. Chapters focus on risk assessment, managing private security, managing the relationship with public security, preparing a security management plan, and assessing allegations or incidents related to security personnel.
Stakeholder engagement: A Good Practice Handbook for Companies Doing	This handbook provides an overview of good practices for stakeholder engagement with emphasis on stakeholder groups that are not within the core operations of the businesses such as affected communities, NGOs, local institutions and any other interested or potentially impacted parties. The first part of the handbook includes effective principles and parties of

WB EHS Guidelines	Summary
Business in Emerging Markets, 2007	stakeholder engagement and useful tools for engagement execution. The second part includes how these practices are best executed and how they fit within each phase of project development.

2.3.2 IFC Performance Standards

The IFC Performance Standards 2012 are an international benchmark for identifying and managing environmental and social risk and have been adopted by many organizations as a key component of their environmental and social risk management (IFC-World Bank Group, 2012). Four (4) of the eight IFC Performance Standards are relevant to the Project. Based on the Project context, and national local level data, it is not considered that the IFC scope for PS 5 (Land Acquisition and Involuntary Resettlement) PS 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources), Performance Standard 7 (Indigenous People) and PS 8 (Cultural Heritage) are triggered for this Project.

Table 2-3: IFC Performance Standards Triggered by The Project

IFC Performance Standard	Objectives	Relevance to the Project
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts	PS 1 underscores the importance of managing environmental and social performance throughout the life of a project. PS 1 requires the client to conduct a process of environmental and social assessment and to establish and maintain an Environmental and Social Management System (ESMS), appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts. PS1 aims to: Identify and evaluate environmental and social risks and impacts of the project; Adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment; Promote improved environmental and social performance of clients through the effective use of management systems; Ensure that grievances from affected communities and external communications from other stakeholders are responded to and managed appropriately; Promote and provide means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them; and Ensure that relevant environmental and social information is disclosed and disseminated.	The project will result in environmental impacts including generation of noise and air pollution during the construction phase and operation phase amongst others. PS 1 is therefore applicable for the project. In order to comply with the IFC requirements of PS 1 an ESIA Study has been undertaken to identify the environment and social risks that may arise due to the project and recommend mitigation measures for the same. The project has also prepared an environmental and social management plan and a number of site-specific management plans including but not limited to, stakeholder engagement plan and grievance redress mechanism and waste management plan. Stakeholders and community members have been also been informed and engaged about the project.

IFC Performance Standard	Objectives	Relevance to the Project
Performance Standard 2: Labour and Working Conditions	PS 2 recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. PS2 aims to: Promote fair treatment, non-discrimination and equal opportunity of workers; Establish, maintain and improve the worker-management relationship; Promote compliance with national employment and labour laws; Protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties and workers in the client's supply chain; and Promote safe and healthy working conditions and the health of workers; and avoid the use of forced labour.	The need to protect the rights of workers involved in the MACCEM Project is triggered by PS2. This ESIA addresses the impacts related to the employment of locals and identifies mitigation measures that will be implemented by MACCEM to safeguard the rights of its workers, and ensure safe and healthy working conditions. MACCEM will need to communicate with the contractors on its HR policies and systems and ensure there is access to grievance mechanisms, health & safety, benefits and welfare provisions. to all workers. Provision of trainings and capacity building support will have to be provided to the contractors.
Performance Standard 3: Resource Efficiency and Pollution Prevention	PS 3 recognises that increased economic activity and urbanisation often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. Thus, PS3 aims to: Avoid or minimise pollution from project activities; Promote more sustainable use of resources (including energy and water); and Reduce project-related Greenhouse Gas (GHG) emissions.	This ESIA includes an assessment of the risk of pollution and includes mitigation measures that is aimed at minimisation of pollution. The requirements of PS 3 on pollution management are addressed in the impact assessment section and the environmental and social management plan and other standalone plan on air quality monitoring and waste management. Complying with the mitigation measures in the Environmental and Social Management and Monitoring Plan (ESMP) and relevant management plans will ensure that negative environmental impacts are avoided and/or reduced and the positive impacts are enhanced.
Performance Standard 4: Community Health, Safety, and Security	PS 4 recognises that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. PS4 aims to: Anticipate and avoid adverse impacts on the health and safety of affected communities during the project life from both routine and non-routine circumstances; and Ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimises risks to the affected communities.	This ESIA includes an assessment of the potential health and safety impacts that may occur due to the Project. The ESMP includes health and safety training for contractors and workers recommendations to minimise safety risks from the project specifically to surrounding communities. Noise, air quality, traffic as well as the social impact assessment, take community health and safety into account in the assessment of impacts.

2.3.3 Consideration For Other Performance Standards

PS 5 (Land Acquisition and Involuntary Resettlement): Not triggered, as the land belonged to the government and was acquired from the government for the existing bagging plant. Additionally, illegal occupants that had makeshift structures for sand selling were given cash compensations and provided another land by the Project. There is no need for involuntary resettlement

PS 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources):

The Project area is already built up with the floors paved with concrete, it does not contain sensitive ecosystems or species. Therefore, there is no need for biodiversity conservation.

PS 7 (Indigenous Peoples): The Project area is a confined place that had been used as a space for sand business and contained make shift structures as offices. There are no records of indigenous communities with the Project Area. Therefore PS 7 is not triggered.

PS 8 (Cultural Heritage): During site investigations, there are no records of archaeological or cultural sites with the Project area. Therefore, PS 8 is not triggered.

2.4 International Conventions and Agreements

2.4.1 United Nations Framework Convention on Climate Change

Sierra Leone ratified this convention on 22nd June, 1995. The objective of this convention is to regulate levels of greenhouse gas concentration in the atmosphere, so as to avoid the occurrence of climate change on a level that would impede sustainable economic development, or compromise initiatives in food production. The Parties are required to protect the climate system for present and future generations. Developing countries should be accorded appropriate assistance to enable them to fulfil the terms of the Convention. The Parties should work in cooperation, so as to obtain maximum benefit from initiatives in the control of the climate systems; The Parties are to prepare national inventories on greenhouse gas emissions, and on actions taken to remove them; formulate and implement programmes for the control of climate change; undertake cooperation in technology for the control of change in the climate system; incorporate suitable policies for the control of climate change in national plans; undertake education and training policies that will enhance public awareness in relation to climate change. The developed country Parties (and other Parties listed commit themselves to take special measures to limit their anthropogenic emissions of greenhouse gases, and to enhance the capacity of their sinks and reservoirs for the stabilization of such gases.

2.4.2 The Stockholm Convention on Persistent Organic Pollutants

This Convention was adopted in Stockholm May 2001and Sierra Leone became a signatory in August, 2001.Persistent Organic Pollutants (POPs) are chemicals that the human body cannot eliminate and as such accumulates in fatty tissues. They are bio-magnified through the food chain, and adversely affect human health and the environment. This convention recommends the elimination or restriction of the production and use of all internationally produced POPs (i.e., Industrial chemicals and pesticides). The convention also seeks the continued minimization and, where feasible, ultimate elimination of the releases of POPs, such as Dioxins and Furans. Stockpiles and waste containing POPs, will be managed and disposed of in a safe, efficient and environmentally friendly manner in accordance with international guidance and best practice.

2.4.3 The Montreal Protocol

The Montreal Protocol on substances that Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer) is an international treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. It has been revised on many occasions (seven times) is believed that adherence to the international agreement will lead to the recovery of the ozone layer by 2050.

2.4.4 Vienna Convention for the Protection of the Ozone Layer

The Vienna Convention, concluded in 1985, is a framework agreement in which States agree to cooperate in relevant research and scientific assessments of the ozone problem, to exchange information, and to adopt “appropriate measures” to prevent activities that harm the ozone layer. The obligations are general and contain no specific limits on chemicals that deplete the ozone layer. The

ozone layer protects the earth against excessive ultraviolet radiation, which could cause damage and mutations in human, plant, and animal cells.

2.4.5 Rotterdam Convention

The Rotterdam Convention is a multilateral treaty to promote shared responsibilities in relation to the importation of hazardous chemicals. The Convention promotes the sharing of information and calls on exporters of hazardous chemicals to use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans. Parties can decide whether to allow or ban the importation of chemicals listed in the Convention, and exporting countries are obliged to ensure compliance by producers within their jurisdiction.

2.4.6 Convention on Wetlands of International Importance - Ramsar Convention

The objectives of the Ramsar Convention are to ensure the wise use of wetlands through stemming the progressive encroachment on and loss of wetlands now and in the future, while recognizing their fundamental ecological functions, and economic, cultural, scientific, and recreational value.

The Ramsar Convention on Wetlands (Ramsar) signed by Sierra Leone on 13 December 1999, became effective on 13 April 2000. Signatory countries to the Ramsar Convention agree to:

Include conservation of wetlands in land use planning throughout the country, including the promotion of ‘wise use’ of wetlands;

Establish nature reserves within wetland areas;

Promote training in the fields of research, management; and consult with other signatory countries about implementation of the convention especially in areas of shared wetlands, shared water systems, and shared species.

3 PROJECT DESCRIPTION

3.1 Site Location and Conditions

The project is situated on a 10.9-acre plot of land adjacent to the Hastings Airstrip and the Jui-Masiaka Highway in Waterloo Rural, within the Western Area Rural District. It is located along the northeastern coast of the Freetown Peninsula at latitude 8°23'18.89" North and longitude 13°7'47.39" West (Figure 3-4).

The site is on the northern side of the Freetown-Masiaka Highway, approximately 15 km from central Freetown. This highway is the primary road linking Freetown, the capital city, to the Northwestern Province, and it serves as a gateway to the other three provinces. The site can also be accessed through the country's main harbor, Queen Elizabeth II Quay, located 14 km to the north in Freetown. From there, Bai Bureh Road connects the Masiaka Highway to the Lungi Airport, which is 25 km to the north along the Port Loko-Freetown Highway.

The road network leading to the project site is well-maintained and paved, bordering both Freetown and the Western Area Rural District. During the site assessment, some construction activities were already underway, having started in November 2022, with some of the civil works still ongoing (see Figure 3-1 below). At this stage, the site had been cleared, with only sparse grasses growing due to the ongoing seasonal rains. The land was levelled, and the terrain is generally flat. However, the surrounding areas show a natural overland flow to the east, leading into a nearby estuary, located about 2.5 km from the site.

A time series analysis of Google Earth imagery from December 2021 reveals that nearly 60% of the site had been used as a stockpile ground by local sand and aggregate traders. The remaining portion contained three warehouse structures and open space.

Previously, the site had served as a parking area for dump trucks, sand, and stone, managed by the Drivers Union. MACCEM, in collaboration with the Ministry of Transport and Aviation and the Ministry of Lands, reached an agreement with the Drivers Union to purchase the land and offer compensation in the form of another land parcel prior to the project's commencement. The replacement land is located at Kissy Town, Waterloo, off the Waterloo-Masiaka Highway, 12 km from the Hastings Project Site.

MACCEM prioritized a transparent and fair process for land acquisition and resettlement. This included engaging with affected stakeholders, such as the Drivers Union, and ensuring that appropriate compensation was provided to the land's previous occupants adhering to all national principles of community consultation, stakeholder engagement, and compensation for displaced persons.

Subsequently, MACCEM signed an agreement with the Government of Sierra Leone (GoSL) to utilize the site for a new cement factory. This factory will meet market demand and help alleviate congestion in the centre of Freetown. The GoSL supported the initiative, and a lease agreement was signed on June 28, 2022, between the GoSL and MACCEM Industries. The agreement is registered under Volume 122, Page 79 in the books of the Registrar General's Office.

Figure 3-1: Existing Site Condition

Figure 3-2: Project Site Access 1

Figure 3-3: Project Site Access 2


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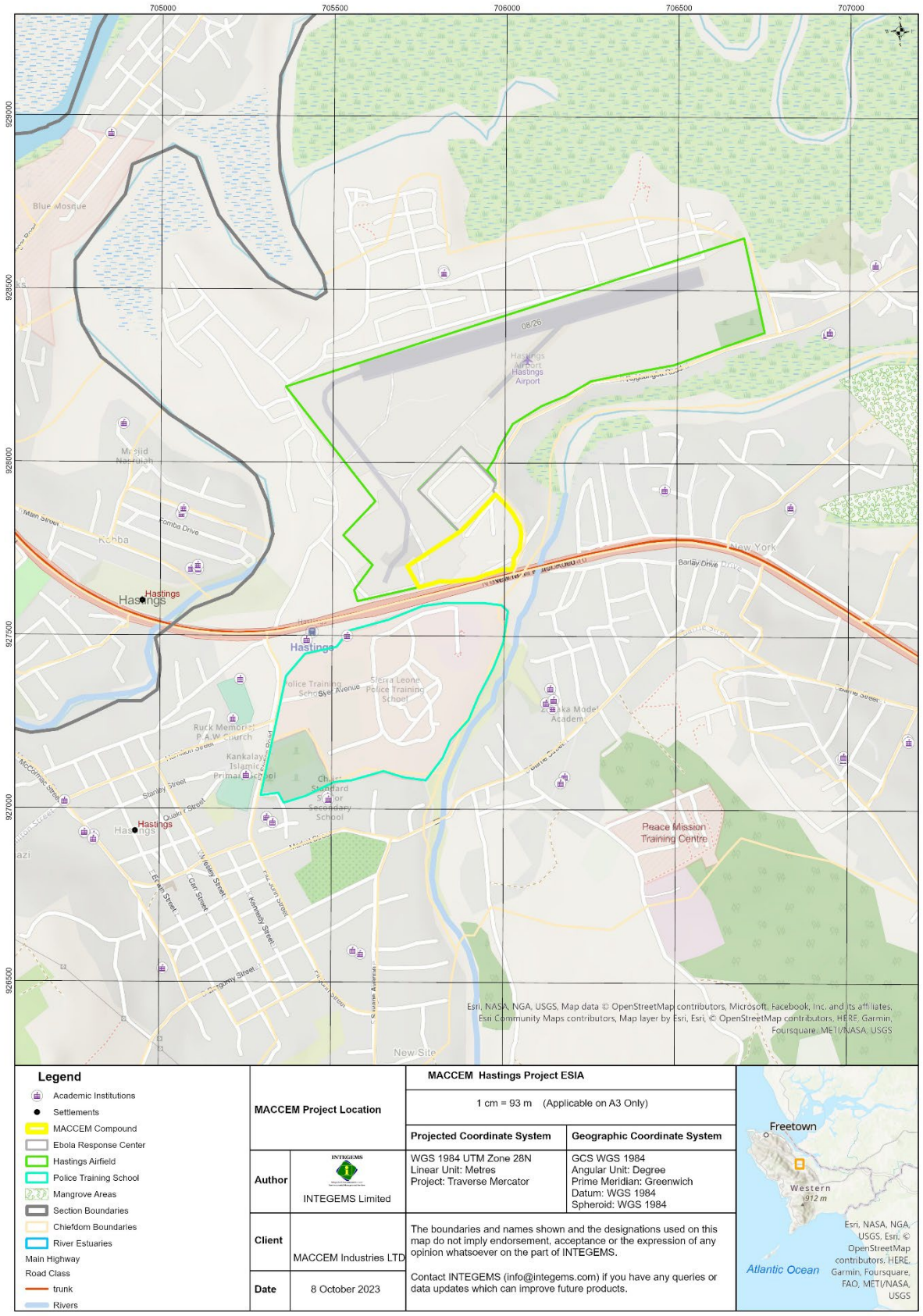
Figure 3-4: Project Location Map



3.2 Project Activities

3.2.1 Development Phase

Civil works are currently ongoing at the site, including ground levelling and the erection of concrete structures for the production machinery and storage facilities. The remaining phases of construction involve building additional warehouses, completing the silo, performing roadworks, installing key plant components and machinery, and establishing the electrical distribution network for the cement factory and its associated facilities. The remaining construction activities will primarily focus on site preparation. This will involve clearing the sparse vegetation cover to prepare for the structures, followed by further levelling, grading, and trenching for the foundations. Once the foundations are in place, the next step will be the erection of steel or concrete-type structures. After the structures are complete, machinery installation, along with cabling and piping, will follow. Additional landscaping will include the creation of a concrete road network that will connect the factory site to the existing highway.

The construction materials required for the project include locally sourced gravel and sand from licensed suppliers and quarry sites. Cement for the concrete base and structures will be sourced from MACCEM's facility at Granville Brook. Water for concrete production will be drawn from the national mains supply and two site boreholes. Other industrial materials will be imported through the port and transported to the site via haulage trucks. Additional materials required for the project include diesel fuel, lubricants, and engine fluids. The construction equipment involved includes a mobile concrete batching plant, concrete mixers, concrete vibrators, excavators, dump trucks, backhoes, air compressors, welding plants, and a 5/10 KVA power generator.

3.2.2 Plant Specifications

3.2.2.1 Overview

MACCEM opted for the Plug & Grind SUPREME® modular grinding plant and peripheral unit, developed by CEMENGAL, S.A. The plant is designed to provide efficient cement grinding with a capacity of up to 80 tons per hour of CEM II (Limestone Cement). This plant has particularly suited the operations of MaCCEM and its Freetown, Sierra Leone location. The plant only processes clinker (imported or sourced externally) into cement via grinding, blending with additives (in this case, gypsum and limestone), and packaging.

3.2.2.2 Key Features

- **Modular Design**: The plant's modularity allows for easy transportation, assembly, and scalability, making it adaptable to various site change in our conditions.
- **Cement Grinding Station**: The plant includes a comprehensive cement grinding station, the plant will grind imported clinker with gypsum, limestone to produce finished cement. The plant is composed of several modules:
    - **Feed Hoppers: For the storage and feeding of clinker and other raw materials.**
    - **Dosing System: Utilizes weigh feeders to ensure accurate material mixing according to the required cement type.**
    - **Ball Mill: Features a two-chamber design with a central drive system rated at 2,700 kW, operating at a speed of 16.5 r.p.m.**
- **Material Handling**: Equipped with a bucket elevator and conveyor belts for efficient transport of raw materials and finished products.
- **Dedusting System**: A dedicated system to minimize dust emissions during operation, ensuring compliance with environmental standards.
- **Mill Process Filter**: This module recovers fine materials suspended in the air, contributing to reduced environmental impact.

3.2.2.3 Performance Guarantees

- **Cement Composition**: The performance test cement consists of 55% clinker, 40% limestone, and 5% gypsum.

- **Fineness**: The target fineness for the cement is set at 3800 Blaine.
- **Production Rate**: The plant guarantees a production rate of 80.0 tons per hour, with a +/- 2% margin of error. However, characteristics such as strength values and chemical composition are not guaranteed under the contract between MACCEM and the manufacturers.

3.2.2.4 Technical Specifications

- **Belt Conveyor**:

1. **Width: 650 mm**
2. **Capacity: 180 t/h**
3. **Speed: ≤1.5 m/s**
4. **Installed Power: 5.5 kW**

- **Bucket Elevator**:

- **Length between shafts: 18 m**
- **Capacity: 180 t/h**
- **Installed Power: 22 kW**

- **Diverter Valve**:

- **Size: 500x500 mm**
- **Drive Type: Pneumatic**

- **Spillage Conveyor**:

- **Installed Power: 0.75 kW**

3.2.3 Operation Phase

The plant shall engage in the full grinding of cement using clinkers, gypsum and limestones. The plant will bag the cements in 25 kg and 50 kg packages and transported to customers, warehouses as will be necessary.

3.2.3.1 Discharge of Raw Materials at Port

The raw materials required for cement grinding, primarily clinker, limestone, gypsum, and other supplementary materials are will imported from international suppliers and local suppliers in some cases. These materials arrive at the port via sea freight in bulk carriers or specialized vessels. The steps involved in the discharge process are as follows:

5. **Arrival of Materials: The bulk carriers dock at the port terminal, where the materials are offloaded.**
6. **Unloading: Raw materials are unloaded using equipment such as cranes and grabbers. They are loaded into dump trucks.**

3.2.3.2 Transportation to Site

Once unloaded from the ship, the raw materials will be transported to the cement plant for further processing. The transportation will occur from Queen Elizabeth II Port in Freetown to MACCEM's site near Hastings Toll Gate via Bai Bureh Road, covering a distance of approximately 18 km in dump trucks. The transportation infrastructure will be carefully managed to avoid delays and ensure a steady flow of raw materials to the plant.

3.2.3.3 Storage at the Plant Site

7. **Once the raw materials arrive at the plant, they will be stored in dedicated storage areas designed to preserve the quality of the materials and ensure easy access for the production process. The storage facilities are as follows:**
8. **Limestone Storage: Since limestone is a primary raw material, it will be stored in a warehouse with a capacity of 1,000 sqm on-site. This warehouse is designed to allow for easy feeding into the crushers for further processing.**

9. **Clinker Storage: Clinker, another primary raw material, will be stored in a separate warehouse in large stockpiles, ensuring efficient handling and access for cement production.**
10. **Gypsum Storage: Gypsum, which controls the setting time of the cement, will also be stored in a dedicated warehouse to maintain its quality and accessibility for the production process.**

3.2.3.4 Packaging and Distribution

Once the cement is processed, it will be packaged and distributed to customers. Packaging and distribution will be done:

11. **Packaging**
    - **Bags: cement will be packaged into 25 kg and 50 kg bags. These bags will be filled using the automatic bagging machines and sealed for shipment.**
    - **Bulk Cement: For large-scale users cement will be transported in bulk via tankers and pneumatic trucks.**
12. **Distribution to Customers**
    - **Transportation: The packaged or bulk cement is loaded onto trucks for distribution to construction sites, warehouses, or retail outlets.**
    - **Logistics Management: A sophisticated logistics network will ensure timely delivery to customers, minimizing delays in construction schedules. Distribution will be coordinated using real-time tracking systems to optimize routes and delivery times.**

3.2.4 Power Supply

At the current bagging plant, the main power supply comes from the national grid, supplemented by a diesel-powered backup generator due to the inconsistent electricity supply in the country. However, the project plans to install an initial 1 MW of solar energy and source an additional 1.6 MW from the national grid and the backup generator to supply power to the grinding and bagging plants. Over the course of three years, the project intends to transition to sourcing all of its power from solar energy.

3.2.5 Water Supply

The clinker processing will utilize a dry process, which does not require water. Therefore, water for the project will only be needed for construction and domestic use. To meet this demand, water will be sourced from the Guma Valley Water Company (GVWC), the national agency responsible for water supply in the Western Area. Additionally, the project plans to abstract water from two boreholes for domestic use. The estimated water demand for the operation is approximately 10,000 liters over a 24-month period.

3.2.6 Waste Management

Construction waste will be sorted into skips or trash cans and removed by a licensed waste contractor for disposal at an approved dumpsite. Any hazardous waste will be disposed of at an appropriate facility. During operations, waste will be limited to off-spec clinker and domestic waste. This waste will also be sorted and collected in bins located at strategic points on-site, to be disposed of by licensed waste contractors. Off-spec clinker will be segregated and evaluated for recycling, where feasible. Adequate facilities will be provided on-site for the segregation, collection, and storage of various types of waste.

3.2.7 Workforce

During the peak construction phase, it is estimated that the project will require approximately 250 to 300 skilled, semi-skilled, and unskilled labourers. As reported, these workers will be sourced from the local labour pool, depending on their skills and qualifications. During the operational phase, around 40 part-time employees and technicians will be employed on-site. These figures will be finalized once the project components and other technical details are confirmed by MACCEM.

3.2.9 Transportation

The raw materials required for cement production - primarily clinker, limestone, gypsum, and other supplementary materials will be sourced from both international and local suppliers. International materials will be transported to the port via sea freight in bulk carriers or specialized vessels, while local materials will be delivered in haulage trucks.

Upon arrival at the port terminal, the materials will be offloaded using cranes and grabbers. They will then be loaded into dump trucks and transported to the cement plant for further processing. The transportation route will follow the Bai Bureh Highway, approximately 18 km from the port to the factory. The transportation infrastructure will be carefully managed to avoid delays and ensure a steady flow of raw materials to the plant. It is anticipated that there will be around 1,000 truck trips per month through Freetown

3.3 Alternative Analysis

The EPA Act mandates that all Environmental Impact Assessments (EIAs), including this ESIA, must identify and describe alternatives to the proposed activity that are both feasible and “reasonable.” These alternatives may include various categories, such as location alternatives, types of activities, design or layout alternatives, technology alternatives, and operational alternatives. Considering project options and alternatives is a fundamental requirement during the planning phase of any project. This process helps to avoid or reduce adverse environmental and social impacts while maximizing or enhancing the benefits of the project.

The consideration of alternatives is an integral part of the detailed design process and the identification of mitigation measures. As a result, alternatives have been thoroughly assessed during both the design and ESIA processes. Several options have been considered for this project, which are outlined below. However, it should be noted that the assessment of alternative locations for the cement factory is outside the scope of this ESIA, as construction of the project began before the commencement of this ESIA study. Therefore, the alternatives analysed are limited to business models, including:

- **No Project Option**
- **Import Bulk Cement and Bagging**
- **Importation of Pre-Bagged Cement.**

3.3.1 Alternative 1: No Project Option

This alternative suggests that the proposed project should not be executed, which would undermine the objective of increasing domestic production and conserving foreign exchange. Given the project's potential to strengthen local industry and reduce reliance on imports, this alternative was ultimately rejected.

3.3.2 Alternative 2: Import Bulk Cement and Bag

This option is presently being practised by several companies in Sierra Leone including Dangote Group and this project proponent – i.e., MACCEM Industries (SL) Limited. However, this option is not acceptable because most of the employment opportunities available to the people from the process of cement production will be lost to the country where finished bulk cement will be imported from. In addition to this, the loss of foreign exchange to the exporting country is a disadvantage. For these reasons, this option is rejected.

3.3.3 Alternative 3: Importation of Bagged Cement

Importing bagged cement will deny the immediate locality a wider range of employment opportunities. Also, this would not be a sustainable venture considering increasing foreign exchange volatility and customs tariffs, which will expose the country to exogenous shocks. The option of importing bagged cement will have the least impact of releasing dust into the environment but it is no longer economically viable and it is therefore not acceptable.

3.3.4 Alternative 4: Production from Raw Materials (Preferred Option)

The Production of cement entails crushing, grinding, firing/blending of basic raw materials at different stages of production. The proposed cement plant is expected to provide about 1,600 jobs in all categories. In addition, there is the transfer of technology associated with installation, operation of the equipment and maintenance and savings on foreign exchange, hence this alternative was chosen.

4 ENVIRONMENTAL AND SOCIAL BASELINE

4.1 Physical Environment

4.1.1 Climate

Sierra Leone typically has a tropical climate, characterized by distinct wet and dry seasons. The wet or rainy season extends from May to October and the dry season from November to April. Both seasons may have some variations in their commencement and duration. The wet season is dominated by the southwest tropical maritime monsoon which is a mass of moisture-laden air that originates over the south-Atlantic Ocean. The rains fall steadily in the wet season with the heaviest in the months of July and August. The wet season has an average rainfall of 3,000 mm, with coastal and southern areas receiving from 3,000 to 5,000 mm annually and inland areas between 2,000–2,500 mm in the drier areas of the north-west to the north–east.

The dry season is mostly dusty and hot Harmattan winds and drought conditions. However, there is pronounced dry season from November to March when flows may be sufficiently reduced to be a constraint. The temperatures are consistently high throughout the country, roughly averaging from 25–27°C, with slightly lower temperatures (22–25°C) during the wet season. Diurnal temperatures vary from 25ºC to 34ºC although they could be as low as 16ºC at night during the Harmattan. The average annual temperature has increased by 0.8ºC since 1960. Data is limited but available data show significantly increasing trends in the frequency of 'hot' nights. The humidity, like the temperature, is usually high as a result of the heavy rains coupled with high temperature and maritime influences. Humidity rises up to 93% in the wet season and decreases inland to about 47% as the rainfall declines.

The wet season is generally dull and cloudy with a mean monthly solar radiation of 280 cal/ cm^2/day, mean hours of sunshine is 3 hours/day in July and August, and pan evaporation generally less than 2.0 mm/day, due to high diurnal humidity. From 1991 to 2015, a mean annual rainfall of about 2,427 mm was recorded, with the highest annual rainfalls in the months of July and August (WBG, 2018).

While there is no clear trend, since 2016 the annual rainfall has been higher than the historical average. Historical rainfall averages for August in Freetown indicate that 530mm can fall within August. On the 14th August 2017 alone, the National Oceanic and Atmospheric Administration (NOAA) satellite recorded between 25- 50mm of rainfall across the area encompassing Freetown, i.e., equivalent to the rainfall that might fall in the winter rainy season over an entire month in England.

Sierra Leone, particularly Freetown is therefore exposed to a range of climate-related challenges, including rising temperatures, changing precipitation patterns, and heightened risk of climate-related extreme weather events. In a high emission, fast-warming scenario, average temperatures could increase to 28.9°C by 2070. Average rainfall is expected to increase, and already heavy precipitation rates are expected to become more volatile and unpredictable, heightening the risks associated with heavy rainfall and drought events.

Floods are most common in the rainy season between May and November but can occur at any time. Flood events in Freetown can be particularly damaging due to the city's steep terrain, which can cause rapid 'flash' flood events in the natural river channels. In low lying, coastal areas, floods, which coincide with storm events or high tides, have the potential to become more widespread. The natural river channels, valleys, river deltas and broad low-lying near coastal areas of the city have been highlighted as high flood hazard zones. Flooding in the natural channels is mainly due to rapid runoff of surface water made worse by deforestation of upper catchment areas. In many parts of Freetown, river drainage channels are blocked by debris and/or are severely narrowed by solid waste. Flooding risk in Freetown is concentrated where urban development has occurred along the natural river channels and their floodplains and on the low-lying areas close to the coast. (CITIES C40, 2022)

It is also noted that there is the potential for wet season rainfall-related flooding to be exacerbated by the impacts of climate change. Heavy rainfall and flooding can pose several climate risks to a project and can disrupt operations, damage equipment, and contaminate raw materials. This can lead to production delays and increased costs for repairs and replacements. The risk of flooding can be planned for by a consideration of predicted climate change in the drainage system design. Mitigation through increased storm drainage capacity should be included in the project design to address this.

The project should consider climate change related temperature change impacts on engine efficiency and implications for greenhouse gas emissions. Data relating to engine efficiency should be considered in the selection of the engines to be used. Selecting an engine with a high threshold point over which efficiency decreases occur, and/or exhibit a slow rate of efficiency decline will ensure that output can be maintained as near as possible to the optimum, and thus minimise operation costs and emissions.

4.1.2 Ambient Air Quality

4.1.2.1 Methodology

The air quality baseline study was undertaken to describe the existing air quality condition of the Project area in three (3) locations within and around the proposed project site. The parameters monitored during the study include Nitrogen dioxide (NO_2), Sulphur dioxide (SO_2), Carbon Monoxide (CO), Particulate Matter with an aerodynamic diameter of less than 10 micrometres (PM_{10}), and Particulate Matter with an aerodynamic diameter less than 2.5 micrometres ($PM_{2.5}$). Meteorological parameters such as Temperature and Relative Humidity were also monitored. These parameters were selected based on the expected air pollutants to be emanated from the Project.

The monitoring was designed to record the average concentrations of each pollutant in the air at each monitoring location over at least six hours period. The air quality monitoring was undertaken using a portable air quality monitor Aeroqual Series 500 sensor, which enables accurate short-term fixed real-time surveying of common outdoor air pollutants. The sensors are held within an interchangeable cartridge (“head”) that attaches to the monitor base which can be removed and replaced in seconds, allowing users to measure as many gases as desired. The air quality monitoring equipment was mounted at a height of about 1.5 metres from ground level and sufficiently away from the disturbance or direct obstacle from the source(s) under consideration to ensure that the air that was monitored is representative of the ambient air in the monitoring location.

The coordinates of the air quality monitoring locations were determined using GPS and site characteristics were documented as shown in the table below. All measurement locations were subjected to site access and security constraints.

4.1.2.2 Air Quality Monitoring Locations

The air quality monitoring was undertaken in three (3) locations within and around the proposed project site. The locations are Project Site, the Community and the Police Training Centre.

Generally, the selection of the locations is based on various factors such as site topography, prevailing wind direction, the layout of the proposed project components, the location of the nearest sensitive receptors and good international industry practices and guidelines. The air quality monitoring locations are shown in the table below.

Table 4-1: Air Quality Monitoring Locations

Site ID	Site Name	Latitude	Longitude
MACCEM ANMP 01	Project Site	8.38878	-13.13003
MACCEM ANMP 02	Community	8.38942	-13.12871
MACCEM ANMP 03	Police Training Centre	8.38700	-13.13092

4.1.2.3 Existing Air Emission Sources

Ambient air quality at the Project Area is generally influenced by activities and sources such as the windblown dust from unpaved roads, and vehicular movements especially during the dry season. Emissions from equipment and machinery used in transportation and industrial operations also contribute to degrade the air quality in the project area. These impacts may affect the environment and human health.

The potential receptors are residents of the Rolangba Community (24.9m), the wetland (100m) and police training school (147.6m) from the site boundary.

4.1.2.4 Results and Analysis

Table 4-2: Daily Average Ambient Air Quality Concentration

Locations	$PM_{2.5}$, µg/m³	PM_{10}, µg/m³	NO_2, µg/m³	CO, µg/m³	SO_2, µg/m³	Temperature, °C	Relative Humidity, %
SLSB Standard Values, µg/m3	**25**	**50**	**200**	**30,000**	**500**	**NA**	**NA**
WHO Guideline Values, µg/m3	**25**	**50**	**200**	**3,000**	**20**	**NA**	**NA**
Project Site	2.7	5.4	42.6	0.0	0.0	29.5	77.9
Rolangba Community	3.1	4.1	41.6	0.0	0.0	30.1	78.2
Police School	6.2	12.0	42.7	7.4	7.4	31.3	73.1

In studying the receiving environment, the following was observed:

- **The study area is characterised by industrial and commercial facilities with some residential dwellings interspersed.**
- **Several sources of air pollutants in the area includes domestic and commercial-scale power generators, road traffic emissions (i.e., exhaust and non-exhaust emissions) and emissions from industrial operations.**
- **Sensitive receptors within the area residences, schools, places of worship and employees of various entities within the Project Area.**
- **Temperatures within the study area ranged from 29.5 ºC to 36.6 ºC with an average of 34.5 ºC over the monitoring period.**

4.1.2.4.1 Particulate Matter

Particulate Matter (PM) are airborne particles that include dust, smoke and soot. PM can either be emitted naturally (e.g., windblown dust from unpaved roads) or through human activity (e.g., stack emissions). PM is defined by size, with coarse particles being between 2.5-10 microns (µm), fine particles less than 2.5 µm, and ultrafine particles less than 0.1 µm.

PM has adverse effects on humans, such as respiratory illnesses (asthma, bronchitis) or cardiovascular diseases and is also considered to be carcinogenic. It can also affect vegetation by inhibiting the plant's photosynthetic properties; by coating the leaves; thereby blocking the penetration of natural light and hindering plant growth.

The PM values recorded during the monitoring were below the SLSB and WHO guideline values implying the air quality is relatively good.

4.1.2.4.2 Sulphur Dioxide

Sulphur dioxide (SO_2) is a colourless gas and is characterised as having a sharp, irritant odour. It is a primary pollutant, which can react easily with other substances to form secondary pollutants such as sulphur trioxide and sulfuric acid, and many others. Industrial processes from human activities that contain sulphur, such as the combustion of coal, oil or gas are the main emission sources of SO2.

When SO_2 is inhaled, it has a damaging effect on the human respiratory system causing coughing and shortness of breath. Either long-term exposure or exposure to a large dose for a short term can result in chronic respiratory disease and the risk of acute respiratory illness. With regards to the impacts on vegetation, SO_2 can inhibit the photosynthetic properties of plants and in some cases, eliminate more sensitive species on the ecosystem level with continuous exposure.

Zero SO_2 concentration were recorded in all monitoring locations. This could be attributed to the absence of SO_2 pollutant sources during the monitoring.

4.1.2.4.3 Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a naturally forming gas, characterised as having an irritating odour. Small quantities can be produced by plants, soil and water, but anthropogenic activities, such as the

combustion of fossil fuels and biomass, are the sources of most NO_2. Nitrogen dioxide is one of a group of gases called nitrogen oxides (NOx). While all of these gases are harmful to human health and the environment, NO_2 is of greater concern. It primarily gets in the air from the burning of fuel in vehicles, power plants, and off-road equipment.

Human respiratory tract irritation represents a direct effect of NO_2 exposures. Due to it being relatively insoluble (relative to SO_2), deep penetration of NO_2 into the lungs can cause potential tissue damage. Effects of NO_2 exposure include alveolar tissue disruption and obstruction of the respiratory bronchioles. Long-term effects of exposure include increased potential for lung infections.

The NO_2 values recorded in all monitoring locations are relatively low compared to the SLSB and WHO guideline values of 200 µg/m^3. The low NO_2 concentration recorded during monitoring could be attributed to less activities that could generate significant NO_2 concentration.

4.1.2.4.4 Carbon monoxide (CO)

The CO values recorded were negligible comparing to standard emission limits. CO values ranged from 0.7 – 1.6 µg/m^3 comparing these values to 3,000 µg/m^3 permissible emission limit set by SLSB and WHO makes CO less of a concern within the study area.

4.1.2.4.5 Temperature and Relative Humidity

Air pollutants are emitted into the atmosphere from a variety of sources and the concentration of pollutants in the ambient air depends not only on the quantities that are emitted but also the conditions and ability of the atmosphere, either to absorb or disperse these pollutants. Understanding the behaviour of meteorological parameters (atmospheric wind speed, wind direction, pressure and temperature) is important because the atmosphere is the medium via which air pollutants are transported away from the source. The relative humidity is inversely proportional to air temperature, which means as air temperature increases, air can hold more water molecules therefore its relative humidity decreases.

The average temperature and humidity values recorded during the monitoring are representatives of the dry season and the weather conditions during the monitoring period.

4.1.2.5 Emission Estimates

This section provides detailed estimates of the emissions of sulphur oxides (SOx), nitrogen oxides (NOx), and particulate matter (PM) during the operation of the Plug & Grind Supreme Modular Grinding Plant. The calculations are based on industry-standard emission factors and specific operational details of the plant.

Plant Description:

The Plug & Grind Supreme Modular Grinding Plant & Peripheral equipment has an estimated capacity of 80 tph of CEM II (Limestone Cement). However, MACCEM intends to have an output of 600,000 tons of CEM II cement annually. The plant includes a hot gas generator with a thermal capacity of 10,000 kcal/kg and auxiliary equipment powered by diesel fuel.

SOURCES OF EMISSION FROM THE PLANT

1. Hot Gas Generator

- **Sox Emissions**: Sulphur oxides are emitted when diesel fuel is burned to generate heat.
- **NOx Emissions**: Nitrogen oxides are produced due to the high-temperature combustion process.
- **PM Emissions**: Minimal compared to other parts, but can occur from incomplete combustion.

2. Grinding Mill

- **PM Emissions**: Significant amount of particulate matter is generated from the grinding of clinker and other raw materials into fine powder.

3. Material Handling Systems (Conveyors, Elevators, Hoppers)

- **PM Emissions**: Dust is emitted during the transfer, storage, and handling of raw materials and finished cement.

4. Diesel-Powered Auxiliary Equipment

- **Sox Emissions**: From the combustion of diesel fuel.
- **NOx Emissions**: From the high-temperature combustion of diesel fuel.
- **PM Emissions**: From the exhaust of diesel engines and machinery.

5. Packing and Bagging Section

- **PM Emissions**: Dust is emitted during the packaging and bagging of cement into sacks for distribution.

Table 4-3: Summary of Emission sources from the Plug and Grind Modular Plant

Plant Section	SOx Emissions	NOx Emissions	PM Emissions
Hot Gas Generator	Combustion of sulphur-containing fuels	High-temperature combustion	Minor PM from incomplete combustion.
Grinding Mill	-	-	Grinding of clinker, gypsum and limestones
Material Handling Systems	-	-	Transfer, storage, and handling dust.
Diesel Auxiliary Equipment	Combustion of diesel fuel	Combustion of diesel fuel	Diesel exhaust.
Packing and Bagging	-	-	Packaging and bagging dust.

ASSUMPTIONS

The following projections are based on several key assumptions. These assumptions must be maintained to ensure the accuracy and reliability of the projected outcomes:

Power Supply

The plant will operate using a diesel-powered generator throughout the entire year.

Production Capacity

The production capacity of 600,000 tons of cement will be consistently met without significant deviations. This means production should neither significantly exceed nor fall below the 600,000-ton threshold.

Data Accuracy

The provided data will remain accurate and unchanged over the period under consideration. Any changes in the data could affect the validity of the projections.

Also, that the following data remains accurate:

Table 4-4: Assumptions for emission calculations

Aspects	Assumption	Source
Production Capacity	600,000 tons of CEM II cement per year.	MACCEM
Composition of CEM II Cement	55% clinker 40% limestone 5% gypsum	MACCEM
Energy Content of Diesel Fuel	42.8 MJ/kg.	Standard industry value for the lower heating value (LHV) of diesel fuel.

Aspects	Assumption	Source
Thermal Capacity of Hot Gas Generator	10,000 kcal/kg.	Manufacturer Specifications
Emission Factors for SOx, NOx, and PM	1.6 kg Sox per ton of diesel fuel consumed. 3 kg NOx per ton of diesel fuel consumed.	U.S. Environmental Protection Agency (EPA) and European Environment Agency (EEA) standard emission factors.
Emission Factors for PM	0.1 kg PM per ton of clinker and 0.05 Kg PM per ton of cement produced.	U.S. Environmental Protection Agency (EPA) and European Environment Agency (EEA) standard emission factors.
Diesel Fuel Density	0.84 kg/litre	U.S. Environmental Protection Agency (EPA) and European Environment Agency (EEA) standard emission factors.
Conversion Factors	1 kcal = 0.004184 MJ.	Standard conversion factor used in energy calculations.

Calculation Steps and Justifications

- **Production Calculations**: Based on provided production rate and composition.
- **Emission Calculations**: Using standard emission factors and conversion methods.
- **Energy Consumption**: Calculated using the thermal capacity of the hot gas generator and the energy content of diesel.

1. Annual Production Capacity

- **Total Production**: 600,000 tons of CEM II cement per year.

2. Composition of CEM II Cement

- **Clinker**: 55% of 600,000 tons = 330,000 tons/year.
- **Limestone**: 40% of 600,000 tons = 240,000 tons/year.
- **Gypsum**: 5% of 600,000 tons = 30,000 tons/year.

3. Fuel Consumption and Emission Factors

Hot Gas Generator

- Thermal Capacity: 10,000 kcal/kg.
- Total Cement Production: 600,000 tons/year.
- Energy Conversion:10,000 kcal/kg × 0.004184 MJ/kcal = 41.84 MJ/kg

Total Energy Required: Energy conversion × annual production × thermal capacity

= 41.84 × 600,000 × 10,000

= **25,104,000,000 MJ/year**

Diesel Energy content: 42.8 MJ/kg.

Fuel Consumption:	Total Energy Required × Diesel energy content 25,104,000,000 / 42.8 = 586,168 Kg/year **= 586.168**

Calculation of emissions from Hot Gas Generator (Using Diesel fuel)

SOx	Annual fuel consumption × Sox diesel emission factor = 586,168 tons/year × 1.6 kg/ton = **937.87 Kg/year**
NOx	Annual fuel consumption × NOx diesel emission factor = 586,168 tons/year × 1.6 kg/ton = **1,758.50 Kg/year**

Calculation of Emissions from Auxiliary Equipment (using diesel fuel)

Diesel consumption	0.5 litres/ton of cement
	Fuel consumed × Annual production = 0.5 litre/ton × 600,000 tons = 300,000 litres/year
Annual diesel consumption	Converting to tons; $\frac{\text{annual consumption} \times \text{fuel density}}{1000}$ $\frac{300{,}000\,\frac{\text{litres}}{\text{year}} \times 0.84\,\frac{\text{kg}}{\text{litre}}}{1000}$ = 252 tons
SOx Emissions from auxiliary equipment	Annual consumptions(tons) × Emission factor of SOx = 252 tons/year × 1.6 Kg SOx/ton = 403.2 kg/year
NOx Emissions	Annual consumptions(tons) × Emission factor of NOx = 252 tons/year × 3 Kg NOx/ton = 756 Kg/year

Particulate matter (PM) Emissions from the Grinding Plant

Emission factor: Clinker Grinding	0.1 kg PM per ton of clinker
Emission factor: For Cement Bagging	0.05 kg PM per ton of cement
Annual PM emissions during grinding	Emission factor × Annual Production = 0.1 kg PM/ton × 600,000 kg/year

	= 60,000 kg/year =60 tons/year
Annual PM emissions during bagging	Emission factor × Annual Production = 0.05 kg PM per ton of Cement × 600,000 tons/year = 30,000 kg/year = 30 tons/year

Table 4-5: Summary of Emissions from for the MACCEM plant

Emission Source	SOx Emissions (kg/year)	NOx Emissions (kg/year)	PM Emissions (Particulate Matter) (kg/year)
Diesel Fuel Consumption	403.2	756	-
Hot Gas Generator	937.87	1,758.5	-
Clinker Grinding	-	-	60,000
Cement Bagging			30,000
Total	**1,341.07**	**2,514.5**	**90,000**

Aligning Emissions Calculations to IFC EHS Guideline for Cement Manufacturing Units

This section presents the revised emissions calculations for the plant, ensuring full alignment with the IFC EHS Guidelines for Cement Manufacturing. The calculations convert emissions data from mass-based units (kg/year) to concentration-based units (mg/Nm³) for comparison with IFC limits.

Assumptions

Total diesel consumption (hot gas generator + auxiliary equipment):	838.168 tons/year
Exhaust gas from diesel combustion (EEA Standard Value):	14.3 Nm³/kg diesel
Total emission (Nm³/year):	= 838,168 kg/year × 14.3 Nm³/kg diesel = 11,985,802 Nm³/year
Converting from kg/year to mg/Nm³ formula: Concentration (mg/Nm³) =	$\frac{Total\ Exhaust\ Gas\ Flow\ \left(\frac{Nm^3}{year}\right)}{Total\ Emission\ \left(\frac{mg}{year}\right)}$
Where:	
Total Exhaust Gas Flow (Nm³/year)	= Total exhaust gas flow rate (Nm³/h) × Total operational hours per year
Total emission (mg/year):	Emission (kg/year) × 1,000,000

Total SOx emissions (in mg/year) = 1,341.07 × 1,000,000

= 1,341,070,000 mg/year

SOx Concentration $= \frac{1{,}341{,}070{,}000 \text{ mg/year}}{11{,}985{,}802 \text{ Nm}^3\text{/year}}$

≈ 111.88 mg/Nm3

Total NOx emissions (in mg/year) = 2,514.5 × 1,000,000

= 2,514,500,000 mg/year

NOx Concentration $= \frac{2{,}514{,}500{,}000 \text{ mg/year}}{11{,}985{,}802 \text{ Nm}^3\text{/year}}$

≈209.72 mg/Nm3

PM emissions (in mg/year) = 90,000 kg/year × 1,000,000

= 90,000,000,000 mg/year

PM Concentration $= \frac{90{,}000{,}000{,}000 \text{ mg/year}}{11{,}985{,}802 \text{ Nm}^3\text{/year}}$

≈7,507.20 mg/Nm^3

Table 4-6: Summary Table for Unabated Emissions

Emission type	Value	IFC EHS Guideline Value	Compliance Status
SOx	111.8	400	Compliant
NOx	209.72	600	Compliant
PM	7,507	30	Non-Compliant

SOx, NOx are well compliant with the IFC Standard guideline values for Cement and Lime manufacturing. PM values are non-compliant; though, the PM calculations are based on unabated emissions from the overall plant operations, including grinding and bagging. The plant is designed with bag filters, separators with 99% efficiency and other very effective de-dusting components. However, enough information was not provided to calculate the emissions after they have been abated.

4.1.3 Noise

The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, including road traffic, industries, wind, humans and, animals. Noise is considered 'nuisance' when it is excessive, disruptive and/or displeasing. Nuisance noise and/or high noise levels can affect both physiological and psychological human health, with long-term excessive noise levels being damaging to human hearing.

Sound level meters for such studies are designed with an in-built weighing, termed the "A-weighted" dB(A) - decibels audible - a scale that approximates the human loudness response. The LA_{eq}, (logarithmic A-weighted equivalent) the most commonly used indicator for noise, is the equivalent continuous A-weighted sound pressure level, over a specified time interval, e.g. 15-minutes, 1-hour, 24-hours, etc. Decibel noise levels cannot be added or averaged arithmetically since they are logarithmic parameters. For example, if one source is generating a noise level of 50 dB(A), and another similar source is placed beside it, the noise level will increase to 53 dB(A), not 100 dB(A). Ten similar sources placed side by side increase the sound level by 10 dB(A), and one hundred sources increase

the sound level by 20 dB(A). However, empirically, the human ear perceives the magnitude increase of 10 dB(A) as a doubling in noise.

The noise baseline has been updated to include an additional monitoring point within in bagging plant. The additional data is to provide comprehensive picture of current air noise conditions surrounding the bagging plant and the impact on occupational health and safety.

4.1.3.1 Methodology

Ambient environmental noise monitoring was undertaken at three (3) locations, the Project site, the Community, Police Training Centre and the Ebola response centre. At each of the locations, a Casella CEL 633A - a Class 1 noise meter was set to log 5-minute averages of the following A-weighted broadband statistical noise descriptors for a monitoring duration of 1 hour per log:

- **LA_{eq} (Equivalent Continuous Sound Pressure Level) –** the Equivalent Continuous Sound Pressure Level is the constant noise level that would result in the same total sound energy being produced over a given period. LAeq is a fundamental measurement parameter designed to represent a varying sound source over a given time as a single number. This number is a measure of the energy contained within the sound at the point of the receiver. This is useful in terms of the potential for sound to damage or disturb and is extensively used in environmental noise standards as well as many other regulations and documents**.**
- **LA_{90} (Background Noise Level) -** The Background Noise Level is the level of noise exceeded by 90% of the time of measurement. It's measured to extensively rate traffic noise and background noise respectively.
- **LA_{10} (Commonly used to quantify road traffic noise) -** This is the level of noise exceeded during 10% of the time of measurement. It's measured to extensively rate traffic noise and background noise respectively.
- **LAF_{max} (Maximum noise levels, fast time response) -** This shows the highest sound pressure level within the measurement period. It is measured to ascertain the maximum sound level attained during any given measurement.
- **LAF_{min} (Minimum noise levels, fast time response) -** This shows the lowest sound pressure level within the measurement period. It's measured to ascertain the minimum sound level attained during any given measurement.

NOTE: All measured noise levels are sound pressure levels measured on the A scale. Therefore, except if explicitly stated, noise values presented in dB in this report is the same as dB(A).

The acoustic environment of the selected monitoring locations has been described for a day-time noise over three days and compared with the WBG EHS guideline values for the day-time noise level in industrial and residential areas. The coordinates of all the noise sampling locations were determined using GPS and site characteristics of the geo-referenced points documented. Photographic reference for each measurement location was also recorded. All measurement locations were subjected to their accessibility and security constraints.

Figure 4-1: Air Quality and Noise Monitoring in the Police Training Ground

Figure 4-2: Air Quality and Noise Monitoring at the MACCEM Project Site

Figure 4-3: Air Quality and Noise Monitoring in Rogbamba Community

4.1.3.2 Guidelines and Standards

4.1.3.2.1 National Standards

The Sierra Leone Standards Bureau (SLSB) is the National Statutory Body responsible for the development and Promulgation of Sierra Leone Standards. Therefore, the national standards used is that of the SLS 83: 2019 (The national Standard for ambient noise level from a facility or activity to which a person may be exposed) that was developed by the institution. These standards are set by activity and industry-specific; the standards applicable to the Project are outlined below:

General Environment

The maximum noise levels from a facility in the general environment specified in column 1 of which a person may be exposed shall not exceed the level specified in column 2, see table below:

Table 4-7: SLSB General Environmental Noise Standard

Facility	Noise Limits B (A) Leq	
	Day (6:00am – 10:00pm)	Night (10:00pm – 6:00am)
Any building used as a hospital, convalescence home, home for the aged, sanatorium and institutes of higher learning, conference rooms, public library, environmental and recreational sites	45	35
Residential buildings	50	35
Mixed residential (with some commercial and entertainment)	55	45
Residential + industry or small-scale production + commerce	60	50
Industrial	70	60

The Environment Protection Agency requires an EIA/ESIA to be carried out as a key procedure for the awarding of license with emphasis on the protection of the environment and inclusive of the social and health impacts, but with no numeric value as a given standard.

Construction site

The maximum noise level from a construction site to which a person in a facility specified in column 1 may be exposed, shall not exceed the level specified in column 2 during the time specified, see table below:

Table 4-8: SLSB Standard Noise Value for Construction Sites

Noise Control Zone	Sound Level dB (A) LAeq	Sound Level dB (A) LAeq
	Day (6:00am – 10:00pm)	Night (10:00pm – 6:00am)
Residential	60	40
Commercial	75	50
Industrial	85	65

4.1.3.2.2 International Standards and Guidelines

Reference to guidance published by two international bodies; the WHO and WBG/IFC have been utilised in this report. The IFC has published Environmental Health and Safety (EHS) Guidelines (April 2007) which are technical reference documents with general and industry-specific examples of international good practice. Reference to these guidelines' forms part of the IFC's environmental and social review procedure and is compulsory for IFC clients.

The IFC 2012 Performance Standards, in conjunction with the WB/IFC EHS Guideline, advises that pollution, in general, be prevented by control at source. Whilst it is acknowledged that the Project is not an IFC project, the EHS Guidelines provide a useful resource in line to achieve IFC compliance. The Guidelines detail the performance levels and environmental management measures considered achievable using the Best Available Technique (BAT).

The IFC PS specifies that noise abatement measures meet one of the following two conditions:

Noise levels from the Project at the most sensitive point of reception should not exceed the limits specified in Table 4-6. This condition utilises the acceptable level criterion, which allows the use of a nominal table value, rather than the actual pre-development ambient level, as the baseline reference. Post-development noise is usually measured at noise receptors located outside the project boundary (e.g., the mining rights boundary) and compared with the applicable baseline level derived from the table.

Noise levels from the Project at the most sensitive point of reception should not cause background levels to increase by more than 3 dB (A). This condition employs the noise emergence criterion, using as baseline the actual ambient level determined by measurement at receptor locations, i.e. both pre- and post-development levels are determined by measurement.

Table 4-9: WBG / IFC EHS Guideline - Noise Level Guidelines

Receptor		Noise Level - One Hour LAeq, dB(A)	
		Daytime (07:00– 22:00)	Nigh-time (22:00-07:00)
a	Residential; institutional; educational	55	45
b	Industrial; commercial	70	70

4.1.3.3 Noise Monitoring Locations

The noise monitoring was initially undertaken in three (3) locations (Project Site, the Community and the Police Training Centre) within and around the proposed project site. Based on recommendations, an addition location was included within the bagging plant.

Table 4-10: Noise Monitoring Locations within and around the Project Area

Site ID	Site Name	Latitude	Longitude
MACCEM ANMP 01	Project Site	8.38878	-13.13003
MACCEM ANMP 02	Community	8.38942	-13.12871
MACCEM ANMP 03	Police Training Centre	8.38700	-13.13092
MACCEM ANMP 04	Bagging Plant	8.389026	-13.129554

4.1.3.4 Existing Noise Emission Sources

Noise emissions in the vicinity of the Project Area largely originates from human activity, primarily from vehicular traffic and trading especially along the transportation corridor. Domestic activities and background music from radios or musical sets are mostly experience during the daytime. Nighttime noise is mostly from vehicular transport and people playing music.

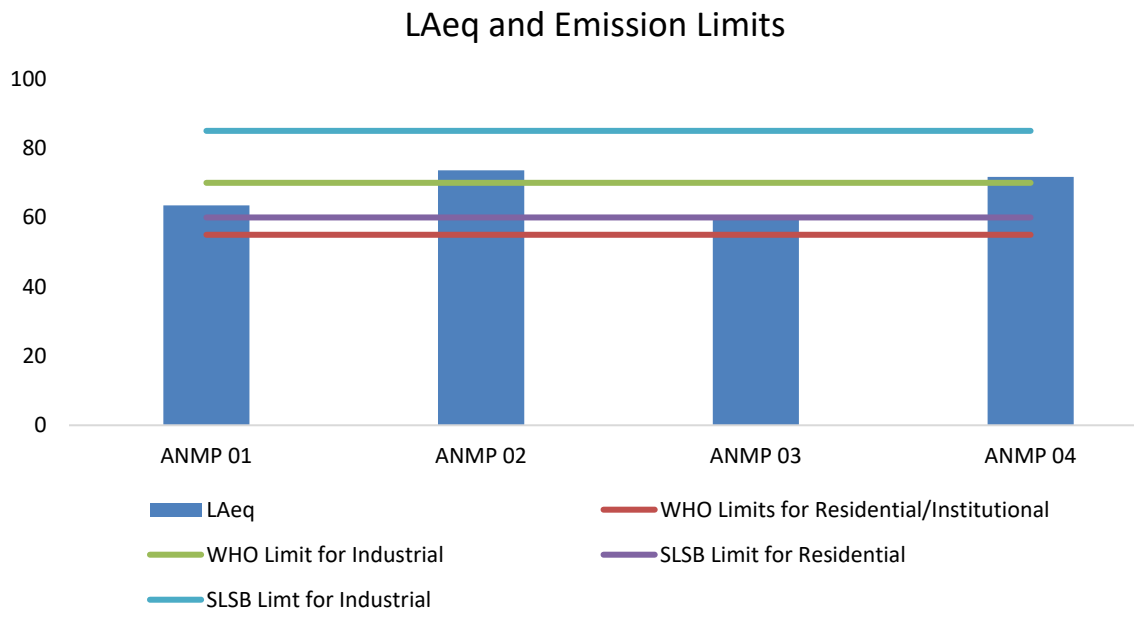
4.1.3.5 Result

The average noise data recorded during the monitoring period is presented in the table below and illustrated in the graph below. For this study, the acoustic environment of the communities has been described for the day-time (07:00 – 18:00). The recorded noise levels have been compared with the WBG EHS Guideline noise levels and SLSB standards for residential areas.

Table 4-11: Noise Monitoring Data

Location ID	Location Name	LAeq	LAF Max	LAF Min	LA10	LA90
MACCEM ANMP 01	Project Site	63.5	93.0	47.3	67.1	58.2
MACCEM ANMP 02	Community	73.6	100.1	52.7	78	58.5
MACCEM ANMP 03	Police Training Centre	59.9	90.3	46.2	61.4	52.4
MACCEM ANMP 04	Bagging Plant	71.7	106.2	46.3	75.1	69.2

Figure 4-4: Noise Monitoring Data



4.1.3.6 Analysis

4.1.4 Hydrology

The project site is well-drained and devoid of major water bodies. However, the site is located within the watershed of Waterloo Creek which empties into the Sierra Leone River Estuary within the zone of the Rokel River. Waterloo Creek originates from the highlands in the Western Area Forest Reserve which is located about 4km south of the project site. Visual observations of the stream indicate signs of pollution with domestic waste and eroded sediments. Nonetheless, the communities rely on this stream for domestic purposes such as washing and cleaning. Groundwater is a critical source of drinking water in the area as well as for water supply to the project.

There is storm water drainage system within the site alongside the warehouse leading to the fence and also by the bagging plant. These allow the runoff to pass through and drains towards the west of the site in line with the prevailing topographic gradient.

Information from site workers indicates the site has not experienced flooding during the wet season and this is mainly due to the topographic gradient of the site. The current drainage system is appropriate to deal with rain water generated during the rainy season.

4.1.5 Topography and Drainage

Freetown is the only mountainous coastal region in West Africa comprising a range of thickly forested mountains rising from sea level to close to 1,000m and dominating the peninsula at the northern end. The general topographical features of the Freetown Peninsula (i.e., Western Area) are characterised by an altitude that ranges between sea level along the Atlantic Ocean and about 850 m. The region is generally rocky in the mountains with sediments in the low-lying areas. The project area is located in the low-lying areas which are generally flat with elevations ranging from 2-31m amsl with gentle slopes towards the estuary averaging at 3.5%. The area is well drained with overland flow towards the creek which empties into the estuary, which is about 2 km from the project site.

4.1.6 Geology and Soils

The regional geology in Western Area is known as the Freetown Igneous Complex (FIC), a major intrusion characterised by a prominent layering of repeated sequences of troctolitic, gabbroic and anorthositic rocks, together with transitional rock types. However, the Project area is located in the

transitional zone between the FIC and Bullom Group along the coast. The Bullom group is the youngest recognised stratigraphic group in Sierra Leone and composes of poorly consolidated sediments formed during the Cenozoic Era.

The geology of the project area determines the soils; therefore, there is only one soil zone within the project area which is mostly sandy and clayey sediments of the Bullom series. Apart from the areas of hard standing, the surface of the site is primarily sand/gravel with patchy weed-type vegetation. Local soils in the area are known to be well drained with dusky reddish gravelly sandy clay loam to clay loam with sand content increasing with depth with some laterite and quartz gravel materials.

4.1.7 Landscape and Visual Amenity

The project site is within the context of a semi-industrialised and urbanised zone with a relatively clear skyline due to the old airstrip. The project fits within the local context of adjacent areas and therefore, it is not anticipated that there will be significant effects associated with landscape and visual amenity. Furthermore, landscape and visual impacts are not considered to be significant development constraints in Sierra Leone. The site is located within the Hastings Airport area along the Jui-Masiaka Highway in Western Area Rural District. The area surrounding the site is the airstrip to the north residential areas to the northeast, the police training school to the south and commercial to the west. These areas are interspersed with residential areas and social infrastructure (schools, mosques/churches, hospitals, etc) and commercial/industrial premises.

4.1.8 Waste Management

The main types of waste that will be produced by the project include general construction waste; waste metal (welding rods, rebar, piping etc); paints and solvents; wood; plastics; paper; electric cabling; glass; empty storage containers; domestic and food waste; waste oils, lubricants and sludges; and, water treatment sludges. As a rough guide almost 15% of construction materials are wasted and a higher volume of waste is produced during the construction phase although for a shorter period than the operational phase. Some construction wastes can be recycled into the community as there are usually markets for scrap metals and waste oil. However, waste oil and scrap metals are required to be collected by EPA-licenced collectors. Other hazardous materials will require careful storage, treatment and disposal. At Operational Phase, waste generated will be mostly unwanted clinkers (off-specs), packings and domestic waste. A waste management plan has been developed to manage waste across the life of the Project

4.2 Biological Environment

The proposed factory site and immediate surroundings comprise mixed residential and industrial areas with little vegetation remaining. The local area is highly built-up and lies just outside the populated peri-urban areas of eastern Freetown. Much of the land within the project area is developed and there is sparse plant cover or habitat, with species of stands of old fruit trees in private premises such as mango and some species of ornamental flowers. The project area has limited habitat for terrestrial fauna to thrive and low terrestrial ecological value. No species of global conservation significance occurs at the site.

4.3 Socio-economic Environment

This section characterises the socioeconomic environment of the project area of influence described in section 4.3.2. Where information on the immediate project area is limited, information concerning the Western Area or Sierra Leone as a whole was used. Data described within this section was derived predominantly from stakeholder consultations, a review of existing literature and the Sierra Leone Population and Housing Census Report[1] and observations.

4.3.1 Socio-economic Structure of Sierra Leone

[1] It should be noted that the final results of the 2021 Mid-term Population and Housing Census were not available at the sub-district level at the time of compilation of this report. Therefore, except where explicitly stated, the population and housing figures reported in this document are referencing the 2015 Population and Housing Census.

Sierra Leone, officially the Republic of Sierra Leone, is a constitutional republic with a directly elected president and a unicameral legislature. It consists of five provinces split into 16 districts. The Western Area is divided into two districts, Western Area Rural and Western Area Urban. The project site is located within the Western Area, which is the most affluent area of the country and is the governmental, cultural and financial centre.

4.3.2 Project Area of Influence

The area of socio-economic influence for the project is considered to be 1km around the site based on a review of the population and economic assets likely to be influenced by the project. This area of influence was selected because it covers all of the adjacent communities where the project is expected to create direct economic or social impact. This includes the Hastings area to the west and south and Rogbangba to the northeast, beyond which is the Sierra Leone River Estuary (SLRE). The area of direct influence is considered to be 100m from the project boundary. This includes the Rolangba Community and police training school.

4.3.3 Demography, Ethnicity and Language

Preliminary results from the 2021 Medium-Term Population and Housing Census (PHC) indicates that the Western Area Rural District's population consisted of 662,156 which indicates that 48.6% of the population is male, and 51.4% female. Nationally, the population from the 2015 PHC has a high proportion of young people (41.5% aged below 15, and only 5.1% above 60). The average household size was 6.0 in urban areas, and amongst poor households in urban areas, was 11.8.

Ethnic groups found within the Western Area include all of the ethnic groups in Sierra Leone. It is unclear which ethnic group is indigenes to the Western Area and consequently the Hastings area, but is assumed that the earliest settlers are Creole. A United Nations Environment Program (UNEP) Report on Sierra Leone (2010) describes the major religions in the Western Area as Islam (60%) and Christianity (30%) practised by groups that have migrated to Freetown. The official language of Sierra Leone is English, although Krio is spoken by 90% of the country's population, and by 10.5% as a mother tongue.

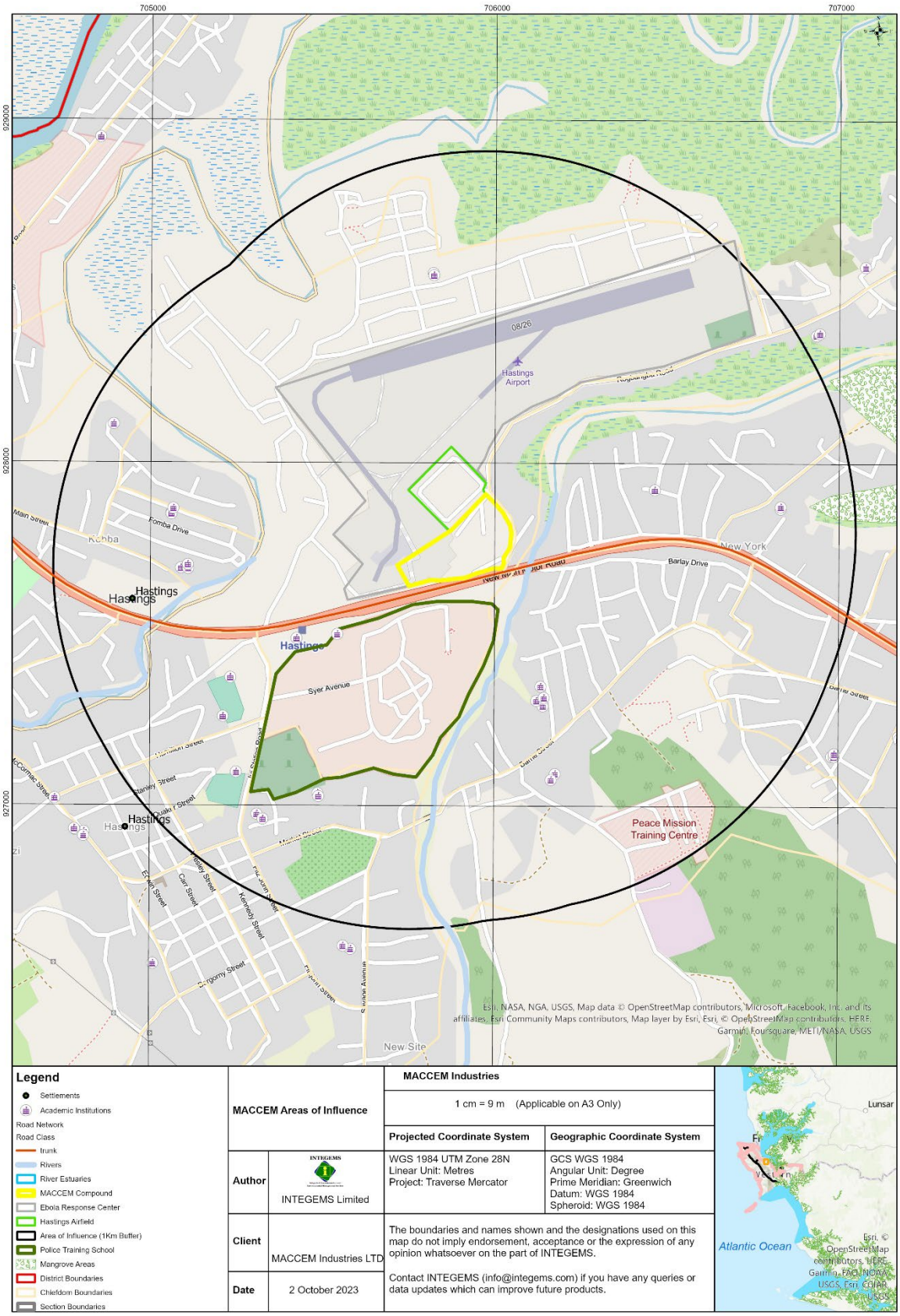
4.3.4 Leadership and Governance Structure

The Rogbanba community, which is located within the Western Area Rural, has a leadership and governance structure similar to that of other communities within the same district. At the helm of the community leadership hierarchy is the headman, who is elected every five years with no limits in the number of terms that he/she can run for. He/she is in charge of overall management, upholding law and order, and fostering community growth. The headman of the community set up a committee that helps with the administration day to day administration of community affairs.

4.3.5 Health

Primary healthcare is the patient's first point of contact with healthcare professionals, usually within the local community. In Sierra Leone, this is delivered at Peripheral Health Units (PHU) which comprise community health centres, community health posts and maternal and child health posts. The ratio of people to PHU in the Western Area is 32,500:1 compared with the national average of 9,000:1. The Atkins report found that the Western Area receives the worst level of service provision nationally from the Ministry of Health and Sanitation (MoHS). However, private and Non-Government Organization (NGO)-run PHU are more widespread in the region than elsewhere. This is likely to ease the pressure on state-operated facilities. Secondary healthcare refers to the services provided by medical specialists, as well as acute care in emergencies. Availability of such services is, by contrast, higher in

Figure 4-5: Project's Socioeconomic Area of Influence



Freetown than nationally, with 1,500:1 hospital bed, and 9800:1 doctor. About 80% of the country's doctors practice in the capital.

According to the 2015 OCHA Survey, the District Health Management Team (DHMT) has a total of 317 registered staff medical and non-medical staff working in health facilities in Western Area. The facilities available in Western Area Rural are: 12 Community Health Centers (CHC), 20 Community Health Posts (CHP), 21 Maternal Child Health Post s (MCHP) and 1 hospital. Traditional medicine forms part of the primary health care system in Sierra Leone. (OCHA Sierra Leone 19 December 2015).

4.3.6 Education

The Ministry of Basic and Senior Secondary Education (MBSSE) is responsible for pre-primary, basic and senior secondary education, while the Ministry of Technical and Higher Education (MTHE) oversees tertiary and vocational education. The education system is divided into two sectors: the formal and the non-formal. The formal sector consists of pre-primary education, primary education, junior secondary education, senior secondary education, and higher education (GoSL; IIEP-UNESCO, 2022). Primary and junior secondary education together comprise basic education, which is compulsory for all children. The probability of accessing primary education is slightly higher for girls than for boys, but retention, completion, and transition rates from primary through senior secondary are still persistently lower for girls (GoSL; IIEP-UNESCO, 2022).

According to the 2021 school census report of the Ministry Basic and Senior Secondary Education (MBSSE), the Western Area Rural District is comprised a total of 1,526 schools, this includes, 276 pre-primary, 471 primary, 220 junior secondary and 88 senior secondary schools. There are few vocational training centres and other educational institutions in the area.

The Rogbamba community has a total of 13 schools. 10 of the schools are primary schools, which also have kindergartens as well, the remaining schools are secondary schools.

4.3.7 Economic Activities

The main economic activities in the project area are petty trading, sand mining, motorbike riding and fishing. Sand mining, fishing and motorbike riding are mostly done by young men, while trading (including fish trading) is done by women of all age groups.

Figure 4-6: Sand mined in the Rogbangba Community

4.3.8 Water Supply

The area has access to the main national water utility provided by Guma Valley Water Company (GVWC) which provides pipe-borne water for domestic uses and a well for drinking. However, boreholes/wells serve as the main source of domestic water supply in the area. Additionally, affluent households use sachet or bottled water from vendors.

Figure 4-7: A Community Borehole

4.3.9 Land Use and Tenure

The predominant land use in the area is mixed commercial and residential while the land tenure system is freehold which unlike leasehold (communal ownership) which exists in the provinces, permits private ownership of land.

4.3.10 Transportation and Accessibility

The Project site is accessible via the main tarred Jui-Masiaka Highway directly into the site compound. However, the road networks within the project area unpaved after the tarred waterloo highway. The unpaved lateritic roads are mostly muddy/marshy and flooded in some areas during the rainy season. The modes of transportation vary but the predominant mode is the commercial light vehicles and motorcycles and movement within the project direct area of influence is mostly via motorbikes.

4.3.11 Energy

The Electricity Distribution and Supply Agency (EDSA) is the sole distributor of electricity in the entire Western Area of Sierra Leone including the Project Area. Fuel for cooking and heating in the Project Area is mainly derived from biomass such as wood and charcoal. However, some affluent households use liquefied petroleum gas (AfriGas or NP Gas).

4.3.12 Telecommunications

There is reasonable coverage of Global System for Mobile Communication (GSM) operators and internet connectivity via 3G/4G/LTE in the Project Area. The most frequently used operators within the area are Orange, Africell and QCell.

4.3.13 Sanitation

Most people in the project area use traditional pit latrines as the main type of toilet facility. The poorest inhabitants and a certain proportion of small children use haphazardly open areas for defecation or defecate in Waterloo Creek.

4.3.14 Vulnerable Groups

Vulnerable groups are people who by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage, or social status may be limited in their ability to claim or take advantage of development benefits. Vulnerable households may include:

- **Households with physical or mental disabled persons**

- **Elderly households with no means of support**
- **Households with persons falling under the generally accepted indicator for poverty**
- **Divorced or widowed female headed households with dependents and low income;**
- **No source of cash income; and**
- **Ethnic minorities that are socially stigmatized and/or economically marginalized.**

In the Project Area some households have disabled person based on the criteria above. Some disabilities were predominantly physical. Support for vulnerable groups mostly comes from family and community people.

4.3.15 Cultural and Archaeological

No cultural or archaeological objects were reported at the site during the construction of the cement factory. No information regarding the archaeological or cultural heritage significance of the site has been identified. Given that the area is already developed with buildings and other infrastructure it is considered unlikely that the site has archaeological value of note.

Cultural practices are present in the community. The community is comprised of traditional leaders. These traditional leaders/ tribal heads play a dominant role in the lifestyles of these communities. The project area, does not have historical monuments or archaeological sites. No sacred site or place of worship is found there.

5 STAKEHOLDER ENGAGEMENT

Stakeholder Engagement is an important component of the ESIA process. The main goals of stakeholder engagement are explained in this section, along with a summary of the approach that was or will be followed.

5.1 Objectives

The objective of stakeholder engagement is to gather information and opinions from stakeholders who may be affected by or have an interest in the Project. Specifically, the objectives of stakeholder engagement are to:

- **Identify interested and affected persons/parties (IAPs) and their profiles, interests, issues/impacts, and concerns relevant to the Project (stakeholder mapping);**
- **Facilitate adequate and timely dissemination of project information including the environmental and social risks and impacts to the stakeholder groups in a timely, clear, accessible, and culturally appropriate manner and format; and**
- **Provide stakeholders with the opportunity to provide inputs and feedback for the ESIA studies and the project development.**

5.2 Stakeholder Identification and Mapping

During the ESIA process, the identification of stakeholders was influenced by the regulations and laws that govern the Project. Stakeholders were categorised based on their influence on the Project, their level of interest in it, and the potential impact the Project may have on them. Once the stakeholders were identified and mapped, the necessary level of engagement and the most effective communication methods for each group were determined. It is important to note that stakeholder mapping and identification will continue throughout the ESIA process and the implementation of the Project. The stakeholders in Table 5-1 have been identified for consultations and engagement. A stakeholder register will be maintained to record all stakeholders, contact details, dates of engagement with comments and follow-up requirements.

Table 5-1: Stakeholders Identified

Stakeholders	Type	Relevance to the Project
Project Communities	Project-affected persons	This group includes host communities in target project areas. The nature of impacts will be determined based on the host communities' consent and willingness to accommodate new projects, which will be monitored over time. Furthermore, the project bears the principle of duty of care for the safety and impacts on the host communities.
Within the Rogbangba community: Individuals, vulnerable social groups, religious leaders, traders, etc.	Project-affected persons	It will be possible to identify further the potentially affected or interested stakeholders for the project activity during the ESIA baseline studies.
Traditional authorities of the Rogbangba community	Project-affected persons	These include head men and council of elders such as mammy queen, youth leader, etc. The Headman is responsible for ensuring peace, harmony, safety, and well-being of the community residents is maintained at all times. The Headman must be informed about the Project, particularly on the benefits that the Project will generate for

Stakeholders	Type	Relevance to the Project
		his community. The support of the Headman is essential to the Project.
Mosques and Churches representing members of the Rogbangba community	Project-affected persons	Religious denominations present within communities are usually receptive to projects that create positive impacts in their lives. They also may be able to represent vulnerable populations who may be impacted by the Project but may not be able to express their voice directly. Additionally, project impact mitigation measures will integrate consideration for the hours of work in consideration of respecting the day of worship for members of the community.
Local NGOs, including gender organisations representing members of the Rogbangba community	Project-affected persons	These will include locally-based NGOs in the project host community that will be able to represent vulnerable populations who may be impacted by the Project but may not be able to express their voice directly.
Western Area Rural District Council	Other and Interested Parties	The district council is directly involved in district and community planning and development. They are responsible for implementing the development project from the central government in their respective jurisdictions.
Ministry of Water Resources (MWR) National Water Resources Management Agency (NWRMA)	Other and Interested Parties	The ministry is responsible to provide strategic leadership for the sustainable management of water resources to enhance socio-economic development for the benefit of all. The NWRA is responsible for the equitable, beneficial, efficient, and sustainable use and management of the country's water resources (GoSL, 2017). The project is required to acquire a Water Use Permit for the mechanical abstraction of water from boreholes for commercial use (Sections 28 and 29).
Ministry of Environment and Climate Change	Other and Interested Parties	The Ministry is responsible to formulate and facilitate the implementation of appropriate policies and programs for sustainable management of the Environment. Therefore, the Ministry is key in guiding to enhance environmental and social sustainability for the project.
Environment Protection Agency-Sierra Leone	Interested Party	The EPA-SL principal environmental regulator in Sierra Leone and will be responsible for the issuance of the EIA Licence for the project.
Ministry of Local Government and Community Affairs (MLGCA)	Other and Interested Parties	MLGCA is the supervisory government authority for the district councils in whose jurisdiction the project will be implemented. The councils periodically report on all development projects implemented in the district to the MLGCA. Therefore, there is a likelihood that the project activities will lead to an interface with the MLGCA.
Ministry of Health and Sanitation (MoHS)	Affected Party	The MoHS National Emergency Medical Services facility is located adjacent to the project site. This facility is a sensitive receptor for air pollutants, noise and vibration.

Stakeholders	Type	Relevance to the Project
China Railway Seventh Group (CRSG)	Project affected Party	The project is located adjacent to the highway and in proximity to the CRSG toll gate, which could be affected by project-related traffic.
Sierra Leone Police	Project affected Party	The Sierra Leone Police Training School is located within the project's area of influence which could potentially make the facility and its users sensitive to noise and dust receptors.
Sierra Leone Civil Aviation Authority	Project affected Party	The project site is located adjacent to the disused Hastings Airport, which is an asset of the Sierra Leone Civil Aviation Authority.
Contractors	Project Team	Contractors will be hired to execute key components of the project that involve civil works, mechanical and electrical installations.
Consultants	Project Team	Consultants are usually recruited for different project components including environmental, health, safety and social impact monitoring and project implementation monitoring and evaluation.

5.3 Stakeholder Engagement Activities Undertaken

A summary of the consultation meetings undertaken is provided in Table 5-2. These engagement activities involved conducting interviews and meetings with community stakeholders, as well as key individuals such as community members, authorities, and NGOs. These consultations were conducted in the local language, Krio, to ensure effective communication and understanding; thus, enabling stakeholders to provide meaningful input.

Table 5-2: The ESIA Stakeholder Engagement Activities

Task	Approach	Objectives	Date
Stakeholder Identification and Mapping	Desktop analysis: Literature review, legislative review, GIS mapping and	To build an effective stakeholder engagement plan and identify the right audience for public consultations.	May, 2023
Stakeholder Notification	Letters, emails, phone calls	To notify IAPs of the commencement of the ESIA process.	May - June, 2023
Stakeholder engagement	Interviews, community meetings	To provide information about the Project to a wider stakeholder base and obtain information views and concerns relevant to the Project.	17 June, 2023

5.4 Summary of Stakeholder Engagement

The summary of the stakeholder engagement feedback is outlined below:

- **The stakeholders are aware about the project, but they were very not very pleased as the land was used by the community people as a sand ground for the sale of sand.**

- **Communities were informed about the new space for doing business which was considered far by residents but appreciated by the business people who had received compensation packages for their makeshift structures and happy that they had a land of their own rather than the government land that they have been occupying.**
- **Stakeholders expect to derive tangible benefits from the project, such as job opportunities for locals, promotion of local content, and improvement to infrastructure especially the road which could contribute to community development.**
- **There were also concerns regarding the impact on the air quality due to cement emission from the factory.**
- **The stakeholders also requested that the Company support to construct a culvert along the road that is usually cut off during the rainy season.**
- **The stakeholders also want the Company to support them with water facility as they have serious challenge with availability and accessibility of water in the area.**

6 IMPACT ASSESSMENT

6.1 Impact Assessment Methodology

This methodology takes into consideration the following criteria:

1. **Nature of impact**
2. **Type of impact**
3. **Duration**
4. **Spatial Extent**
5. **Probability/Likelihood**
6. **Severity or benefits**

6.1.1 Assessment of Potential Impacts

An integrated approach that links the biophysical with the socio-economic components of the environment has been used to conduct the impact assessment. The impact assessment is divided into impact prediction, evaluation, mitigation/enhancement, and residual impact assessment (see Figure 6-1).

- **Impact Prediction: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.**
- **Impact Evaluation: to evaluate the significance of the predicted impacts by considering their magnitude or likelihood of occurrence, and the extent, value and/or importance of the affected resource/receptor.**
- **Mitigation and Enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.**
- **Residual Impact Evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.**

Iteration of these parts occurs in each stage of an ESIA process to varying degrees. The basic elements used in the evaluation of impact significance are described in Table 6-1 and the characteristics that are used to describe the consequence of an impact are outlined in Table 6-2.

The activities and events associated with the Project have been determined based on the activities described within the Project Description, and the potential for interactions with the environment and socio-economic setting identified in the baseline description. The identification of the potential impacts ensures that all potentially significant environmental, socio-economic, health, and safety impacts identified and taken into account in the ESIA process and the Project. Hence, the potential impacts on physical, socio-economic, biological, safety, and health resources and receptors have been described.

Figure 6-1: Impact Assessment Process

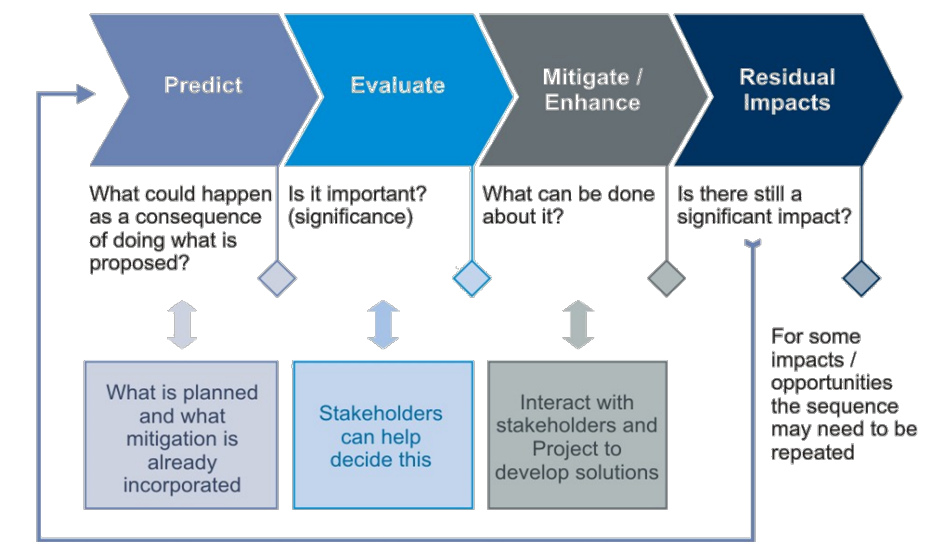


Table 6-1: Impact Assessment Dimensions

Dimension	Description	Categories
Type	The type of impact is specified based on the nature of the receptor (receiving environment).	Biophysical
		Social
		Economic
Nature	The most obvious impacts are those directly related to the project and can be directly attributed in space and time to the causal action. Indirect or secondary impacts generally cause less obvious changes occurring later and far from the source of impact. In general, cumulative effects are caused by the amplification of an impact when combined with the impacts of other projects completed recently or underway. Considered individually, these impacts may be insignificant, but together, they become important by their concentration in one place and frequency. The effects may be cumulative through the addition or interaction of different impacts such that the overall effect is greater than the sum of individual effects.	**Direct/Primary:** Impacts that result from the direct interaction between the Project's activities and the receiving environment.
		Indirect/Secondary: Impacts that follow from primary interactions between the Project's activities and the environment as a result of subsequent interactions within the environment.
		Cumulative: Impacts acting together to affect a particular environmental and social resource or receptor.
Status	Specifies whether or not the impact is beneficial or adverse	**Positive:** Impacts are beneficial to the relevant communities and valued ecosystem components.
		Negative: Impacts are adverse to the communities and valued ecosystem components.
Geographic Extent/Spatial Scale	The geographic extent is defined as how far an effect propagates and it takes into account the extent to which adverse effects, caused by the project, may occur in areas far removed from it, as well as how they may contribute to any cumulative environmental effects. Depending on the type of impact, it is possible to predict the extent of the geographical area of impact for each site and evaluate variation in magnitude.	**Local:** Impact that occurs in the vicinity of the project and affects a locally important resource (in contrast, an impact on a nearby conservation area, even restricted spatially, would constitute an international impact).
		Regional: Impacts that affect regionally important resources or is felt at a regional scale as determined by administrative boundaries, habitat types
		National: Impacts that affect nationally important resources or affects an area that is nationally important or protected.

Dimension	Description	Categories
		International: Impacts that affect internationally important resources such as areas protected by International Conventions.
Duration/Temporal Scale	Duration refers to the period over which an effect occurs	**Short-term**: impact predicted to last only for a limited period (such as during construction phase, drilling, etc.) but will cease on completion of the activity, or as a result of mitigation measures and natural recovery. An impact may last for a short term; in this case, less than a year. A temporary impact may span several days, weeks or months. However, it must be reversible. For species, impact occurs for less than one generation.
		Medium-term: Impact that will continue over a period (i.e., one to ten years), continuous, intermittent, or repeated. For species, impacts occur for more than one generation.
		Long-term: Impact that will continue over an extended period (i.e., one to ten years), continuous, intermittent, or repeated. For species, impacts occur for more than one generation. When it lasts for a long-term and is irreversible, it is referred to as a permanent impact.
		Permanent: When an impact lasts for a very long-term and is irreversible, it is referred to as a permanent impact.
Frequency	Closely relates to the duration of the effect is its frequency. The frequency of effects and the potential of the environment to recover from these effects are considered important.	**Once:** Occurs only once
		Continuous: Occurs regularly and regular intervals
		Sporadic: Occurs rarely and at irregular intervals
Reversibility	Reversibility refers to the recovery once an impact has occurred. Irreversible environmental impacts are considered more significant than those that are reversible.	**Reversible:** Environmental component recovers to pre-project level. The rate of recovery is important.
		Irreversible: Impact that causes a permanent change in the affected receptor or resource (e.g., the felling of the old-growth forest as a result of the occupation of the site, landscape changes caused by project).

Dimension	Description	Categories
Likelihood	Likelihood is defined as the probability of an impact occurring, taking into account two criteria: (1) Probability of occurrence – if there is a high, medium or low probability that a particularly significant environmental impact will occur. (2) The certainty of significance – there will always be some uncertainty ('confidence limit') associated with an ESIA.	**Unlikely:** Low probability (<50%) that impact will occur, or high uncertainty in significance prediction.
		Likely: High probability (>50%) that impact will occur, or high certainty that impact will be significant
		Definite: Very high probability (99.9%) that a significant impact will occur.
Magnitude	Magnitude measures the severity of environmental effects, including perception. In general, magnitude is expressed in terms of severity (major, moderate, minor or negligible). Magnitude, as opposed to the importance, also takes into account other aspects of the magnitude of impact, including its reversibility or irreversibility.	**Negligible:** The impact on the environment is not detectable or there is no perceptible change to people's way of life.
		Low: The impact affects the environment in such a way that natural functions and processes are not affected or the communities can adapt.
		Medium: Where the affected environment is altered but natural functions and processes continue, albeit in a modified way or the communities can adapt with some difficulties
		High: Where natural functions or processes are altered to the extent that it will temporarily or permanently cease or not be able to adapt to changes.

Table 6-2: Impact Consequence Definition[2]

Impact Characteristics	Definition	Criteria
Magnitude	Major -	Substantial deterioration or harm to receptors in the receiving environment (e.g., the impact is of conservation importance or identified thresholds, will often be exceeded).
	Moderate -	Moderate/measurable deterioration or harm to receptors in the receiving environment (e.g., identified thresholds will occasionally be exceeded).
	Minor -	Minor deterioration (nuisance or minor deterioration) or harm to receptors in the receiving environment (e.g., not easily measurable or identified thresholds will not be exceeded).
	Minor+	A minor improvement which is not easily measurable.
	Moderate +	Moderate improvement within or better (lower) than the threshold levels.
	Major +	Substantial improvement within or better (lower) than the threshold levels or publicity favourable.
Spatial Scale	local	Site-specific or confined to the study area.
	Regional	May be defined in various ways, e.g. cadastral, catchment, topographic.
	National / International	Nationally or beyond
Duration	Short term / reversible / unsustainable	Less than 3 years
	Medium term / partially reversible / sustainable	3 to15 years
	Long term / irreversible / sustainable	>15 years

[2] Use these definitions to define the consequence in Part B

Table 6-3: Consequence Rating[3]

				Spatial Scale / Population		
				Local	Regional	National
Magnitude	Minor	Duration	Long-term	Medium	Medium	High
			Medium-term	Low	Low	Medium
			Short-term	Low	Low	Medium
	Moderate	Duration	Long-term	Medium	High	High
			Medium-term	Medium	Medium	High
			Short-term	Low	Medium	Medium
	Major	Duration	Long-term	High	High	High
			Medium-term	Medium	Medium	High
			Short-term	Medium	Medium	High

Table 6-4: Significance Rating[4]

		Consequence		
		Low	Medium	High
Probability (of exposure to impacts)	Definite	Medium	Medium	High
	Likely	Low	Medium	High
	Unlikely	Low	Low	Medium

6.1.2 Management Recommendations and Post-management Significance

Practicable management measures were then listed, using the IFC's management hierarchy: *"Recommendations for management should focus on avoidance, and if avoidance is not possible, then to reduce, restore, compensate/offset negative impacts, enhance positive impacts and assist project design."*

Once the significance of an impact has been characterised, the next step is to evaluate what mitigation and enhancement measures are warranted.

Practicable mitigation and optimisation measures are recommended and impacts are rated in a prescribed way both without and with the assumed effective implementation of mitigation and optimisation measures. Mitigation and optimisation measures are either:

- **Essential: measures that must be implemented and are non-negotiable; and**
- **Best Practice: recommended to comply with best practice, with adoption dependent on the proponent's risk profile and commitment to adhere to best practice, and which must**

[3] Consequence is rated based on definition of magnitude, spatial extent and duration

[4] Significance is rated based on consequence and likelihood

be shown to have been considered and sound reasons provided by the proponent if not implemented.

For this impact assessment, the following mitigation hierarchy has been adopted:

- **Avoid at Source: reduce at Source: avoiding or reducing at source through the design of the Project.**
- **Abate on Site: add something to the design to abate the impact (e.g., pollution control equipment).**
- **Abate at Receptor: if an impact cannot be abated on-site then control measures can be implemented off-site.**
- **Repair or Remedy: some impacts involve unavoidable damage to a resource (e.g., agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.**
- **Compensate in Kind; Compensate through other Means: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).**

The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

6.1.3 Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the residual impact significance is identified (i.e., a repeat of the impact assessment steps discussed above). In some cases, it may only be possible to reduce the impact to a certain degree such as where an impact could not be completely avoided. All residual significant impacts are described in this report with commentary on why further mitigation is not feasible.

The degree of significance attributed to residual impacts is related to the weight that should be given to them in deciding on the Project:

- **Reversibility: The degree to which an environment can be returned to its original/partially original state.**
- **Irreplaceable loss: The degree of loss which an impact may cause.**
- **Mitigation potential: The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in Table 6-5 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.**

Table 6-5: Criteria considered post mitigation

Reversibility	
Reversible	*The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.*
Irreversible	*The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.*
Irreplaceable loss	
Resource will not be lost	*The resource will not be lost/destroyed provided mitigation measures are implemented.*

Resource will be partly lost	*The resource will be partially destroyed even though mitigation measures are implemented.*
Resource will be lost	*The resource will be lost despite the implementation of mitigation measures.*
Mitigation potential	
Easily achievable	*The impact can be easily, effectively and cost effectively mitigated/reversed.*
Achievable	*The impact can be effectively mitigated/reversed without much difficulty or cost.*
Difficult	*The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.*
Very Difficult	*The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.*

6.2 Environmental and Social Impact Assessment

6.2.1 Construction Phase

6.2.1.1 Air Quality

The primary sources include:

- Exhaust emissions from running engines (carbon monoxide, nitrogen oxides, sulfur dioxide, hydrocarbons);
- Earthworks, loading/unloading operations, transportation to and from the plant and quarry sites (dust);
- Fugitive emissions from loading/unloading operations of raw construction materials and process equipment (dust);

The composition and quantities of emissions from the above sources will depend on type of activities and number of simultaneously operating vehicles.

The main receptors are workers, nearby residents and communities in close proximity to the Project site particularly those sensitive to dust and particulate emissions.

The impact is expected to be localised, minimal and of a short duration.

Table 6-6: Air Quality

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Moderate	Low	-	Low
Mitigation and Management						
• Provide PPE to the construction workers; • Switch off vehicle engine and machinery when not in use; • Locate machinery, fuel storage and dust generating activities away from site boundaries and sensitive receptors where possible;						

- Vehicles and plant/equipment should be fitted with appropriate emission control equipment and be serviced and maintained in accordance with the manufacturers' specifications; and
- Implementation of routine air quality monitoring program to determine whether there are any significant increases in emissions and impacts at sensitive receptors.
- An air quality management plan has been developed for detailed mitigation strategy

Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Low	-	Low

6.2.1.2 Noise Emissions

Noise is more than a mere nuisance. At certain levels and durations of exposure, it can cause physical damage to the eardrum and the sensitive hair cells of the inner ear and result in temporary or permanent hearing loss, known as noise-induced hearing loss.

Noise emissions associated with the construction activity will include noise from machinery engines, vehicles used for transporting materials and power generation. The main receptors are workers, nearby residents, communities in close proximity to the Project site.

Table 6-7: Noise Emissions

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Moderate	Low	-	Low

Mitigation and Management

- Provide personal protective equipment (PPEs) to the construction workers;
- Switch off vehicle engine and machinery when not in use;
- Locate machinery and other dust generating activities away from site boundaries and sensitive receptors where possible;
- Vehicles and plant/equipment should be fitted with appropriate noise attenuators and be serviced and maintained in accordance with the manufacturers' specifications; and
- Host community should be informed about the activities and complaints on noise shall be recorded, adequately investigated and necessary remedial measures taken, if required.
- Implementation of routine noise management plan to determine whether there are any significant increases in emissions and impacts at sensitive receptors.

Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Low	-	Low

6.2.1.3 Road Traffic

Construction of the factory will generate supplementary traffic flow of trucks and special vehicles as for the transportation of materials. Estimated construction transport flow will increase average traffic in the vicinity of the site. The additional traffic could cause accidents for the local population and users of these roads. Before mitigation, this risk is deemed high.

Table 6-8: Road Traffic

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Moderate	High	-	High
Mitigation and Management						
• Sensitize drivers on road safety. • Limit traffic speed and/or volume control through traffic measures, especially in areas with high human activity. • Monitoring vehicle speed and installing speed bumps with the provision of adequate signage; • Heavy motor vehicle (HMV) traffic should be restricted to daylight hours if at all possible. Headlights of HMV should be on at all times, especially in rainy conditions; • Crossings could be established in areas which are not safe to cross - residents and regular road users should be consulted with regard to the location of crossings; • A traffic management plan has been developed for detailed mitigation measures.						
Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Medium	-	Medium

6.2.1.4 Job Opportunities

The construction phase of the project will require labour, this will provide job opportunities to locals. The employment of locals will improve the standard of living of the locals and multiplying effect in the region. The creation of jobs will lead to increased income, expenditure and investment enhancement.

These opportunities include job such as security guards, casual workers, and contractors. The opportunities are expected to be short-term during the construction phases and the impact is positive and it is expected to be of medium significance.

Table 6-9: Job opportunities/Employment of Local Residents

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Medium	+	Medium
Mitigation and Management						

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
• Preference should be given to local people during employment, where applicable; • Establishment of a "local labour desk" at the Project site or contractor offices to identify a local labour pool; and • Implementation of skills development programmes to support locals in obtaining employment opportunities. • Ensure access of equal opportunity and benefit for female workers • Ensure all the workers get fair compensation. • An employee and HR manuals have been developed for detailed management of employment risks						
Post-Management Assessment						
Local	Short-term	Likely	Minor	Medium	+	Medium

6.2.1.5 Workers Health and Safety

Construction site activities entail physical risks and a potential for accidents, injuries or diseases due to repeated exposure to mechanical actions. The most common construction site accidents are: falling from heights, collision with contusive objects, collision with construction equipment (cranes, loaders, hoist, etc.), burns (soldering works), sliding, packaging, etc. Before mitigation, this risk is deemed high.

Table 6-10: **Workers Health and Safety**

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Moderate	Medium	-	Moderate
Mitigation and Management						
• Loading and unloading operation of equipment and construction materials should be done under the supervision of a trained professional. • Appropriate PPEs shall be provided to all workers onsite • An accident reporting and monitoring record should be maintained. • MACCEM will implement robust and comprehensive occupational health and safety measures to prevent accidents and reduce the consequences of non-conformance events; • MACCEM will provide training, awareness and supervision to ensure all of its construction workers to comply with the OHS procedures; • An emergency response procedure will be available on site to ensure provision of first aid for personnel in case of an emergency						
Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**

Local	Short-term	Likely	Minor	Low	-	Low

6.2.1.6 Waste Management

Wastes generated during the construction phase are numerous. They consist mainly of inert wastes (land and earthmoving materials, concrete and other inert materials, bricks and pellets), ordinary wastes (scrap metals, plastics, formwork timber and paperboards) and hazardous wastes (paint, glue, varnish, bitumen, used oils, etc.). These wastes are a physical risk not only for construction workers and visitors but also for the physical environment especially as leachate infiltrates the soil and their flow into surface water. Before mitigation, this risk is deemed average.

Table 6-11: Waste Management

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Low	-	Low
Mitigation and Management						
• Waste management must be a priority and all waste must be collected and stored effectively. • Waste products will be collected and recycled to enhance their value where applicable • MACCEM will contact licenced waste collectors collect unrecycled solid wastes produced during the construction phase of the cement factory; • Wastes and building materials will be quickly eliminated, lubricating oils packaged and eliminated off-site, household garbage and oily rags picked up while spilled inflammable liquids will be promptly cleaned up. • A waste management plan has been developed to provide detailed mitigation strategies.						
Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Low	-	Low

6.2.1.7 Surface and Ground Water

Runoff and ground water could be affected by the construction of the cement factory since this water can be laden with particulates. Accidental pollution is also to be feared due to possible fuel/lubricant leaks from construction and transport equipment to the ground, leading to a potential water contamination risk. This risk is deemed average.

Table 6-12: Surface and Ground Water

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Moderate	-	Moderate

Mitigation and Management
• Design storm water drainage to discharge surface runoff in the nearby natural drainage and prevent sedimentation. • Regularly monitor the water quality; • Maintain logbook for water consumption; • Prepare and implement water conservation scheme e.g., rainwater harvesting at the project site. • A water management plan has been developed to mitigate impacts associated with water resources

Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Low	-	Low

6.2.1.8 Community Health and Safety

The Project will carry several risks that could result in impacts to public safety where such impacts are transferred or received outside of the Project site. Such impacts may relate to un-warranted releases of wastewater, excessive dust and vehicular accidents and road accidents. The population living near the access roads to project site will be the most affected. This impact is mitigated by the distance of inhabited areas from construction activities and roads used by construction equipment. Before mitigation, this risk is deemed average.

Table 6-13: Community Health and Safety

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Long term	Definite	Moderate	Medium	-	Medium

Mitigation and Management
• Demarcating the construction site area to avoid intruders • Inform the local population as soon as works start, by erecting road signs. • Developing, communicating and implementing road safety and accident prevention measures for the local population; • Implement safe entrances/exits of worksites to hinder as little as possible population displacements. • Keep regular liaison with local communities and authorities to discuss security and safety risks. • Develop the traffic management plan to ensure that traffic arrangement during the construction is well-managed. • The Project will employ its own security staff, who will provide security control across the site. • Establish a grievance mechanism accessible for the communities to report dust concerns and take an immediate investigation. • A stakeholder engagement plan has been developed to manage stakeholders throughout the life of the Project

Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Low	Low	-	Low

6.2.1.9 Influx of Job Seekers

The construction site will attract job-seekers into the neighbouring communities and even those further off. The risks of insecurity for women, conflicts with the local populations, intervention of the forces of law and order could be generated. This will most likely have a negative impact by compounding the demographic pressure likely to disrupt social relationships and cause social tensions and conflict. Before mitigation, this risk is deemed moderate

Table 6-14: Influx of Job Seekers

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Long term	Definite	Minor	Moderate	-	Moderate
Mitigation and Management						
• Institutionalizing recruitment through the local authorities • Engage regularly, with the local authorities to manage and monitor influx • Develop a hiring policy giving priority to residents. • Recruit locally where possible to avoid competition						
Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Low	Low	-	Low

6.2.2 Operations Phase

6.2.2.1 Air Quality

Emissions of air pollutants from the project's operation phase are mainly associated with the industrial process emissions released from cement Production. The cement production process will be associated with emissions of sulphur dioxide, nitrogen oxides, carbon dioxide and particles.

Additional sources of atmospheric and fugitive emissions comprise of vehicular transportation of raw materials.

Dust and exhaust gas emissions from the movement of machines, loading, and transportation will also contribute to degrade the air quality. If no mitigation measure is adopted, the concentration of particles produced can be high.

The main receptors are operations staff and other contractors that will be working on the site and communities along the access roads. The impact before mitigation is deemed high.

Table 6-15: Air Quality

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Moderate	Medium	-	Medium
Mitigation and Management						
• Provide PPE to the operation workers; • Switch off vehicle engine and machinery when not in use; • Locate machinery, fuel storage and dust generating activities away from site boundaries and sensitive receptors where possible; • Vehicles and plant/equipment should be fitted with appropriate emission control equipment and be serviced and maintained in accordance with the manufacturers' specifications; and • Periodic monitoring will be undertaken to determine whether there is any significant decline of in air quality from the baseline and corrective measures implemented. • An air quality management plan has been developed to manage emissions from the Project						
Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Low	-	Low

6.2.2.2 Noise Emissions

Noise is more than a mere nuisance. At certain levels and durations of exposure, it can cause physical damage to the eardrum and the sensitive hair cells of the inner ear and result in temporary or permanent hearing loss, known as noise-induced hearing loss.

Noise emissions associated with the operation activity will include noise from machinery engines, vehicles used for transporting materials and power generation. Noise impacts is mostly limited to the project boundaries but will however propagate beyond depending on scale of the operation.

There main receptors are workers, nearby residents, communities in close proximity to the Project site.

The impact is expected to be localised, minimal and of a short duration

Table 6-16: Noise Emissions

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Moderate	Low	-	Low
Mitigation and Management						
• Provide PPE to the construction workers; • Switch off vehicle engine and machinery when not in use; • Locate machinery, fuel storage and dust generating activities away from site boundaries and sensitive receptors where possible;						

- Construction of berms/ walls along mining area perimeter to act as a noise screen
- Host community should be informed about the activities and complaints on noise shall be recorded, adequately investigated and necessary remedial measures taken, if required.
- Night time activity should be minimised as much as possible, especially relating to activities
- conducted close to the communities
- Implementation of routine noise monitoring program to determine whether there are any significant increases in emissions and impacts at sensitive receptors.
- A noise management plant has been developed to provide detailed mitigation strategy

Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Low	-	Low

6.2.2.3 Road Traffic

Truck Movement to and from Site

The project operation will require transportation of materials, fuel and the sale of cement from the site. Waste materials will also need to be transported away from the site. It is estimated that there will be 1,000 truck trips a month through Freetown, therefore, the project will generate a reasonable volume of additional traffic that may have some impact on road safety and adverse road conditions. The significance of the potential traffic safety risks during the operation is assessed to be medium/ high.

Table 6-17: Transportation movement to and from Site

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Moderate	High	-	High

Mitigation and Management

- Sensitize equipment drivers on road safety.
- Monitoring vehicle speed and installing speed bumps with the provision of adequate signage;
- Heavy motor vehicle (HMV) traffic should be restricted to daylight hours if at all possible. Headlights of HMV should be on at all times, especially in rainy conditions;
- Crossings could be established in areas which are not safe to cross - residents and regular road users should be consulted with regard to the location of crossings.
- A traffic management plan has been developed to mange impacts from traffic and transportation

Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Medium	-	Medium

13. Transport from Clinker to Port

Raw materials for the processing will be transported to the cement plant via road using the main access road, the Freetown Masiaka Highway. The materials will be hauled using dump trucks to the cement plant and it will be carefully managed to avoid delays and maintain a steady flow of raw materials to the plant.

The traffic movement and volume from the clinker to the port may contribute to deterioration of the quality of the road network as well as generate noise and vibration along the routes, in particular, the main highway. The traffic route does not go within the residential communities in the project area therefore there is no significant impact to nearby communities.

The magnitude of the potential traffic impacts associated with deterioration of the public roads is and the sensitivity of the receptor (community residents and road users) is considered moderate for this impact.

Table 6-18: Transportation from Clinker to Port

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Moderate	High	-	High
Mitigation and Management						
• MACCEM has developed a Traffic Management Plan (TMP) and will oblige contractors to develop such plans or comply with the Company's route optimisation outlined in the plan. • The Company will consider whether deliveries should be scheduled to avoid peak times to reduce congestion and the risk of incidents as well; • Mandatory pre-trip examinations of drivers shall be practiced (including check for potential signs of alcohol or drug intoxication). • Drivers' training will be performed to inform them on the relevant speed limits and traffic safety • risks and regularly monitor compliance with safe driving practices. • Road maintenance works should be performed in case of the public roads' deterioration due to the operations traffic movements.						
Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Medium	-	Medium

6.2.2.4 Job Opportunities

The operation of the new cement factory will provide job opportunities for the locals (skilled and unskilled labour). These opportunities include job such as security guards, casual workers, and contractors. The opportunities are expected to be medium to long term. The impact is positive and it is expected to be of medium significance.

Table 6-19: Job Opportunities

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**

Local	Long-term	Likely	Minor	Low	-	Low

Mitigation and Management

- Preference should be given to local people during employment, where applicable;
- Establishment of a "local labour desk" at the Project site or contractor offices to identify a local labour pool; and
- Implementation of skills development programmes to support locals in obtaining employment opportunities.
- Ensure access of equal opportunity and benefit for female workers
- Ensure all the workers get fair compensation.
- A HR policy has been developed to cater for fair employment strategy

Post-Management Assessment

Spatial Extent	Duration	Likelihood	Magnitude	Consequence	+/-	Significance
Local	Long-term	Likely	Moderate	Medium	-	Medium

6.2.2.5 Workers Health and Safety

Activities linked to the operation of the cement factory comprise chemical, thermal and physical risks and a potential for accidents or injuries if safety instructions are not followed. Before mitigation, it is deemed high.

Table 6-20: **Workers Health and Safety**

Pre-Management Assessment

Spatial Extent	Duration	Likelihood	Magnitude	Consequence	+/-	Significance
Local	Short-term	Likely	Moderate	High	-	High

Mitigation and Management

- Appropriate PPEs shall be provided to all workers onsite
- An accident reporting and monitoring record should be maintained.
- MACCEM will implement robust and comprehensive occupational health and safety measures to prevent accidents and reduce the consequences of non-conformance events;
- MACCEM will provide training, awareness and supervision to ensure all of its construction workers to comply with the OHS procedures;
- An emergency response procedure will be available on site to ensure provision of first aid for personnel in case of an emergency

Post-Management Assessment

Spatial Extent	Duration	Likelihood	Magnitude	Consequence	+/-	Significance

Local	Short-term	Likely	Minor	Medium	-	Medium

6.2.2.6 Waste Management

The cement production process does not generate waste water. The main wastes generated during operation will be of the household (eateries, toilets, etc.) and industrial (carton, wood or metallic packaging, lubricants and various oils, etc.). Before mitigation, it is deemed average.

Table 6-21: Waste Management

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Low	-	Low
Mitigation and Management						
• Waste management must be a priority and all waste must be collected and stored effectively. • Waste products will be collected and recycled to enhance their value where applicable • MACCEM will contact licenced waste collectors collect unrecycled solid wastes produced during the construction phase of the cement factory; • Wastes and building materials will be quickly eliminated, lubricating oils packaged and eliminated off-site, household garbage and oily rags picked up while spilled inflammable liquids will be promptly cleaned up. • A waste management plan has been developed for further details.						
Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Low	-	Low

6.2.2.7 Surface Water

Contaminated Stormwater Runoff

Stormwater runoff from the cement plant may be contaminated with dust, hazardous materials (hydrocarbons etc.) and runoff from materials such as gypsum, cement product, as well as fuel, oil and lubricant spills. If not properly managed this contaminated stormwater may enter the surface resources impacting water supply to communities. Rainfall events could result in these pollutants reaching surface water bodies and sometimes the groundwater table. The impact is expected to be moderate.

Table 6-22: Contaminated Stormwater Runoff

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Moderate	High	-	High

Mitigation and Management
• Implement a stormwater management plan which will separate dirty water from clean water and divert run off from dirty areas to a pollution control dam which should have a silt trap to settle any sediment, and oil separators; • Store all potential sources of contamination with secondary containment and appropriate. • In the event that spills do occur, they will have to be managed in accordance with the project's ESMP and Waste Management Plan • Equip all trucks and equipment carrying fuels or oil with spill response materials and train personnel in the use of such materials. • Use oil & silt traps to remove these types of contaminants from stormwater.

Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Low	Medium	-	Medium

6.2.2.8 Ground Water

The potential for ground water pollution is likely due to possible accidentally fuel/lubricant leaks/spills. The operations of the cement factory will pose a risk to the groundwater quality and has the potential to affect community wells. This will include fuel sources, raw materials, waste generated, cooling water etc.

The impact is however assessed to be of medium significance without the implementation of recommended mitigation measures and low with mitigation measures.

Table 6-23: Ground Water Contamination

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Moderate	High	-	High

Mitigation and Management
• Ensure accidental spill and leak management protocols are in place to minimise contamination. • Implement the Waste Management Plan for the generated waste streams including solid, liquid, hazardous and non-hazardous, including oils and greases • Store all potential sources of contamination with secondary containment and appropriate Storm Water management systems in place to ensure that contaminants are not released to the water resource through Storm Water runoff. • Equip all trucks and equipment carrying fuels or oil with spill response materials and train personnel in the use of such materials

Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**

Local	Short-term	Likely	Low	Medium	-	Medium

6.2.2.9 Community Health and Safety

The first impact generated will be road accidents involving pedestrians, cyclists, motorcyclists, motorists and other road users living in the area. The population living near the access roads to project site will be the most affected. This impact is mitigated by the distance of inhabited areas from construction activities and roads used by construction equipment. Before mitigation, this risk is deemed average.

Table 6-24: Community Health and Safety

Pre-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Long term	Definite	Moderate	Medium	-	Medium
Mitigation and Management						
• Developing, communicating and implementing road safety and accident prevention measures for the local population; • Implement safe entrances/exits of worksites to hinder as little as possible population displacements. • Keep regular liaison with local communities and authorities to discuss security and safety risks. • A grievance redress mechanism has been developed back with a stakeholder engagement plan to manage issues from the community						
Post-Management Assessment						
Spatial Extent	**Duration**	**Likelihood**	**Magnitude**	**Consequence**	**+/-**	**Significance**
Local	Short-term	Likely	Minor	Low	-	Low

6.2.3 Decommissioning Phase

The factory decommissioning phase consists in the cessation of operations and decommissioning of installations and equipment. The main anticipated impacts will be on air quality, noise, workers' health and safety, etc. Dismantling will follow relevant national and international regulations.

7 CONCLUSION

The ESIA study has been undertaken for MACCEM proposed Cement Factory in line with statutory requirements of the EPA Act 2022 and other relevant national and international standards, regulations and best practises.

The ESIA process has identified appropriate measures required by the Project to avoid, minimise, mitigate, offset, or compensate for adverse impacts; and to enhance beneficial impacts where practicable. The existing environmental baseline conditions (biophysical and socio-economic) as well as sensitive components of the study area have been established through literature research and complemented with field data gathering exercise.

Interactions between the biophysical and socio-economic components of the environment and the proposed Project Area were used to identify, characterize and evaluate the potential and associated impacts of the proposed project. Thereafter, mitigation measures to ensure the sustainability of the Project based on best industry practices, available technology and level of knowledge were developed for the adverse impacts.

Engagements with stakeholders within the project area have been carried out and shall continue throughout the project lifecycle. Consultation and engagement meeting ensured that answers to questions concerning the proposed project were provided to the satisfaction of stakeholders.

Finally, an Environmental, Social Management Plan (ESMP) has been developed to ensure that procedures for managing adverse impacts of the Project development as well as the implementation of the environmental and social commitments made are maintained throughout the duration of the project. The ESMP also contains the environmental monitoring programme that would be used to monitor future changes to the environment from the Project activities.

This ESIA concludes that the impacts of the proposed Project are manageable and that its construction, operation, closure and post-closure will not present irreversible, unacceptable risks to the environment and people.

APPENDICES

Appendix A: Photographs from Stakeholder Consultations

Community Meeting in Rogbangba – Project Host Community

Community Meeting in Rogbangba – Project Host Community

Community Meeting in Rogbangba – Project Host Community

Community Meeting in Rogbangba – Project Host Community

Appendix B: Sample of Stakeholder Notification Letter

INTEGEMS

Integrated Geo-information and Environmental Management Services

INTEGEMS Limited
8G Technical Institute Drive
Off Main Motor Road
Congo Cross
Freetown
Sierra Leone

Email: info@integems.com
Website: www.integems.com

7 June 2023

Saidu Kamara
Headman
Rogbangba Community
Western Area Rural District
Western Area.

Dear Sir,

Notice of Environmental and Social Impact Assessment (ESIA) for MACCEM Industries (SL)Limited's Cement Manufacturing Factory in Hastings

MACCEM Industries (SL) Limited (hereinafter, MACCEM) has contracted Integrated Geo-information and Environmental Management Services (INTEGEMS) Limited to undertake an ESIA for its proposed Cement Manufacturing Factory in Hastings, Western Area Rural District.

The assessment seeks to identify the potential beneficial and adverse environmental, social and health impacts relating to the proposed cement manufacturing activities and to identify appropriate management measures for the project's development, construction and operation. The study will be conducted in accordance with the Environmental Protection Agency Act of 2022, other relevant national legislation as well as Good International Industry Practice (GIIP) standards.

As a key stakeholder, you are hereby notified of the Project and invited to participate in the ESIA process by providing any data, information, inputs and/or comments relevant to the Study. We have attached a Background Information Document (BID) on the project and the ESHIA Process for your information.

If you would like to make comments or have any questions or suggestions with regard to the study, please fill out the Registration and Comment Sheet attached to this letter and submit it to INTEGEMS at the address above. You can also send your comments via email at mm.kamara@integems.com or contact Mansa-Musa Kamara (Senior Consultant) at +232 78 089 643 if you require any clarifications.

We look forward to your contributions and thank you in advance for your commitment to participate in the process.

Yours faithfully

Samuella Faulkner, Managing Director/Principal Consultant, INTEGEMS Limited

Attached: Background Information Document and Stakeholder Registration and Comment Sheet

The The registered (Registration Number: SL 060119INTEG04810) business address in Sierra Leone is: 8G Technical Institute Drive, Off Main Motor Road, Congo Cross, Freetown, Sierra Leone.

Appendix C: Attendance Registers

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MACCEM: BASELINE STUDY – ENVIRONMENTAL SOCIAL IMPACT ASSESSMENT (ESIA)

STAKEHOLDER ENGAGEMENT ATTENDANCE REGISTER

No	Name	Designation	Institution/Community	Phone/Email	Signature
1.	Alhaji Saidu Tonkeh Kamara	Headman	Rogbangba Hastings Wharf Community	076835364 077 041702	
2.	Abdul Karim Kabba	Chairman Working Comm.	" "	076799299	
3.	Abdul Rahman Bangura	Chairman	Chairman Hastings Wharf	078987730	
4.	Alusine S. Bangura	Community Secretary	Rogbangba Hastings Wharf	077511224(sap) 034 288220	
5.	Saidu A. Kargbo	Community P.R.O	" "	099-750587	
6.	Alhaji Ibrahim Kolleyah Kamara	Stakeholder	" "	079-529914	
7.	Haja Zainab Mansaray	"	" "	077 653440	
8.	Haja Yabom Sesay	"	" "	077 501435	
9.	Mohamed Sallieu Bah	"	" "	076303835	
10.	Madiana Kamara	"	" "	076-124614	

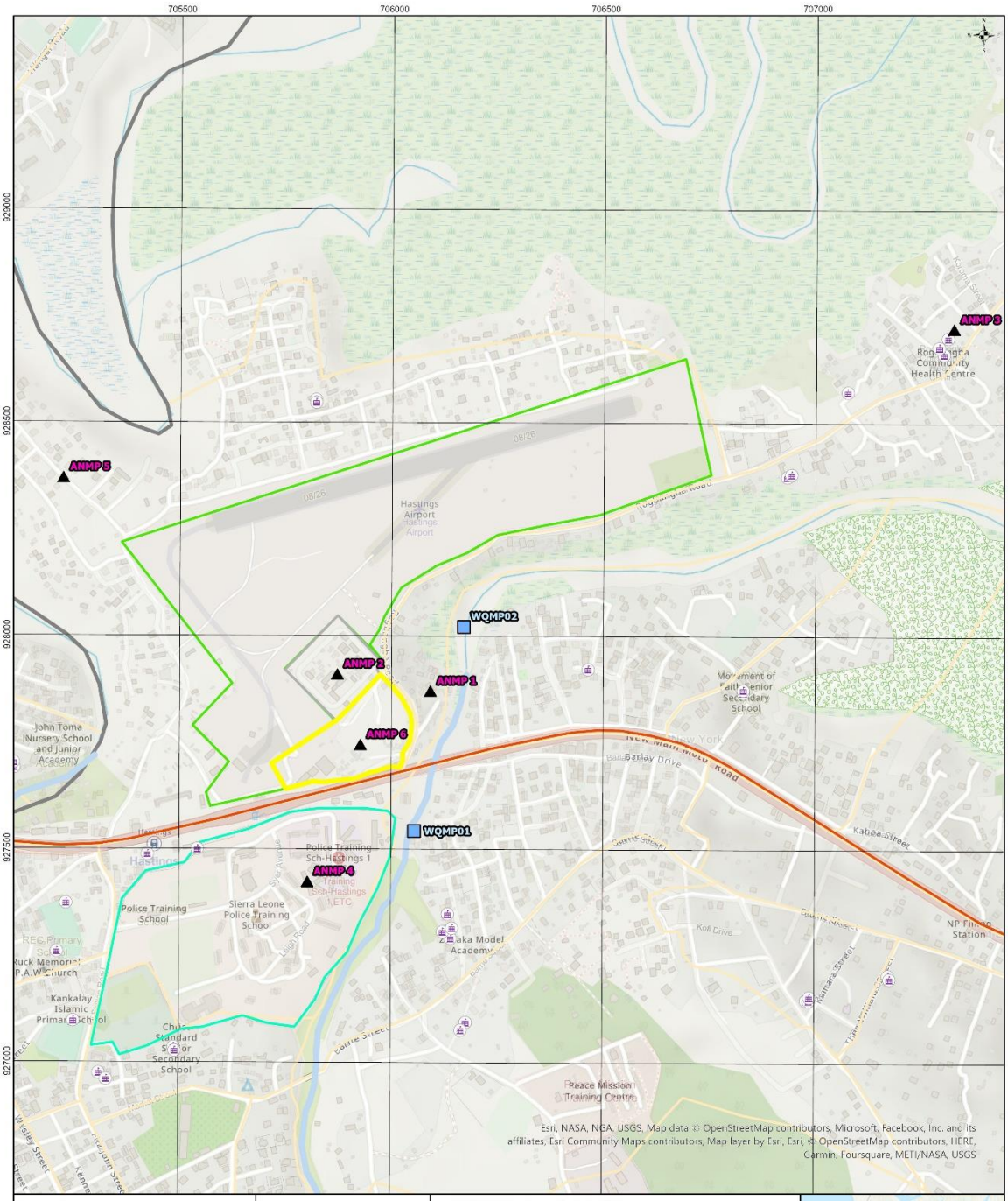
INTEGEMS

MACCEM: BASELINE STUDY – ENVIRONMENTAL SOCIAL IMPACT ASSESSMENT (ESIA)

STAKEHOLDER ENGAGEMENT ATTENDANCE REGISTER

No	Name	Designation	Institution/Community	Phone/Email	Signature
11.	Abdulrahman Kanu	Stakeholder	Hastings Wharf	077401803	
12.	Simeon Alimamy Forna	"	Rogbangba	076799089	
13.	Sorie Ibrahim Kanu	"	"	078445461	
14.	Alie Kargbo	"	Hastings Wharf	079419659	
15	Hassan Sesay	Asst. Youth Leader	" "	079 030693	
16	Unissa Kamara	Youth P.R.O	" "	030195367	
17	Alimamy Kanu	Deputy Y/Leader	" "	080 242900	
18	Assanatu S. Kamara	Stakeholder	Rogbangba Hastings Wharf	088 874117	
19	Osman Mansaray	Youth Rep.	" "	072005959	

Appendix D: Map of Proposed Environmental Monitoring Locations



Legend

- Potential Air and Noise Monitoring Points
- Potential Water Quality Monitoring Points
- Settlements
- Academic Institutions
- MACCEM Compound
- Hastings Airfield
- Ebola Response Center
- Police Training School
- River Estuaries

Main Highway
Road Class
- trunk
- Rivers
- Section Boundaries
- Chiefdom Boundaries
- Mangrove Areas

MACCEM Monitoring Locations		**MACCEM Hastings Project ESIA**	
		1 cm = 85 m (Applicable on A3 Only)	
		Projected Coordinate System	**Geographic Coordinate System**
Author	INTEGEMS Limited	WGS 1984 UTM Zone 28N Linear Unit: Metres Project: Traverse Mercator	GCS WGS 1984 Angular Unit: Degree Prime Meridian: Greenwich Datum: WGS 1984 Spheroid: WGS 1984
Client	MACCEM Industries LTD	The boundaries and names shown and the designations used on this map do not imply endorsement, acceptance or the expression of any opinion whatsoever on the part of INTEGEMS. Contact INTEGEMS (info@integems.com) if you have any queries or data updates which can improve future products.	
Date	7 September 2023		

Integrating innovative Geographic Information Systems (GIS) and remote sensing technologies with geo-information, environmental management and research expertise and experience to effectively and efficiently respond to socio-economic, environmental and natural resources management challenges and opportunities

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