FINAL REPORT

ENVIRONEMNTAL AND SOCIAL IMPACT STATEMENT (ESIS) AND ACQUISITION OF ENVIRONMENTAL PERMIT FROM ENVIRONMENTAL PROTECTION AGENCY (EPA)

In Respect Of

CONSULTANCY SERVICES TO AID THE CONSTRUCTION OF THE WORLD BANK AFRICA CENTRE OF EXCELLENCE IN COASTAL RESILIENCE (ACECoR) MULTI-PURPOSE BUILDING COMPLEX AT THE UNIVERSITY OF CAPE COAST

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LIST OF ABBREVIATIONS

AAU	Association of African Universities
ACE	Africa Centre of Excellence
ACECoR	Africa Centre of Excellence in Coastal Resilience
AER	Annual Environmental Report
BP	Bank Procedures
CBD	Convention on Biological Diversity
CCMA	Cape Coast Metropolitan Assembly
CCTV	Closed Circuit Television
CITES	Convention on International Trade of Endangered Species
CMS	Convention on Migratory Species
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CSO	Civil Society Organisations
EA	Environmental Assessment
ECOWAS	Economic Community of West African States
EHS	Environmental Health and Safety
EHSGs	Environmental, Health and Safety Guidelines
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EM	Environmental Manager
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ERP	Enterprise Resource Planning
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards
FC	Forestry Commission
FI	Financial Intermediary
GBV	Gender Based Violence
GHG	Greenhouse Gas
GMMB	Ghana Museums and Monuments Board
GPS	Global Positioning System
GRM	Grievance Redress Mechanism
GWCL	Ghana Water Company Limited
HSE	Health, Safety and Environment
ICT	Information and Communications Technology
IDA	International Development Association
IE	Inclusive Education
IEC	International Electrotechnical Commission
IUCN	International Union for Conservation of Nature
MOE	Ministry of Education
MSDS	Material Safety Data Sheet
NCC	National Commission on Culture
NCCP	National Climate Change Policy
NCR	Non-Conformance Report
NCTE	National Council for Tertiary Education
NEP	National Environmental Policy
NF	Non-forest
NGO	Non-governmental Organizations
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NPLD	Non-Pioneer Light Demander
O_3	Ozone/Trioxygen
OHS	Occupational Health and Safety
OP	Operational Policies
PBL	Problem-Based Learning
PDS	Power Distribution Services
PEA	Preliminary Environmental Assessment
PER	Preliminary Environmental Report

PPE	Personal Protective Equipment
RAP	Resettlement Action Plan
RBF	Results-Based Financing
RFU	Regional Facilitation Unit
SB	Shade Bearer
SO2	Sulphur Dioxide
SOP	Standard Operating Procedures
SSA	Sub-Saharan Africa
SSSI	Sites of Special Scientific Interest
TBD	To Be Determined
TCP	Town and Country Planning
UCC	University of Cape Coast
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VAWG	Against Women and Girls
WHO	World Health Organization
WRC	Water Resource Commission
WRC	Water Resources Commission

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INTRODUCTION

The World Bank in conjunction with the Regional Facilitation Unit (RFU), of the Africa Centres of Excellence (ACE) Project (ACE 1) recognized the need to scale up the success of the Phase 1 of the African Higher Education Centres of Excellence (ACE) project and expand the benefits accrued to the Centres and their Countries.

As part of the Africa Center of Excellence Impact Project (ACEII), the World Bank and the Government of Ghana (GoG) is supporting a five-year capacity building program at the University of Cape Coast to promote coastal resilience within the West and Central African sub-regions. The objective of the Africa Centre of Excellence in Coastal Resileince (ACECoR) Project is to support the development of technical and scientific capacity of young African professionals to develop integrated solutions to address coastal degradation in the countries of intervention through short to long-term professional and academic postgraduate training (PhD and MPhil) programmes

OBJECTIVES OF THE ACECoR PROJECT

The Project Development Objective (PDO) is to improve the quality, quantity and development impact of postgraduate education to address the challenges of coastal and marine degradation in selected African countries primarily is West and Central Africa through regional specialization and collaboration.

The expected impact of the Centre therefore, is that the coastal and marine sectors of West Africa contributes to the promotion of sustainable economic development through sustainable coastal resource utilisation in the partner countries.

To achieve this, the ACECoR project therefore aims to build regional capacity to deliver high quality postgraduate courses and to conduct and disseminate international caliber applied scientific research focused on addressing development challenges within the region. Given the limited resources available to support postgraduate training and applied research in SSA, the ACECoRproject is designed to increase specialization and excellence in higher education. Furthermore, the University of Cape Coast will be placed in a strategic position to enhance regional collaboration through other university, governmenat and private sectornetworks. This will build regional platform for capacity development essential to Africa's growth within the Blue Economy. To further these objectives, the World Bank approved for the University of Cape Coast to build a befitting Multipurpose infrastructure, for ACECoR, equipped with the appropriate facilities for the trainings.

PROJECT DESCRIPTION

As part of the ACECoR project, the University of Cape Coast proposes to construct a multipurpose educational complex to accommodate research laboratories, offices and lecture rooms. The proposed ACECoR Buiding is expected to provide the needed academic infrastructure and research facilities that can enable ACECoR to run the existing programmes of Disaster Risk Management and Migration, Fisheries Science, Oceanography and Limnology and Integrated Coastal Zone Management, in addition to new programmes in Physical Oceanography, Coastal and Marine Engineering, Forestry Engineering and Marine Meteorology, which will be developed and mounted later. Specifically, the project will help in

- Training 120 students at the postgraduate (PhD and Masters) level in the programmes stated above
- Organising short courses for 570 professionals across Africa in the areas already described.

The proposed site for the ACECoR Building is located on a plot of land near the UCC West Gate (See Figure 6-3, page 43) towards the Duakor Road at UCC Old Site.

OBJECTIVE OF THE ESIA ASSIGNMENT

The objective of the assignment is to conduct an Environmental and Social Impact Assessment (ESIA) and produce an Environmental and Social Impact Statement (ESIS), which is a requirement for the issuance of an Environmental Permit by the Environmental Protection Agency (EPA) to cover the ACECoR building project. It is anticipated that the ACECoR Building Project will have some environmental and social impacts and thus categorised by the World Bank's Environmental and Social Risk Classification as a Category B project. The World Bank Environmental and Social Safeguard Policy OP 4.01 has been triggered. In view of this, it was considered appropriate to undertake an Environment and Social Impact Assessment Studies to identify the potential impacts, assess the impact significance, proposed mitigations measures and develop an ESMP.

RELEVANT POLICES LEGAL AND ADMINISTRATIVE FRAMEWORKS

The proposed ACECoR Building project is required to comply with the following key legislations and policies relevant to the ESIA Study:

National Policy

- The National Environment Policy (2013);
- The National Environmental Sanitation Policy dated April 2010;
- National Health Policy (2007);
- National Climate Policy, (2012);

The relevant national laws and legislations particularly to guide the preparation of the ESIA for the proposed project include the following:

- The Constitution of Ghana, 1992
- The State Lands Act, 1962
- Lands Commission Act 2008, Act 767
- Environmental Protection Agency Act 1994, Act 490
- Environmental Assessment Regulations 1999, LI 1652
- Fees and Charges (Amendment) Instrument 2015 (LI 2228)
- Local Government Act 2016, Act 936
- Lands (Statutory Wayleaves) Act, 1963 (Act 186)
- The State Lands Act, 1963 (Act 125)
- The Labour Act, 2003 (Act 651)
- Workmen's Compensation Law, 1987, PNDCL 187
- Wetlands Management (RAMSAR Sites) Regulations, 199
- Land Use and Spatial Planning Act, 2016 Act 925
- World Bank Environmental and Social Policies and Standards

The ACECoR Project is a multi-institutional and sectoral project. The following are the relevant ministries and sector agencies with various administrative roles and responsibilities under the project:

- The Ministry of Education
- National Council for Tertiary Education
- Environmental Protection Agency
- Town and Country Planning
- Electricity Company of Ghana
- Ghana Water Company Limited
- Cape Coast Metropolitan Assembly
- Forestry Commission
- National Commission on Culture
- Civil society and the media

ALTERNATIVE CONSIDERATIONS

Decision making is mainly supported by the EIA tool so if there is no choice among options, there is no reason for a decision. The consideration of alternatives is central to sound decision-making; it increases public participation and improves transparency thus ensuring better accountability of the decision. Therefore, alternatives are very important for better governance and sustainability.

Consistent with the above and in order to enable the proposed ACECoR Building project seek different ways of minimizing its impacts on the environment and at the same time achieve its objectives, several alternatives were assessed through its architectural and engineering designs and environmental planning through this EIA. The alternatives considered as part of the conception of this project are:

i. No action scenario;
ii. Project implementation scenario - Alternative Sites 1&2
iii. Project implementation scenario – Alternative sites 3 & 4
iv. Refurbishment of the existing Fort St. Jago, Elmina in the Central Region
v. Alternative Schedule
vi. Alternative Design

BASELINE INFORMATION

The project will be located within the University of Cape Coast (UCC) which is in the Cape Coast Metropolitan Assembly (CCMA) in the Central Region of Ghana. CCMA is bordered by the Gulf of Guinea to the south, Komenda- Edina- Eguafo- Abirem Municipal Assembly to the west, Abura- Asebu- Kwamankese District to the east and Twifo-Heman- Lower Denkyira District to the north. The Municipality covers a total land area of approximately 122 sq. km and lies within latitude $5^{o}.07^{1}$ to $5^{o}.07^{1}$ north of the Equator and between longitudes $1^{o}.11^{1}$ to $1^{o}.41^{1}$ west of the Greenwich Meridian.

The Cape Coast metropolis lies within the zone of heavy seasonal rainfall. The area generally experiences two main rainy seasons. The seasons are however not distinct. There is a major rainy season that reaches its peak in May-June and a minor season between September and November. The average annual rainfall is about 1250mm. The degree of saturation of surface soils is very high in May–June, i.e during the peak of the first rainy season. The period between January to April is relatively dry and maximum desiccation of surface soils takes place. The temperature in the Metropolis varies between 24^{o}c and 32^{o}c. The hottest months are February and March, just before the main rainy season, while the coolest months are June, July and August. The relative humidity is between 60% and 80%. The variability in climate in the metropolis is influenced more by rainfall than temperature.

The site is relatively flat and approximately 30 feet above sea level. The project site is underlain by rocks of the Sekondian formation which consists of sandstones, grits, shales and mudstones, nodules of limestone and siderite. The superficial soils are silty sands and clays. The recorded ambient noise levels within the University of Cape Coast, including the project site, were within the permissible limits set by the Ghana EPA.
The major stream and river in the Metropolis are the Siwere and Kakum respectively. Lagoons include the Fosu. Rivers and streams end up in wetlands and finally drain into the Fosu Lagoon at Bakaano and the sea at Abakam. Quality analysis carried on water samples from the channel that traverses the site indicated that the pH ranged from 5.95 to 6.8, making the water slightly acidic. Turbidity ranged from 3.5 NTU to 67 NTU with the electrical conductivity ranging from 840 µS/cm to 1430 µS/cm. Iron in the samples ranged from 1.5 mg/L to 16.88 mg/L. Other metals recorded included Cd (0.025 – 0.035 mg/L), Mn (0.52 – 1.17 mg/L), Ni (0.083 – 0.14 mg/L), Pb (0.17 – 0.47 mg/L) and Zn (0.17 – 0.85 mg/L). With the exception of Pb, which was elevated, all other metals recorded levels that met the permissible limits set by the Environmental Protection Agency (EPA) of Ghana. The nutrient levels were variable. The concentration of NO_3 ranged from 0.44 mg/L to 4.30 mg/L, which was less than the set limit of 50 mg/L. On the other hand, PO_4-P levels ranged from 0.32 mg/L to 4.75 mg/L. The concentration of oil and grease ranged from 6.3 mg/L to 15 mg/L. The original vegetation of the project site within the University of Cape Coast has been degraded primarily due to the previous clearance of the vegetation on site for the establishment of various infrastructure found in the surroundings of the proposed project site. The

physiognomy of the original vegetation has been destroyed leading to the preponderance of early stages secondary succession species. The star rating of the flora revealed that most of the species are of low conservation status or have not been star rated. Four species of small mammals distributed in four different families were recorded in this study. The species were *Arvicanthis niloticus*, *Cricetomys gambianus*, *Euxerus erythropus* and *Thyronomys swinderianus* of the Muridae, Nesomyidae, Sciuridae and Thryonomyidae families respectively. The IUCN classification of the mammalian species in this study shows that all the species are of least concern. The mammalian species obtained in this study are also of no threat globally and nationally. The conservation status of the herpetofauna species obtained at the site revealed no conservation concern as three species forming 60% of the herpetofauna were categorized as least concern and two representing 40% of the herpetofauna species have not been categorized.

STAKEHOLDER CONSULTATION

Stakeholder Engagement under ACECoR began early from the project identification to allow stakeholders' views and concerns to be considered in the project design, and to provide inputs to the project environmental and social assessment and mitigation plan. The engagement also sought to disseminate and disclose project related information and to plan project implementation, monitoring and evaluation arrangements. Engagements included both formal and several informal methods. Stakeholders span government institutions, Development Partners, private sector, CSO/ NGOs, the university community (academia) and the adjoining community.

ENVIRONMENTAL AND SOCIAL IMPACTS IDENTIFICATION

The potential positive and adverse impacts of the project covering the design, construction, operation and decommissioning phases have been identified, evaluated and significance determined.

Positive impacts

The Positive Impacts at the design phase are:

- Creation of employment and business opportunities;
- Generation of income and source of government revenue; and
- Environmental opportunities.

The positive impacts of the construction phase are:

- Creation of employment;
- Market for goods and services;
- Creation of market for the local community; and
- Increased economic activities and revenue.

The positive impacts of the operational phase are:

- Improved infrastructure for research and learning;
- Improved workers' wellbeing and working efficiency;
- Creation of employment opportunities.
- Enhanced coastal environmental management opportunities

At the decommissioning phase, the following are the potential positive impacts:

- Creation of employment and business opportunities;
- Income generation;
- Provision of cheaper building materials; and
- Environmental conservation and restoration.

Adverse Impacts:

The potential moderate and significant adverse impacts covering the construction and operational phases are:

- Loss of Flora and Faunal Habitats
- Emission of Air pollutants
- Generation of Noise
- Dust pollution/ air quality deterioration
- Increased Pressure on Utilities
- Increased Heavy Traffic
- Generation of Construction Waste
- Occupational Health and Safety (OHS) Risks

MITIGATION AND MONITORING MEASURES

The project's significant impacts are analysed, reviewed further and mitigation measures are proposed in Table 9-1, that will enable the impacts to be managed, reduced or avoided where possible. The impacts are rated HIGH, MODERATE or LOW.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan covers labour management plan, including working conditions and management of worker relationships, protection of the work force, operational health and safety, and workers engaged by third parties. It also includes a Grievance Redress Mechanism (GRM) that provides unrestricted opportunity for the contractor, workers, project-impacted persons and the general public to lodge complaints related to any aspect of the ACECoR building project for prompt redress. The GRM is in two forms – manual, where the form is accessed from the project site office or the Environmental and Social Safeguards Officer, and the electronic form (eGRM), where the grievance is logged directly in the eGRM interface on ACECoR's website.

The ESMP has also been developed with an aim to outline actions necessary to prevent, mitigate and control possible negative impacts or disadvantages during the different phases of the project onto the environment and to analyse steps that could be taken in respect to this.

INSTITUTIONAL ARRANGEMENTS

An Institutional arrangement and management structure with defined roles and responsibilities for the following key actors have been presented:

- ACECoR Responsibilities;
- World Bank Responsibilities
- Responsibilities of the Consulting Engineer
- Responsibilities of the contracting entity (i.e. University of Cape Coast) and
- Environmental Manager

CONCLUSION

In conclusion the proposed project will have several positive economic and educational impacts. The project will play an important role in enhancing the capacity of the University of Cape Coast to deliver high quality postgraduate courses related to coastal and marine degradation and will conduct and disseminate international caliber applied research focused on addressing development challenges in West Africa. However, the project will present environmental and social risks similar to most building and infrastructure projects, which include: generation of wastes (municipal, construction and demolition wastes; changes in soil characteristics; emission of air pollutants amongst others. These risks can be adequately managed and monitored through the proposed mitigation measures, that includes frameworks for developing waste management plans, OHS plans

and hazardous materials safety plans. It will cost one million, three hundred and fifty Ghana Cedis (GHS 1, 350, 000.00) to fully implement the ESMP. Conditions, processes and procedures along the project timespan may change as the environment and its factors are dynamic. This makes it important for an organization to continuously improve its ESMP, with the objective of improving the overall environmental performance. Again, not every process within the ESMP will be expected to improve all the time, hence there is the need for so continual improvement so as to plan, monitor, and realize improvements in some processes that have been identified for improvement. As an efficient ESMP is characterized by continual improvement the need to systematically improve different processes within the ESMP in order to provide overall improvements is very pertinent. It is therefore recommended that Management of ACECoR should see continuous improvement as a key requirement for this ESMP and commit to it.

1.0 INTRODUCTION

1.1 BACKGROUND

The coastal zone of West Africa, just like any other coastal zone in the world is confronted with a myriad of problems. These problems have resulted from rapid population growth and urbanization, as well as the impact of climate change and poor land use practices. Currently about 68% of sandy beaches of West Africa are being eroded at an average rate of two (2) meters per annum with low lying areas perennially inundated. This is further compounded by poor sanitation and rapid encroachment of coastal wetlands leading to the destruction of natural habitats and biodiversity. Indeed, the challenge of coastal degradation is multi-faceted and resolving it will require multi-faceted and synergistic approaches built on reliable data and human expertise. There is however a lack of scientific data on coastal degradation at national and regional levels. Currently there is limited knowledge on the extent of coastal degradation facing the West African sub-region. What is also missing are the types of degradation and where they are occurring along the coast. Again, information is needed on the impact of the coastal degradation on human society and biodiversity. Under the influence of both climatic and anthropogenic stressors, effective management of coastal degradation is also affected by limited historical time-series data as well as expertise in technical areas to resolve the problem of coastal degradation in developing countries. The degradation is characterized among others by the erosion of shoreline, pollution of coastal and marine ecosystems and the apparent lack of technical and scientific capacity to effectively utilize and manage coastal and marine assets.

Africa Centre of Excellence (ACE)

The World Bank in conjunction with the Regional Facilitation Unit (RFU), of the Africa Centres of Excellence (ACE) Project (ACE 1) recognized the need to scale up the success of the Phase 1 of the African Higher Education Centres of Excellence (ACE) project and expand the benefits accrued to the Centres and their Countries.

As part of the Africa Center of Excellence Impact Project (ACEII), the World Bank and the Governemnt of Ghana (GoG) is supporting a five-year (2019-2023) capacity building program at the University of Cape Coast to promote coastal resilience within the West and Central African sub-regions. The objective of the Africa Centre of Excellence in Coastal Resileince (ACECoR) Project is to support the development of technical and scientific capacity of young African professionals to develop integrated solutions to address coastal degradation in the countries of intervention through short to long-term professional and academic training programmes. It will deliver high quality post graduate courses, international caliber research focused on addressing coastal development challenges. In this context, University of Cape Coast is leading the World Bank (ACEII) Impact project on Capacity Building sub-component. This will be achieved through partnerships and collaboration with academia, research institutions and industry, locally and internationally.

It is anticipated that the ACECoR Building Project will have some environmental and social impacts, hence, according to the World Bank's Environmental and Social Risk Classification, is a Category B project. The World Bank Environmental and Social Safeguard Policy OP 4.01 has been triggered. In view of this, it was considered appropriate to undertake an Environment and Social Impact Assessment Studies to identify the potential impacts, assess the impact significance and proposed mitigations measures and develop an ESMP. The preparation of an environmental and social impact assessment or environmental and social management framework is a requirement for the Project Funding Proposal as per the World Bank Safeguards Policy Conditionalities.

This Environmental and Social Impact Statement (ESIS) for the ACECoR project has been prepared as part of the Ghana EPA regulatory requirements for environmental permitting and decision making by the World Bank and other relevant government agencies. This ESIS includes a Preliminary Environmental and Social Management Plan (ESMP) which will be used in the preparation of bid documents for the selection of a Contractor for the execution of the project. Based on the Concept Design the Contractor to be selected will prepare a detailed ESMP at the detailed design stage.

1.2 OBJECTIVES OF THE PROJECT

The Project Development Objective (PDO) is to improve the quality, quantity and development impact of postgraduate education in selected universities through regional specialization and collaboration.

The ACE projects aim to build regional capacity to deliver high quality postgraduate courses and to conduct and disseminate international caliber applied research focused on addressing development challenges in SSA. Given the limited resources available to support postgraduate training and applied research in SSA, the ACE projects are designed to increase specialization and excellence of higher education. Further, universities will enhance regional collaboration through university networks. This will build regional capacity essential to Africa's development. The ACE project leverages institutional and national strengths to serve regional needs. To achieve results, the ACE projects use a regional model with the following elements: transparent and competitive selection of centers; a strong focus on regional collaboration and student recruitment; strong government and institutional ownership; results-based financing (RBF) with independent verification of results; a robust monitoring and evaluation.

The need to scale up the success and expand the benefits accrued to the Centres and their respective countries gave birth to ACE II. ACE II will focus on increasing the quality and relevance of post-graduate education in selected universities through regional specialization, applied research, upfront University-Industry linkage and better Regional and International coordination. ACE II is not an absolute replacement for ACE I, but rather seeks to build on the success achieved and expand the reach of the benefits from ACE I. It further aims at upscaling performing Centers hence, only performing ACE I Centers have been upgraded to ACE II.
The Regional Facilitation Unit for the ACE II Impact Project is the Association of African Universities (AAU).

1.2.1 Project Components

The project has three components:

- ***Component 1*** aims to build and strengthen the capacity of competitively selected ACE Impact centers based in higher education institutions across West and Central Africa.
- ***Component 2*** seeks to expand the regional scope of impact of the ACEs funded under Component 1 by providing demand-side funding for partnering institutions and regional students to buy the training and services from the ACEs.
- ***Component 3*** will fund, through a Regional IDA grant of US$10 million to the Association of African Universities (AAU), the facilitation of the ACE Impact project's regional activities and support to centers under the project.

1.3 ENVIRONMENTAL AND SOCIAL CLASSIFICATION OF THE PROJECT AND KEY OBJECTIVE OF THE ESIA

The objective of the assignment is to conduct an Environmental and Social Impact Assessment (ESIA) and produce an Environmental and Social Impact Statement (ESIS), which is a requirement for the issuance of an Environmental Permit by the Environmental Protection Agency (EPA) to cover the ACECoR building project. The Constitution mandates that appropriate measures be taken to protect and safeguard the national environment. Similarly, LI 1652 mandates that no undertaking which is likely to adversely impact on the environment or public health commences without the conduct of an EIA and prior approval of the Environmental Protection Agency (EPA).

The ESIA is also needed because the Project is financed by The World Bank, as such, the Project is required to meet or satisfy The World Bank's Environmental and Social policies and Standards. The Project has been classified as a Category B Project per the World Bank criteria for categorizing projects based on environmental significance, type, location, sensitivity, and scale. Category B Projects refer to projects that involve site specific and immediate project environment interactions and have adverse impacts that are not sensitive, diverse,

unprecedented and are mostly reversible. Though they generally do not significantly alter natural systems and resources or consume much natural resources (e.g. ground water), the conduct of an ESIA is a requirement.

The World Bank is committed to its safeguard policies and Environmental and Social Standards (ESS) which are targeted at preventing and mitigating undue harm to people and their environment in development initiatives or projects supported by the Bank through Investment Project Financing. This ESIA therefore evaluated several issues which relate to the physical and biological environment of the Project area, as well as socio-economic, cultural, health and safety issues. The ESIA identified potential impacts (positive and negative) that may result from the Project and recommended applicable mitigation measures for negative impacts and enhancement measures for positive impacts.

Specifically, the objective of the ESIA report is therefore to present the following:

- A comprehensive description of the Project and relevant Project alternatives assessment;
- The ESIA process and a review of legislation, standards and guidelines pertinent to the Project and associated ESIS;
- Description of stakeholder engagement activities;
- A comprehensive baseline study and review of the physical, biological and socio-economic characteristics of the Project area;
- Assessment of potential impacts to the physical, biological and socio-economic environments within the Project's area of influence;
- Mitigation measures and associated management plans targeted at avoiding, reducing or managing the severity of identified impacts; and
- Assessment of potential cumulative impacts associated with other planned, existing or project-related developments in the Project area.

1.4 SCOPE OF THE ESIA

Emanating from the purpose and objectives of the ESIA studies, the following is the scope of the assignment:

- Provide technical expertise for the conduct of environmental and social impact assessment (ESIA) on the ACECoR building project.
- Prepare an ESIA Management Plan for the ACECoR building Project
- Provide the requisite technical and administrative assistance including the provision of all required documentation in securing an Environmental permit for the ACECoR Building.
- Educate the surrounding Community on the Project

The ESIA shall be undertaken in accordance with the requirements of the Environmental Assessment Regulations 1999 (LI 1652) and the Ghana EIA Procedures as well as the World Bank Group's Environmental Health and Safety Guidelines (EHSG) will also be observed. The key stages in Ghana's EIA procedures are presented below and these will inform the scope of works for the consultancy:

- Registration of the project with EPA;
- Environmental and Social Impact Assessment (ESIA) of the project and preparation of Environmental and Social Impact Statement (ESIS), and
- Issuance of Environmental permit by EPA.

1.4.1 Registration of the Project with EPA

In collaboration with the University of Cape Coast Project Coordinating Unit (PCU) ACECoR Building Project was registered with the EPA. The EPA Environmental Assessment Registration Form (Form EA1) was procured, completed and submitted to the EPA Regional office in Cape Coast on 26th November 2021. The completed Environmental Registration was accompanied with the Land Use letter from the Estate Department of the University of Cape Coast, Site and Block Plans for the ACECoR Building Project. Further administrative

processes are ongoing as part of the Environmental Permitting processes for the ACECoR Building Project by EPA.

1.4.2 Scoping Study of the Project

The first stage in the ESIA process involved a scoping study. The scoping study provided an overall understanding of the biophysical and socioeconomic baseline situation and provide an overview of the range, depth and trend of issues subsequently studied in detail during the main ESIA. The scoping exercise set the focus for ESIA studies, data collected and other resources used for the conduct of the ESIA.

Specifically, the consultant did the following:

1) Collected baseline information on bio-physical and socio-economic conditions and developments in the subproject area which aided the prediction of impacts;
2) Facilitated the consultation and participation of relevant stakeholder government Ministries, Departments and Agencies (MDAs), Metropolitan/Municipal Assemblies and all affected persons or groups of persons as well as businesses by the subproject in the process of identifying and assessing the environmental and social impacts of the subproject;
3) Identified the most relevant and significant environmental and social issues of concern out of a myriad of issues and focused on them in the ESIA; and
4) Prepared a draft ESIA and presented same to the EPA for its review and issuance of permit.

In addition to the above, the consultant paid attention to the identification of health and safety issues related to the construction of the ACECoR Building Project.

2,0 PROJECT DESCRIPTION

2.1 PROJECT OVERVIEW

In September 2018, the University of Cape Coast was competitively selected by the World Bank from among solicited proposals received from across universities in West and Central Africa to establish the Africa Centre of Excellence in Coastal Resilience (ACECoR) on its campus. The selection brings the ACECoR into a network of 53 Centres of Excellence (ACEs) in Africa approved by the World Bank to host a Regional Centre of Excellence. The University of Cape Coast will receive a counterpart funding to the tune of US$ 6.5 from the World Bank and Government of Ghana to implement the project. The call for proposals was rolled out by the Association of African Universities (AAU) and the Regional Facilitation Unit (RFU) of the Africa Centres of Excellence (ACE) Project, with support from the World Bank, under the ACE for Development Impact Project.

ACECoR will carry out education, research and outreach programmes. These programmes will be implemented in collaboration with other academic institutions and industries within the country, sub-region and at the global level to ensure a multi- and interdisciplinary approach to addressing coastal degradation across the sub-region.

The Centre aims at achieving excellence in training both students and professionals in selected areas as a way of enhancing coastal resilience and promoting policies through:

i. Enhancing old academic programmes and developing new programmes to train professionals in the coastal issues
ii. Improve teaching and learning environment and resources for training and research
iii. Enhance human resource capacity for teaching and research in the thematic areas of the project
iv. Establish strategic academic and industry sector partnerships for outreach through students/faculty exchange, networking, conferences and workshops

2,2 PROPOSED ACECOR BUILDING PROJECT

As part of the ACECoR program, the University of Cape Coast proposes to construct a multipurpose educational complex to house the Centre. The building complex will accommodate research laboratories, offices and lecture rooms. The proposed ACECoR Buiding Project is expected to provide the needed academic infrastructure and facilities that can enable ACECoR to do the following:

- Train 120 graduates at the postgraduate (PhD and Masters) levels in addition to 570 professionals (in short courses) across Africa in the areas already described. In addition to existing programmes of Disaster Risk Management and Migration, Fisheries Science, Oceanography and Limnology and Integrated Coastal Zone Management, new programmes in Physical Oceanography, Coastal and Marine Engineering, Forestry Engineering and Marine Meteorology will be developed and mount for the training of postgraduate students.

- Among others ACECoR will:
  - establish new and relevant post-graduate programs to address the challenges of coastal degradation within the sub-region;
  - provide support for the development and delivery of short courses in the areas mentioned, accredited to relevant international bodies;
  - develop mentoring support systems for faculty for effective administration and management, as well as course delivery;
  - provide incentives for lecturers to teach, guide research and provide in-service training to professionals in delivery of short courses;
  - provide Smart Classrooms with state-of the art facilities including science laboratories with ICT equipment to promote research and deliver the trainings;

- supply computer hardware and software to deliver the course to the expected standards; and
- provide placements in industry for selected students and support lecturers to attend conferences, workshops to upgrade their skills, with fees paid through scholarships and living expenses funded by this Project
- initiate a scheme for five (5) post-doctoral fellows to be selected from within the región

- In terms of academic programmes, the Centre will admit and train 120 postgraduate students made up of thirty (30) PhD and ninety (90) masters students. The Centre will ensure strong industry linkages, encourage female participation and will facilitate an estimated 40% of total student intake into the program from within the African sub-region. ACECoR will work towards developing and securing local and international accreditation for modular academic programmes.These academic programs shall be grounded on five (5) thematic and applied research areas as follows:
  - Coastal Geomorphology and Engineering;
  - Climate Change Adaptation and Mitigation;
  - Disaster Risk Management and Migration ;
  - Ecosystems and Biodiversity Science; and
  - Blue Economy, Governance and Social resilience

- ACECoR to introduce short courses to train 570 African Professionals and students in the following areas of emphasis:
  - Integrated Coastal Zone Management
  - Climate Change Adaptation and Mitigation in Coastal Areas
  - Fisheries Resources Management

2.2.1 Expected Results of ACECoR's Activities

Expected results of ACECoR's activities will include:

i. Enhanced capacity of staff of the University to deliver high-quality training to increase the number of postgraduate students and supply of highly skilled graduates (30 PhDs, 90 masters, 570 short courses participants)
ii. Enhanced research capacity to publish 50 scientific articles in both international and local journals and communicate applied research at regional and international conferences and workshops during the project period.
iii. Strong collaboration with academic partners established for joint research and training,
iv. Partnership between UCC and sector industry established to enhance faculty and student internships, training of practitioners and research into industry problems to influence national and regional policies.

2.3 PROJECT LOCATION

Administratively, the project is located in Cape Coast, the capital of the Cape Coast Metropolitan Assembly and the Central Region of Ghana. The proposed site for the ACECoR Building is a plot of land near the UCC West Gate towards the Duakor Road at UCC Old Site. The GPS Location of the site is 5^0 6' 8" N, 1^0 17'5" W. The proposed site is currently undeveloped and overgrown with vegetation and various tree species (Figure 2-1) with several adjoining landuses (Figures 2-2 and 2-3).
The following are the adjacent land uses:

- On the northern end is the UCC Enterprise water production facility, which is about 100m from the site.
- On the southern end is the Takoradi-Cape-Accra main road which is about 300m away from the site.
- On the South-Western end is the Duakor community and on the western end is an undeveloped land overgrown with vegetation interspersed with trees and shrubs

- On the eastern end is the Duakor Road from the UCC West Gate entrance to UCC. Beyond the Duakor Road and opposite to the site on the Eastern side is the U.C.C. Sports Complex building, basketball courts, the sports stadium and other academic facilities.

The proposed site has adequate road access both from the eastern and northern sides. However, future vehicular access to the site during the construction and operational stages may preferably be through the northern side in order to minimise potential traffic impact. The site is also readily accessible to utilities such as water and electricity from the Ghana Water Company Limited (GWCL) and Electricity Company Ghana Limited (ECG) respectively.

Figure 2-1: Location of ACECoR Building site with nearby landuses

 ACECoR Building Project Site-18.11.2021	 ACECoR Building Project Site-18.11.2021
 Northern end of ACECoR Project Site: UCC Enterprise Project Building-18.11.2021	 Southern End of ACECoR Project Site: UCC Enterprise Project Building-18.11.2021

Figure 0-2: Photo Gallery: ACECoR Building Project Site

Western End of the ACECoR Buiilding Porject Site: The Western Gate Entrance Road To UCC-18.11.2021

Western End of the ACECoR Buiilding Porject Site: The Western Gate Entrance Road To UCC-18.11.2021

UCC Enterprise Building Sign board-18.11.2021

UCC Enterprise Building-18.11.2021

Figure 0-3: Photo Gallery: Adjacent Land uses of ACECoR Building Project Site

2.4 ACECoR Building Project Design Components

The proposed ACECoR Building Project, which is intended to serve as a Multi-purpose Educational Complex (Figure 2-4), is five-story building with each floor having a unique design and layout to serve specific purposes. The Block layout and components of the various floors are as follows:

- **Ground Floor**: Conference room, offices for academic, research and administration, reception and entrance hall, lobby, entrance terrace
- **First Floor**: Mini auditorium, syndicate meeting rooms, ICT lab, offices
- **Second Floor**: Library, offices, study booths, research commons, incubation centre
- **Third Floor**: Library, office, labs
- **Fourth Floor**: Outdoor sitting area, restaurant, rooms, roof below
- **Fifth Floor**: Rooms and offices

2.4.1 Car Parking Facility

The proposed ACECoR Building Project is supported with a car parking facility adjacent to the proposed site for the building and it is located on the southern end of the site. The facility is planned to accommodate a minimum of 50 cars.

2.4.2 Utilities

ACECoR through collaboration with the Directorate of Physical Development and Estate Management (DPDEM), UCC, Ghana Water Company Limited, Electricity Company of Ghana (ECG) and the Cape-Coast Regional Fire Service will supply the needed utilities such as Water, Electricity, Sewerage, Drainage Systems, Transport and Traffic needs and Fire requirements.

It is anticipated that the water supply and utilization at the project site will fall under two (2) categories: consumptive and no-consumptive uses. The major consumptive uses are for human sustenance, with themain non-consumptive uses being fire-fighting, sanitation and hygiene and for aesthetics beautification purposes. The estimated total demand for potable water for the development will range between 50 to 100 cubic metres per day.

The source of the water supply will be from the Ghana Water Company Limited through the Brimso Waterworks that provides water for the Cape Coast Metropolis. Historically, the supply of water to UCC has been from Ghana Water Company Limited (GWCL) operations. Cape Coast used to experience perennial water shortage with its attendant problems. Therefore, Ghana Water Company Limited (GWCL) instituted some measures including dredging of the Brimsu dam and construction of a new water treatment plant at Sekyere Hemang to improve water supply situation in the Region.

Figure 0-4: Architectural Impression of the Proposed ACECoR Building Project

Figure 0-5: North Wing of the Proposed Multipurpose Educational Complex (Phase 1)

2.5. PROJECT ACTIVITIES

Several activities will be undertaken at different stages in the construction of the multipurpose building. The stages of the project and the major activities to be carried out include but not limited to:

Site Preparatory/Pre-Construction Phase: This stage includes all physical site preparation activities necessary for the commencement of construction and it includes vegetation and top soil removal, creation of access route, land levelling, carting of materials to and from the site, establishment of a site office and hoarding of the project site.

Construction Phase: This phase will be characterized by activities including excavations, movement of overburden, operation of construction equipment, masonry and carpentry work, landscaping among others. These activities will result in direct and indirect effects on pollution from noise, traffic, air quality, public health and occupational health and safety.

Operational Phase: Activities during this phase include scheduled cleaning of the site and facility before occupancy and the safe disposal of general waste generated and scheduled maintenance to be carried out. The safe storage, use and disposal of hazardous laboratory chemicals will also be carried out.

2.6. INPUTS REQUIRED FOR THE IMPLEMENTATION OF THE PROJECT

Several materials and equipment will be employed in the execution of the ACECoR building. The material schedule for the project includes but not limited to the following:

1. Cement
2. Water
3. Steel Rebar
4. Coarse Aggregate

5. Expansion Joint Material-Flexcell
6. Laterite
7. Damp Proof Membrane
8. Marine Board
9. Nails
10. Plastic Tongue and Groove
11. Timber Hardwood
12. Concrete Blocks
13. Timber Doors
14. Aluminium Frames
15. Glass Panels
16. Emulsion Paint
17. Skimming Powder
18. Ceramic Tiles
19. Aluminium Sheets
20. Tipper trucks
21. Excavators
22. Bulldozer
23. Water pumping machines
24. Compactors
25. CO_2 and Dry powder fire extinguishers

3.0 BRIEF DESCRIPTION OF APPROACH AND METHODOLOGY

3.1 METHODOLOGY

Consistent with the Ghana EIA Procedures for gaining environmental approval and procuring environmental permit from Environmental Protection Agency, the methodology began with the registration of the Project with EPA.

3.1.1 ACECoR Building Project Registration and Screening

The EPA Environmental Assessment Registration Form (Form EA1) was completed and submitted to the EPA following a site inspection/project screening jointly conducted with the EPA, UCC and Messrs Environ Engineering and Management Consult (EEMC). The completed Environmental Registration was accompanied with the Land Use letter from the Directorate of Physical Development and Estate Management of the University of Cape Coast, Site Plan and Block for the ACECoR Building Project.

3.1.2 Literature Review

Key team members reviewed and assessed all information referred to in the TOR for its relevance and suitability to support the assessment process. Key data gaps / baseline assessment requirements were identified. The literature review facilitated the following:

- A detailed description of the project with respect to spatial coverage, preliminary design layout, magnitude, implementation schedules and costs as well as human resources.
- Acquisition of information on the general and project site specific baseline information
- Sufficient understanding the project design (site plan and architectural drawings), land use, local environmental conditions, development strategies and plans (local and national) as well as the policy and legal documents among others.
- Area maps, relevant legislations, regulations and guidelines and standards were also sourced and reviewed.

3.1.3 Field Visit, Observation Assessment and Biodiversity Survey

Field visit was organized by UCC and the Consultant on the 18th of November, 2021, to enable the consultant familiarize itself with the ACECoR Building Poject site and the following:

- Proposed ACECoR Building Project site and zoning issues.
- Phases and components of the project:
  - Site clearing and site preparation
  - Foundation works as part of Phase 1 activities
  - Access to utilities such as water and electricity
  - Road access to the site

Detailed field observation assessment was undertaken to enable determination of the exact socio- economic activities within the proximity of the project site. Checklists were used along with observations to check on possible environmental impacts of the project would have on the environment during both construction and operational phases.

Field survey adopted various techniques for baseline data collection on the existing environmental conditions, namely:

- Field observations and recordings including taking photos of the project site and its vicinity.
- Use of checklists for determining potential environmental impacts of the proposed project.
- Consultations within the neighbourhood of the project site.

Flora survey was carried out between August and September, 2021 at the study site as well as its environs to have a complete assessment of the flora of the area. The systematic sampling method was mainly used to collect data on the flora. Both area- based and non-area-based techniques were used to sample the flora. For the flora survey, direct/opportunistic observation, identification of animal spoors and setting of traps were used.

Figure 3-1 shows an enumerator observing flora on a section of the study area.

Flora examination on the ACECoR Building site -20.09.2021

Figure 3-1: An enumerator observing flora on a section of the study area. (Source: Field work, 2021)

Water and sediment quality assessment was carried out on the storm drain that runs westwards along the southern reaches of the project site (Fig 2-7). This drain empties into the Iture wetlands 8 km west of the project site. Water and sediment sampling and assessment followed internationally accepted protocols. Sampling was done on the 20th of November, 2021 whilst laboratory analysis was carried out on the 23rd of November, 2021.

Water sampling near at the entry point of the stream into the ACECoR Building Project Site near the UCC West Gate -20.11.2021

Water sampling at the midsection of the stream traversing the Project site 20.11.2021

Sampling at the lower reaches of the stream: 20.11.2021

Taking *in situ* readings water quality readings: 20.11.2021

Figure 3-2: Water sampling at the study site (Source: Field work, 2021)

Ambient noise levels and assessment of risk perception of were also determined between the 22nd and 23rd of November 2021. The Garmin Etrex hand-held Global Positioning System (GPS) and Precision-grade sound level meter -RION NL-22 (Higashimotomachi, Tokyo, Japan) were used to obtain the coordinates of locations and measure of noise levels generated from the locations respectively.

3.1.4 Data Analysis and Evaluation of Alternatives

Data from the various assessments carried out were analysed as follows:

Noise Analysis: Noise records from the Precision-grade sound level meter -RION NL-22 (Higashimotomachi, Tokyo, Japan) was analyzed using the Insight software to obtain the relevant measurements (LAeq, LAMax, LAmin, LA10 and LA50). The results were compared with the Ghana Environmental Protection Agency (EPA) guidelines.

Water quality analysis: The analytical results of the water samples were compared with the permissible limits set by the Environmental Protection Agency (EPA) of Ghana. The minimum and maximum levels of the various parameters at the various sampling locations were also determined as the baseline values for the site.

Floral analysis: The list of species obtained was used in the determination of the proportions of taxa and life forms. The species were classified under various life forms, viz: Trees, Shrubs, Climbers, Lianes, Ferns and Herbs. The relative diversity, ecological guild and star rating system of the Forest of Ghana Geographic Information Exhibitor manual (Hawthorne, 1995) were also used to analyze the data.

Faunal analysis: The abundance of the species was subjectively assessed on a 4-point scale, namely; common, frequent, occasional, or rare (CFOR) by asking three hunters to independently rate the species. The International Union for Conservation of Nature and Natural Resources (IUCN, 2011) and the Ghana Wildlife Conservation Regulation 1971 (LI 65) were used to determine the conservation and protection status of the animal species. Under the Wildlife Conservation Regulation, all animal species listed under Schedule 1 are Wholly Protected in Ghana from any form of hunting and capture.

Method for analysing data from the socio-economic surveys and the social and human environment: Already analysed social, socio-economic and human environment data for the study area were obtained from literature, other surveys such as the 2021 Population and Housing Census and annual reports of the Cape Coast Metropolitan Assembly. Additionally, professional and in-depth knowledge of the study area was relied upon.

Method for the analysis of data from the consultation meetings: The output from the consultative meetings were categorised into various dimensions including those affecting the biophysical environment, employment, livelihoods, environmental protection, permitting and certification, worksite safety, Gender-based violence among others. These categories were then ranked based on the number of stakeholder groups making inputs.

Methods for identifying and analysing impacts: The project's impacts were identified using a developed checklist (see Table 8-1), public consultation and professional knowledge. Impacts were first distinguished as either positive or negative. The proposed project's negative impacts were analysed to denote their significance based on their characteristics and this was also impacts per project phase using an impact identification matrix. Significance was judged based on their capacity to change baseline conditions beyond acceptable standards or legislative provisions. A qualitative scoring matrix was used to give a value/score of each impact on the environment.

Method for the prescription of mitigation measures: Mitigation methods were proposed based on the appropriateness and applicability of prevention, control, compensatory or remediation actions to best manage, reduce, or where possible, avoid the identified impacts.

Method for the evaluation of alternatives: The combination of proposed site location, technologies to be employed, product mix, scale of construction, potential environmental impacts, capital and operating costs, suitability under local conditions, and institutional, training, and monitoring requirements were considered in the evaluation of project alternatives.

3.1.5 Public Consultation and Stakeholder Engagement

Stakeholder engagements were undertaken of the proposed project to capture the views and concerns of interested and affected parties. The engagement process entailed face to face meetings / interviews. Stakeholders span government institutions (EPA, Metropolitan Assembly), Development Partners, the private sector, CSO/ NGOs, the university community (academia) and the adjoining community.

3.1.5.1 Summary of the report from the stakeholder engagements

Principally, all stakeholders consulted were in favour of the project as it was seen as a means of addressing the critical issues of coastal degradation and resilience. They alluded to the many positives the project brings and pledged their support for it. The consultations brought the following issues to the fore which must be considered in line with good practices:

- Acquisition of building permits and other regulatory permits
- Provision of appropriate PPEs for workers and ensuring that all standards relating the work on site are complied with by contractors and artisans
- The need to put measures in place to allow students and authorities express their views on the project without victimization
- Increase women's participation
- Avoiding GBV (sexual harassment against students and workers)
- Include construction strategies for green building

4.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

4.1 OVERVIEW

Key regulatory framework, policies and standards are presented to meet Ghana and international requirements.

4.2 NATIONAL LEGISLATION

The Environmental Protection Agency Act 1994 (Act 490) is the main legislation for ESIA studies. The Act grants the Environmental Protection Agency (EPA) enforcement and standards-setting powers, and the power to ensure compliance with the Ghana environmental assessment requirements/procedures. Additionally, the EPA is required to create environmental awareness and build environmental capacity among all sectors. The EPA, including its Regional and District Offices, is also vested with the power to determine what constitutes an 'adverse effect on the environment' or an activity posing 'a serious threat to the environment or public health', to require environmental assessments and environmental management plans of an undertaking, and to regulate and serve enforcement notices for any offending or non-complying undertaking. The EPA is required to conduct monitoring to verify compliance with given approval/permit conditions, required environmental standards and mitigation commitments.

The Environmental Assessment (EA) Regulations,1999 combine both assessment and environmental management systems. The regulations prohibit commencing an undertaking/activity without prior registration and environmental permit (EP). Undertakings are grouped into schedules for ease of screening and registration and EP. The schedules include undertakings requiring registration and EP (Schedule 1), EIA mandatory undertakings (Schedule 2), as well as Schedule 5-relevant undertakings (located in Environmentally Sensitive Areas).

The Regulations also define the relevant stages and actions, including registration, screening, preliminary environmental assessment, scoping and terms of reference (ToR), environmental impact assessment, review of EA reports, public notices and hearings, environmental permitting and certification, fee payments, environmental management plan, suspension/revocation of permit and complaints/appeals.

Under the EA Procedures it is required that an Environmental Impact Statement is prepared by the proponent to clearly present an assessment of the impacts of the proposed project on the environment based on the terms of reference as stipulated in the scoping report. The EA Procedures requires that potential direct and indirect impacts of the project on the environment covering the pre-construction, construction, operation, decommissioning and post decommissioning stages are addressed.

Additionally, the proposed ACECoR Building project is required to comply with the following key legislations and policies relevant to the ESIA Study:

<u>National Policy</u>

- The National Environment Policy (2010);
- The National Environmental Sanitation Policy dated April 2010;
- National Health Policy (2007);
- National Climate Policy, (2012);

The relevant national laws and legislation particularly to guide the preparation of the ESIA for the proposed project include the following:

- The Constitution of Ghana, 1992
- The State Lands Act, 1962
- Lands Commission Act 2008, Act 767
- Environmental Protection Agency Act 1994, Act 490
- Environmental Assessment Regulations 1999, LI 1652
- Fees and Charges (Amendment) Instrument 2015 (LI 2228)

- Local Government Act 2016, Act 936
- Lands (Statutory Wayleaves) Act, 1963 (Act 186)
- The State Lands Act, 1963 (Act 125)
- The Labour Act, 2003 (Act 651)
- Workmen's Compensation Law, 1987, PNDCL 187
- Wetlands Management (RAMSAR Sites) Regulations, 199
- Land Use and Spatial Planning Act, 2016 Act 925

The ACECoR Project is a multi-institutional and sectoral project. The following are the relevant ministries and sector agencies with various administrative roles and responsibilities under the project:

- The Ministry of Education
- National Council for Tertiary Education
- Environmental Protection Agency
- Town and Country Planning
- Electricity Company of Ghana
- Ghana Water Company Limited
- Cape Coast Metropolitan Assembly
- Forestry Commission
- National Commission on Culture
- Civil society and the media

Table 0-1: Relevant Policy and legal Framework

No.	Legal Framework and Key Compliance Requirements	Applicability to Proposed Project
1.	**The National Environmental Policy (2010) –** The 2010 National Environmental Policy[1] (NEP) sets out a new vision for environmental management in Ghana and is based on an integrated and holistic management system for the environment. It is aimed at sustainable development now and in the future. The policy seeks to unite Ghanaians in working toward a society where all residents of the country have access to sufficient and wholesome food, clean air and water, decent housing and other necessities of life that will further enable them to live in a fulfilling spiritual, cultural and physical harmony with their natural surroundings. The NEP is defined under key operational principles of accountability, equity, environmental justice, inclusivity and open information, precautionary and polluter pays principles. Within the NEP are sector specific environmental protection policies. The NEP is intended to serve as the roadmap for Ghana towards protection, management and promoting sustainability of environmental objects.	The NEP is to serve as the roadmap the ACECoR Building Project towards the protection, management and promoting sustainability of environmental objects. Construction activities will thus be carried out in ways that conform to all principles of the NEP in ensuring the protection of the environment.
2.	**Environmental Sanitation Policy (Revised, 2010) –** This revised Environmental Sanitation Policy lays the basis for developing a systematic approach and framework for identifying and harnessing resources for value-for-money services to all. It is the outcome of reviews to address limitations of the old policy published in 1999 and a result of nation-wide consultation among sector stakeholders. The Policy has been revised to update its scope to meet current development objectives and address aspirations of sector actors. The revision also takes on board the changing context of national and international development priorities. Emphasis is placed on the need to ensure systematic collection of data on wastes from all sectors of the economy to support relevant research and development to meet the challenges of managing wastes associated with the growing economy and rapidly changing lifestyles.	The UCC ACECoR Building Project will take cognizance of this Environmental Sanitation Policy by placing the appropriate emphasis on the need to ensure systematic collection of data on wastes to meet the challenges of managing construction wastes. In the construction and operational phases of the multipurpose building, the different types of wastes generated will be documented and managed in ways that promote environmental sustainability. Acceptable and best-practice waste management activities will be implemented within the project footprint in line with the policy.
3.	**National Climate Change Policy (2012) –** The main purpose of the NCCP is to help policy makers think about the national policy actions and programmes needed to contribute to the fight against climate change and how such needs can be articulated in order to seek or leverage internal and external resources from public, private and international organisations.	The UCC ACECoR building will consider Climate Change in the design, construction and operationalisation of the building. The construction will take into consideration measures that will contribute to the fight against climate change in all facets of the project. The materials to be used and sources thereof should all be in line with the policy.
4.	**National Inclusive Education Policy –** The Inclusive Education Policy defines the strategic path of the government for the education. The Policy builds upon sections in the 1992 Constitution, the National Development Agenda, the Education Strategic Plan and International Commitments to achieve national as well international goals for creating an environment for addressing the diverse education needs of Ghanaians. The Inclusive Education Policy provides an opportunity for all stakeholders in the education sector to address the diverse learning needs of various categories of citizens in the Ghanaian education system under the universal design for learning and within a learner friendly environment for all. IE is based on the value system which holds that all persons who attend an educational institution are entitled to equitable access to quality teaching and learning, and which	The UCC ACECoR Program must be consistent with The Inclusive Education Policy which provides opportunity for all stakeholders in the education sector to address the diverse learning needs of various categories of citizens in the Ghanaian education system under the universal design for learning and within a learner friendly environment for all. The construction of the building will take into consideration the diverse learning needs of the various categories of potential users of the facility and incorporate.

[1] [1] National Environmental Policy (Revised) 2010 comes in to replace the 1992 National Environmental Policy broad vision founded on and directed by respect for all relevant principles and themes of environment and sustainable development. The policy describes major environmental challenges in Ghana and recommends operational policies, sector strategic goals and sector environmental policies to combat them.

No.	Legal Framework and Key Compliance Requirements	Applicability to Proposed Project
	transcends the idea of physical location but incorporate the basic values that promote participation, friendship and interaction.	
5.	**The Education Strategic Plan (2010-2020) –** The Education Strategic Plan stipulates that, the Ministry of Education shall ―provide education for those with physical and mental impairments, orphans, and those who are slow or fast learners, by including them, wherever possible, within the mainstream formal system or, only when considered necessary, within special units or schools.	The UCC/ACECoR project must be consistent with the Education Strategic Plan of the Minstry of Education in that the construction of the multi-purpose complex will lead to the provision of a facility conducive for effective teaching and learning, with provision of spaces for different ability groups. It will also add up to the stock of educational facilities in the country.
6.	**The Constitution of the Republic of Ghana, 1992** The 1992 Constitution[2] of Ghana sets out the first source of environmental protection requirements in Ghana. Article 36 (9) of the Constitution states that "the State shall take appropriate measures needed to protect and safeguard the national environment for posterity; and shall seek co-operation with other states and bodies for purposes of protecting the wider international environment for mankind". In addition, Article 41 (k) requires that all citizens protect and safeguard the natural environment of the Republic of Ghana. Article 25 (1) states that all persons shall have the right to equal educational opportunities and facilities and with a view to achieving the full realization of that right. The following sections of Article 25 (1) are referenced: (c) higher education shall be made equally accessible to all, on the basis of capacity, by every appropriate means, and in particular, by progressive introduction of free education; (d) functional literacy shall be encouraged or intensified as far as possible; (e) the development of a system of schools with adequate facilities at all levels shall be actively	The University of Cape-Coast(UCC)/ACECoR Project, being a public entity, will ensure that the project complies with relevant constitutional provisions. Potential Environmental and Social Impacts of the ACECoR Project will be comprehensively identified, evaluated, significance of impacts determined and appropriate mitigation and enhancement measures developed and implemented to ensure a sustainable development in line with the constitution.
7.	**The Education 2008 (Act 778) -** The objective of Act 778 enacted in 2008, is to provide for the establishment of an educational system intended to produce well-balanced individuals with the requisite knowledge, skills, values, aptitudes and attitudes. Lift deleted to implementation strategies.	UCC/ACECoR must provide an education system intended to produce well balanced individuals with the requisite knowledge, skills, values, aptitudes and attitudes. The educational system must also ensure disability inclusiveness. The design, construction and management of the building will be carried out with these expectations as guides.
8.	**University of Cape Coast Law, 1992 [PNDC Law 278] -** The University was established with an original mandate to train graduate professional teachers for Ghana's second cycle institutions and the Ministry of Education to meet the manpower needs of the country's accelerated education programme at the time. This original mandate was revised in the mid-1990s, and led to the University expanding and diversifying its programmes in response to changing needs. The University of Cape Coast was established in October, 1962 as a University College affiliated to the University of Ghana, Legon. On 1st October, 1971, the University College became an autonomous institution with the authority to confer its own degrees, diplomas and certificates by an Act of Parliament - The University of Cape Coast Act, 1971 [Act 390]. The first Act was subsequently replaced with the University of Cape Coast Law, 1992 [PNDC Law 278]. The existing Law (P.N.D.C.L. 278) is under review after being in force for 25 years.	The ACECoR Program needs to take cognizance of the UCC Act as the University is expanding and diversifying its programmes in response to changing needs. The construction of the multipurpose building will add on to the infrastructure of the University that is employed to providing the form of education U.C.C. is set up to provide.
9.	**The State Lands Act 1963, Act 125** The Act 125 vests the authority to acquire land for the public interest in the President of the Republic. It also gives responsibility for registering a claim on the affected person or group of persons, and provides details	The University of Cape-Coast, as an institution of the state, has the required rights without incumberances to the parcel of land on which the ACECoR

[2] [2] The 1992 Constitution of the Republic of Ghana sets out the Rights, Freedom, Duties and Obligation of every citizen of Ghana. These are these are the constitutional rights of Ghanaians. The constitution also defines specific requirements for the protection of the Environment such as provided under: Article 37(3); Article 39(6); Article 41(k); Article 268 and Article 269.

No.	Legal Framework and Key Compliance Requirements	Applicability to Proposed Project
	of the procedure to do this. The State Lands Act, 1962 provides some details to be taken into consideration when calculating compensation such as definitions for (1) cost of disturbance, (2) market value, (3) replacement value, and so on.	building Project will be implement. The construction of the building will be governed by the requirements in the Act.
10.	**Environmental Protection Agency (EPA) Act 1994, Act 490** The Environmental Protection Agency (EPA) Act 1994 (Act 490) gives mandate to the Agency to ensure compliance of all investments and undertakings with laid down Environmental Assessment (EA) procedures in the planning and execution of development projects, including compliance in respect of existing ones. The EPA is the responsible for issuing environmental permits for operations such as this project subject to EPA review.	The process of gaining environmental approval and procuring environmental permit from Environmental Protection Agency begins with the registration of the building Project with the EPA. The construction of the building will be in compliance with the Environmental Assessment (EA) procedures for approval of the EPA. An EPA permit will be obtained and the permitted conditions complied with throughout the project implementation.
11.	**Lands Commission Act 767** The Lands Commission Act 2008 re-establishes the Lands Commission to integrate the operations of public service land institutions in order to secure effective and efficient land administration to provide for related matters. The objectives of the Commission include among others to: ▪ Promote the judicious use of land by the society and ensure that land use is in accordance with sustainable management principles and the maintenance of a sound eco-system; and ▪ Ensure that land development is effected in conformity with the nation's development goals.	The proposed project has implications for landuse. In collaboration with Directorate of Physical Development and Estate Management of the University of Cape-Coast, the management of the landuse issues will be undertaken in line with the requirements of the Lands Commission Act 767 in order to protect the ecosystem and enhance sustainability during the construction of the building.
12.	**Environmental Assessment Regulations 1999, LI 1652** The Environmental Assessment Regulations 1999 (LI 1652) enjoins any proponent or person to register an undertaking with the Agency and obtain an Environmental Permit prior to commencement of the project. This regulation allows the EPA to place proposed undertakings at the appropriate level of environmental assessment.	The development of the proposed project is being guided by LI 1652 including registering with the EPA and obtaining an environmental permit.
13.	**The Fees and Charges (Amendment Instrument), 2015 (LI 2228)** The Fees and Charges (Amendment) Instrument 2015 (L.I. 2228) provides comprehensive rates, fees and charges collectable by Ministries, Department and Agencies (MDAs), such as the Environmental Protection Agency, for goods and services delivered to the public.	UCC/ACECoR, in obtaining an environmental permit for the building from the EPA, will pay all necessary fees and charges as prescribed by LI 2228.
14.	**Forestry Commission Act, 1999 (Act 571)** This Act relates to the Protection and management of wetland sites of special scientific interest (SSSI). It requires the protection of vital ecosystems and valuable environmental components	UCC/ACECoR will ensure the protection of mangroves and wetlands within the Project area during the construction of the building.
15.	**Wild Animals Preservation Act, 1961** Protection of wild animals, birds and fish. Protection of critical species and habitats	UCC/ACECoR will ensure the protection and management of terrestrial wildlife and their habitats during the construction of the building.
16.	**Rivers Act, 1903** Protection and sustainable use of rivers and related matters. Section 3 of the Act prohibits a person from dredging a river or extracting the water for construction purposes unless a license is obtained	Protection of water resources during the construction and operation of the facility will be ensured.
17.	**Local Governance Act 2016 (Act 936)** The Local Governance Act 2016 (Act 936) seeks to give a fresh expression to government's commitment to the concept of decentralization. It is a practical demonstration of a bold attempt to bring the process of governance to the doorstep of the populace at the regional and more importantly, the district level. The Act establishes metropolitan, municipal and district assemblies as the highest decision-making authority at the local level with powers to enforce zoning and building regulation as well as responsibility of waste management.	The proposed multi-purpose educational complex at the University of Cape Coast in Cape Coast requires approval from the Cape Coast Municipal Assembly (Building Permit) prior to the commencement of works. The construction of the building will be carried out in tandem with the established legislations of the metropolitan assembly.
18.	**The Labour Act 2003, Act 651** The purpose of the Labour Act, 2003 (Act 651) is to amend and consolidate existing laws relating to employers, trade unions and industrial relations. The Act provides for the rights and duties of employers and workers; legal or illegal strike; guarantees trade unions the freedom of associations and establishes Labour Commission to mediate and act in respect of all labour issues. Under Part XV (Occupational Health Safety and Environment), the Act explicitly indicates that it is the duty of an employer to ensure the worker works under satisfactory, safe and healthy conditions.	The contractor and ACECoR building management team are required by the Act to ensure the welfare , safety and health of workers by providing a safe working environment and the required apparatus needed for safe work. Again, the rights and duties of employees will be clearly spelt out, and freedom of trade union association will be respected.

No.	Legal Framework and Key Compliance Requirements	Applicability to Proposed Project
19.	**Workmen's Compensation Law 1987** It is to provide for the payment of compensation to workmen for personal injuries caused by accidents arising out and in the course of their employment. The tenets of the law places a large share of the burden of supporting workers injured at the workplace on the shoulders of the employers.	The Law enjoins UCC/ACECoR as an employer to ensure and be responsible for the safety of workers and ensure appropriate compensation is paid to workers for injuries arising in the course of work. During the construction of the building, employees will be trained on managing their health and safety in addition to detailing their responsibilities and the Contractor's liabilities towards their safety.
20.	**Land Use and Spatial Planning Act (Act 924), 2016** The Act consolidates the laws on land use and spatial planning. It provides sustainable development of land and human settlements through a decentralized planning system and ensures judicious use of land to improve the quality of life, promote health and safety in respect of human settlements.	The choice of land for the building will be in conformity with the landuse plan of the University. Again, the building will be sited and construction carried out in such a way as not to have huge negative impacts on the environment, but to improve the quality of health and safety in adjoining human settlements.
21.	**Factories Offices and Shops (Amendment) Act (No. 275 of 1991)** Deals with registration of factories (including indication of the numbers of male and female employees and of the welfare facilities provided), notification of occupational accidents and illnesses, health and welfare standards (lighting, ventilation, dust, noise, etc.), safety measures, complaints in relation to dangerous conditions and practices, offences and legal proceedings, administration of the Act, duties of persons employed and prohibition on deductions from wages.	The multipurpose building will have adequate welfare facilities for both male and female employees during the construction and operational phases. Again, adequate provision for occupational health and safetyissues including the provision of appropriate protective equipment will be ensured. Systems to ensure safety, report accidents and complaints will also be institutionalised during the construction of the multipurpose building.
22.	**National Building Regulations 1996, (LI 1630)** National Building Regulations 1996, (LI 1630) is a legislative instrument mandated by the Local Government Act. The core principle of the National Building Regulations like most National Codes is the provision of guidelines for safety, health and governance is a legislative instrument mandated by the Local Government Act. The core principle of the National Building Regulations like most National Codes is the provision of guidelines for safety, health and governance.	UCC/ACECoR must ensure that Building Permit is acquired before the commencement of the ACECoR Building Project. Again, the building must meet all statutory building requirements before commencement of construction.
23.	**Public Health Act, 2012 (Act 851) –** The Public Health Act, 2012, Act 851 revises and consolidates all the laws and regulations pertaining to the prevention of disease, promote, safeguard and maintain and protect the health of human and animals, and to provide for related matters. The law has merged all provisions in the criminal code, ordinances, legislative and executive instruments, acts, bye-laws of the District Assemblies etc.	UCC/ACECoR are enjoined to the provision of sanitary stations and facilities, destruction of vectors including mosquitoes, protection of water receptacles and the promotion of environmental sanitation. In the construction and operational phases of the project, systems will be put in place to assure public health and hygiene.
24.	**Ghana Disability Act, 2006 (Act 715) –** Ghana's Disability Law was passed in 2006, aimed at ending the discrimination that faces people with disabilities. The Act offers a legal framework to protect the rights of physically and mentally disabled persons in all areas of life, from education, training and employment to physical access and health care. It is also intended to promote the creation of an environment that will advance the economic well-being of disabled people and enable them to function better in society.	UCC/ACECoR must ensure the provision of relevant facilities that will ensure the safe use by persons with disabilities and promote the creation of an environment that will advance the economic well-being of disabled people and enable them to function better in society. The project site and eventually the building itself will be disability-friendly during construction and when operational.
25.	**National Museum Decree 1969 (NLCD 387)** This law relates to the Custodian and preservation of Ghana's material cultural heritage (movable and immovable). Section 8 (1) specified that "no person shall by means of excavation or similar operation search for any antiquity unless authorised by a permit". Section 9 of the Decree provides requirements for the removal of antiquity. Section 10 (1) behoves responsibility for any person who discovers an antiquity and the owner or occupier or any land upon which an antiquity is discovered on becoming aware of the discovery to without delay notify the Board.	This policy will direct the identification, assessment and removal of archaeological artefacts identified during construction works where excavation occurs. When there is a Chance Find, the procedure as enumerated in 8.2 will be triggered to deal with it.

4.3 INSTITUTIONAL FRAMEWORK

The ACECoR Project is a multi-institutional and sectoral project. The following are the relevant ministries and sector agencies with various roles and responsibilities under the project:

Table 0-2: Institutional Framework

No.	Institutional Framework and Key Compliance Requirements	Applicability to Proposed Project
1.	**The Ministry of Education (MOE)** - established under the Civil Service Law 1993 and the PNDC Law 327, the MOE is mandated to provide relevant education to all Ghanaians as a vehicle for human growth and national development. The goal of the MOE is to formulate and implement policies that would ensure quality and accessible education to all Ghanaians to meet the needs of the labour market; and accelerate the acquisition of requisite skills to achieve human development, good health, poverty reduction, national integration and international recognition and to create an honest, creative and responsible citizenship.	The Ministry of Education's vision is to prepare and equip all Ghanaians with relevant education and skills to promote socio-economic development and national orientation. Its mission is to provide relevant education with emphasis on science, information, communication and technology to equip individuals for self-actualization and peaceful coexistence as well as skills for the workplace for national development. In this regard, the construction of the building will add up to the stock of educational facilities in the country thus inproving the accessibility of education to all and accelerating the acquisition of requisite skills for the job market.
2.	**National Council for Tertiary Education (NCTE) -** At the tertiary level, the NCTE which is facilitating the implementation of the ACE Impact project in Ghana is the key coordinating agency. The Tertiary Education sector is expected to produce cadres of highly qualified individuals to support economic and social development in Ghana. Ghana has eight state and at least 11 private universities.	The Tertiary Education sector is expected to produce cadres of highly qualified individuals to support economic and social development in Ghana
3.	**Environmental Protection Agency -** The principal institution established for environmental protection in Ghana is the EPA, created under the Environmental Protection Agency Act, 1994 (Act 490). The EPA's policy direction is articulated by the Environmental Assessment Regulations, 1999 (LI 1652). These two pieces of legislation mandate the EPA to manage, control and monitor compliance of environmental regulations by specific industries.	The EPA has an important role in the Project implementation as the lead environmental regulator, which oversees compliance with environmental assessment requirements, facilitate public participation and disclosure, and issue environmental permits for the project. The EPA has the mandate to decide on project screening, guide the conduct of the environmental assessment studies and to grant environmental approval for the project to commence. Its mandate also covers monitoring of implementation phase of the project to confirm compliance with approval conditions, mitigation measures, and other environmental commitments and quality standards.
4.	**Town and Country Planning (TCP)** - The Town and Country Planning is responsible for planning and management of growth and development of cities, towns and villages in the country. It therefore seeks to promote sustainable human settlements development based on principles of efficiency, orderliness, safety and healthy growth of communities.	With regards to the Proposal, TCP will ensure that the architectural designs or drawings, structural designs, mechanical and electrical systems design, geotechnical designs of the buildings and facilities are in conformance with national and local regulatory requirements.
5.	**Electricity Company of Ghana (ECG):** is responsible for the provision of quality, reliable and safe electricity services to support the socio-economic growth and development of Ghana.	With regards to the proposal, ECG will ensure that the required power output would be provided from the national grid.
6.	**Ghana Water Company Limited (GWCL)** - As a public utility company, GWCL functions as the country's bulk water supplier and oversees the urban water sector. It undertakes capacity building in Water Quality Monitoring and Surveillance in Ghana.	With regards to the proposal, GWCL will ensure that water supply to the project would be provided through dedicated pipelines to the site.
7.	**Cape Coast Metropolitan Assembly (CCMA)** - The construction activities of the ACECoR Project falls under the jurisdiction of the Cape Coast Metropolitan Assembly. The CCMA is responsible for the spatial planning and zoning of the municipality.	With regards to the proposed construction, CCMA will ensure that the development falls within the zonal laws and regulations of the municipality. Moreover, CCMA will be required to issue Building Permit to certify Project implementation.
8.	**Forestry Commission (FC) -** The FC of Ghana is responsible for the regulation of utilization of forest and wildlife resources, the conservation and management of those resources. The Timber Validation Department of the Forestry Commission of Ghana is responsible for verifying the legal origins of timber products harvested in Ghana for local utilization and for export.	With regards to the Proposal, FC will ensure that any tree which requires to be cut is done under FC Tree Felling Guidelines.

No.	Institutional Framework and Key Compliance Requirements	Applicability to Proposed Project
9.	**National Commission on Culture (NCC)** – The NCC is in charge of implementing the cultural policy on physical cultural resources, which requires the preservation of monuments, all forts and castles, designated shrines, mosques, church buildings, old city walls and gates, cultural sites, palaces, public and private buildings of historical significance and monumental sculptures. These are required to be protected from neglect, desecration and/or destruction.	Under the policy, the NCC - in collaboration with the EPA - is required to identify heritage sites of Ghana and collect, collate and store indigenous beliefs and practices associated with them. And ensure their preservation. Any find of cultural artefacts during the construction of the building will be immediately brought to the attention of the NCC for prompt recovery and preservation. A chance-find protocol will be put in place during the construction to in this regard.
10.	**Civil society and the media** play a strong role in environmental awareness, and in influencing to the extent possible, the decision making process related to environmental issues. Ghana has Non-governmental organizations (NGOs) actively participating in the environmental arena, on issues ranging from public awareness and environmental education to waste collection and community self-help programs. NGOs have been increasingly involved in project implementation, in public debate, in hearings/consultations on EA, and also in monitoring compliance with environmental laws. The media have contributed to increased awareness and to changes in behavior.	Civil society and the media will be engaged throughout the construction of the project so as to identify emerging concerns and promptly address them in order not to generate aggitations that will hamper the progress of work.

4.4 NATIONAL ENVIRONMENTAL QUALITY GUIDELINES

The guidelines provide for permissible levels for ambient air quality, noise levels and effluent quality guidelines for discharge into natural water bodies. The environmental guidelines being adopted for this project include;

- National Ambient Noise Level Guidelines (NANLG); and
- National Effluent Quality Discharge Guidelines (NEQDG).
- World Bank Group Environmental Health and Safety Guidelines

The above guidelines are presented in Annex 3

4.5 INTERNATIONAL TREATIES, CONVENTIONS AND PROTOCOLS

Table 4-3 below summarises the international and regional treaties, conventions and protocols to which the Government of Ghana is a signatory and identifies those aspects of the Project where they may be relevant.

Table 0-3: International Treaties, Conventions and Protocols Applicable to Project

Treaty/Convention/Protocol	Objective	Relevance to the Project
Convention on Biological Diversity (CBD) (1992)	Preserving and sustaining biological diversity.	Biodiversity studies and management/preservation as well as impact of construction activities on floral and fauna.
Convention on Migratory Species (CMS) of Wild Animals (1983)	An international regime for the protection of migratory animals and their habitats, and the prevention, reduction and control of factors that endanger them.	Likelihood of construction activities affecting the habitat and route of migratory species
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) (1993)	To conserve and protect the wise use of wetlands through local, regional and national actions and international cooperation.	Potential impact of construction works and operations on waterbodies connected to drainage channels traversing the project site
Vienna Convention for the Protection of the Ozone Layer	Protection of the Ozone Layer	Installation of air-conditioning systems and facilities must comply with standards and protocols relating to the use prohibited Ozone depleting substances.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973)	To enforce that international trade in specimens of wild animals and plants does not threaten their survival	Construction activities could threaten the survival of wild flora and fauna of conservation interest
United Nations Framework Convention on Climate Change (1992)	The reduction of negative changes to the earth's climate, with focus on greenhouse gases. Places focus on industrialised countries to reduce emissions. Developing countries like Ghana are currently exempt from the reduction requirement; however, this may change	Management of GHG emissions associated with the Project.
Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention), Paris (1975)	International Convention to identify and conserve the world's cultural and natural heritage	Protection of natural heritage and zones of cultural influence within the Project area
Convention Concerning the Protection of Workers Against Occupational Hazards in the	The Convention encourages that employers in consultation with their workers understand project	This is applicable in dealing with project occupational health and safety issues that could arise from

Working Environment due to Air Pollution, Noise, and Vibration (ILO No. 148)	hazards related to air pollution, noise pollution, and vibrations	the use heavy construction equipment that may generate noise and vibration with associated occupation health impacts.
Bamako Convention on the Ban and Import to Africa and the Control of Transboundary Movement and Management of Hazardous Waste (1991)	The Convention, affirming a commitment to address the problem of hazardous wastes in Africa, bans the import into Africa and the control of transboundary movement and management of hazardous wastes within Africa	Plant and material selection for construction and demolition. Hazardous waste management and health protection.
African Convention on the Conservation of Nature and Natural Resources	The objectives of this Convention are: to enhance environmental protection; to foster the conservation and sustainable use of natural resources; and to harmonize and coordinate policies in these fields with a view to achieving ecologically rational, economically sound and socially acceptable development policies and program	Potential impact of construction activities on biodiversity and management of wetlands
Universal Declaration on Human Rights	The law provides for the promotion of respect for rights and freedoms and for progressive national and international measures to secure the effective recognition and observance among people of signatories themselves and among the territories under their jurisdiction. Key provisions include: Article19: Everyone has the right to freedom of opinion and expression. Article 20: (1) Everyone has the right to freedom of peaceful assembly and association. (2) No one may be compelled to belong to an association. Article 24: Everyone has the right to rest and leisure, including reasonable limitation of working hours and holidays with pay	Relevant in handling potential employment or labour issues and protection of worker welfare that may arise during construction activities
Arhaus Convention on Public Access to Information and Participation in Decision Making and Access to Justice in Environmental Matters (1998)	Protection of the right of present and future generations to live in an environment adequate to their health and well-being. Each party would promote the rights of access to information, public participation in decision-making and access to justice in environmental matters in accordance with the provision of this Convention.	Enhance Project information disclosure, public consultation and stakeholder engagement for the Project

4.6 WORLD BANK ENVIRONMENTAL AND SOCIAL POLICIES AND STANDARDS

The ESIA will be undertaken in reference to the following WB environmental and social safeguard policies:

- Operational Policy 4.01 – Environmental Assessment
- Operational Policy 4.04 – Natural Habitats

Other World Bank Environmental and Social Standards (See Annex 4) and Environmental Health and Safety Guidelines are applicable to this Project. Identified project actions triggering safeguard policies and objectives have been presented below in Table 4-4: Safeguard Policies Triggered by the Project.

Table 0-4: Safeguard Policies Triggered by Project Actions

OP/BP	Safeguard	Policy objectives	Project Actions triggering Safeguard
4.01	Environmental Assessment	Help ensure the environmental and social soundness and sustainability of nvestment projects. Support integration of environmental and social aspects of projects in the decision-making process.	ACECoR Project– CATEGORY B. National Environmental Legislation and Regualtory procedures will be followed to ensure compliance with relevant environmental permitting requirements and construction of the project.
4.04	Natural Habitats	Promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions.	• Site clearing, site preparation and digging of foundations
4.11	Physical Cultural Resources (PCR)*	Assist in preserving PCR and in avoiding their destruction or damage. PCR includes resources of archaeological, paleontological, historical, architectural, religious (including graveyards and burial sites), aesthetic, or other cultural significance.	• There are no physical cultural resources (PCR) at the proposed site that will be affected
4.12	Involuntary Resettlement*	Avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.	• There is no potential for Resettlement/displacement of farmers
4.36	Forests*	Realize the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.	Considering that the project area is within the University of Cape Coast compound, OP 4.36 is not triggered. The ACECoR Building Project area is considered as area that will loss vegetative cover. From preliminary site visits, there are identifiable tree species in the area that may be affected. It will be recommended a development strategy that will avoid an indiscriminate destruction of the trees will be adopted. The foot of the building and other facilities will be carefully selected to prevent the destruction of the trees.

**Safeguard Policies Does not apply*

5.0 BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

The project will be located within the University of Cape Coast (UCC) which is in the Cape Coast Metropolitan Assembly (CCMA) in the Central Region of Ghana. CCMA is bordered by the Gulf of Guinea to the south, Komenda- Edina- Eguafo- Abirem Municipal Assembly to the west, Abura- Asebu- Kwamankese District to the east and Twifo-Heman- Lower Denkyira District to the north. The Municipality covers a total land area of approximately 122 sq. km and lies within latitude $5^{o}.07^{1}$ to $5^{o}.07^{1}$ north of the Equator and between longitudes $1^{o}.11^{1}$ to $1^{o}.41^{1}$ west of the Greenwich Meridian (Owusu et al., 2018; MOFA, 2021). The project site is a 1.72 Hec land located at the South campus of the University of Cape Coast and adjacent the UCC Enterprises building. The direct impact zones are the areas within the immediate vicinity of the project especially the UCC Enterprise compound, some sections of the Duakor community and the Science taxi rank whilst the indirect impact zones encompass the whole University campus.

5.1 NATURAL ENVIRONMENTAL CONDITIONS

5.1.1 Topography

The land in the Metropolis is generally hilly with valleys in between the hills. The highest point is approximately 60m above sea level (MOFA. 2021). The project site is relatively flat and approximately 30 feet above sea level.

5.1.2 Soils and Geology

The rock type of the metropolis is of the Birimian formation and consists of schist and introduce granites and pegmatite. The types of soil series found in the Municipality include Chichiwere- Kakum, Ayensu- Chichiwere and Achenfu- Kuntu- Suprudu. The project site is underlain by rocks of the Sekondian formation which consists of sandstones, grits, shales and mudstones, nodules of limestone and siderite. The superficial soils are silty sands and clays (MOFA, 2021).

5.1.3 Climate

Temperature: The temperature in the Metropolis varies between 24^{o}c and 32^{o}c. The hottest months are February and March, just before the main rainy season, while the coolest months are June, July and August (Asamoah, 1973; MOFA, 2021).

Humidity: The relative humidity is between 60% and 80%.

Precipitation: There are two seasons of rainfall with peak in May- June and October with annual rainfall total volume ranging between 750mm and 1,000mm. The variability in climate in the metropolis is influenced more by rainfall than temperature (MOFA, 2021).

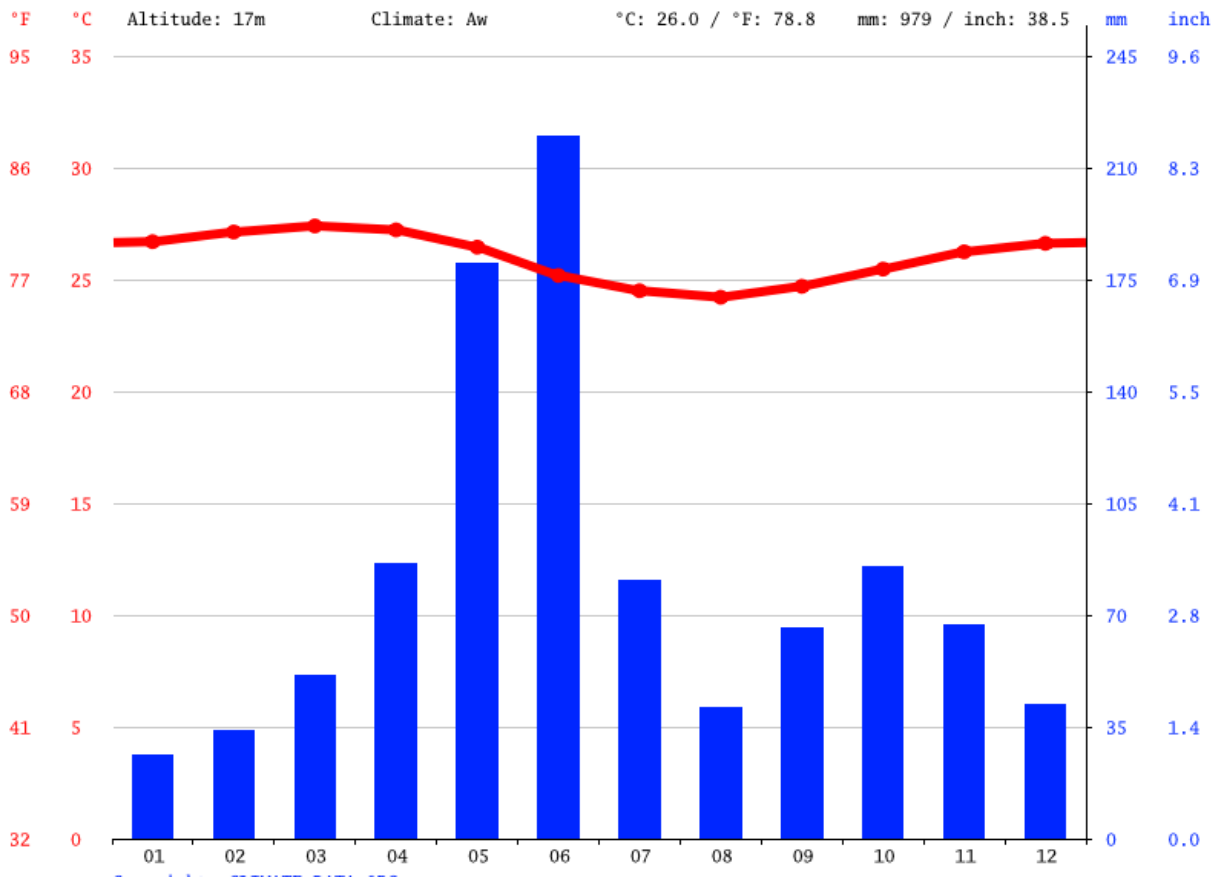

Figure 0-1: Climate graph for study area (Source: CLIMATE-DATA.ORG)

5.1.4 Ambient Air

Ambient air quality is satisfactory at the site. There are no activities within the UCC and immediate environs that generate excessive dust and emissions. The only source of emission is from moving vehicles. During the harmattan/dry season dust levels may be elevated due to the influence of the north east trade winds.

5.1.5 Noise Levels

The range of ambient noise level measurements recorded inside the University of Cape Coast compared to the permissible guidelines of the Ghana EPA are as shown in Table 5-1. From the table, all areas within the University, including the project site, recorded noise levels that were within the permissible limits as set by the Ghana EPA.

Table 0-1: Ambient Noise Level Guidelines of the Ghana EPA (Source: GEPA, 2017)

DESCRIPTION OF AREA OF NOISE RECEPTION	MAXIMUM RECORDED NOISE LEVEL dB (A)		PERMISSIBLE NOISE LEVEL dB (A)	
	DAY 0600 – 2200	NIGHT 2200 – 0600	DAY 0600 – 2200	NIGHT 2200 – 0600
Faculty areas	40	10	55	50
Area with some commercial activities	50	30	60	55
Areas with entertainment or public assembly and place of worship such as churches and mosques	60	78	65	60
Areas of residence - Halls at the University of Cape Coast	30	45	55	48
Project site	30	25	60	55

5.1.6 Hydrology

The major stream and river in the Metropolis are Siwere and Kakum respectively. Lagoons include the Fosu. Rivers and streams end up in wetlands and finally drain into the Fosu Lagoon at Bakaano and the sea at Abakam (MOFA, 2021). Figure 5-1 shows the map of Cape Coast, Fosu lagoon, and some of its settlements.

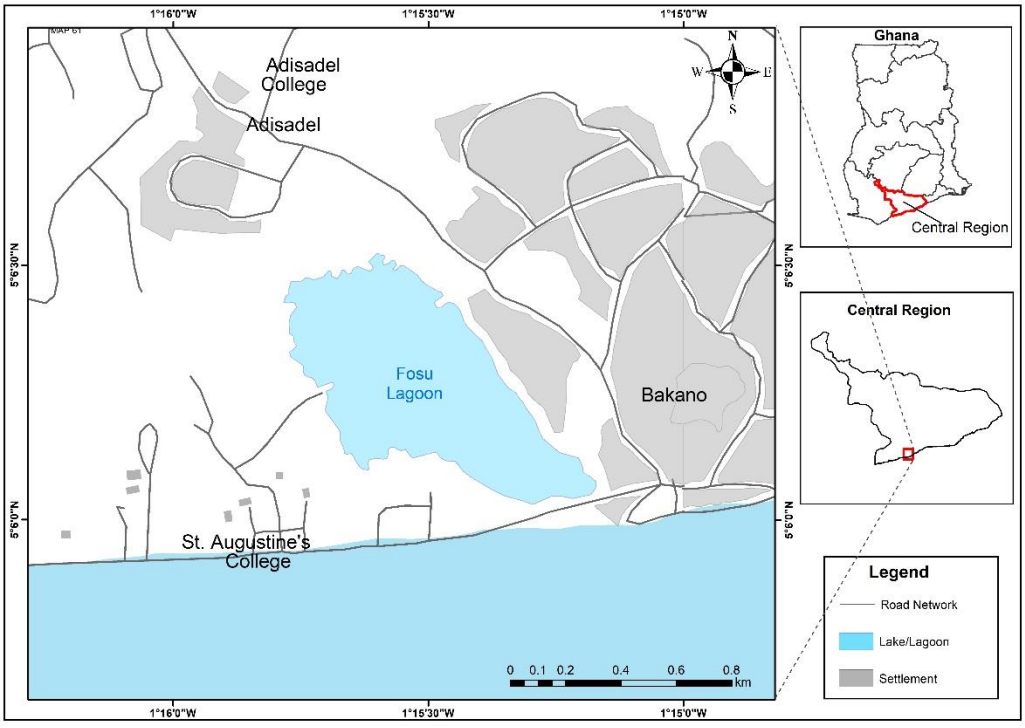

Figure 0-2: Map of Cape Coast showing the Fosu Lagoon and some settlements (Source: Nature Today, 2019)

Quality analysis carried on water samples from the channel that traverses the site indicated that the pH ranged from 5.95 to 6.8, making the water slightly acidic. Turbidity ranged from 3.5 NTU to 67 NTU with the electrical conductivity ranging from 840 µS/cm to 1430 µS/cm. Iron in the samples ranged from 1.5 mg/L to 16.88 mg/L. Other metals recorded included Cd (0.025 – 0.035 mg/L), Mn (0.52 – 1.17 mg/L), Ni (0.083 – 0.14 mg/L), Pb (0.17 – 0.47 mg/L) and Zn (0.17 – 0.85 mg/L). With the exception of Pb, which was elevated, all other metals recorded levels that met the permissible limits set by the Environmental Protection Agency (EPA) of Ghana. The nutrient levels were variable. The concentration of NO_3 ranged from 0.44 mg/L to 4.30 mg/L, which was less than the set limit of 50 mg/L. On the other hand, PO_4-P levels ranged from 0.32 mg/L to 4.75 mg/L. The

concentration of oil and grease ranged from 6.3 mg/L to 15 mg/L. The project is not envisaged to impact groundwater quality and quantity.

5.1.7 Risk of Natural Disasters

The main natural disaster risk to the building project is hydro-meteorological in the form of occasional flooding. The increasing intensity and duration of precipitation in recent years have increased the vulnerability of the project area to occasional flooding. This is exacerbated by the site being lowlying and at the toe of a slope. Run-off thus collects and accumulates on the site before gradual infiltration into the soil. Again, a channel that runs along the southern reaches of the site overflows and floods the project site during episodes of intense precipitation. This occurrence, is however not very frequent. The enlargement of the channel and the direction of runoff from the site into the channel through the construction of adequately-sized drains will help manage this risk. In terms of seismic activity, especially earthquakes, the project area is within the low hazard zone for Ghana (zone 3) and thus there is no real risk from earthquakes (Ahulu et al. 2018). On this basis, the geotechnical assessment recommended a ground acceleration of 0.35g which represents the average for the range 0.14 - 0.57g for the design in line with the recommendation for engineering structures in zone 3.

5.1.8 Vegetation and Flora Survey

A vegetation survey for the project site was undertaken between August and September, 2021. The coastal area falls under two main vegetation zones, forest and savanna. The vegetation of the Metropolis is mainly secondary forest with thickets and shrubs growing to a mean height of 4.5 m.

The original vegetation of the project site within the University of Cape Coast has been degraded primarily due to the previous clearance of the vegetation on site for the establishment of various infrastructure found in the surroundings of the proposed project site. Most of the plant families contain very low numbers (Table 5-2). The physiognomy of the original vegetation has been destroyed leading to the preponderance of early stages secondary succession species as shown in Figure 5-3 below.

Grass cover on ACECoR Biulding site -18.11.2021

Shrub and tree cover of the ACECoR building site -18.11.2021

Figure 5-3: Vegetative cover of some sections of the ACECoR building site (Source: Field work, 2021)

The star rating of the flora revealed that most of the species are of low conservation status or have not been star rated. It is recommended that conscious effort should be made to plant trees in unused spaces after the construction of the proposed project.

Table 0-2: Plant species of the study area

Species name	Family	Life form	Star rating	Ecological guild
Acacia mangium Willd.	Mimosaceae	Tree sapling	NA	NA
Ageratum conyzoides L.	Asteraceae	Herb	NA	Pioneer
Alchornea cordifolia (Schum. & Thonn) Muell.Arg	Euphorbiaceae	Shrub	Green	Pioneer
Andropogon gayanus Kunth.	Poaceae	Herb	NA	NA
Aspilia africana (Pers.) C.D.Adams	Asteraceae	Climber	NA	Pioneer
Azadirachta indica A.Juss.	Meliaceae	Tree	NA	NA
Baphia nitida Lodd.	Papilionaceae	Tree sapling	Green	SB
Bidens pilosa L.	Asteraceae	Herb	NA	Pioneer
Boerhavia diffusa L.	Nyctaginaceae	Herb	NA	Pioneer
Bracharia deflexa (Schum.) C.E.Hubbard ex Robyns	Poaceae	Herb	NA	Pioneer
Bryophylum pinnatum (Lam) Kuntz.	Crassulaceae	Herb	NA	NA
Caesalpina pulcherrima (Linn.) SW.	Caesalpinaceae	Shrub	NA	NA
Calopogonium mucunoides Desv.	Papilionaceae	Herb	NA	Pioneer
Capsicum frutescens L.	Solanaceae	Herb	NA	Pioneer
Cassia occidentalis L.	Caesalpiniaceae	Shrub	NA	Pioneer
Ceiba pentandra Gaertn.	Bombaceae	Tree	Green	Pioneer
Centrosema pubescens Benth.	Papilionaceae	Climber	Green	Pioneer
Chromolaena odorata (L.) King & Robinson	Asteraceae	Shrub	Green	Pioneer
Coix lacryma-jobi L	Poaceae	Herb	NA	Pioneer
Combretum racemosum P. Beauv.	Combretaceae	Climber	Green	Pioneer
Commelina benghalensis L.	Commelinaceae	Herb	Green	Pioneer
Crotalaria retusa L.	Papilionaceae	Herb	NA	Pioneer
Cynodon dactylon (L.) Pers.	Poaceae	Herb	NA	NA
Cyperus rotundus L.	Cyperaceae	Herb	NA	Pioneer
Dactyloctenium aegyptium (L.) P.Beauv.	Poaceae	Herb	NA	NA
Desmodium adscendens (Sw.) DC.	Papilionaceae	Herb	NA	Pioneer
Digitaria horizontalis Willd.	Poaceae	Herb	NA	Pioneer
Dissotis rotundifolia (Sm.) Triana	Melastomataceae	Herb	Green	Pioneer
Echinochloa cruspavonis (Kunth) Schult.	Poaceae	Herb	NA	Pioneer
Elaeis guineensis Jacq.	Palmaceae	Tree	Pink	Pioneer
Eleusine indica (L.) Gaertn.	Poaceae	Herb	NA	Pioneer
Emilia coccinea (Sims) G.Don.	Asteraceae	Herb	NA	Pioneer
Euphorbia heterophylla L.	Euphorbiaceae	Herb	NA	Pioneer
Euphorbia hirta L.	Euphorbiaceae	Herb	Green	Pioneer
Euphorbia prostrata L.	Euphorbiaceae	Herb	NA	Pioneer
Fluerya aestuans (L.) ex Miq.	Urticaceae	Herb	NA	NA
Hewittia sublobata L	Convolvulaceae	Climber	NA	Pioneer
Hibiscus esculentus L.	Malvaceae	Herb	NA	NA
Hilleria latifolia (Lam) H. Walt	Phytolaccaceae	Herb	NA	NA
Hyptis suaveolens Poir	Lamiaceae	Herb	NA	NA
Ipomoea involucrata L.	Convolvulaceae	Climber	NA	Pioneer
Ischaemum rugosum Salisb.	Poaceae	Herb	NA	Pioneer
Leptochloa caerulescens Steud.	Poaceae	Herb	NA	Pioneer
Lycopersicum esculentum Mill.	Solanaceae	Herb	NA	NA
Mallotus oppositifolius (Geisel.) Muell.Arg.	Euphorbiaceae	Tree	Green	SB

Mangifera indica L	Anacardiaceae	Tree seedling	NA	Non forest
Manihot esculenta Crantz.	Euphorbiaceae	Shrub	NA	NA
Maniophyton fulvrum Mull. Arg.	Euphorbiaceae	Liana	Green	NPLD
Melanthera scandens (Schum. & Thonn.) Roberty	Asteraceae	Climber	NA	Pioneer
Melochia corchorifolia L.	Sterculiaceae	Herb	NA	Pioneer
Mimosa nigra L.	Mimosaceae	Herb	NA	Pioneer
Mimosa pudica L.	Mimosaceae	Herb	NA	Pioneer
Mollugo verticillata L.	Molluginaceae	Herb	NA	Pioneer
Momordica charantia L.	Cucurbitaceae	Climber	NA	Pioneer
Morinda lucida Benth.	Rubiaceae	Tree sapling	Green	Pioneer
Musa paradisiaca L.	Musaceae	Herb	NA	NA
Mussaenda elegans Schum. & Thonn.	Rubiaceae	Climber	Green	Pioneer
Panicum laxum Jacq.Sw. PR.Br.	Poaceae	Herb	NA	Pioneer
Panicum maximum Jacq.	Poaceae	Herb	Green	Pioneer
Paspalum conjugatum Berg.	Poaceae	Herb	NA	Pioneer
Paspalum scrobiculatum L.	Poaceae	Herb	NA	Pioneer
Pauzolzia guineensis Benth	Urticaceae	Herb	NA	NA
Pennisetum polystachion (L.) Schult.	Poaceae	Herb	NA	Pioneer
Phyllantus amarus Schum. et. Thonn.	Solanaceae	Herb	NA	Pioneer
Physalis angulata L.	Solanaceae	Herb	NA	NA
Physalis micrantha Link	Solanaceae	Herb	NA	NA
Rottboellia cochinchinensis (Lour.) W.Clayton	Poaceae	Herb	NA	Pioneer
Schrankia leptocarpus DC.	Mimosaceae	Herb	NA	Pioneer
Schwenckia americana L.	Solanaceae	Herb	NA	Pioneer
Setaria barbata (Lam) Kunth.	Poaceae	Herb	NA	Pioneer
Sida acuta Burn. F.	Malvaceae	Herb	NA	Pioneer
Sida cordifolia L.	Malvaceae	Shrub	NA	NA
Sida rhombifolia L.	Malvaceae	Shrub	NA	Pioneer
Solanum nigrum L.	Solanaceae	Herb	NA	Pioneer
Solanum torvum Sw.	Solanaceae	Herb	NA	Pioneer
Spigelia anthelmia l.	Loganiaceae	Shrub	NA	Pioneer
Starchytarpheta indica (L.) Vahl.	Verbenaceae	Shrub	NA	Pioneer
Talinum triangulare (Jacq.) Willd.	Portulacaceae	Herb	NA	Pioneer
Tridax procumbens L.	Asteraceae	Herb	NA	Pioneer
Urena lobata L.	Malvaceae	Herb	NA	Pioneer
Vernonia cinerrea (L.) Less.	Asteraceae	Herb	NA	Pioneer
Xanthosoma sagittifolium (L.) Schoott	Araceae	Herb	NA	NA
Zea mays L.	Poaceae	Herb	NA	NA
Bambusia vulgaris Schrad ex Mendel	Graminae	Tree	Green	Swamp
Leucaena leucocephala (Lam) De Wit	Mimosaceae	Shrub	NA	Pioneer
Khaya ivorensis A. Chev.	Meliaceae	Tree	Scarlet	NPLD
Delonix regia (Hook.) Raf.	Fabaceae	Tree	NA	NA
Tectonia grandis L.	Lamiaceae	Tree	NA	Non -Forest
Peltophorum ptericarpum (DC.) Backer ex K. Heyne	Fabaceae	Tree	NA	NA
Gmelina arborea Roxb. ex Sm.	Lamiaceae	Tree	NA	Non -Forest

Table 0-3: Family, number of plant species and relative diversity

Family	**Number of species**	**Relative diversity**
Poaceae	18	21.69
Asteraceae	8	9.64
Solanaceae	8	9.64
Euphorbiaceae	7	8.43
Malvaceae	5	6.02
Papilionaceae	5	6.02
Mimosaceae	4	4.82

Caesalpinaceae	2	2.41
Convolvulaceae	2	2.41
Rubiaceae	2	2.41
Urticaceae	2	2.41
Araceae	1	1.21
Bombaceae	1	1.21
Combretaceae	1	1.21
Commelinaceae	1	1.21
Crassulaceae	1	1.21
Cucurbitaceae	1	1.21
Cyperaceae	1	1.21
Lamiaceae	1	1.21
Loganiaceae	1	1.21
Meliaceae	1	1.21
Molluginaceae	1	1.21
Musaceae	1	1.21
Nyctaginaceae	1	1.21
Palmaceae	1	1.21
Phytolaccaceae	1	1.21
Portulacaceae	1	1.21
Sterculiaceae	1	1.21
Verbenaceae	1	1.21
Anacardiaceae	1	1.21
Melastomataceae	1	1.21

Table 0-4: Distribution of the plant species among various life forms

Life form	**Number of species**	**Proportion of species (%)**
Herbs	57	63.33
Shrubs	10	11.11
Trees	14	15.56
Climbers	8	8.89
Liane	1	1.11
Total	**90**	**100**

Table 0-5: Star rating of plant species of the study area

Star rating	**Number of species**	**Proportion of species (%)**
Green	15	16.67
Pink	1	1.11
Scarlet	1	1.11
Not Available	**73**	81.11
Total	**90**	**100**

Table 0-6: Ecological guild of plant species of the study area

Guild	**Number of species**	**Proportion of species (%)**
Pioneer	60	66.67
SB	2	2.22
NPLD	2	2.22
Non Forest	4	4.45
Not Available	21	23.33

Swamp	1	1.11
Total	**90**	**100**

5.1.9 Fauna Survey

The faunal survey was concurrently undertaken with the vegetation survey between August and September 2021. Four species of small mammals distributed in four different families were recorded in this study. The species were *Arvicanthis niloticus*, *Cricetomys gambianus*, *Euxerus erythropus* and *Thyronomys swinderianus* of the Muridae, Nesomyidae, Sciuridae and Thryonomyidae families respectively (Table 5-7). The IUCN classification of the mammalian species in this study shows that all the species are of least concern. The lack of vegetation on the site and the activities of the nearby community members have contributed to the near absence of fauna in the proposed project site. The study has revealed that the mammalian species obtained in this study are of no threat globally and nationally.

Table 0-7: Mammals of the study area and their conservation status

Family	**Species Name**	**IUCN Conservation Status**
Muridae	*Arvicanthis niloticus* (African grass rat) – sighting	Least concern
Nesomyidae	*Cricetomys gambians* (Giant gambian rat) – hole, sighting, trapped	Least concern
Sciuridae	*Euxerus erythropus* (Squirrel) sighting	Least concern
Thyronomyidae	*Thyronomys swinderianus* (Grass cutter) – trapped, faeces	Least concern

Thryonomys swinderianus trapped in a thicket near the site

Gambian rat trapped by a farmer in nearby cassava farm.

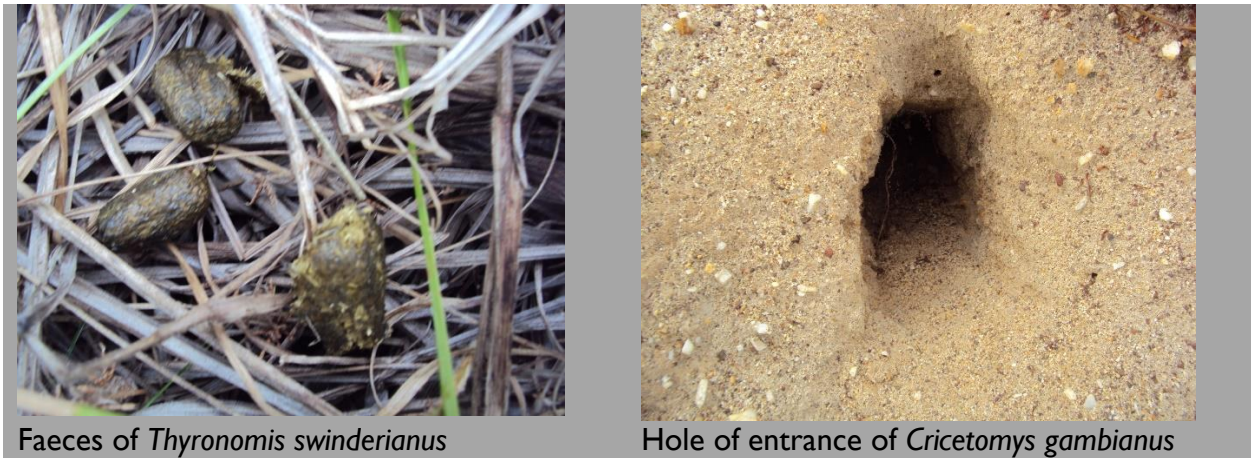

Figure 0-4: Photo of some animal species identified on the proposed project site

5.2.0 Herpetofauna Survey

The herpetofauna survey recorded 5 species consisting of 2 reptiles distributed in 2 families and 3 anurans in two families (Table 5-8). The conservation status of the herpetofauna species obtained in this study revealed no conservation concern as three species forming 60% of the herpetofauna were categorized as least concern and two representing 40% of the herpetofauna species have not been categorized.

Table 5-8: **Herpetofauna of the study area and their conservation status**

Family	**Species**	**IUCN Conservation Status**
Amphibian		
Bufonidae	*Bufo regularis* (Common toad)	Not categorized
Bufonidae	*Nectophryne afra* (African tree toad)	Least concern
Ranidae	*Hoplobatrachus occipitalis* (African Groove-crowned frog)	Least concern
Reptile		
Agamidae	*Agama agama*	Least concern
Boidae	*Thelotornis kirtlandii* (Twig snake)	Not categorized

5.3 SOCIO-ECONOMIC CHARACTERISTICS

5.3.1 Population

The population of the Central Region is 2,859821. Out of this, 1,390,987 (48.6%) are males and 1,468,834 (51.4%) are females. The population of the Metropolis according to 2021 population and housing census stands at 189,925 with 92,790 males (48.8%) and 97,135 (51.2%) females. The metropolis has a sex ratio (number of males per 100 females) of 96. The proportion of the metropolis youth (less than 15 years) is 28.4 percent depicting not too broad base a population pyramid which tapers off with a small number of elderly (60 years and older) persons (4.5%). The total age dependency ratio for the metropolis is 49.1, the age dependency ratio for males is lower (48.2) than that of females (49.9). Out of the population 11 years and above, about 90.0 percent are literate and

10.0 percent are non-literate. The proportion of literate males is higher (94.1 %) than that of females (85.6%). About seven out of ten people (67.2%) indicated they could speak and write both English and Ghanaian languages. (Ghana Statistical Service, 2021). The number of regular students at the University of Cape Coast is estimated at 25,263, made up of 23537 (13072 males; 10456 females) undergraduate and 1726 (1084 males; 645 females) postgraduate students.

5.3.1.1 The level of education in the study area

The Cape Coast Metropolis is endowed with many schools, ranging from basic to tertiary institutions. These schools attract people from all over the country and the West Africa Sub-region, who pursue various levels of academic and professional education. The Metropolis is considered the cradle of education in Ghana as it boasts of some of the best basic (University Basic schools, Pere Plange School, Flowers Gay) and secondary (Mfantsipim School, St. Augustine's College, Adisadel College, Wesley Girls High School and Holy Child College) schools in Ghana. The Metropolis boasts of over 70 Pre-Schools, 81 JSS, 10 Senior Secondary Schools (SSS), one Technical School, one teacher training college and 2 universities. Enrolment levels are very high because people generally perceive the schools to be among the best performing institutions in the country; thus, since 2017, most of the second cycle institutions are always over-subscribed. Even at the basic level, enrolment is generally high with girls slightly ahead of boys. However, the trend changes at the second cycle level and boys become a dominant force in the schools. Of the population currently in school, more than one-third (34.4%) are in tertiary institutions, 27 percent in primary, 13.1 percent in JHS and 11.4 percent in SHS education. Whiles there are currently more males (40.4%) in tertiary institutions in the Metropolis, a relatively smaller proportion of the females (28%) are in this level of education. On the other hand, the proportion of females in primary (28.4), JHS (14.2) and SHS (15) is higher than males; 25.8, 12.2, 8.1 respectively (Ghana Statistical Service, 2021).

5.3.1.2 The health situation

Health Services in the Metropolis are a mix of both government and private institutions, and are structured along the three-tier system of the Primary Health Care strategy namely the community, sub-district and the regional levels. The Metropolis is endowed with a good number of health facilities to facilitate access to health care. They include hospitals, clinics and CHPS compounds. There is a regional hospital, district hospital and various clinics that provide health care to the population. The regional hospital, the Cape Coast Teaching Hospital, serves as a referral centre for the region with the former Central Regional Hospital now serving as the Metropolitan Hospital. The University of Cape Coast Hospital currently supplements the efforts of the two facilities. The most prevalent diseases in the Metropolis as recorded at the OPDs of health facilities include malaria, upper respiratory infection, skin disorders and diarrhoea. However, the ten top causes of mortality in the Metropolis are malaria (26.8%), anaemia (19.1%), pneumonia (8.1%), tuberculosis (7.7%), HIV/AIDS (4.8%), hypertension (3,8), cerebral vascular accidents (CVA) i.e. Stroke (3.8%), gastro-intestinal disorders (3.3%), meningitis (2.4%) and cord sepsis (1.9%).

5.3.1.3 Access to water and electricity

The Metropolis is quite well served with potable drinking water. All communities are served with pipe-borne water from the conventional treatment plants at Brimsu and Sekyere Hemang. Over 90% of the residents are supplied from these sources. Rural supplies in the form of bore-holes, wells and untreated water from the rivers makes up just 1% of the drinking water system in the Metropolis. Approximately 40% of homes have pipe-borne water with the remaining percentage obtaining water supply outside their homes. The main problems with water supply in the Metropolis are the perennial drying up of the Kakum dam and the impact of artisanal mining activities on the Pra river, which feeds the Sekyere Hemang treatment plant. The other problems relate to the use of old equipment in pumping water to households, frequent power outages, which affect the distribution system and non-payment or irregular payment of tariffs to enable the Ghana water Corporation to expand its facilities. The southern part of Metropolis is well supplied with power through the national grid by the Electricity Company of Ghana. The northern parts however, are not fully connected to the national grid. In all, over 85% of residents of the Metropolis have access to electricity supply in spite of the intermittent power fluctuations experienced at certain times. Institutions and individuals who can afford augment the electricity supply from

the national grid with power generation plants. The use of renewable sources of power is not significant in the Metropolis.

5.3.1.4 The situation of vulnerable populations in the study area and within the University

The significant vulnerable group in the Metropolis are the people with disabilities (PWDs). Around 2.5 % of the population of the Metropolis have one form of disability or the other. Whiles 2.4 percent are males, 2.6 percent are females. There are more persons with disabilities in the urban areas (2.7%) than in the rural settlements (1.9%) of the Metropolis (Ghana Statistical Service, 2021). The most common disability among PWDs in the Metropolis are sight (46.2%) and physical (26.9%) disabilities. Almost half (49.2%) of female PWDs are suffering from sight disability compared with 42.5 % of their male counterparts. For all other types of disabilities however, more of male PWDs are affected than females in the same category. A similar pattern is observed in both urban and rural areas of the Metropolis, although the proportion of PWDs in the urban areas is higher. Though the prevalence of the sight disability is almost the same in urban (41.1%) as in rural (41.6%) localities, the prevalence is much higher among urban male PWDs (43.5%) than those in rural areas (37.7%), and also much higher among urban female PWDs than their rural counterparts (45.4%). The prevalence of physical disability is much higher in urban (27.4%) than in rural (24.5%) areas. But physical disability in urban male PWDs (27.4%) is slightly lower than in rural male PWDs (28.5%). It is also higher among urban females with disabilities (27.3%) than rural females with disabilities (20.7%). Social support for these vulnerable group is in the form of governmental support through the LEAP scheme. This is however not sufficient enough. Some of the PWDs thus resort to begging on the streets and living on the benevolence of family and friends.
The University also have its fair share of PWDs which remain the dominant vulnerable group. Around 2% of the student population suffer from one form of disability or the other. There are more male than female PWDs in the University. The most common forms of disabilities include sight and physical disabilities. The University provides specialized services including disability-friendly residential accommodation in the students' halls of residence, library facilities and guided walkways. Access to most lecture rooms have also been made disability-friendly. Support systems in the form of peer helper systems are also in place to aid mobility of PWDs on campus.

5.3.2 The Local Economy

About 54.7 percent of the population aged 15 years and older in the central region are economically active while 45.3 per cent are economically not active. Of the economically active population, 90.7 percent are employed while 9.3 percent are unemployed. Of the employed population, about 32.5 percent are into sales and services. Apart from this, there are artisans (23.6 percent), professionals (13.2 percent) and those in agriculture and related employment account for 6.8 percent (Ghana Statistical Services, 2021).

5.3.2.1 Agriculture and Fisheries in the Cape Coast Metropolis

Farmers and fishermen as well as those into agricultural-related activities form about 60% of the population (Ghana Statistical Services, 2000 Population Census).

Active agricultural population is approximately 28,000. Commercial farmers are approximately 0.3% and peasants (majority) approximately 99.7%. The available land for agriculture is about 8,000 Ha. This implies that higher levels of production could be achieved for crops to meet both domestic and export market. About 3,500 Ha currently under cultivation, with more available for expansion or development. Land holding, however, is less than 1ha for most farmers. Major tree crops in the Metropolis are oil palm, citrus and coconut (Table 5-8) and the major staple crops are cassava, plantain and maize (Table 5-9). Poultry is the major livestock production in the Metropolis (Table 5-10)

Marine fishing is another major activity along the coast. Mainly canoes and few motorized vessels do this. The commonest marine fish catch is the Anchovy, followed by Round sardinella (Table 5-11). The commonest fish

catch in the lagoon is the blackchin tilapia constituting about 90% of total fish catch in terms of weight (Baffour-Awuah, 2012).

Table 0-8: Major Tree Crops in the Cape Coast Metropolis

CROP	AREA (HA) UNDER PRODUCTION	AVERAGE YIELD MT/HA	ANNUAL PRODUCTION (MT)
Oil Palm	90	7.5	675
Citrus	738.64	11.47	8,474.65
Coconut	22	5	110

Source: Ministry of Food and Agriculture (http://mofa.gov.gh/site/?page_id=1453)

Table 0-9: Major Staple Crops in the Cape Coast Metropolis

CROP	AREA (HA)	AVERAGE YIELD MT/HA	ANNUAL PRODUCTION MT/HA
Maize	678	1.83	1,240.7
Cassava	736	14.12	10,392.32
Sweet potato	55	10.2	561
Plantain	134	8.95	868.15
Groundnut	10	0.60	6.0
Tomato	45	0.16	7
Pepper	91	0.088	8
Egg Plants	52	0.09	5
Cabbage	10	0.60	6
Lettuce	5	0.17	0.85
Carrot	4	0.57	2.3

Source: Ministry of Food and Agriculture (http://mofa.gov.gh/site/?page_id=1453)

Table 0-10: Livestock Production in the Cape Coast Metropolis

TYPE OF LIVESTOCK	NUMBERS
Cattle	110
Sheep	18,000
Goat	24,000
Pig	400
Poultry (improved)	45,000
Grasscutter	54
Local birds	63,000
Ducks	115
Rabbit	50

Source: Ministry of Food and Agriculture (http://mofa.gov.gh/site/?page_id=1453)

Table 0-11: Livestock Production in the Cape Coast Metropolis

TYPE OF FISH	ANNUAL TOTAL (kg)

Anchovy	7,582.56
Barracuda	6.07
Bumper	453.10
Burrito	44.00
Burro	233.93
Cassava/ croaker	74.97
Decapterus (pamplo)	694.67
Frigate mackerel	736.28
Horse mackerel	493.45
King fish	9.44
Long- finned herring	135.54
Meagre	176.12
Moonfish	280.68
Pampano	324.40
Ribbon fish	504.38
Rancador	23.64
Round sardinella	1,836.14
Scald mackerel	67.31
Chub mackerel	74.51
Sharks	2.23
Shrimps	189.12
Threadfin	24.78
Miscellaneous	178.13

Source: Ministry of Food and Agriculture (http://mofa.gov.gh/site/?page_id=1453)

5.3.3 Social Amenities

The Metropolis is home to nine senior high schools, one technical institute, one teacher training college, two nursing training colleges and two universities. Also, there are two large castles that mirror the historical development of this country and which are classified by UNESCO as world heritage monuments.

The University of Cape Coast is home to several infrastructure which serve as social facilities to enhance teaching and learning. These include hospitals, clinics, churches, mosques and schools, police stations and fire service stations (See Figure 5-3 below).

Our Lady Seat of Wisdom Catholic Church
This church seats 500 people and is located about 2 km away from the proposed site for ACECoR.

University Interdenominational Church
The University Interdenominational Church (UIC) is adjacent the Catholic Church which has a seating capacity of about 500 people. UIC is distanced about 2 km from the proposed site.

Mosque. The Mosque on UCC campus is located about 1. 9 km from the proposed site. This is the only place of worship for Muslim student and faculty on campus.

Students' Clinic located about 1.8 km from the proposed ACECoR site.

UCC Hospital. It is located about 300 m from the proposed location.

UCC Primary School. The primary school is located at 350 m from the proposed site.

Community School at Kwaprow. This is about 4 km m from the site.

UCC stadium. The Stadium is located behind the University Hospital and lies adjacent the UCC primary School. It is distanced about 250 m from the proposed site.

Students Residence. University Alumni Hall approximately 1.8 km from the site

Figure 0-5: Social Amenities within the University of Cape Coast

6.0 ALTERNATIVES CONSIDERATION

Decision making is mainly supported by the EIA tool so if there is no choice among options, there is no reason for a decision. The consideration of alternatives is central to sound decision-making; it increases public participation and improves transparency thus ensuring better accountability of the decision. Therefore, alternatives are very important for better governance and sustainability.

The International Principles of EIA Best Practice (IAIA/IEA, 1999) states as a basic principle that 'EIA should be systematic" and that "the process should result in full consideration of all relevant information on the affected environment, of proposed alternatives and their impacts, and that as an operational principle, "specifically the EIA process should provide for the examination of alterantives to establish the preferred or most environmentally sound and benign option for achieving the objectives of the ACECoR Project objectives".

Consistent with the above and in order to enable the proposed ACECoR Building project seek different ways of minimizing its impacts on the environment and at the same time achieve its objectives, several alternatives were assessed through the architectural and engineering designs and environmental planning through this EIA. The alternatives considered as part of the conception of this project are:

i. No action scenario;
ii. Project implementation scenario - Alternative Sites 1&2
iii. Project implementation scenario – Alternative site 3
iv. Refurbishment of the existing Fort St. Jago, Elmina in the Central Region
v. Alternative Schedule
vi. Alternative Design

6.1 NO ACTION SCENARIO

The "No Action Scenario" assumes that the proposed project will not be implemented. This implies that there will be no construction of the ACECoR multi-purpose educational complex. This implies that ACECoR will have to make do with the small office space allocated to them within the College of Education Studies Lecture Theatre Building (C.A Ackah Lecture Theatre) University of Cape Coast. Obviously, this will not lead to the project achieving its overall developmental objective. If the status quo prevails, there will be no adverse environmental and social impacts such as noise and waste generation as well as accidents and occupational health and safety risks associated with the construction phase.

From an environmental perspective, not carrying out this development may be the best option. Without the development, the area would remain a relatively undisturbed area providing a habitat for the varied flora and fauna presently observed. This area will continue to be impacted, although minimally, by anthropogenic and natural factors. From the educational and socio-economic perspective, the "no action" alternative may not be the best alternative as the numerous benefits to be gained from the development both locally and nationally would not be realised and the educational and other resources within the University of Cape Coast will be underutilized.

6.2 REFURBISHMENT OF THE EXISTING FORT ST. JAGO, ELIMINA, TO HOST ACECOR

The University of Cape Coast is desirous of establishing a cooperative agreement with the Ghana Museums and Monuments Board (GMMB) to create and expand opportunities for outstanding educational and outreach programmes in coastal conservation in Ghana. The partnership will reinforce the commitment of both institutions to serve the government and people of Ghana by developing sustainable coastal environmental programmes, promote tourism, encourage fisheries management, conserve biodiversity and work with stakeholders towards alleviating poverty in coastal areas. Given the strategic locations of the University and the Fort (Figure 6-1), the University invited the Ghana Museums and Monuments Board for partnership to promote these goals for mutual gains.

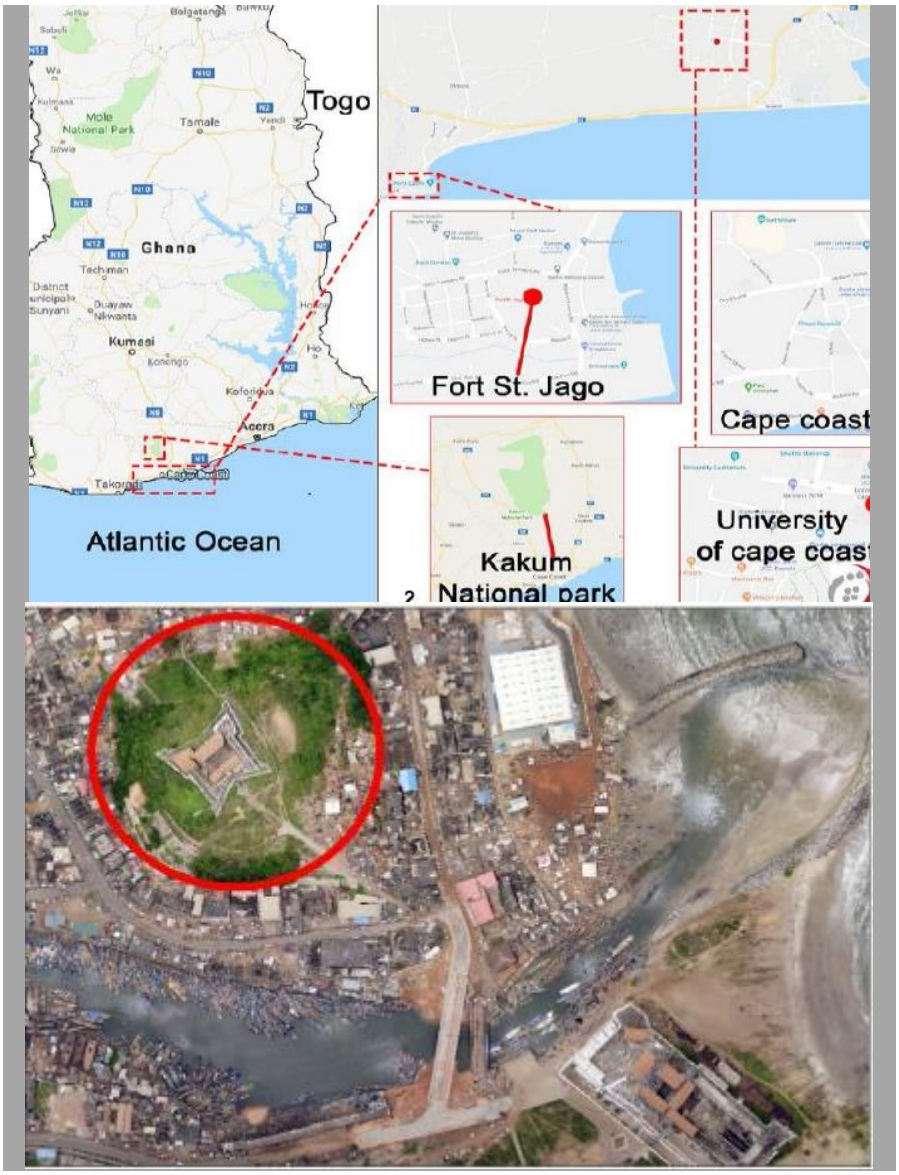

Figure 0-1: Location of Fort Jago in Elmina in the Central region of Ghana

Over the years, the Fort has been put to various uses such as a prison, hospital, and rest house. It is currently in fairly poor condition and not being put to any formal use. Its utility as Ghana's cultural heritage and its symbolism in human history is gradually being lost, dwindling its potential for tourism and income generation. There is therefore the urgent need to salvage the situation. To do so will require rehabilitation and redefinition of the use of the facility within the context of history, culture, socio-economic activities and environmental needs of the local people. This proposal was made by the University of Cape Coast to partner the Ghana Museums and Monuments Board for the joint use and maintenance of Fort St. Jago to pursue common goals. The arrangement will lead to the University of Cape Coast adopting and refurbishing the Fort St, Jago for use as one of the study centres of the University, purposely to house ACECoR.

Unfortunately, after several months of perusing this option, GMMB has not shown interest in the project and the Ministry of Tourisms, Culture and Creative Arts is not committed to the process and is unwilling to support

this proposal. Therefore, this alternative cannot be further considered since availability of the Fort cannot be guaranteed.

6.3 ALTERNATIVE SITES

Alternative Sites 1&2: This option involves pursuing the proposal but on two parcels of land situated between the Sandwich Lecture Theatre and the Institute of Education (New Building) at the North campus of the university. During this assessment it was observed that the area is flood-prone as it lies in a waterway. Undertaking the project there will be economically and environmentally costly as lots of excavations and filling will need to be done for the land to support the kind of building proposed. Again, there is the tendency of increased flooding within the area as surface drainage will be impaired by the building. Hence, the environmental impacts of choosing this site will be enormous.

Figure 0-2: Aerial Photograph of the alternate sites 1 & 2 for ACECoR

Alternative Site 3: The third alternative site which was proposed by the university had less disturbed natural environment, vegetation and soil. This implies that it will be more disruptive and has the potential to lead to significant loss of flora and fauna. This alternative is not seen as a sustainable option.

Figure 0-3: Aerial Photograph of the alternate site 3 for ACECoR

Alternative Site 4 (Preferred Site): The fourth alternative site (See figure 6-4 below) is a parcel of land near the UCC West Gate towards the Duakro community at the UCC Old Site. This parcel of land, which is within the confines of the University (UCC), was evaluated using the following criteria.

Table 0-1: Preferred Site Evaluation Criteria

Criteria	Description
Land size, shape and adjoinging land uses	4.23 Acres (1.72 Hec), North: UCC Enterprise Water Production Facility, East: Duakor Road, West: Underveloped, South: UCC West Gate
Topography	Gently sloping
Geotechnical considerations	Geotechnical assessment duely undertaken. Report attached as Annex 5
Availability	The land is free from any incumberances as it is fully owned by the University and has been officially ceded to ACECoR as per allocation letter in Annex 6
Ecology and Environment	The ecology and environment is not a critical habitat but a natural habitat which will require that development is undertaken in a manner to minimize impact on the natural habitat.
Social and Safety	The project design, construction and operation and decommission will be in accordance with Good International Industry Practice (GIIP), taking into consideration safety risks to third parties.
Public Acceptance	No objection from any of the stakeholders, including the nearest community, has been raised.
Utility	Power and water will be sourced from the national distribution systems (ECG and GWCL)
Legal Matters	The project has the legal backing of the University. No legal issues have been raised on any aspect of the project, and none is envisaged for the duration of the project.

Figure 0-4: Aerial Photograph of the preferred proposed site for ACECoR

6.4 Alternative Schedule

This option entails carrying out the proposal at a later time thereby offsetting its impacts to that time. The benefit will be that, there may be improvements in baseline conditions and technologies that may be involved with the proposal. However, these are not guaranteed, and it may only lead to delays in development, therefore carrying out the proposed project with mitigation would be a preferred option due to this uncertainty. In addition, carrying out the proposed project at later time may lead to more operational and logistic costs due to increasing inflation and standards of living. More importantly, the project may not be completed at the expiration of the ACE (III) period as it is for a fixed period of five years.

6.5 Alternative Designs

This option entails undertaking the project but with different infrastructural designs that encompass buildings materials, and utilities.

Option 1: The architectural and engineering designs of this alternative design option makes the project prohibitively expensive and will require more space and will lead to loss of flora and fauna. This design has a greater horizontal expanse and thus a bigger land-take. This will lead to the extensive removal of vegetation and excavation of soil which will negatively impact the natural environment. The ecological impact of this design will be quite high. Again, this design uses a lot of glass as structural components and also in cladding and glazing. This would mean the project would use more energy and resources as compared to the preferred project option. The positive environmental impact of this option is that it offers balance with nature that will create ambience, however, it is not a 'green' design.

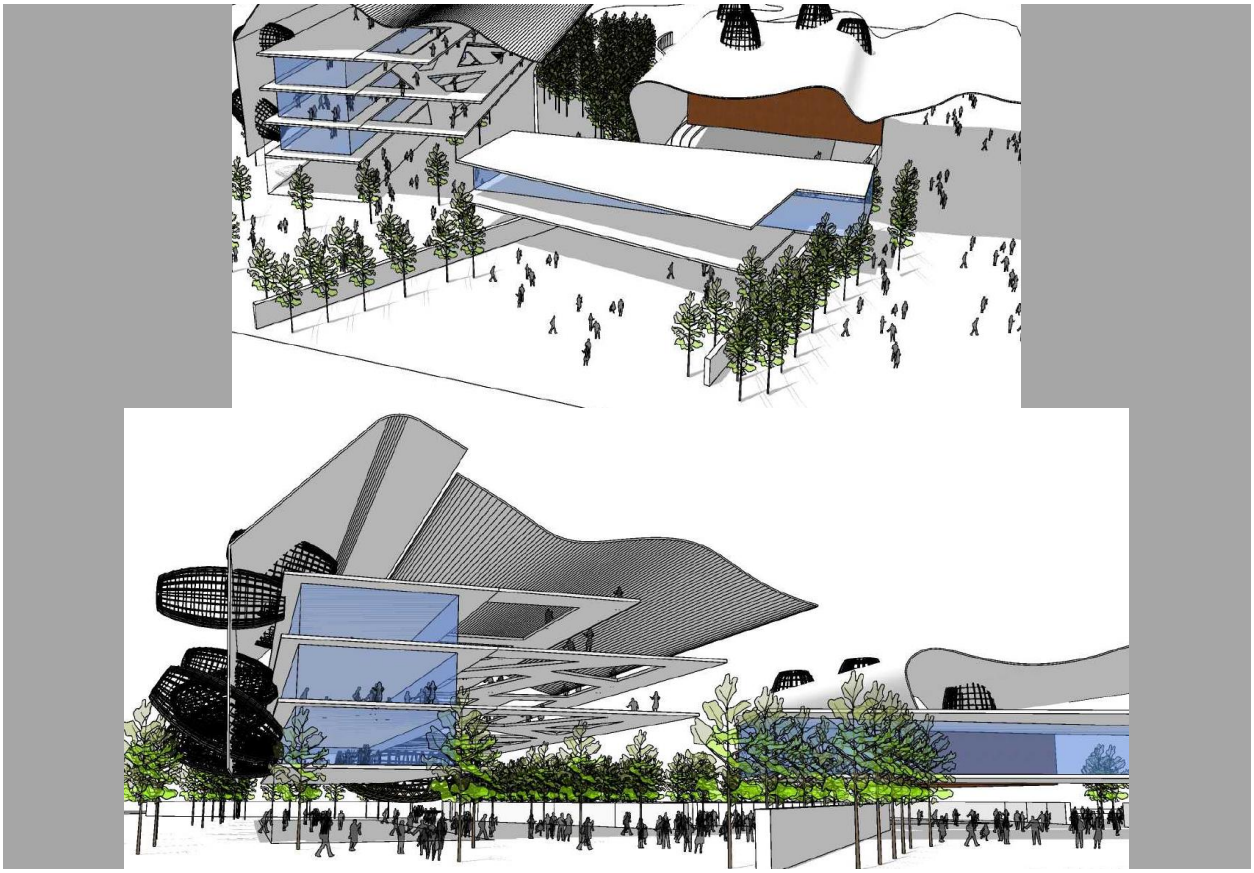

Figure 0-5: Alternative Design for the ACECoR multi-purpose educational building

Option 2: This project design and site option, which was achieved by considering the options available that would ensure cost-effectiveness and avoid or reduce environmental and social impacts as much as possible.

Figure 0-6: Preferred Alternative Design for the ACECoR multi-purpose educational building

Table 0-2: Qualitative scoring matrix of project alternative

Project Alternatives	Severity of Negative Environmental Impact
No action scenario	No impact
Project implementation scenario - Alternative Sites 1&2	Moderate
Project implementation scenario – Alternative site 3	Very High
Project implementation scenario – Alternative site 4	TBD
Refurbishment of the existing Fort St. Jago, Elmina In the Central Region	Minor
Alternative Schedule	Moderate
Alternative Design – Option 1	High
Alternative Design – Option 2 (preferred)	Moderate

On the basis of the above qualitative scoring the Alternative design option 2 is the preferred option for this project. The Refurbishment of the existing Fort St. Jago, Elmina in the Central Region is not the preferred option because it can have significant impact on the cultural asset and the availability of the Fort cannot be guaranteed.

7.0 STAKEHOLDER CONSULTATION

7.1 OVERVIEW

The importance of promoting public participation is to make the Environmental and Social Assessment Processes open, transparent and robust. Communication between the assessment team and the public (project users) is the key to public participation.

Stakeholder consultations are crucial component in the preparation and implementation of ESIA. Specifically, it aims to achieve the following objectives:

- To provide information about the project and its potential impacts to those interested in or beneficiaries or those affected by the project, and solicit their opinion in that regard
- To educate and solicit views from all stakeholders to enhance the implementation mechanisms and processes
- To manage expectations and streamline misconceptions regarding the project
- To ensure participation and acceptance of the project by all relevant stakeholders

Stakeholder Engagement under ACECoR began early from the project identification to allow stakeholders' views and concerns to be considered in the project design, and to provide inputs to the project environmental and social assessment and mitigation plan. The engagement also sought to disseminate and disclose project related information and to plan project implementation, monitoring and evaluation arrangements. Engagements included both formal and several informal methods. Stakeholders span government institutions, Development Partners, private sector, CSO/ NGOs and academia. The stakeholders consulted included The Development Institute, Hen Mpoano, Ghana, Friends of the Nation, Ghana, West Africa Coastal Area Management Program (WACA), LightHouse Foundation, The Ministry of Science, Environment, Technology and Innovation. The consultations took place between November 2018 to December 2019.

7.2 UNIVERSITY COMMUNITY ENGAGEMENT

The project has consulted and engaged different stakeholders within the university community in designing the project. The project has engaged with the leadership of the university (office of the Vice Chancellor), Directorate of Physical Development and Estate Management (DPDEM), Directorate of Research Innovation and Consultancy (DRIC-UCC), Procurement Section, College of Agriculture and Natural Sciences, College of Humanities and Legal Studies, School of Graduate Studies School of Biological Sciences, Departments of Environmental Science and Water and Sanitation, faculty members and students. No objection to the project was raised by any unit in the University. The engagements with the University community took place from February 2019 to August 2019.

7.3 EXTERNAL STAKEHOLDERS

The project has also engaged with external stakeholders such as the private sector, the World Bank, the Ministry of Education, Ghana Tertiary Education Commission, Environmental Protection Agency, Other universities and ACE Centres in Ghana, universities in the United States of America, USAID, DANIDA and the US National Oceanic and Atmospheric Administration. External stakeholders were consulted between March 2018 and June 2021.

During the consultations and engagements, the following were the key suggestions made on potential environmental and social impacts that could be associated with the ACECoR:

Table 7-1: Suggestions from stakeholders

S.N.	Suggestion	Stakeholder
1.	Acquisition of building permits and other regulatory permits	• EPA • The World Bank • Other ACE Centres in Ghana
2.	Provision of appropriate PPEs for workers and ensuring that all standards relating the work on site are complied with by contractors and artisans	▪ EPA ▪ The World Bank ▪ USAID ▪ Other ACE Centres in Ghana
3.	The need to put measures in place to allow students and authorities express their views on the project without victimization	• The World Bank • GTEC • Other ACE Centres in Ghana
4.	Increase women's participation	• The World Bank • USAID • GTEC • Other ACE Centres in Ghana
5.	Avoiding GBV (sexual harassment against students and workers)	• The World Bank • USAID • GTEC • Other ACE Centres in Ghana
6.	Include construction strategies for green building	• EPA • The World Bank • USAID • Other ACE Centres in Ghana

7.4 FRINGE COMMUNITIES

Consultations were held on the 29th of November, 2021, with the leadership of the immediate adjourning community – the Duakor community – and taxi drivers who operate a taxi station around the project site to brief them on the project and receive their concerns or objections if any. On behalf of the community members, the chief and elders pledged support for the project and raised no objection to it. They contended that they are settlers / squatters on the University land, they have been given prior notice by the University of possible future use of the land, so are aware of their obligations to the University. Once the project is not going to directly interfere with their activities and especially livelihoods, they have no issues. They only ask to be considered for employment when the project takes off. The taxi drivers also agreed to move from the portion of the area earmarked as an access to the project site.

The following elders were consulted:

- Togbe Ayivi II – Chief of Duakor
- David Kobla Attipoe – Elder and Spokesman

Chief of Duakor and Linguist during the consultation

Deputy Director of ACECoR in a handshake with • Togbe Ayivi II after the consultation

Safeguards Officer of ACECoR in a handshake with Togbe Ayivi II after the consultation

Group picture of University management and Elders of Duakor after a working visit where the project was discussed.

Figure 7-1: Consultations with leadership of the Duakor community

8.0 IMPACTS IDENTIFICATION AND SIGNIFICANCE

Option 2 of the alternative designs is the preferred option for the construction of the multi-purpose building and it entails carrying out the proposal with mitigation measures to prevent, offset or avoid its negative impacts thereby maximizing it gains. This option would therefore lead to achieving the project's objectives sustainably. As compared to the other options, this option is environmentally friendly and economically prudent than the other options as it involves using the best available environmentally friendly building materials and processes to minimize the risks to the environmental and social systems in the area. Unlike the other designs, Option 2 cuts down on the quantity of glazed glass to be used for windows and other facilities, thus reducing the energy requirements for cooling. Its vertical design also affords maximization of land as less land would be taken when compared to the other horizontally-sprawling designs. This will invariably result in minimal removal of vegetation thus preserving the natural environment.

8.1 IMPACT IDENTIFICATION AND ANALYSIS

To assess the significance of the proposed project's impacts, the impacts were first identified from their source which are the project's activities/equipment/processes/materials and then the impact receptor which are the baseline environmental and social conditions. This was carried out through the use of the Impact Checklist (Table 8-1). This was also informed by the public participation exercise. The impacts were then classified as either positive or negative for each construction project phase. The impacts were lastly analysed in terms of their characteristics on the aforementioned baselines to define their significance by using a matrix and this was also informed by the public participation exercise to identify the acceptable risks. Lastly through literature reviews, professional knowledge, engagements with the proponent and engagements with stakeholders, mitigation measures were developed commensurate to the significance of impacts. This facilitated the development of the Environmental and Social Management Plan in this report. This entire process is illustrated through Figure 8-1.

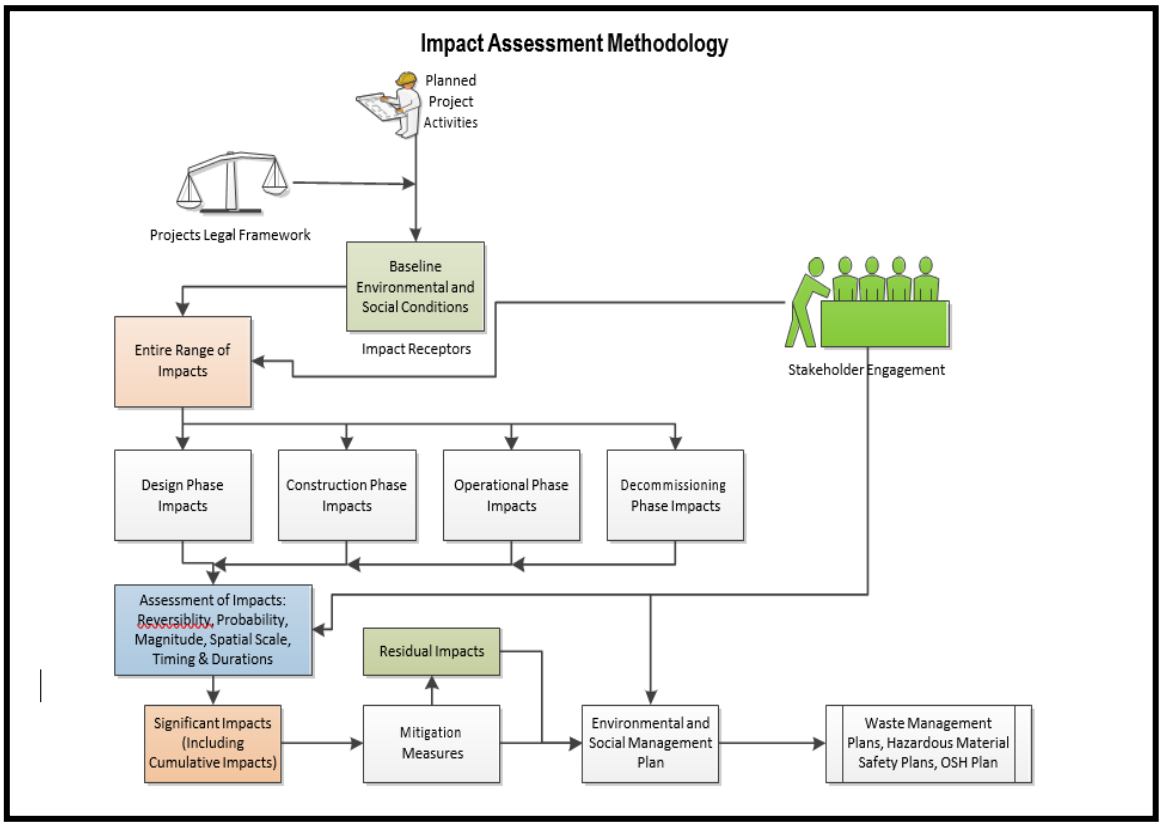

Figure 0-1: Flow Chart of Project Impact Assessment Methodology

Table 0-1: Checklist of Project's Likely Impacts

Environmental aspect	Design Phase	Construction Phase	Operational Phase	Decommissioning Phase
Water				
Pollution		✓	✓	✓
Surface flow		✓	✓	✓
Water Balance		✓		✓
Air				
Pollution		✓	✓	✓
Noise		✓	✓	✓
Soil				
Soil loss		✓		✓
Contamination		✓	✓	✓
Compaction		✓		
Bio-Diversity				
Loss of Flora		✓		
Loss of Fauna		✓		
Extinction of				
Habitat Alteration		✓		✓
Population and Social Dynamics				
Population size		✓	✓	
Diseases		✓	✓	✓
Quality of Life		✓	✓	
Employment		✓	✓	✓
Utilities		✓	✓	✓
Land uses		✓	✓	✓
Others				
Environmental Opportunities	✓	✓	✓	✓
Economy	✓	✓	✓	✓
Landscape Design		✓		✓
KEY	✓	**Denotes an Impact**		

8.1.1 Positive Impacts

The development of this project will have several significant positive impacts both locally and nationally. The many positive impacts would be sustained over the long term. In general, it will help fight poverty and boost shared prosperity, as well as encourage investment in knowledge and skills in all sub-sectors of education. The project will produce highly qualified human resources for priority growth sectors. More specifically, the project will promote awareness among all national stakeholders about the environmental and social issues of Project activities and respect for the environment and will promote key principles of sustainable development.

The construction of the facility will also come with several other positive impacts. There will be opportunities for both short-term and medium-term employment, an improvement in the livelihoods of individuals who will be employed and ultimately an improvement in the local economy. It will also improve upon the security within the project's footprint as several young individuals who are unemployed and thus involved in petty crimes would have an ulternative source of livelihooh that would take them off crime thus improving general security in the area.

Build Capacity: The project will build and strengthen capacity in higher education. It will enhance skills development and knowledge generation (through applied research) to address development challenges. ACECoR will train 120 graduates at the postgraduate (PhD and Masters) levels in addition to 260 professionals (in short courses) across Africa in the areas already described. In addition to existing programmes of Disaster Risk Management and Migration, Fisheries Science, Oceanography and Limnology and Integrated Coastal Zone Management, new programmes in Physical Oceanography, Coastal and Marine Engineering, Forestry Engineering and Marine Meteorology will be developed and mounted for the training of postgraduate students.

Strengthening and Regionalizing Higher Education: ACECoR will recruit a high-quality regional student body and work towards a highly trained workforce with skills tailored to the needs of the sector; partnering with industry and sector stakeholders to identify regional needs; and disseminating research results both in international publications and through appropriate regional channels.

Contribution to the achievement of the Sustainable Development Goals (SDGs): The ACECoR project will also contribute to the achievement of the SDGs especially SDG 4 which talks about inclusive and equitable quality education and promote lifelong learning opportunities for all. Specifically, goals 4.3, 4.4, 4.5 4.7, 4a, 4b are linked to the ACECoR project.

Specifically, the following positive impacts will be achieved under the construction of the multi-purpose educational complex:

8.1.1.1 Design Phase

Creation of Employment and Business Opportunities: The design phase of the project will create employment and business opportunities for various professionals/consultants who will be involved in the planning stages of the project. They will include: project managers, engineers, architects, building economists, land surveyors, environmentalists, economists, urban planners among others. These professionals may be employed directly in the project or be consultants whose services will be procured.

Generation of Income and Source for Government Revenue: Income generated from the consultancies and services undertaken will provide income which will be taxed and generate revenue for the state. In addition, fees levied for the submission of plans to the local authorities and state agencies for approval and application for services will generate revenue that is used to meet the various governmental goals and objectives.

Environmental Opportunities: The design phase of the project will also present opportunities for green/sustainable designing of the project, which support the minimization of environmental impacts whilst fortifying the project to achieve its intended objectives. It's at this stage that the opportunities which will enable the project to achieve a sustainable development are discovered, explored and integrated into the project.

8.1.1.2 Construction Phase

Short-term employment opportunities will be generated for unskilled, semi-skilled and skilled labour in the construction sector, ranging from masons, carpenters to building technicians to architects during the construction phase of the project. This will lead to improved income profiles for workers on the project. In

addition, local food and other vendors and itinerant traders will provide food and other services for the site workers. These short to medium-term direct and indirect employment opportunities that will be created by the project will generate income for beneficiaries, thereby boosting the local economy.

Creation of Employment: The construction activities will generate both direct and indirect employment i.e. employees involved in the production, sale and transportation of the building materials, construction of the building, maintenance of the building and management. Security services, cleaning and waste collection are also some of the services that will benefit indirectly. There will also be employment opportunities created for workers involved in the civil and interior works of construction such as engineers, masons, foremen, bricklayers, machine operators, interior designers, electricians, masons etc.

Market for Goods and Services: To facilitate the construction activities, goods and services, including raw materials, plumbing services, electrical fittings, transport, landscaping and finishing items will be needed. It therefore offers a market for these goods and services promoting the primary and secondary sectors involved in their procurement such as: quarrying and brick production; furniture and carpentry; glass production; plant and gardening; tarmac, asphalt and bitumen; chemicals; building contractors; electric fittings; plumbing fittings and water infrastructure etc.

Create Market for local Communities: The influx of labour into the area and subsequent people/workers to service them or provide them with goods such as food will be another positive impact of the proposed project. This is taken as positive since the population increase if sustainable will create additional market for goods and services offered in the area, increase the amount of mobilized capital and also increase the social capital in the area.

Increased Economic Activities and Revenue: The construction phase of the project will also increase the economic activities in the area, and revenue for the central government through taxes and businesses that will be formed to service the increased population. These services include health, food and nutrition, transport and recreation that the workers taking part in the construction will require from time to time.

8.1.1.3 Operational Phase

Improved Infrastructure for Research and Learning: The project will lead to new buildings, lecture halls, laboratories, and equipment- education infrastructure – which are crucial elements of learning environments in universities. There is strong evidence that high-quality infrastructure facilitates better instruction, improves student outcomes, and reduces dropout rates, among other benefits. The quality of university facilities is linked to education outcomes for students and teachers. Infrastructure helps deliver positive outcomes for both students and teachers. Thus, the level of infrastructure for research and learning will be improved, leading to an improvement in the quality of training of students.

Improved Workers Wellbeing and Working Efficiency: The project will provide well planned, good value infrastructure that meets the needs of users and contribute to better workers well-being and comfort. It will reduce or remove overcrowding in office spaces due to inadequate provision of highly spacious and very comfortable infrastructure; improve the total number of worker spaces availability and adequate seating and waiting spaces. The provision of additional working space will enhance the efficient delivery of services.

Creation of Employment Opportunities: The proposed project will create employment in three tiers; the first being the staff who will be primarily involved in its implementation, supervision and maintenance. The second tier will be lecturers and researchers that the university may employ to provide services. The third tier of employment creation will be for the people who will take the opportunities presented to service the increased population and the population's amenities.

8.1.1.4 Decommissioning Phase

Creation of Employment and Business Opportunities: The decommissioning phase and its activities will create business for the contracting company that will be charged with pulling down the structure and transporting the resultant materials/debris. All these income streams will be taxed and generate income for the central government. Additionally, the decommissioning activities will create employment and job opportunities for different professionals including engineers, demolition experts, landscapers and gardeners, foremen, supervisors, masons and truck drivers amongst others.

Income Generation: Decommissioning the project will create recyclable materials and equipment such as: stones, bricks, metals, furniture, switchboards, pumps etc. may be sold for income albeit cheaper than new ones they will generate taxable income for the proponent.

Provision of Cheaper Building Materials: The decommissioning phase of the project will create recyclable building materials such as bricks, stones, metals, glass, wiring, furniture, electronics and water pumps, plumbing etc. which at present market trends will be cheaper than new ones. This will thus provide cheaper building materials for future projects. It is also possible that the materials may be donated and used for development projects (schools, hospitals etc.) in much needed areas. This will assist in promoting development where it is mostly needed and generally improve the quality of life in those areas and cumulatively in the country.

Environmental Conservation and Restoration: The recycling of the waste to be used as raw materials in other construction process reduces the demand for raw materials. This in turn reduces the potential impact to the environment that would have been felt if the demand of the raw materials hadn't reduced.

8.1.2 Negative Impacts

8.1.2.1 Construction Phase

Loss of Flora and Faunal Habitats: The project site does not lie in any protected or ecologically sensitive area and also not a habitat or spawning ground for any threatened, rare or endangered species. The selected site is currently an open area with grass and shrub vegetation. The site is for the most part previously disturbed, however, plants and animals still utilise these habitats and depend on them for survival. The clearing of vegetation during construction activities is a high possibility. The possible clearing of vegetation, topsoil and the digging of trenches will disturb the habitat of fauna and flora inhabiting the corridor of influence. Vegetation has a great effect on the general and localized environment and normally can modify the microclimate. The de-vegetation will lead to loss or reduction of floral and faunal diversity. The vegetation is important as sources of food and habitat for various animals. It also assists in maintaining the structure of the soil by holding the particles together. This enables the soil microorganisms to flourish as their habitat; the soil is stable. This in turn allows the organisms easily convert the dead leaves and plans to humus which helps enrich the soil as well as prevent soil erosion. Converting the land area into a mostly built environment will minimize the natural process of the existing vegetation.

Deterioration of source of building materials: The opening of sand and burrow areas to extract construction materials like sand and gravel for the civil works would lead to the creation of pits. Rainwater will collect in the burrow pits and depressions, creating pools of stagnant water, if they are not re-instated. Stagnant water provides a suitable habitat for the breeding mosquitoes and snails that are vectors for the bacteria. The excavated trenches and pits could serve as death trap for animals and human beings in the vicinity of the sand and burrow pits.

Changes in Surface and Sub-Surface Hydrology: Together with the loss of flora, changing the characteristics of the project site from its present state to a more built state and changing the soil's characteristics, the proposed project will lead to a change in the water regime at the project site. Vegetation clearing and grading activities, coupled with poor drainage will contribute to an increase in surface runoff and erosion of the soil. Movement

of heavy construction machinery (e.g. bulldozer, excavator, etc.) can affect the soils ability to support plant growth, as such increasing erosion potential. Erosion due to rainfall could be exacerbated in the area from topsoil (and vegetation) removal.

Changes in Soil Characteristics: Several changes in the characteristics of the soil may result due to the excavation and compaction of soil for the foundation. The excavation may lead to losses in the accumulated soil carbon and this is a known source of GHGs i.e. CO_2. Removal of more than several inches of soil during clearing can lead to reduction in the overall fertility of the soil. Additively this excavation can also alter the soil's structural stability; hence reducing its structural integrity. Compacting the soil to lay the foundation, erecting temporary structures, and pressure from the heavy vehicles (trucks, tractors etc.) can reduce the soil's percolative ability and thereby increasing run-off either on specific routes or over a large area. Together with the laying of foundation and erecting of ancillary structures, this will further lead to changes in surface and sub-surface hydrology by changing the flow and recharge rates at the project site.

Emission of Air pollutants and Emanation of unpleasant odours: The works involved in this phase of this project will also emit various air pollutants and unpleasant odours which can have negative effects on both human and environmental health. Exposure to cement dust, emission from paints, thinners and chemicals for treating wood and the solvents as well as delivery vehicles can reduce ambient air quality and put site workers at the risk of respiratory tract diseases. Dusts from the soil excavation, carving of bricks and movement of trucks on loose top soil after the land has been cleared can pollute the air. Excavations and the use of cement and sand among other like- materials are bound to increase the dust and particle levels in the air around the development area. Such effects should be avoided through the use of dust screens. Workers at the site should also be provided with protective clothing to avoid negative health effects. Also, engines burning fossil fuels (vehicular and generators) will emit oxides of Carbon, Sulphur and Nitrogen, and these also pose risks to human and environmental health on top some of them being GHGs such as (CO_2). Welding operations will also emit gases and fumes such as ozone, chromium particularly in its hexavalent state (Cr^{6+}), nickel (potential carcinogens), cadmium and lead, whilst others include: NOx, NO2, CO, CO2, O3 from mild and stainless-steel welding. The health effects of exposure to these fumes can include irritation of the upper respiratory tract (nose and throat), tightness in the chest, wheezing, metal fume fever, lung damage, bronchitis, pneumonia or emphysema. While particulate welding fume is usually fairly easy to see, gaseous fumes are invisible. Unpleasant odours may emanate from several sources at the construction site. Construction activities generate a huge amount of waste, including concrete, metal scraps, and wood, which, if not properly disposed off, will be a major source of foul odour especially when they become wet or come into contact with chemicals. Again, faulty sewers will lead to the escape of sewer gases, and the unpleasant smell reminiscent of a rotten egg will be apparent. Gases and fumes can also be sources of unpleasant smell which can cause significant health problems to construction workers, including damage to the nervous and respiratory system when inhaled. These often originate from chemicals, asphalt, and diesel, among other sources. Paint is one of the most common sources of foul-smelling chemicals in construction. Many of the machines used in the construction sites can also generate fumes with foul smell. Stagnant water in the can also be a cause of odour. Once water has accumulated within the construction site, it can have a sulfurous smell, which can be easily noticeable if it is already in a large excavation. Odour exposure may cause adverse effects on humans, and negatively influence their psychophysical well-being and behaviour. Prolonged exposure to odour can generate undesirable reaction in people, such as unease, discomfort, irritation, anger, depression, nausea, headaches. Thus, repeated exposure to odour can lead to a high level of annoyance, with the receptor becoming sensitive to the odour.

Table 8-2 below delineates some of the air pollutants expected from the project and the environmental and social aspects that they present a risk on.

Table 0-2: Operational Phase Air Pollutants, their Sources and Risks

Pollutant	Sources	Risks
CO_2	Fossil fuel engines (vehicles, generators,water pumps etc.) Cooking Any burning activities e.g. welding.	**GHG and micro-climate modification Acid run-off Suffocation – Poisonous in large quantities**
CO	Fossil fuel engines (vehicles, generators, water pumps etc.) Cooking Any burning activities e.g. welding.	**Acid run-off Suffocation – Poisonous gas**
SO_2	Fossil fuel engines (vehicles, generators, water pumps etc.) Welding	**Acidified run-off GHG Poisonous gas Respiratory diseases and complications**
NOx, NX(g)	Fossil fuel engines (vehicles, generators, water pumps etc.) Welding	**Some forms are poisonous GHG – NO2 Smog Respiratory illnesses and complications**
Dusts and Particulates (PM-10) Heavy metals (Pb)	**Fossil fuel engines(vehicles, generators, water pumps etc.)** **Construction activities undertaken for O&M**	**Heavy metals are poisonous when ingested Respiratory diseases Pollute rivers and underground water Environmental Haze**

Generation of Noise: The construction activities and processes will also generate noise above the ambient levels of the area. Increased noise levels are expected from clearing equipment and construction machinery. The primary noise source associated with site preparation and construction works will be noise from operation of construction machinery such as excavators, compactors, haulage trucks etc., as well as noise from construction activities and workers. Increased noise levels have the potential of causing auditory fatigue, temporary and permanent loss of hearing ability, sleep disorders, and can even contribute to learning problems in children. One of the risks of the noise would be to the surrounding areas where they may create a nuisance or disturbance to students and staff of the university. Per EPA guidelines, the permissible ambient noise levels in residential areas are 55 decibels (dBA) during the day and 48 dBA at night. Those at and around educational and health facilities are 55 dBA during the day and 50 dBA at night, while the noise level for areas with light commercial or light industrial activities are 60 dBA and 55 dBA during the day and night respectively. Whereas at the site the loud noises pose a risk to the workers and site personnel since loud noises increase the risk of ear damage and deafness. There may be an increase in the levels of noise in the construction site owing to the nature of machinery in use and the activities such as drilling and excavation. The normal levels of 55 decibels recommended by EPA and World Health Organization (WHO) may be surpassed in the duration of the construction process. Table 8-3 below shows some of the levels of noise that can emitted from the project's activities during this phase.

Table 0-3:: Noise Levels of Some Construction Equipment[3]

Equipment	Noise Levels
Back Hoe	85-95 Db
Chain Saw	110 dB
Front-end Loader	90-95 dB
Jackhammer	112 dB
Lawn Mower	90 dB
Tractor	95-105 dB

Increased Pressure on Utilities: The processes and activities involved in the construction of the project would place added pressure on infrastructure services and utilities such as roads, water, drainage and energy. This may contribute to service disruptions since the utility and service requirements of this stage are intensive.

Increased Heavy Traffic: In this phase, the main roads leading to the site area will serve the additional vehicles used for the transportation of materials, equipment and staff to the site. The project will contribute to increasing the amount of heavy traffic plying the roads around it. Heavy trucks have the risk of causing accidents due to their limited manoeuvrability but also place added pressure on the roads and can lead to failure (cracks and potholes).

Population Influx: During the construction phase there will be an influx of people mainly working in the development. There will also be an increase in population due to the opportunities presented in providing goods and services during project implementation. This secondary increase will mainly entail retailers of foodstuffs and other commodities. Waste from such commodities might pollute the area if a designated dumping place is not allocated. The population will increase since the opportunities will be open to both local and people from other areas and thereby increasing the population. This increase in population will create pressure on utilities as well as present social risks through the interaction with the students. Again, the influx of people will potentially result in vices such as theft, sexual exploitation, gender-based violence, drug use/abuse and truancy Also, it may present a security risk in the area.

Generation of Construction Waste: The construction phase will lead to generation of construction wastes from the civil works and operations on the materials involved in the processes. These wastes include: plastics, metal shavings, wood shavings, food wastes, plants, gases (Carbon, Nitrous and Sulphurous Oxides), fumes (from glues and other hydrocarbons), stone shavings, ceramics, bricks, glass, cardboard, soil, cement, asphalt, sand, concrete, paper, paints, sealants, adhesives, fasteners, construction effluent (grey water). This phase will also lead to generation of waste heat through its run-off (water used for cooling) and the electric and diesel machines used in the construction activities. This type of waste poses risks to both human and environmental health and thus the proposed project would require an adequate waste management strategy, occupational health and safety strategy, and hazardous material safety plan. Some environmental impacts would include soil contamination, water and air pollution, whereas health risks include: breathing complications and respiratory diseases, cancer, skin disorders, poisoning etc.

Occupational Health and Safety (OHS) Risks: Exposure to dust/emission during site clearing as well as mixing of concrete and elevated noise level within the work environment could also have negative implications on the health of the site workers during the construction phase of the project. Work related accidents such as burns, falls and cuts may also occur due to human errors, workers not wearing appropriate PPEs required for their assignments and mechanical faults on equipment. Accidents may also result from improper storage of equipment, paints and other solvents and construction materials as well as poor management of construction

[3] Matczak W. & Gromiec J. (2000). *Occupational exposure to gases emitted in mild and stainless steel welding.* US National Library of Medicine National Institutes of Health. Med Pr. 2001;52(6):423-36. Washington State Department of Labor and Industries. (n.d). Noise Basics. Retrieved January 20, 2012 from http://www.lni.wa.gov/wisha/noisebank/noisebasics.pdf

waste. Another source of accidents during the construction phase of the project is human-vehicular conflicts as equipment and supplies are transported to the site and waste is hauled from the construction site to designated disposal site. Accidents of this nature can result in spills, destruction of property, injuries and fatalities on site. Several OHS risks may occur from the activities, processes, materials and equipment involved in the construction phase of the project. These risks are listed in Table 8-4 alongside their source.

Table 0-4: Construction Phase OHS Risks

OHS Risk	Source
Injuries or Injurious substances, materials and equipment	○ **Moving parts of equipment e.g. saws, tractors, grinders etc.** ○ **Moving heavy materials** ○ **Open foundation pits** ○ **Raised building materials and equipment e.g. bricks, saws, hammers, steel pipes & fittings etc.** ○ **Sharp edges of nails, knives, saws, glass** ○ **Open flames, heat generating or using processes.** ○ **Working at heights** ○ **Emission of radiation i.e. EMFs from electrical equipment and bright lights from welding operations** ○ **Corrosive chemicals**
Fire	o **Flammable liquids & gases, chemicals, electricity, welding, open flames, heated materials and heat producing processes such as grinding, burning fuels etc.**
Intoxication	o **Toxic substances, corrosive chemicals, adhesives, waste gases, smoke, dusts and emitted particulate matter.**

Fire Risks: Construction areas prone to spontaneous fire combustion activities will include: fuel storage bay, mechanical workshop with welding and steel cutting facilities, smoke from burning garbage/refuse, cigarette smoking sections and carpentry shops. Smoking will be prohibited at the construction stage. Potential impacts from spontaneous fire combustion are significant, direct, moderate and non-beneficial. Mitigation measures are required.

Community Health and Safety Risks: During the construction phase, there will be excavation of trenches on site. If the site is not hoarded, safety signs not provided, and trenches not covered quickly and/or well protected, then the general public will be at risk of accidental falls, being hit by falling objects or cuts. These accidents can cause injuries and fatalities. Trucks supplying materials to the site may also be involved in accidents which may involve residents of the communities along the haulage routes. Such accidents can cause injuries, fatalities, loss of property and/or traffic disruptions along the haulage routes.

Incidence of Crime and Conflicts: Civils works can be associated with theft and pilfering of construction materials normally from the general public and site workers. Site workers can also steal from the offices within the immediate project environs. Other crimes include sexual harassment, illicit sexual affairs and rape as well as defilement, which are criminal under the laws of Ghana. There may also be conflicts arising out of accidents and destruction of property by the contractors' work force, equipment on vehicles.

8.1.2.2 Operational Phase

Generation of Waste: Waste streams that will be generated by workers, students and clients who visit the office during the post construction phase of the project includes paper, plastics and food residue. The generation of waste will have significant impacts on workers at the office in terms of public health as well as reducing the

amenity/aesthetic value of the facilities, if not well managed. Generation of solid and liquid waste during the construction and operational phase of the project is a significant impact because of its association with sanitary related diseases like malaria and cholera.

Water and Energy Consumption: The water and energy consumption will be expected to increase, because of the expected increase in staff and student population. Demands for energy in lighting, air conditioning, escalator/elevator machinery running, refrigeration, communication devices and other facilities running will increase. Similarly, water consumption at the operational phase will increase, because of increased population expectancy in staff and student populations. In all cases, the potential impacts will be significant, minor and controllable with mitigation measures.

Increased Air Pollution: Cumulatively with other projects and activities carried out in the area the proposed project will emit pollutants to the air that present risks to human and ecosystem health. Table 8-5 below delineates some of the air pollutants expected from the project during the operational phase and the environmental and social aspects that they present a risk on.

Table 0-5: Operational Phase Air Pollutants, their Sources and Risks

Pollutant	Sources	Risks
CO_2	Fossil fuel engines (vehicles, generators, water pumps etc.) Cooking Any burning activities	**GHG and micro-climate modification Acid run-off Suffocation – Poisonous in large quantities**
CO	Fossil fuel engines (vehicles, generators, water pumps etc.) Cooking Any burning activities e.g. welding.	**Acid run-off Suffocation – Poisonous gas**
SO_2	Fossil fuel engines (vehicles, generators, water pumps etc.)	**Acidified run-off GHG Poisonous gas Respiratory diseases and complications**
NOx, NX(g)	Fossil fuel engines (vehicles, generators, water pumps etc.)	**Some forms are poisonous GHG – NO_2 Smog Respiratory illnesses and complications**
Dusts and Particulates (PM10) Heavy metals (Pb)	**Fossil fuel engines (vehicles, generators, water pumps etc.) Construction activities undertaken for O&M**	**Heavy metals are poisonous when ingested Respiratory diseases Pollute rivers and underground water Environmental Haze**

Generation of Noise: The activities of this phase of the project will also generate noise and these will be from various point sources such as diesel generators without silencers and also any repair works that may be carried as necessitated by the project's operations. Mobile sources of noise will mainly include cars and the trucks that will be ferrying goods to the project. Although the noise levels emitted during this stage will be less than during the construction the impact will have more receptors since there will be more people in the area as a direct result of the project being operational.

Generation of waste: Several waste streams will be generated from the operational phase of the project and these have been delineated in Table 8-6 below alongside their sources and risks they present if not properly managed.

Table 0-6: Operational Phase Wastes

Waste	Source	Risks
Municipal Waste | Solid Waste Garbage, Kitchen & Office Wastes	Kitchen, restaurants, shops, supermarkets, residential area, offices, repair works, plants, plastics (tubes, binders, wrappings, metals (from clips, pins, lids), paper, cloth etc.	**Water pollution, nuisances, air pollution on decomposition, soil contamination, water borne diseases, respiratory illnesses**
Municipal Waste | Liquid Waste Grey water, Sewerage	Kitchen, shops, offices, recreational areas, residential area, washings, cooking oils, adhesives, fuel, chemicals, toilets, soaps and detergents	**Water pollution (surface & subsurface), air pollution, soil contamination, water borne diseases**
Chemical and hazardous wastes	laboratory	**Water pollution (surface & subsurface), air pollution, soil pollution**
Waste Heat	**Electronics, Vehicles, Air Conditioning, Power Generators, Water Pumps, Cooking and Heating activities (in house), Cooling water for machines**	**Thermal Pollution of Rivers from run- off Microclimate modification**

8.1.2.3 Decommissioning Phase

Decommissioning of the proposed project is an unlikely option. However, it is important to note that decommissioning may become necessary in view of different layout and land use needs of the university which may change and will require the building to be pulled down. In the unlikely event decommissioning is necessary, a decommissioning plan will need to be fashioned out should it become necessary at any point in time.

This ESIA emphasises decommissioning activities such as dismantling of work camps and site office facilities and removal of machinery and equipment from the project site. These activities can lead to potential environmental and occupational health and safety risks and impacts.

Generation of Noise: There will be a considerable increase in noise owing to the demolition process. This will be a short-term impact and will be felt throughout the demolition process. The main sources of noise will include: cars and trucks; the civil works of pulling down the project's-built structures (especially if explosives are used), and mechanized equipment that will be used in the processes involved in this project phase.

Generation of Demolition Waste: The decommissioning phase of the project will create demolition wastes which share similar characteristic with construction wastes and therefore similar risks. The only two main differences are that: (1) demolition waste can easily be accounted for before the empty building shell is pulled down, and (2) if explosives are used they will form part of the waste. Waste in form of debris and pieces of metal and wood will arise. Thus, creating a need of disposing off the waste and all the disadvantages associated with waste mismanagement will arise such as spread of diseases. It is hoped that this phase will be implemented only under unavoidable circumstances for instance aging of the building and/or pertinent rights arising.

Increased Heavy Traffic: Materials from the buildings and equipment will have to be transported to and from the site through the use of trucks and tractors/bulldozers and these will increase the amount of heavy traffic in the area. Although it is expected that at the time when the project will be decommissioned there will be substantial developments in infrastructure (transport), the trucks with limited manoeuvrability will pose a risk to the general public and other vehicles/drivers on top of placing extra pressure on the roads.

OHS Risks: The decommissioning phase will have several OHS risks from the civil works involved, equipment, materials and processes. This may be added to if explosives are used and although their use is not known for now, an assessment has been made assuming or incorporating their use since they present a cost-effective way of demolition, which is safe when controlled.

8.1.3 Social Impacts

Gender Inclusion: The project will identify the gender specific barriers and design specific actions aimed at contributing to closing these gaps. The project will also assess gender specific challenges for female and male lecturers, researchers and students and ensure any response considers gender needs. In the construction of the building, gender equity and inclusion will to a much extent be respected. Discrimination against females will as much as possible not be entertained. Qualified females will be given equal opportunities for employment and progression and where necessary, an affirmative action policy in terms of employment will be instituted. Additionally, decent changing and sanitary facilities will be made available on-site especially for the female staff.

Disability Inclusion: Disabled persons constitute one of the largest vulnerable groups at risk of exclusion in the educational sector of developing countries, including Ghana. Without consideration for disability-related needs and support, the project may exacerbate this inequality and limit access to quality learning for persons with disabilities. The project will ensure these activities reflect disability issues. The buiding site will be made disability-friendly through the provision of disability-friendly walkways and rest areas.

Risk of Gender Based Violence (GBV): The construction of the building is envisaged to bring about an increase in the local population due to the labour influx associated with the increased economic activities emanating from the project. Such population increase will invariably be associated the risk of GBV. The project will apply the University of Cape Coast's sexual harassment policy and related addendum developed for ACECoR in managing the risk associated with GBV. Workers will be taken through the policy; spelling out their duties, rights and responsibilities in ensuring an environment free from GBV. An effective system to deal with on-site and immediate community GBV will be instituted.

Stakeholder Engagement: The project will ensure early, continuous and inclusive (including vulnerable/disadvantaged groups) stakeholder engagement. Beyond consultations, the project will expect to conduct Citizens Engagement Feedback surveys and potentially use some civil society organizations CSO to validate project results.

Grievance Redress Mechanism (GRM): The project design will incorporate a comprehensive project-wide GRM which will enable a broad range of stakeholders to channel concerns, questions, and complaints to the various implementation agencies.

8.2 RISK ASSESSMENT

8.2.1 Risk Duration and Reversibility for Construction and Operational Phase

REVERSIBILITY	DURATION OF IMPACT				
	Temporary 1	**Short term 2**	**Medium term 3**	**Long term 4**	**Permanent 5**
Reversible 1	**Construction Phase** Incidence of Crime and Conflicts •Increased Heavy Traffic	**Construction Phase** Waste disposal issues	**Construction Phase** Generation of Construction Waste		
Recoverable 2		**Construction Phase** •Emission of Air pollutants •Generation of Noise •Dust pollution/ air quality deterioration, Deterioration of source of building materials •Occupational safety and Health problems •Occupational Health and Safety (OHS) Risks Population Influx	**Construction Phase** Changes in surface and sub-Surface Hydrology •Changes in Soil Characteristics •Increased Pressure on Utilities Fire Risks Community Health and Safety Risks **Demolition Phase** Generation of Noise Generation of Demolition Waste Increased Heavy Traffic OHS Risks	**Operational Phase** Generation of Waste. Water and Energy Consumption. Increased Air Pollution Generation of Noise Generation of Waste	
Irreversible 3				**Construction and Operational Phase** Gender Based Violence	**Construction Phase** Loss of Flora and Faunal Habitats

8.2.2 Risk Severity and Probability for Construction and Operational Phase

PROBABILITY	SEVERITY OF IMPACT				
	Negligible 1	**Minor 2**	**Moderate 3**	**High 4**	**Very High 5**
Rare 1					
Unlikely 2					
Reasonably possible 3		• Deterioration of source of building materials	• Population Influx • Changes in surface and sub-Surface Hydrology • Occupational safety and Health problems • Waste disposal issues	Fire Risks Community Health and Safety Risks	
Likely 4			• Changes in Soil Characteristics • Incidence of Crime and Conflicts		Gender Based Violence
Almost certain 5			• Loss of Flora and Faunal Habitats • Emission of Air pollutants • Generation of Noise • Dust pollution/ air quality deterioration • Increased Pressure on Utilities • Increased Heavy Traffic • Generation of Construction Waste • Occupational Health and Safety (OHS) Risks		

Key

Low	Impact either too small to be measured or, even if quantifiable, not causing any material change in the environment.
Modest	Impact capable of causing change in the environment but not fundamentally affecting the status, potential productivity, or usage of the environment.
High	Impact capable of causing sufficient change in the environment to affect the status, potential productivity, or usage of the environment.

9.0 MPACT MITIGATION MEASURES

9.1 PROPOSED MITIGATION MEASURES

The project's significant impacts are analysed, reviewed further and mitigation measures are proposed in Table 9-1 below, that will enable the impacts to be managed, reduced or avoided where possible. The impacts are rated HIGH, MODERATE or LOW. The rating of the impact was determined as a product of the severity of the risk and probability of occurrence. A severity-occurrence product of 1 – 5 is classified as low impact; 6 – 15 as moderate impact and 16 – 25 as high impact.

Table 0-1: Proposed Mitigation Measures

Likely Impact & Reference	Proposed Mitigation Measures	Impact
Construction Phase		
Loss o f flora and Faunal Habitats	Landscaping with indigenous species on completion of construction. Maintaining of landscaped gardens, terraces, conservation and management of the vegetation and gardens. Clearing vegetation only in construction areas and demarcating areas where no clearing will happen.	**Low**
Changes in surface and sub- surface hydrology	During construction, the design (of the drainage system) should ensure that surface flow is drained suitably into the public drains provided to control flooding within the site. Drainage channels should be installed in all areas that generate or receive surface water such as car parking, driveways and along the building block-edges of the roofs. The channels should be covered with gratings or other suitable and approved materials to prevent occurrence of accidents and entry dirt that would compromise flow of run-off. The channels should be designed with regards to the peak volumes such as periods or seasons when there is high intensity of rainfall which is also not common in the project area but just in case such an event occurs. They should never at any time be full due to the resulting heavy downpours. The drainage channels should ensure the safe final disposal of run-off /surface water and should be self-cleaning which means it should have a suitable gradient. Storm water generated from roof catchments should be harvested, stored and made use in various activities such as general cleaning and watering of flowers and lawns. This will reduce run-off reaching the drainage channels. Paving of the side walkways, driveways and other open areas should be done using pervious materials to encourage water recharge and reduce run-off volume.	**Low**

Changes in soil characteristics	Sprinkling water on the soil to prevent dust from rising. Creating specific paths for the trucks**.** Ensuring there is enough space for normal percolation of water. Preventing pollution from construction wastes by having specific sites for collection, sorting and transport of wastes. Proper installation and configuration of drainage structures to ensure their efficiency. Installing cascades to break the impact of water flowing into the drains. Controlling the earthworks and ensuring the management of excavation activities. Compacting areas with loose soil. Landscaping**:** Providing soil erosion control structures on the steeper areas of the site and controlling construction activities during the rainy season.	**Low**
Emissions of Air pollutants	Sprinkling water on soil before excavation and periodically when operations are under way to prevent raising of dusts. Enclosing the structures under construction with dust proof nets. Using efficient machines with low emission technologies for the ones that burn fossil fuels. Controlling the speed and operation of construction vehicles. Regular maintenance and services of machines and engines. Use of clean fuels e.g. unleaded and de-sulphurized fuels. Educate and raise awareness of construction workers on emission reduction techniques.	**Low**
Generation of Noise	Using equipment with noise suppressing technologies. Providing workers with PPEs against noise e.g. ear plugs. Placing signs around the site to notify people about the noisy conditions. Regular maintenance of equipment to ensure they remain efficient and effective. Complying with the EPA noise regulation. Construction works should be carried out only during the specified time which is usually as from 0800 hrs to 1700 hrs. There should not be unnecessary horning of the involved machinery. Provision of bill boards at the construction site gates notifying of the construction activity and timings.	**Low**
Increased Pressure on Utilities	Employing water conservation techniques and only using the required amounts of water to prevent wastage. Employing power saving techniques such as switching off equipment when not in use, using natural light whenever possible. Using machines with power saving technologies i.e. high efficiency equipment. Providing proper sanitary facilities for construction workers. Inspecting the drainage facilities regularly to ensure they are free of debris that may reduce their efficiency.	**Low**
Increased Heavy Traffic	Placing signs around the site notifying other vehicles about the heavy traffic and to set the speed limit around the site. Ensuring all drivers for the project comply to speed regulations. Making sure the construction doesn't occupy the road reserves and complying to traffic and land demarcation obligations. Ensuring all vehicles used for the project are in good working condition both legally and commensurate to their intended use.	**Low**

Labour Influx	Workers to be issued with jobs cards to monitor their movements in the site area Only authorised personnel should be allowed entrance to the site. Presence of a work registry book where workers sign in and out Educating the workers on proper sanitation methods. Sensitizing the worker on HIV/AIDS. Making available suitable facilities for the collection, segregation and safe disposal of the wastes. Putting in place a Covid-19 management system for the site to check the incidence and spread of Covid-19. This will involve respecting social distancing, handwashing and hand sanitizing, daily body temperature checks, adherence to nose-mask wearing where appropriate and periodic Covid checks. Ensuring all waste is placed in their designated bins and disposed of through legally acceptable methods**.**	**Low**

9.2 CHANCE FIND PROCEDURES

In the event of finding previously unknown sites or feature of cultural value during project implementation, the following standard procedures for identification, protection from theft, treatment and recording should be followed.

Specifically,

(a) Stop the activities in the area of the chance find.
(b) Delineate the discovered site or area.
(c) Secure the site to prevent any damage or loss of removable objects.
(d) Notify the Supervising Engineer who in turn will notify the responsible authorities.
(e) The Ministry of Tourism, in collaboration with responsible local authorities (where applicable), would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures.
(f) The Ministry of Tourism and National Museums and Monument Board will make decisions on how to handle the findings. This could include changes in the layout (such as when finding irremovable remains of cultural or archaeological importance), conservation, restoration, and salvage.
(g) The Ministry of Tourism shall communicate implementation of the authority decision concerning the management of the finding in writing.
(h) Construction work could resume only after permission is given from Ministry of Tourism or other responsible authorities concerned with safeguarding the cultural heritage.

These procedures must be referred to as standard provisions in construction contracts, Safeguards Procedures for Inclusion in the Technical Specifications for Contracts. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed. Relevant findings will be recorded in the Monitoring Reports and the World Bank Implementation Supervision Reports (ISRs), and Implementation Completion Reports (ICRs) will assess the overall effectiveness of the project's cultural property mitigation, management, and activities, as appropriate.

10.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 LABOUR MANAGEMENT PLAN

The project recognises the need to protect the fundamental rights of workers since the workforce is a valuable asset, and a sound worker-management relationship is a key ingredient in the sustainability of the project. Through a constructive worker-management relationship, and by treating the workers fairly and providing them with safe and healthy working conditions, the project will create tangible benefits, such as enhancement of the efficiency and productivity of their operations. The objectives of the labour management procedure are:

- To promote the fair treatment, non-discrimination, and equal opportunity of workers.
- To establish, maintain, and improve the worker-management relationship.
- To promote compliance with national employment and labour laws.
- To protect workers, including vulnerable categories of workers such as women.
- To promote safe and healthy working conditions, and the health of workers.
- To avoid the use of forced and child labour.

The project will engage the following categories of workers:

- *Direct Workers*: people employed or engaged directly by the project to work specifically in relation to the project.
- *Contracted workers:* people employed or engaged through third parties to perform work related to the project.

10.1.1 Working Conditions and Management of Worker Relationship

The project will adopt and implement human resources policies and procedures appropriate to its size and workforce that set out its approach to managing workers consistent with the requirements and national laws.

The project will provide workers with documented information that is clear and understandable, regarding their rights under national labour and employment law and any applicable collective agreements, including their rights related to hours of work, wages, overtime, compensation, and benefits upon beginning the working relationship and when any material changes occur.

Project workers will be provided with information and documentation that is clear and understandable regarding their terms and conditions of employment. The information and documentation will set out their rights under national labour and employment law (which will include any applicable collective agreements), including their rights related to hours of work, wages, overtime, compensation and benefits. This information and documentation will be provided at the beginning of the working relationship and when any material changes to the terms or conditions of employment occur.

The project will not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The project will base the employment relationship on the principle of equal opportunity and fair treatment and will not discriminate with respect to any aspects of the employment relationship, such as recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices. The project will take measures to prevent and address harassment, intimidation, and/or exploitation, especially in regard to women.

The project will provide a grievance mechanism for workers to raise workplace concerns. The project will inform the workers of the grievance mechanism at the time of recruitment and make it easily accessible to them. The mechanism will involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned, without any retribution. The mechanism will also allow for anonymous complaints to be raised and addressed. The mechanism will not impede access to other judicial or administrative remedies that might be available under the

law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

10.1.2 Protecting the Work Force

Child Labour: The project will not employ children in any manner that is economically exploitative or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Under the Ghana Children Act 1998, the minimum age for admission of children into employment is fifteen (15). However, children may be employed at the age of thirteen (13) to do light work. The minimum age for engagement of persons in hazardous work is eighteen (18). The minimum age for employment or engagement set out in the World Bank's Environmental and Social Standard 2 is age 14. The project will comply with the World Bank's minimum age and children under the age of 14 will not be employed under this project. The project will also ensure that children under the age of 18 are not be employed in hazardous work. All work of persons under the age of 18 will be subject to an appropriate risk assessment and regular monitoring of health, working conditions, and hours of work.

Forced Labour: The project will not employ forced labour, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labour, such as indentured labour, bonded labour, or similar labour-contracting arrangements. The project will not employ trafficked persons.

10.1.3 Occupational Health and Safety

The project will provide a safe and healthy work environment, taking into account inherent risks in its particular sector and specific classes of hazards in the client's work areas, including physical, chemical, biological, and radiological hazards, and specific threats to women. The project will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, as far as reasonably practicable, the causes of hazards. The project will address areas that include the:

i. identification of potential hazards to workers, particularly those that may be life-threatening;
ii. provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances;
iii. training of workers;
iv. documentation and reporting of occupational accidents, diseases, and incidents; and

10.1.4 Workers Engaged by Third Parties

With respect to contracted workers the project will make reasonable efforts to ascertain that the third parties who engage contracted workers are reputable and legitimate organisations and have an appropriate labour management procedure. The project will establish policies and procedures for managing and monitoring the performance of such third-party employers. In addition, the project will incorporate these requirements in contractual agreements with such third-party. Contracted workers will have access to a grievance mechanism. In cases where the third party employing or engaging the workers is not able to provide a grievance mechanism to such workers, the project's grievance mechanism will be available to the contracted workers.

11.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

This ESMP is developed with an aim to outline actions necessary to prevent, mitigate and control possible negative impacts or disadvantages during the different phases of the project onto the environment and to analyse steps that could be taken in respect to this.

11.1 ENVIRONMENTAL FRAMEWORK

11.1.1 Environmental Policy

The implementation of the activities proposed by ACECoR must be consistent with all applicable policies, laws, regulations, and notifications. It is the responsibility of the Vice Chancellor, Sectoral, ACE Centre Director, and the Environmental and Social Safeguard Officer (and the contracting entity) to ensure that project activities are consistent with the applicable regulatory and legal frameworks. Additionally, it is also to be ensured that activities are consistent with World Bank policies, Performance Standards and guidelines.
The management policy of the proposed development is ensuring a clean and safe environment within the site and support of environmental health and safety both within and outside the project through proactive and responsible activities. The measures that are to be enforced would be implemented under the following framework:

Land

- Ensuring the presence of floral cover on unpaved surfaces so as to maintain the soil's structure within the project area and where flora has been lost. Landscaping should be undertaken
- Ensuring proper waste management of both solid and liquid wastes is implemented to prevent soil contamination and creation of an unsightly environment

Biodiversity

- Maintain where possible trees and larger flora by planting more trees at or near the site during and after construction phase of the development
- Buffer creation and maintenance between the project and other land uses to mitigate micro climate changes

Air

- Maintenance of low levels of dust generation during construction through either surfacing the bare areas of any roads as well as by watering areas that are not paved.
- Installation of scrubbers on all the machinery used during construction that has a certain level of emission
- Setting up screens and buffer fences to reduce the amount of fugitive dust and noise generated during construction
- Use of noise absorbent padding in fixed installations
- Use of silencers in heavy earth moving machines and pumps
- Use of ear-muffs by staff to reduce any exposure to increased noise
- Retention and consistent planting of green-belts barriers between source and receiver,
- although long-term strategy trees are effective noise barriers and flower bushes or shrubs can be grown around noise emitting utilities

Water

- Ensure conservation of water in the construction phase through wise and only necessary use and recycling where possible
- Maintenance of floral cover within the non-paved areas in order to reduce direct evaporation and maintain the micro-climate or the area
- Management of any liquid and solid wastes to ensure that they don't lead to pollution of surface and

sub-surface waters
- Using water catchment techniques such as roof catchment where water harvested can used for cleaning or lawn maintenance purposes
- Employing sustainable drainage measures that mimic the normal drainage of water to prevent increasing run-off to high levels as result of the development. These methods include using materials that allow water percolation in making paved surfaces such as the parking lot; using green roofs where possible or water catchment.

Hazards
- Hazards especially from moving vehicles and trucks in and out of the site could be handled properly
- Erecting hazards warning signs
- Using smaller trucks that make narrow turnings
- Construct storm water drains to channel flood waters
- Keep the percentage of the area of impervious surface as low as possible to reduce runoff during storm periods and in respect to the slope of the project area.

11.1.2 Health, Safety and Environmental (HSE) Risk

Some of the HSE risks from the project will come from the following aspects:

Construction Phase HSE Aspects
- Air emissions
- Water emissions
- Moving parts
- Heavy equipment and trucks
- Inflammable materials
- Hazardous/Poisonous chemicals and substances
- Storage areas
- Ladders
- Working at heights
- Electricity
- Open pits
- Heated surfaces, solids and fluids
- Wastes
- Raised materials and equipment, etc.

Operational Phase HSE Aspects

Slippery floors
- Moving parts and barriers
- Storage areas
- Heated surfaces, solids and fluids
- Cold surfaces, solids and fluids
- Hazardous/Poisonous chemicals and substances
- Inflammable materials
- Electricity
- Wastes
- Air emissions
- Water emissions
- Vehicles and service trucks, etc.

Decommission Phase HSE Aspects
- Falling debris

- Air emissions
- Water emissions
- Heated surfaces, solids and fluids
- Hazardous/Poisonous chemicals and substances
- Moving vehicles and trucks
- Heavy equipment and materials, etc.

11.1.2.1 Environmental Policy Statement

ACECoR shall undertake the development and operation of the Project in an environmentally responsible way by complying with the national and World Bank environmental policies.

As a means of achieving this, ACECoR will include this ESMP with project contract documents that it issues to any third party who carries out all or part of the Contracting Entity's obligations in terms of the contract. ACECoR should procure the construction in an environmentally responsible way by imposing adherence to the provisions of the ESMP as a contractual obligation in respect of every project contract document for the construction activities.

11.2 OBJECTIVES OF THE ESMP

The objectives of this ESMP are as follows:

- To state standards and guidelines for compliance to environmental/social management
- To communicate the aims and goals of the ESMP and incorporate environmental management into the project planning, construction and operational phases;
- To guide Contracting Entities, sub-contractors and the various other workers involved in the Project in meeting the legislative and best practice commitments set out in the ESIA;
- To set out cost effective mitigation measures in order to minimize the extent of negative environmental/social impacts, to enhance positive environmental impacts and
- To provide guidance regarding method statements which are required to be implemented to achieve the environmental specifications; and
- To define corrective actions to be taken in the event of non-compliance with the specifications of this ESMP in order to prevent long-term environmental degradation.

11.3 APPLICABILITY TO OTHER DOCUMENTATION

This ESMP applies to work to be undertaken with regards to the construction of the multi-purpose educational complex. The ESMP should be read in conjunction with all documents that comprise the suite of documents for this Contract. This may include various applicable standard specification and environmental legislation. Third parties appointed by the Contracting Entity in terms of the contract should validate compliance with the conditions of this ESMP.

The ESMP is a dynamic document subject to similar influences and changes as are wrought by variations to the provisions of the project specification. Information contained in this current version will be reviewed and updated annually. The findings and recommendations of periodic assessments (annually or more frequently) by internal/external auditors will be used to update the current version at that time, if required. Substantial changes to the ESMP should be submitted to the relevant state authorities, including the Environmental Protection Agency (EPA) for approval before construction continues.

11.4 MANAGEMENT FRAMEWORK

11.4.1 ACECoR Responsibilities

The ultimate responsibilities for the implementation of the above-described safeguards instruments and processes are with the Vice Chancellor, ACE Centre Director, and the Environmental and Social Safeguard Officer working closely with the ACE Deputy Director. The Project Environmental and Social Safeguard Officers will work with the Centre Director and will be responsible for compliance with national environmental regulations, as well as the Banks E&S safeguards policies. The Vice Chancellor, SAB, ACE Centre Director, and the Environmental and Social Safeguard Officer will ensure that no contracts for works that have a physical impact are signed, or re-construction or rehabilitation of proposed activities initiated without the required safeguards instruments in place and approved by the World Bank. No activity with physical environmental and social impact should be implemented without the approved safeguards instruments.
ACECoR will perform the following roles:

- See that all contracting companies tendering for work in the project affected area receive a copy of the ESIA, ESMP and any other relevant project documents and are assisted in understanding their responsibility to operate within the framework of the measures defined in the ESMP. When adjudicating tenders, ACECoR should confirm that Contracting Entities have made appropriate allowance for management of environmental and social matters and develop their own ESMPs (where necessary) which shall be approved;
- See that on appointment, contracting companies shall sign the ESMP component of this ESIA so the ESMP will then become part of the contract and be legally binding on the Contracting Entity. Contracting companies will also receive the required training or be guided to understand their responsibility to operate within the framework of the measures defined in the ESMP;
- Enforce that the responsibility for implementing and complying with the conditions of the ESMP forms part of the conditions of appointment of all Contracting Entities throughout the life of the project;
- See that independent environmental experts are appointed to audit the implementation of, and compliance with, the ESMP and monitoring plan on an annual basis; and the independent environmental audits, together with other relevant monitoring information, are made available to the public, throughout the life of the project.
- See that a formal senior management review of environmental management performance is undertaken on a quarterly basis for the first one-year, then on monthly basis throughout lifespan of the project. Senior management responsibility will include the review and approval of any proposed measures to improve environmental performance.
- See that training and awareness creation is provided to all Contracting Entities in environmental and social management and the mitigation of impacts, to ensure they are aware of their responsibilities and are competent to carry out their work in an environmentally and socially responsible manner. ACECoR should not tolerate transgressions of the provisions of the ESMP.
- Make sure there is availability of human and financial resources needed to conduct all environmental management, mitigation and monitoring activities throughout the project phases.

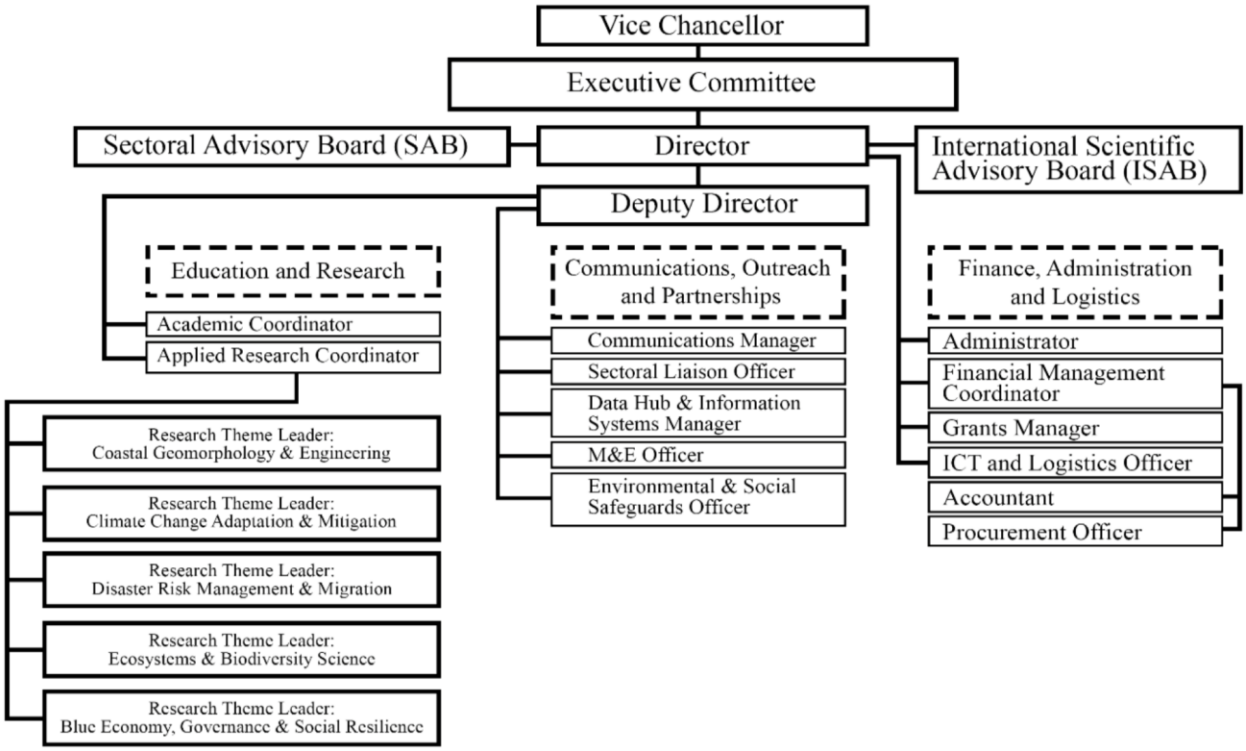

Figure 0-1: Organogram of the Africa Centre of Excellence in Coastal Resilience (ACECoR)

11.4.2 World Bank Responsibilities

- The World Bank Task Team will be responsible for the review of the safeguards instrument (ESMP) prepared by the client (ACECoR) and also provide guidance during its implementation.
- The Task Team will also review the Terms of References for the preparation of safeguard instruments and contracts if needed, to ensure that their scope and quality are satisfactory to the Bank.
- The Task Team will review tender documents and construction contracts regarding due consideration of the safeguard instruments, and the inclusion of effective and enforceable contractual clauses.
- The task team will ensure that no contracts for works that have a physical impact are signed, or re-construction or rehabilitation of proposed activities initiated without the required safeguards instruments in place.
- The task team will also monitor the implementation of the different prepared instruments through regular supervision missions (which will include an environmental and/or social specialist) during which document reviews, site visits and spot-checks will be conducted. Depending on the circumstances, Third Party Monitoring may also be used for supervision and monitoring and would thus complement the efforts of the task team.

11.4.3 Responsibility of RFU/AAU

Specifically the role of the AAU which is the RFU will be to serve as a stop gap measure in project implementation between ACECoR and the World Bank through:

- Providing intial review of safeguards instrument (ESMP) prepared by the client (ACECoR) and providing guidance during its implementation
- Organizing site verification missions in accordance with formulated DLI 4.3 milestones.
- Facilitating periodic meetings between ACECoR and relevant stakeholders with ACECoR in addressing DLI 4.3 related grievances

11.4.4 Responsibilities of the Consulting Engineer (Supervision Consultant)

The engineer or supervision consultant is responsible for:

- Enforcing the environmental specifications of the project.
- Monitoring compliance with the requirements of the specification.
- Documenting, in conjunction with the Contracting Entity, the state of the site prior to construction activities commencing. This documentation may be in the form of photographs, video recording or other appropriate formats.
- Maintaining high standard of site supervision and operation to reduce risk of damage to environmental components.

11.4.5 Responsibilities of the Contracting Entity

The Contracting Entity is required to:

- Be responsible for the overall implementation of the ESMP.
- Be conversant with the requirements of this ESMP and enforce sub-contractors or third parties who carry out all or part of the Contracting Entity's obligation under the Contract comply with the requirements of this ESMP.
- Be responsible for the procurement of relevant environmental permits that are required for the construction and operation of the Project.
- Supply method statements for activities requiring special attention as specified and/or requested by the Project Developer for the duration of the Contract.
- Bear the costs of damages/compensation resulting from non-compliance with the ESMP.
- Be responsible for informing the Project Developer or Supervision Consultant of foreseeable activities that will require their input in a timely manner.
- Appoint a suitably experienced and qualified person to fulfil the role of the Environmental Manager (EM) as detailed in this ESMP.
- Conduct activities in a manner that minimizes/avoids impacts to the environment, affected residents and the public in general.

11.4.6 Responsibilities of the Environmental Manager (EM)

The Contracting Entity should procure the appointment of the EM, at their cost, for the duration of the Project, and the EM would be responsible for the overall implementation of the EMP in accordance with the requirements of the Contract. There should be an approved EM on the site at all times, and it is proposed that the EM is made part of the construction project management team. The EM should make sure that outlined environmental issues are communicated to the Contracting Entity and personnel involved in the Project before construction commences. The ESMP should be kept on-site and made accessible to all personnel.

The EM is to understand and enforce the environmental responsibilities as stated in the ESMP and also ensure that all members of the project operate on site in an environmentally considerate manner, as prescribed by the ESMP. The EM is to be fully versed in the contents of the ESMP and is to enforce that the activities of the contracting team remain in compliance with the code of conduct and site-specific protection measures

identified by the ESMP. The EM will be responsible for all monitoring and reporting activities such as noise, water and dust/air quality monitoring. The EM is to ensure that all monitoring records are available for review by the competent authority when needed. The EM is to coordinate all specialists that are required on site, if and when required.

Specific roles/activities to be performed by the EM are outlined below:

- Enforce site protection measures on-site;
- Ensure that all the environmental authorizations and permits required in terms of the applicable legislation have been obtained;
- Monitor and verify compliance with the ESMP and contract and keep records of compliance/non-compliance, and make them available to the external auditor;
- Monitoring and verifying that environmental impacts are kept to a minimum;
- Reviewing and approving construction method statements with input from the Contracting Entity, where needed, in order that the environmental specifications contained within the ESMP are adhered to;
- Keeping accurate and detailed records of all activities on-site;
- Monitoring the undertaking by the Contracting Entity of environmental awareness training for all new personnel on-site;
- Assess the Contracting Entity's environmental performance from which a brief monthly statement of environmental performance is drawn up for record purposes;
- Enforce that third parties who carry out all or part of the Contracting Entity's obligations under the Contract are conversant with the requirements of the ESMP and the site protection measures;
- Enforce that the Contracting Entity complies with every applicable legislation;
- Maintain a register of complaints and queries by members of the public at the site office and the actions taken in response to these complaints;
- Recommend that the Contracting Entity suspend any or all works on-site if the third parties who carry out all or part of the Contracting Entity's obligations under the Contract fail to comply with the said specifications;
- Conduct environmental audits for compliance with the ESMP and Contract, and report on the findings to the Supervision Consultant; and
- Undertaking a continual internal review of the ESMP and submitting any changes to the Contracting Entity and Supervision Consultant, as well as the Client for review and approval.

The EM is expected to have the following qualifications, as a minimum:

- A good working knowledge of relevant environmental policies, legislation, guidelines and standards.
- The ability to conduct inspections and audits and to produce thorough, readable and informative reports.
- The ability to manage public communication and complaints.
- The ability to think holistically about the structure, functioning and performance of environmental systems.
- Proven competence in the application of the following integrated environmental management tools:
  - ✓ Environmental and Social Impact Assessment.
  - ✓ Environmental management plans/programs.
  - ✓ Environmental auditing.
  - ✓ Mitigation and optimisation of impacts.
  - ✓ Monitoring and evaluation of impacts.
  - ✓ Environmental Management Systems.

The UCC and/or Supervision Consultant will have the authority to instruct the Contracting Entity to replace the EM if, in their opinion, the appointed person is not fulfilling his/her duties in terms of the requirements of

the ESMP. The decision to replace an EM will be made jointly by the UCC and/or Supervision Consultant and the Contracting Entity. Such instruction should be in writing and should clearly set out the reasons why a replacement is required and within what timeframe.

11.5 RECORD KEEPING AND REPORTING

The Contracting Entity should enforce that a filing system identifying documentation related to the ESMP is established. A list of reports likely to be generated during the project is set out below:

- Environmental and Social Management Plan.
- Relevant communications detailing changes of design/scope that may have environmental implications.
- Daily, weekly and monthly site monitoring reports.
- Occupational Health and Safety reports.
- Complaints register.
- Training manual and attendance registers.
- Incident and accident reports.
- Emergency preparedness and response plans.
- Permits and legal documents, including letters authorising specific personnel of their duties as Occupational Health and Safety representatives, or as part of emergency preparedness teams, e.g. fire teams, etc
- Weekly report from EM (regardless of whether there has been an incident).
- Monthly site meetings
- Method statements from the Contracting Entity for various phases of the project.

11.6 ENVIRONMENTAL DOCUMENT CONTROL

The Contracting Entity should be responsible for establishing a procedure for environmental document control. The environmental document control procedure should comply with the following requirements:

- Documents should be identifiable by organisation, division, function, activity and contact person.
- Documents should identify the personnel and their positions, who drafted and compiled the document, who reviewed and recommended approval, and who finally approved the document for distribution.
- Documents should be dated, provided with a revision number and reference number, filed systematically, and retained for a specified period.
- The Contracting Entity should see to it that documents are periodically reviewed and revised, where necessary, and that current versions are available at all locations where operations essential to the functioning of the ESMP are performed. Documents should be made available to the external auditor, UCC and/or Supervision Consultant

11.7 ENVIRONMENTAL, HEALTH AND SAFETY TRAINING AND AWARENESS

The Contracting Entity is expected to enforce that its employees and any third party who carries out all or part of the Contracting Entity's obligations under the Contract are adequately trained with regard to the implementation of the ESMP, as well as regarding environmental, social and legal requirements and obligations. Every employee should have an induction presentation on environmental awareness as part of the recruitment process. Where possible, the presentation needs to be conducted in the language of the employees.

- The training by the Contracting Entity should, as a minimum, include the following:
- General environmental, health and safety awareness training describing the importance of policies, standards, key environmental and social sensitivities or requirements of the Project;
- Conformance to Standard Operating Procedures (SOP) as means to avoid or reduce environmental and social impacts;
- Requirements of the ESMP and how it will be implemented and monitored on site;
- Prevention and handling of fire and other incidences, including procedures to be followed in the event of non-compliance with the environmental, social and health requirements;

- The significant environmental and social impacts, actual or potential, as a result of their work activities;
- The environmental and social benefits of improved personal performance;
- Their roles and responsibilities in achieving conformance with the environmental policy and procedures, including emergency preparedness and response requirements;
- The potential consequences of departure from specified operating procedures;
- Provide appropriate PPEs and orientation and support on the use of PPEs to all employees and visitors so that they can act in an appropriate and safe manner;
- The mitigation measures that need to be implemented when carrying out their work activities;
- General water management;
- Details of and encouragement to minimise the production of waste and re-use, recover and recycle waste where possible;
- Details regarding archaeological and/or historical sites that may be unearthed during construction, and the procedures to be followed should these be encountered; and
- The procedures which should be followed should a graveyard/cemetery be encountered or unearthed during the construction phase.

Training should be provided at pre-construction phase as well as construction and possibly operation phases, as needed. The training can be in different forms, namely:

- Induction training for staff, including modules on: health and safety, environmental and social awareness, accommodation rules, worker code of conduct, stakeholder engagement, grievance mechanisms and cultural heritage awareness;
- Toolbox training for specific tasks;
- Training for individuals involved in tasks with specific responsibilities; and
- Refresher training programs to facilitate continual improvement in environmental and social awareness for Project personnel.

Works which may pose a hazard to humans and animals are to be adequately protected and appropriate warning signs erected. The Contracting Entity should also provide adequate and operational fire safety equipment at all times, and personnel on-site should be trained on how to operate fire extinguishers, etc.

The Contracting Entity should also implement an HIV/AIDS awareness programme at the site camp. A training needs analysis should also be conducted by the EM to identify the appropriate environmental, health and safety training programs, and the appropriate target groups amongst the employees of the Contracting Entity. Environment, health and safety awareness training programs should be targeted at three distinct levels of employment, i.e. the executive, middle management and labour. The training programs should contain the following information:

- The names, positions and responsibilities of personnel to be trained.
- The framework for appropriate training plans.
- The summarized content of each training course.
- A schedule for the presentation of the training courses.

The Contracting Entity should enforce that records of training interventions are kept in accordance with the record keeping and documentation control requirements as set out in the ESMP. The training records should verify each of the targeted personnel's training experience. Assessment of the effectiveness of the training programs should be included as part of the internal audit procedures.

11.8 EMERGENCY PREPAREDNESS AND RESPONSE

The Contracting Entity should compile and maintain his own environmental and social emergency procedures approved by the Client so that there will be an appropriate response to unexpected or accidental actions or incidents that will cause environmental impacts, throughout the construction and maintenance stages of the project. Such activities may include:

- Accidental discharges to water and land.
- Accidental spillages and exposure of employees to hazardous substances.
- Accidental fires.
- Traffic accidents.

These plans should include:

- Emergency organisation (manpower) and responsibilities, accountability and liability.
- A list of key personnel.
- Details of emergency services applicable to the various areas along the route (e.g. the fire department, spill clean-up services, etc.).
- Internal and external communication plans, including prescribed reporting procedures where required by legislation.
- Actions to be taken in the event of different types of emergencies.
- Incident recording, progress reporting and remediation measures required to be implemented.
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release.
- Training plans, testing exercises and schedules for effectiveness.
- Contracting Entities performing work for UCC should be appropriately trained and have ready access to equipment and supplies that would allow them to contain and control some emergencies to an extent until the arrival of an Emergency Response Team.

11.9 INCIDENT REPORTING AND REMEDY

If a leakage or spillage of hazardous substances occurs on-site, the local emergency services should be immediately notified of the incident. The following information should be provided:

- The location.
- The nature of the load.
- The status at the site of the accident itself (i.e. whether further leakage is still taking place, whether the vehicle or the load is on fire).

Written records should be kept on the corrective and remedial measures decided upon and the progress achieved therewith over time. Such progress reporting is important for monitoring and auditing purposes. The written reports may be used for training purposes in an effort to prevent similar future occurrences.

11.10 CHECKING AND CORRECTIVE ACTION

The EM and Supervisory Consulting firm should monitor the ongoing conformance or lack thereof by the Contracting Entity and sub-contractors. The Supervisory Consulting firm should consult with and report non-conformances with the ESMP to the EM, with a copy of such report being given to the Contracting Entity, UCC. In any non-conformance report ("NCR"), the Supervisory Consulting firm should also stipulate the recommended corrective action that needs to be taken to remedy such non-conformance. The Contracting Entity is deemed not to have complied with the ESMP if, inter alia:

- There is evidence of contravention of the ESMP specifications within the boundaries of the construction site, site extensions and haul/access roads.
- There is contravention of the ESMP specifications that relate to activities outside the boundaries of the construction site.
- Environmental damage ensues due to negligence.
- Construction activities take place outside the defined boundaries of the site without the approval of the Supervision Consultant or EM.
- The Contracting Entity fails to comply with corrective or other instructions issued by the Supervision Consultant within a specific time period.
- The EM has failed to recognize, act on or bring the non-compliance issue to the attention of the Supervision Consultant.
- Littering by the Contracting Entity on site.
- Lighting of illegal fires by the Contracting Entity on site. Persistent or unrepaired oil leaks from the

Contracting Entity's vehicles.
- Excess dust or excess noise emanating from site.
- Possession or use of intoxicating substances by the Contracting Entity on site.
- Any Contracting Entity vehicles being driven in excess of designated speed limits.
- Removal and/or damage by the Contracting Entity to fauna, flora or cultural or heritage objects on site.
- Urination and defecation by Contracting Entity staff anywhere except in designated areas.

11.11 REMEDIAL ACTION

Remedial action would be managed by the EM in two categories as described below.
Specified Corrective Action: This constitutes remedial or mitigatory measures specified by the Supervisory Consulting firm in any NCR, coupled with a specified time limit within which the specified corrective action needs to be completed, at the expense of the party identified in the NCR as being responsible for carrying out the said work. The Supervisory Consulting firm may on requests grant an extension of time for the implementation of such corrective action. If the said corrective action has not been carried out within the period stipulated by the Supervisory Consulting firm in the NCR or agreed on between the Supervisory Consulting firm and the Contracting Entity, the non- conformance in question would be dealt as Formal Remedial Work.

Formal Remedial Work: Where a non-conformance has resulted in environmental damage to the site which cannot be rectified as per the Supervisory Consulting firm 's specified corrective action or where the Contracting Entity has failed to carry out any of the Supervisory Consulting firm's specified corrective actions within the prescribed time limit (or permitted extension thereof), the Supervisory Consulting firm should convene a meeting between representatives of the Contracting Entity and UCC. At this meeting, appropriate remedial work/mitigatory measures should be discussed and agreed, and failing agreement within 10 days, such dispute should be resolved in accordance with the dispute resolution provisions contained in the Contract. The Supervision Consultant should issue an instruction to the Contracting Entity to procure execution of the remedial work as agreed between the parties, and the Contracting Entity should be obliged to procure such remedial work within the prescribed period to the satisfaction of the Supervision Consultant. Failure by the Contracting Entity to comply with an instruction from the Supervision Consultant to procure the carrying out of the required remedial work would constitute a material breach of Contract, entitling the Client to the applicable remedy provided for in the Contract.

11.12 GRIEVANCE REDRESS

When grievances are reported they need to be addressed in a consistent and verifiable manner. This will be done through the implementation of a grievance procedure or a Grievance Redress Mechanism (GRM) that will be operated by the ACECoR and will allow project beneficiaries to submit questions, complaints or suggestions via email, phone, text message, or regular mail.
The Environmental and Social Safeguard Office will be the first point of contact and for resolution of grievances. The GRM (grievance procedure) should be followed for all grievances relating to the Project, and is divided into the following six (6) steps:

- Step 1: Receive and log grievance - a grievance form will be filled for all complaints received and added to the on-site grievance system for tracking.
- Step 2: Acknowledge grievance.
- Step 3: Assess and prioritise grievance and forward to relevant function.
- Step 4: Investigate and resolve grievance.
- Step 5: Sign off on grievance - The resolution will be documented on the relevant consent (grievance) forms and verified.
- Step 6: Monitor.

Dedicated telephone numbers and e-mail addresses will be made available to contractor workers to aid them lodge their grievances for redress. In addition to this, the AAU has also developed a Regional GRM which is

electronic (eGRM) and accessible through ACECoR's website. Grievances can be filed directly via the portal The Contractor will be given access to the eGRM where grievances can be logged directly to AAU.

11.13 ENVIRONMENTAL AND SOCIAL MITIGATION AND MONITORING PLAN

The ESMMP below specifies the actions that will be taken and specifies the parties responsible for these actions and the schedule for these tasks. It also sets out the indicators or criteria that will be used to monitor (1) whether the mitigation actions have been implemented, and (2) whether they are effective and sufficient. The ESMMP provides a basis for systematic implementation of ESIA. In addition to establishing responsibilities and schedules, ESMMP is the vehicle for translating ESIA conditions (which are often very general) into specific, implementable, verifiable actions.

Table 0-1: Project Environmental and Social Mitigation and Monitoring Plan (ESMMP)

LIKELY IMPACT	MITIGATION MEASURES	RESPONSIBLITY	COSTS (GHC)	INDICATOR	FREQUENCY
CONSTRUCTION PHASE					
Loss of Flora and Faunal Habitats	Landscaping with indigenous species on completion of construction. Maintaining of landscaped gardens, terraces, conservation and management of the vegetation and gardens. Clearing vegetation only in construction areas and demarcating areas where no clearing will happen	Contractor Entity Environmental Manager, ACECoR Safeguards Officer	35,000.00	Presence of vegetative cover in earlier cleared areas	Once
Changes in surface and sub- surface hydrology	During construction, the design (of the drainage system) should ensure that surface flow is drained suitably into the public drains provided to control flooding within the site. Drainage channels should be installed in all areas that generate or receive surface water such as car parking, driveways and along the building block-edges of the roofs. The channels should be covered with gratings or other suitable and approved materials to prevent occurrence of accidents and entry dirt that would compromise flow of run-off. The channels should be designed with regards to the peak volumes such as periods or seasons when there is high intensity of rainfall which is also not common in the project area but just in case such an event occurs. They should never at any time be full due to the resulting heavy downpours. The drainage channels should ensure the safe final disposal of run-off /surface water and should be self-cleaning which means it should have a suitable gradient. Storm water generated from roof catchments should be harvested, stored and made use in various household activities such as general cleaning.	Contractor Entity Environmental Manager, ACECoR Safeguards Officer	50,000.00	Number of engineered storm channels % of paved area to vegetated area Number of covered drainage channels Number of channels overflowing after heavy precipitation	Monthly Monthly Monthly Post precipitation

	This will reduce run-off reaching the drainage channels. Paving of the side walkways, driveways and other open areas should be done to encourage water recharge and reduce run-off volume. Ensuring there is enough space for normal percolation of water. Proper installation and configuration of drainage structures to ensure their efficiency. Installing cascades to break the impact of water flowing into the drains.				
Changes in soil characteristics	Sprinkling water on the soil to prevent dust from rising. Creating specific paths for the trucks. Preventing pollution from construction wastes by having specific sites for collection, sorting and transport of wastes. Controlling the earthworks and ensuring the management of excavation activities. Compacting areas with loose soil. Landscaping. Providing soil erosion control structures on the steeper areas of the site & controlling activities during the rainy season.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer, EPA	40,000.00	Amount of dust per volume of air. % of paved area to vegetated area. Amount of run-off i.e. flow rate of run-off in m^3/s. Amount of soil in run-off or drained water – kg/m^3	Weekly Once Daily Daily
Air pollutants	Sprinkling water on soil before excavation and periodically when operations are under way to prevent raising of dusts. Enclosing the structures under construction with dust proof nets. Using efficient machines with low emission technologies for the ones that burn fossil fuels. Controlling the speed and operation of construction vehicles. Regular maintenance and services of machines and engines. Use of clean fuels e.g. unleaded and de-sulphurized fuels. Educate and raise awareness of construction workers on emission reduction techniques.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer, EPA	50,000.00	Amount of gaseous emissions per day: ppm in air per day Amount of particulate emission per day: ppm in air per day	Monthly Monthly

Generation of Noise	Using equipment with noise suppressing technologies. Providing workers with PPEs against noise e.g. ear plugs. Placing signs around the site to notify people about the noisy conditions. Regular maintenance of equipment to ensure they remain efficient and effective. Complying with the EPA noise regulation. Construction works should be carried out only during the specified time which is usually as from 0800 hrs to 1700 hrs. There should not be unnecessary horning of the involved machinery. Provision of bill boards at the construction site gates notifying of the construction activity and timings	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer, EPA Member of the public	60,000.00	Quality of PPEs (ear muffs, ear plugs) Amount of noise generated: dB	Daily Daily
Increased Pressure on Utilities	Employing water conservation techniques and only using the required amounts of water to prevent wastage. Employing power saving techniques such as switching off equipment when not in use, using natural light whenever possible. Using machines with power saving technologies i.e. high efficiency equipment. Providing proper sanitary facilities for construction workers. Inspecting the drainage facilities regularly to ensure they are free of debris that may reduce their efficiency.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer, EPA, GWCL, PDS	90,000.00	Amount of water consumed per day: m3/day Amount of electricity consumed per day: Kwh Number of machines and equipment serviced per month Amount of fuel consumed per day: Litres/day Number of drainage blockages per month Amount of water consumed per day: m^3/day	Daily Daily Monthly Daily Monthly Daily

Increased Heavy Traffic	Placing signs around the site notifying other vehicles about the heavy traffic and to set the speed limit around the site. Ensuring all drivers for the project comply to speed regulations. Making sure the construction doesn't occupy the road reserves and complying to traffic and land demarcation obligations. Ensuring all vehicles used for the project are in good working condition both legally and commensurate to their intended use.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer, EPA, CCMA	10,000.00	Visibility and clarity of notification signages Number of incidents/complaints	Daily, Monthly Daily, Monthly
Population Influx	Workers to be issued with jobs cards to monitor their movements in the site area. Only authorised personnel should be allowed entrance to the site. Presence of a work registry book where workers sign in and out Educating the workers on proper sanitation methods Sensitizing the worker on HIV/AIDS	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer	20,000.00	Presence of a work registry book. Issuing of job cards Presence of sanitary Services Number of sanitation briefings held Number of sensitization workshops held	Spot checks, Weekly Monthly Monthly
Generation of Construction waste	Making available suitable facilities for the collection, segregation and safe disposal of the wastes. Ensuring all waste is dumped in their designated areas and legally acceptable methods. Following Cape Coast Metropolitan Assembly regulations on Waste. Management. Employing a waste management plan. Using waste minimization techniques such as buying in bulk. Allocating responsibilities for waste management and identifying all sources of	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer, EPA, CCMA	80,000.00	Provision of labelled wastebins for waste segregation Amount of wastes generated per day i.e. kg/day per specific waste type. Quality of PPEs	Daily Daily Daily

	wastes, and ensuring wastes are handled by personnel licensed to do so. Making available suitable facilities for the collection, segregation and safe disposal of the wastes. Creating waste collection areas with clearly marked facilities such as colour coded bins and providing equipment for handling the wastes. The bins should be coded for plastics, rubber, organics, glass, timber, metals etc. Ensuring all wastes are dumped in their designated areas and through legally acceptable methods and that the bins are regularly cleaned and disinfected. Assessing and creating opportunities for Regulation, Reducing, Reusing, Recycling, Recovering, Rethinking and Renovation. Creating adequate facilities for the storage of building materials and chemicals and controlling access to these facilities. Ensuring bins are protected from rain and animals.			Volumes of commingled waste	Daily
OHS Risks	Employing an OHS plan that will outline all OHS risks and provide a strategy for their management. (See Appendices 7 & 8). Ensuring all potential hazards such as movable machine parts are labelled. Raising awareness and educating workers on risks from equipment and ensuring they receive adequate training on the use of the equipment. Providing the workers with adequate PPEs and monitoring regularly to ensure they are replaced on time when they wear out. Placing visible and readable signs around where there are risks. Ensuring there is security in and around the site to control the movement of people. Providing safe and secure storage for equipment and materials in the site and	UCC Site personnel Contractor, EPA Area OHS Officer, City Council, District Public Health Officer	100,000.00	Number of incidents/accidents per monthly Quality of all PPEs Number of drills per quarter. Effectiveness of drills Visibility and clarity of signs and alerts Efficiency of equipment such as fire fighting equipment	Weekly Daily and as often as possible Quarterly After every drill Daily and spot checks Weekly and spot checks

	maintaining MSDSs. Placing visible and readable signs to control the movement of vehicles and notify motorists and pedestrians around the, and workers in the site. Providing fire fighting equipment and in easily accessible areas as well as ensuring site personnel are well trained to use them as well as maintaining them regularly. Labelling chemicals and material according to the risks they possess. Creating safe and adequate fire and emergency assembly points and making sure they are well labelled. Establishing emergency procedures against hazards and ensuring the workers stay aware/educated on following them and commensurate to the magnitude and type of emergency, by conducting regular drills and involving the neighbours.			Quality and efficacy of storage Level of awareness of workers Number of assembly points	Daily and spot checks Once quarterly and spot checks
OPERATIONAL PHASE					
Increased Pressure on available utilities	Implementing water conservation techniques such as having faucets with dead man tap openers. Using only the required amounts of water during normal operations. Creating awareness through signs of conservation of water and electricity. Using natural light during the day for lighting purposes. Using machines and equipment with a high level of power efficiency in the offices and residential houses and servicing them as often as required to maintain their efficiency. Using gas in the kitchens/restaurants for cooking purposes.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer, EPA, GWCL, PDS	50,000.00	Amount of water consumed per day: m3/day Amount of electricity consumed per day: Kwh Number of machines and equipment serviced per month Amount of fuel consumed per day: m3/day Number drainage blockages per month	Daily Daily Monthly Daily Monthly
Micro-climate modification	Advocating for the use of other renewable sources of energy such as wind and solar energy.	ACECoR Safeguards Officer, EPA	150,000.00	Numbers of trees planted Ratio of paved surface	TBD

	Use of clean fuels e.g. unleaded and de-sulphurized fuels in vehicles. Paving should only be carried out where necessary to reduce the reflection of the solar radiations. Landscaping the site with indigenous species of plants. Using sustainable drainage systems that mimic the natural percolation of water into the soil, and green roofs where possible. Using efficient equipment that emit little or no waste heat			to unpaved surfaces	
Security Threats	Employing of security guards/ competent security firm at the site and searching all vehicles and people entering the project. If possible the use of CCTV cameras to monitor security within the site. Collaborating with the national police on security matters. Placing alarms around the project and establishing emergency preparedness and response procedures.	Contractor – Site Foreman, Contractor Entity Environmental Manager	100,000.00	Presence of a security personnel Number of security incidences Number of security drills and emergency response drills	Daily Weekly Once Quaterly
Sociocultural Impacts	Integrating Equal Opportunity Principles in Procurement and human resource policies. Promoting social cohesion and integration among people in the area. Creating awareness towards the diversity of cultures and different economic background of the people in the project staff and residents through sensitization. Allowing the residents and businesses to form social groups and networks that build social capital. Targeting social investment programs towards the local communities and region.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer	45,000.00	Staff Diversity ratios Number of discrimination incidences and reports Number of social groups Number of social investment strategies targeted at the local community Level of integration of cultural appreciation into staff training programs	Quarterly Quarterly Yearly Yearly Every time training is held and reviewed.

Increased Air pollution	Install scrubbers in the exhausts of motor vehicles to filter the toxic fumes Use of clean fuels such as solar and wind energy sources. Use of de-sulphurized and unleaded fuels in vehicles. Banning the burning of wastes and other materials at the site. Using efficient equipment, machines and engines that emit less pollutants	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer		Efficacy of equipment and machinery Amount of gaseous emissions per day: ppm in air per day Amount of particulate emission per day: ppm in air per day	Weekly and on procurement Bi-weekly Bi-weekly
Increased surface runoff	Using materials that mimic natural percolation of water. Landscaping to ensure there are areas where water will percolate underground. Constructing proper drains and monitoring them to ensure there are no blockages. This also includes ensuring the size of the drains can accommodate storm flows during the rainy season.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer	45,000.00	Drainage flow rate: m^3/day Ratio of paved areas to vegetated areas Number of drainage blockages	Daily Quarterly Quarterly
Increased traffic	Erecting visible and clear signs to control the movement of vehicles in and out of the site. Having alternative entrances and exits for emergency operations. Placing signs around the site notifying other vehicles about the heavy traffic and to set the speed limit around the site. Ensuring all drivers for the project comply to traffic regulations Making sure the construction doesn't occupy the road reserves and complying to traffic and land demarcation obligations. Ensuring all vehicles used for the project are in good working condition both legally and commensurate to their intended use.		20,000.00	Number of traffic congestions per day Duration of traffic jams/congestion: hours Number of traffic incidents and accidents per month	Daily Daily Monthly
Generation of waste	Developing and implementing a waste management plan. Following Cape Coast Metropolitan Assembly regulations on Waste Management. Using waste minimization techniques such as buying in bulk, buying pre-processed	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer	60,000.00	Amount of waste generated per day per waste type: Kg/day Adequacy/quality of waste management equipment (bins, PPEs	Daily Weekly

	foods in the restaurants etc. Allocating responsibilities for waste management and identifying all sources of wastes, and ensuring wastes are handled by personnel licensed to do so. Making available suitable facilities for the collection, segregation and safe disposal of the wastes. Creating waste collection areas with clearly marked facilities such as colour coded bins and providing equipment for handling the wastes. The bins should be coded for plastics, rubber, organics, glass, paper, electrical equipment etc. Ensuring all wastes are dumped in their designated areas and through legally acceptable methods and that the bins are regularly cleaned and disinfected. Assessing and creating opportunities for Regulation, Reducing, Reusing, Recycling, Recovering, Rethinking and Renovation. Creating adequate facilities for the storage of materials and chemicals and controlling access to these facilities. Ensuring bins are protected from rain and animals.			such as gloves, boots etc.) Visibility and clarity of notices and signs	 Daily
OHS Risks	Employing and EHS/OHS plan. (See Appendices 7 & 8) Provision of PPEs to all personnel working in potentially hazardous areas or with potentially hazardous equipment, and replacing the PPEs on wear and tear. Placing readable signs alerting people of hazardous such as for slippery floors. Servicing equipment and machine to ensure efficiency. Providing firefigh ting equipment and maintaining them to ensure they are fully functional. Delineating fire and emergency assembly points and creating awareness to ensure all people at site are aware of them, e.g.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer	80,000.00	Number of incidents/accidents per monthly Quality of all PPEs Number of drills per quarter Effectiveness of drills Visibility and clarity of signs and alerts Efficiency of equipment	Monthly Daily Quarterly After every drill Daily and spot checks

	through the use maps on elevators, staircases etc. Putting in place and ERP and ensuring all people in the project are aware of it and the procedures to follow commensurate to the level of emergency. Providing adequate storage for hazardous and flammable substances and controlling access to them. Monitoring the movement, handling and management of wastes to ensure they safely managed and don't present any EHS risks. Working state agencies in the management of emergencies and disasters to ensure multilateral and inter-sectoral approaches to this management. Performing emergency drills on a frequent basis, setting benchmarks for response and evaluating performance to ensure continuous improvement of response and preparedness.			such as fire fighting equipment Quality and efficiency of storage Level of awareness of workers Number of assembly points	Weekly Daily and spot check Quarterly, Once
Generation of Noise	Erecting signs and notifying other users of noisy activities. Conducting all noisy activities during the day when permissible levels are higher. Provision of PPEs such as ear plugs for employees working in noisy conditions or with noisy equipment. Using equipment with low noise ratings or noise reduction technologies such as for the generators	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer	50,000.00	Visibility and Clarity of Signs Amount of noise generated per day: dB Adequacy and quality of noise PPEs (ear muff, ear plugs)	Daily
DECOMMISSIONING PASE					
Generation of Noise	Carrying out the decommissioning works only during the specified time from 0800hrs to 1700hrs where permissible levels of noise are high and acceptable. Machineries should be maintained regularly to reduce noise resulting from friction. Providing workers with Personal Protective Equipment such as earmuffs when operating noisy machinery and when in a noisy environment.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer	50,000.00	Quality of PPEs (ear muffs, ear plugs) Amount of noise generated: dB	Daily Daily

	Provision of bill boards at the construction site gates notifying people of the activities and timings. Shielding the area to reduce noise propagation				
Generation of demolition waste	Following Cape Coast Metropolitan Assembly regulations on Waste Management. Employing a waste management plan, which will involve assessing and creating opportunities for Regulation, Reducing, Reusing, Recycling, Recovering, Rethinking and Renovation. Removing reusable and recyclable material from the building before demolition to minimize the amount of waste. Allocating responsibilities for waste management and identifying all sources of wastes, and ensuring wastes are handled by personnel licensed to do so. Making available suitable facilities for the collection, segregation and safe disposal of the wastes. Ensuring all wastes are dumped in their designated areas and through legally acceptable methods.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer	80,000.00	Amount of wastes generated per day i.e. kg/day per specific waste type. Quality Of PPEs Quality and capacity of waste management equipment (bins, signs, PPEs etc.)	Daily Daily Daily
Increased Heavy Traffic	Placing signs around the site notifying other vehicles about the heavy traffic and to set the speed limit around the site. Ensuring all drivers for the project comply to speed regulations. Making sure the construction doesn't occupy the road reserves and complying to traffic and land demarcation obligations. Ensuring all vehicles used for the project are in good working condition both legally and commensurate to their intended use.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer	30,000.00	Visibility and clarity of the signs and alerts Number of incidents per month Complaints per month Number of vehicular breakdowns and unscheduled workshop visits	Daily Monthly Monthly Monthly
OHS Risks	Employing an OHS plan that will outline all OHS risks and provide a strategy for their management. Ensuring a11 hazards such as movable parts are labelled.	Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer	90,000.00	Number of incidents/accidents per month Quality of all	Monthly Daily

	Raising awareness and educating workers on risks from equipment and ensuring they receive adequate training on the use of the equipment. Providing the workers with adequate PPEs and monitoring regularly to ensure they are replaced on time when they wear out. Placing visible and readable signs around where there are risks and undertaking the riskier demolition activities first and in isolation. Emergency assembly points and making sure they are well labelled. Ensuring there is security in and around the site to control the movement of people. Providing safe and secure storage for the waste and materials in the site. Placing visible and readable signs to control the movement of vehicles and notify motorists and pedestrians around the, and workers in the site. Providing fire fighting equipment and in easily accessible areas as well as ensuring site personnel are well trained to use them as well as maintaining them regularly. Labelling chemicals and materials according to the risks they possess. Creating safe and adequate fire and Establishing emergency procedures against hazards and ensuring the workers stay aware/educated on following them and commensurate to the magnitude and type of emergency, by conducting regular drills and involving the neighbours.			PPEs Visibility and clarity of signs and alerts Efficiency of equipment such as fire fighting equipment Quality and efficiency of storage Level of awareness of workers Number of assembly points	Daily Weekly Weekly Bi-weekly Once
Emission of Air Pollutants	Using efficient equipment and machines with efficient engines meaning low emission. Using clean fuels such de sulphurized diesel and unleaded fuels. Using Dust screens. Removing components with potential of	Demolition Contractor Contractor – Site Foreman, Contractor Entity Environmental Manager, ACECoR Safeguards Officer, EPA	60,000.00	Amount of gaseous emissions per day: ppm in air per day Amount of particulate emission per day: ppm in air per day	Daily Daily

	emitting hazardous gases or particulates separately and under caution to prevent emissions.				

12.0 CONCLUSIONS AND RECOMMENDATIONS

In conclusion the proposed project will have several positive economic and educational impacts. The project will play an important role in enhancing the capacity of the University of Cape Coast to deliver high quality postgraduate courses related to coastal and marine degradation and will conduct and disseminate international caliber applied research focused on addressing development challenges in West Africa. However, the project will present environmental and social risks similar to most building and infrastructure projects, which include: generation of wastes (municipal, construction and demolition wastes; changes in soil characteristics; emission of air pollutants amongst others. These risks can be adequately managed and monitored through the proposed mitigation measures, that includes frameworks for developing waste management plans, OHS plans and hazardous materials safety plans. It will cost one million, three hundred and fifty Ghana Cedis (GHS 1, 350, 000.00) to fully implement the ESMP. Conditions, processes and procedures along the project timespan may change as the environment and its factors are dynamic. This makes it important for an organization to continuously improve its ESMP, with the objective of improving the overall environmental performance. Again, not every process within the ESMP will be expected to improve all the time, hence there is the need for so continual improvement so as to plan, monitor, and realize improvements in some processes that have been identified for improvement. As an efficient ESMP is characterized by continual improvement the need to systematically improve different processes within the ESMP in order to provide overall improvements is very pertinent, It is therefore recommended that Management of ACECoR should see continuous improvement as a key requirement for this ESMP and commit to it.

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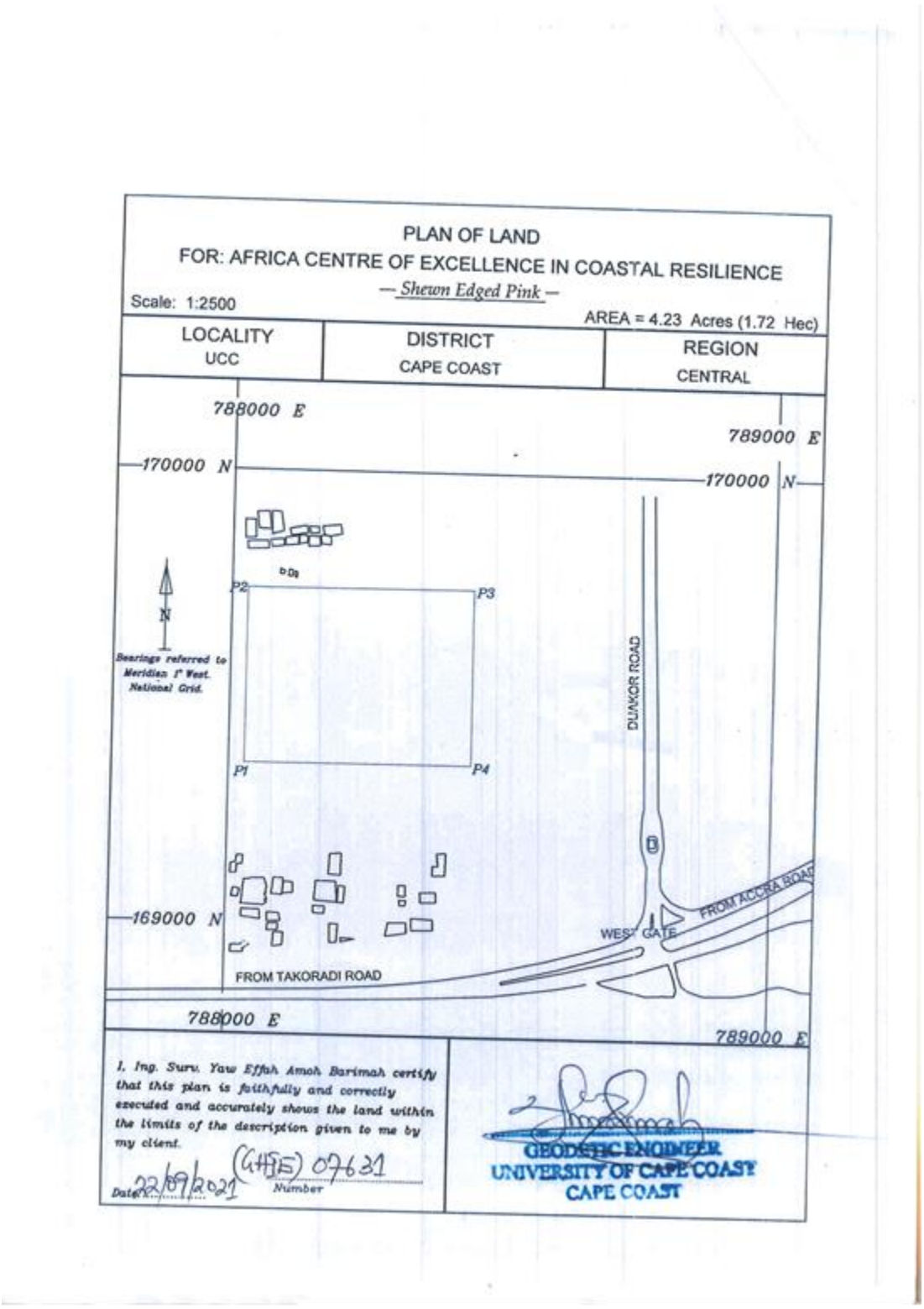
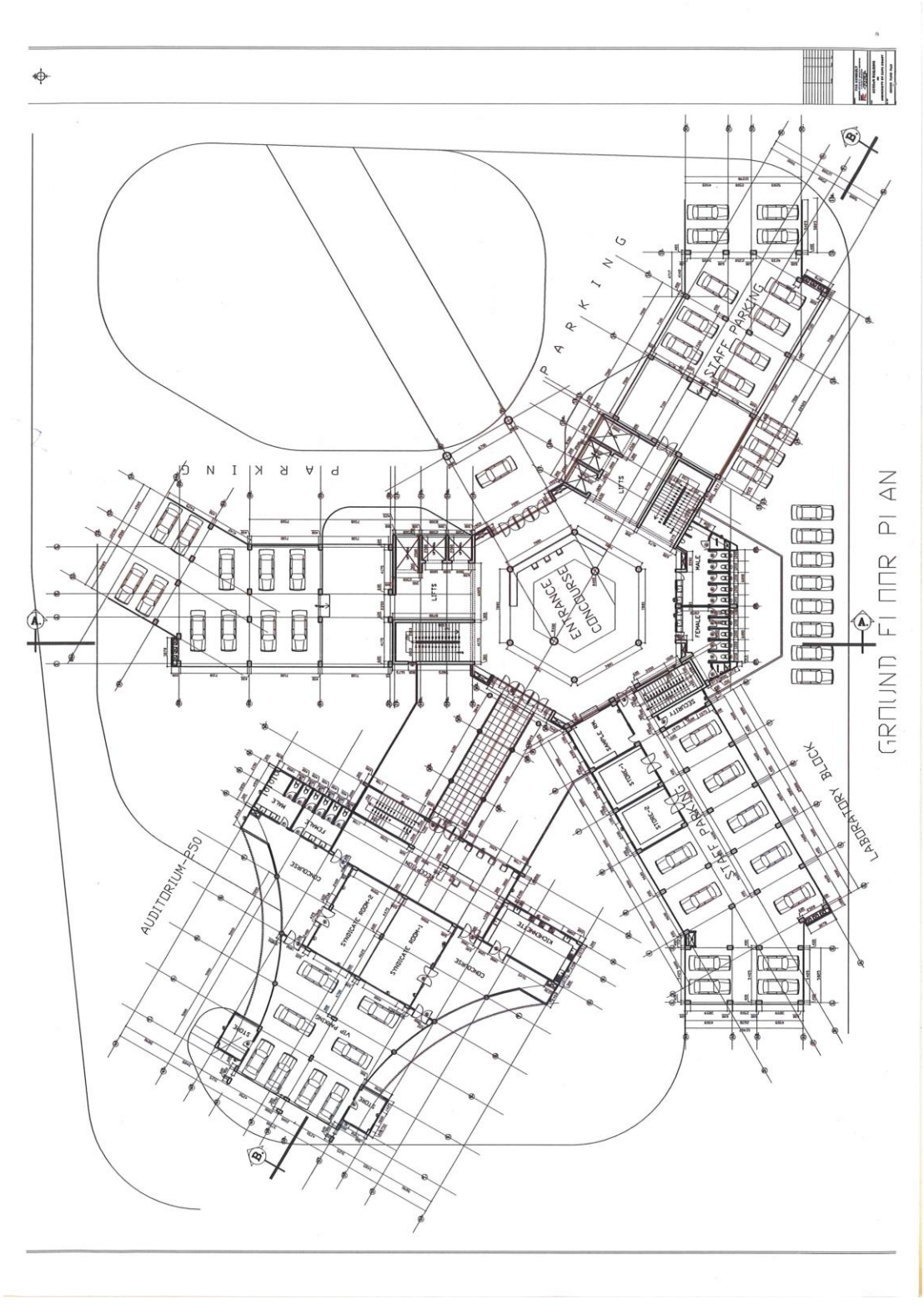
ANNEXES

ANNEX 1: ACECOR BUILDING PROJECT SITE PLAN



ANNEX 2: ACECOR BUILDING PROJECT BLOCK PLAN



ANNEX 3: EPA NATIONAL ENVIRONMENTAL QUALITY GUIDELINES

National Ambient Air Quality Guideline Values

The guideline provides for permissible guideline values for a variety of air pollutants as shown in the table below:

National Ambient Air Quality Guideline Values

Substance	**Time Weighted Average (TWA)**		**Averaging Time**
Sulphur Dioxide (SO_2)	900 µg/m^3	Industrial	1 hr
	700 µg/m^3	Residential	1 hr
	150 µg/m^3	Industrial	24 hr
	100 µg/m^3	Residential	24 hr
	80 µg/m^3	Industrial	1 yr
	50 µg/m^3	Residential	1 yr
Nitrogen Oxides (measured as $N0_2$)	400 µg/m^3	Industrial	1 hr.
	200 µg/m^3	Residential	1 hr.
	150 µg/m^3	Industrial	24 hr
	60 µg/m^3	Residential	24 hr
Total Suspended Particulate	230 µg/m^3	Industrial	24 hr
	150 µg/m^3	Residential	24 hr
	75 µg/m^3	Industrial	1 yr
	60 µg/m^3	Residential	1 yr
PM_{10}	70 µg/m^3		24 hr
Smoke	150 µg/m^3	Industrial	24 hr
	100 µg/m^3	Residential	24 hr
	50 µg/m^3	Industrial	1 yr
	30 mg/m^3	Residential	1 yr
Carbon Monoxide	100 mg/m^3		15 min
	60 mg/m^3		30 min
	30 mg/m^3		1 hr
	10 mg/m^3		8 hr
Hydrogen Sulphide	150 µg/m^3		24 hr
Mercury	1 µg/m^3		1 yr
Lead	2.5 µg/m^3		1 yr
Cadmium	10 - 20 ng/m^3		1 yr
Manganese	1 µg/m^3		24 hr
Dichloromethane (Methylene Chloride)	3 mg/m^3		24 hr
1,2-Dichloroethane	0.7 mg/m^3		24 hr
Trichloroethane	1 mg/m^3		24 hr
Tetrachloroethene	5 mg/m^3		24 hr
Toluene	8 mg/m^3		24 hr
Arsenic	30 ng/m^3	Industrial	24 hr
	15 ng/m^3	Residential	24 hr
Fluoride	10 µg/l		24 hr

National Ambient Noise Level Guideline (NANLG)

The guideline provides for permissible night and day noise levels for variety of settings ranging from residential areas with negligible or infrequent transportation to predominantly heavy industrial areas as shown in the table below.

National Ambient Noise Quality Guideline Values

ZONE	DESCRIPTION OF AREA OF NOISE RECEPTION	PERMISSIBLE NOISE LEVEL IN dB(A)	
		DAY 0600 - 2200	NIGHT 2200 - 0600
A	Residential areas with low or infrequent transportation	55	48
B1	Educational (school) and health (hospital, clinic) facilities	55	50
B2	Areas with some commercial or light industry	60	55
C1	Areas with some light industry, places of entertainment or public assembly, and places of worship located in this zone	65	60
C2	Predominantly commercial areas	75	65
D	Light industrial areas	70	60
E	Predominantly heavy industrial areas	70	70

National Effluent Quality Guidelines

The national effluent quality discharge guideline levels as administered by the EPA are as provided in the table below.

General Effluent Quality Guidelines for Discharge into Natural Water Bodies- Maximum Permissible Levels

Parameter	EPA Recommended Guideline Value
pH	6 – 9
Temperature Increase	<3oC above ambient
Colour	200 TCU
Turbidity	75 NTU
Conductivity	1500 uS/cm
Total Suspended Solids	50 mg/l
Total Dissolved Solids	1000 mg/l
Oil/Grease	5.0 mg/l
Sulphide	1.5 mg/l
Total Phosphorus	2.0 mg/l
Biochemical Oxygen Demand (BOD_5)	50 mg/l
Chemical Oxygen Demand (COD)	250 mg/l
Nitrate	50 mg/l
Ammonia as N	1.0 mg/l
Alkalinity as $CaCO_3$	150 mg/l

Phenol	2.0 mg/l
Mercury	0.005 mg/l
Total Arsenic	1.0 mg/l
Soluble Arsenic	0.1 mg/l
Lead	0.1 mg/l
Total Pesticides	0.5 mg/l
Fluoride	10 mg/l
Chloride	250 mg/l
Sulphate	200 mg/l
Total Coliforms	400 MPN/100ml
E. coli	0 MPN/100ml
Cadmium	0.1 mg/l
Chromium (+6)	0.1 mg/l
Total Chromium	0.5 mg/l
Copper	5.0 mg/l
Nickel	0.5 mg/l
Selenium	1.0 mg/l
Zinc	10.0 mg/l
Silver	5.0 mg/l
Tin	5.0 mg/l
Aluminum	5.0 mg/l
Antimony	5.0 mg/l
	0.05 mg/l

(Source: Environmental Protection Agency, Accra 1997)

ANNEX 4: SUMMARY OF WORLD BANK ENVIRONMENTAL AND SOCIAL SAFEGUARD FRAMEWORK (ESSF)

Environmental and Social Standards	REQUIREMENTS	SCOPE OF APPLICATION
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts:	This standard evaluates the potential environmental and social risks and impacts associated with each stage of a project (the project lifecycle) in its area of influence. It examines project alternatives; identifies ways of improving projects election, siting, planning, design, and implementation by preventing, reducing, mitigating, or compensating for adverse environmental and social impacts and enhancing positive impacts. It includes the process of mitigating and managing adverse impacts throughout the project implementation so that the project is environmentally and socially sound and sustainable. ESS1 considers the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous people, and physical cultural resources); and trans-boundary and global environmental aspects.	*Applicability to the Project: The standard provides guidance on assessing the Project's potential environmental and social risks and impacts and addressing potential impacts through planning and mitigation hierarchy approach.*
ESS 2: Labour and Working Conditions:	The World Bank through the ESS2 promotes the fair treatment, non-discrimination and provision of equal opportunities for workers engaged on projects it supports. It strongly encourages protection of all project workers, including vulnerable groups such as women, persons with disabilities, children (of working age) and migrant workers, contracted workers and primary supply workers, as appropriate. It provides certain requirements that the project must meet in terms of working conditions, protection of the work force (especially the prevention of all forms of forced and child labour), and provision of a grievance mechanism that addresses concerns on the project promptly and uses a transparent process that provides timely feedback to those concerned.	*Applicability to the Project: The standard provides guidance on promoting the safety and health of the project workers and recognises the need for the project to create employment and income generation opportunities that will lead to poverty alleviation and economic growth of project stakeholder communities*
ESS 3: Resource Efficiency and Pollution Prevention and Management:	The ESS3 provides requirements for projects to achieve the sustainable use of resources, including energy, water and raw materials, as well as implement measures that avoids or reduces pollution resulting from project activities. The standard places specific consideration on hazardous wastes or materials and air emissions (climate pollutants) given that the current and projected atmospheric concentration of greenhouse gases threatens the welfare of present and future lives.	*Applicability to the Project: The project is expected to through this standard, avoid or limit all sources of pollution to air, water and land as a result of the project. The project will adopt efficient and effective resource use, pollution prevention and mitigation or management technologies and practices.*
ESS 4: Community Health and Safety:	This standard recognizes that project activities, project equipment and infrastructure of increase the exposure of project stakeholder communities to various health, safety and security risks and impacts and thus recommends that projects implement measures that avoids or limits the occurrence of such risks. It provides further requirements or guidelines on managing safety, including the need for projects to undertake safety assessment for each phase of the project, monitor incidents and accidents and preparing regular reports on such	*Applicability to the Project: The project will be guided by this standard in managing and/or addressing issues relating to the health and safety of the project stakeholder, with particular attention to people who, because of their particular circumstances, may be vulnerable.*

Environmental and Social Standards	REQUIREMENTS	SCOPE OF APPLICATION
	monitoring. ESS4 also provides guidance on emergency preparedness and response.	
ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement:	It is recognized that project-related land acquisition causes physical displacement and economic displacement or both which often leaves adverse impacts on communities and affected persons. Involuntary resettlement is triggered in situations involving involuntary taking of land or involuntary restrictions of access to the use of land, including cases where people or communities may have traditional or customary tenure or recognizable usage rights. ESS5 aims at avoiding involuntary resettlement to the extent feasible, or to reduce its adverse social and economic impacts. It promotes participation of displaced people in resettlement planning and implementation, and its key economic objective is to assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement. The standard prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to Bank appraisal of proposed projects.	*NOT APPLICABLE TO THE PROJECT:* *The land is owned by the University and has been ceded to ACECoR as per Annex 6. There are no issues with landuse and involuntary resettlement. However, the project will be guided by this standard when applicable.*
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources:	ESS6 promotes the conservation of biodiversity or natural habitats. The World Bank supports the protection and maintenance of the core ecological functions of natural habitats and the biodiversity they support. The World Bank encourages projects to incorporate into their development, environmental and social strategies that address any major natural habitat issues, including identification of important natural habitat sites, the ecological functions they perform, the degree of threat to the sites, and priorities for conservation.	*Applicability to the Project: The project will be guided by this standard and will consider the views, roles, and rights of groups, including local non-governmental organizations (NGOs) and local stakeholder communities, and involve such in planning, designing, implementing, monitoring, and evaluating the project. Involvement may include identifying appropriate conservation measures, managing protected areas and other natural habitats, and monitoring and evaluating specific actions.*
ESS 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities:	ESS7 addresses distinct social and cultural groupings such as "indigenous ethnic minorities" or "vulnerable and marginalized groups" and encourages that development projects provide benefits for all, irrespective of unique cultural identities and aspirations that are distinct from mainstream groups in a given society. The standard discourages the marginalization of men, women and children in indigenous cultures often different from mainstream groups and advocates for their inclusion in consultation processes about the design and implementation of projects,	*Applicability to the Project: There are no indigenous people or underserved traditional local communities within the project area. However, the project will be guided by this standard in achieving that objective.*

Environmental and Social Standards	REQUIREMENTS	SCOPE OF APPLICATION
	as well as respect for their human rights, dignity, identity and culture.	
ESS 8: Cultural Heritage:	This standard sets out general provisions on cultural heritage preservation and recommends protecting cultural heritage from the adverse impacts of project activities. It addresses physical or tangible cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be in urban or rural settings, and may be above or below ground, or underwater. It also addresses intangible cultural heritage such as practices, representations, expressions, instruments, objects and cultural spaces that communities recognize as part of their cultural heritage. Projects involving significant excavations, demolition, movement of earth, flooding, or other environmental changes are to take cognizance of this standard in the ESMF.	*Applicability to the Project: The Project will need to still take cognizance of tangible and intangible cultural heritage sites and items, including potential archaeological heritage within the project's area of influence. The Project will adopt measures such as undertaking meaningful consultations with stakeholders regarding cultural heritage and implementing basic mitigation measures at the construction phase, such as a chance find procedure.*
ESS9: Financial Intermediaries (FIs):	This standard recognizes that strong domestic capital and financial markets and access to finance are important for economic development, growth and poverty reduction. FIs are required to monitor and manage the environmental and social risks and impacts of their portfolio and FI subprojects, and monitor portfolio risk, as appropriate to the nature of intermediated financing. The way in which the FI will manage its portfolio will take various forms, depending on a number of considerations, including the capacity of the FI and the nature and scope of the funding to be provided by the FI.	*Applicability to the Project: There are no FIs involved in this project. However, the project will be guided by this standard when applicable.*
ESS 10: Stakeholder Engagement and Information Disclosure:	The World Bank through the ESS10 seeks to encourage open and transparent engagement between the Borrower and the project stakeholders project-affected parties) throughout the project life cycle. The standard establishes a systematic approach to stakeholder engagement that potentially helps the Borrower to identify stakeholders and build and maintain a constructive relationship with them, as well as disclose information on the environmental and social risks and impacts to stakeholders in a timely, understandable, accessible and appropriate manner and format. It recommends that stakeholder engagements are commenced as early as possible in the project development process and continued throughout the lifecycle of the Project. This allows for stakeholders' views to be considered in the project design and environmental and social performance. The Borrower is also expected to implement a grievance mechanism to receive and facilitate resolution of concerns and grievances.	*Applicability to the Project: The Project will engage with various stakeholders at the project design, planning and project implementation stages. The project will prepare and disclose a Stakeholder Engagement Plan.*

ANNEX 5: GEOTECHNICAL REPORT

Geotechnical Investigation Report for Design and Construction of Proposed ACECOR Building at University of Cape Coast

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February, 2021

TABLE OF CONTENTS

1.0 INTRODUCTION

A geotechnical investigation has been conducted on a parcel of land at the University of Cape Coast. The geotechnical investigation forms part of engineering studies for the design and construction of the ACECOR Building.

The objective of the investigation was to obtain information about the geological conditions at the site and assess the subsurface soil conditions so as to determine the soil parameters and soil bearing capacity to be considered for the design and construction of the foundations.

The subsurface conditions revealed by the investigation are discussed in this report. The report discusses the activities carried out as part of the investigations, presents the results and makes recommendations for the design of the foundations.

2.0 SITE DESCRIPTION

2.1 The Site

The location of the site is shown in Figure 1.

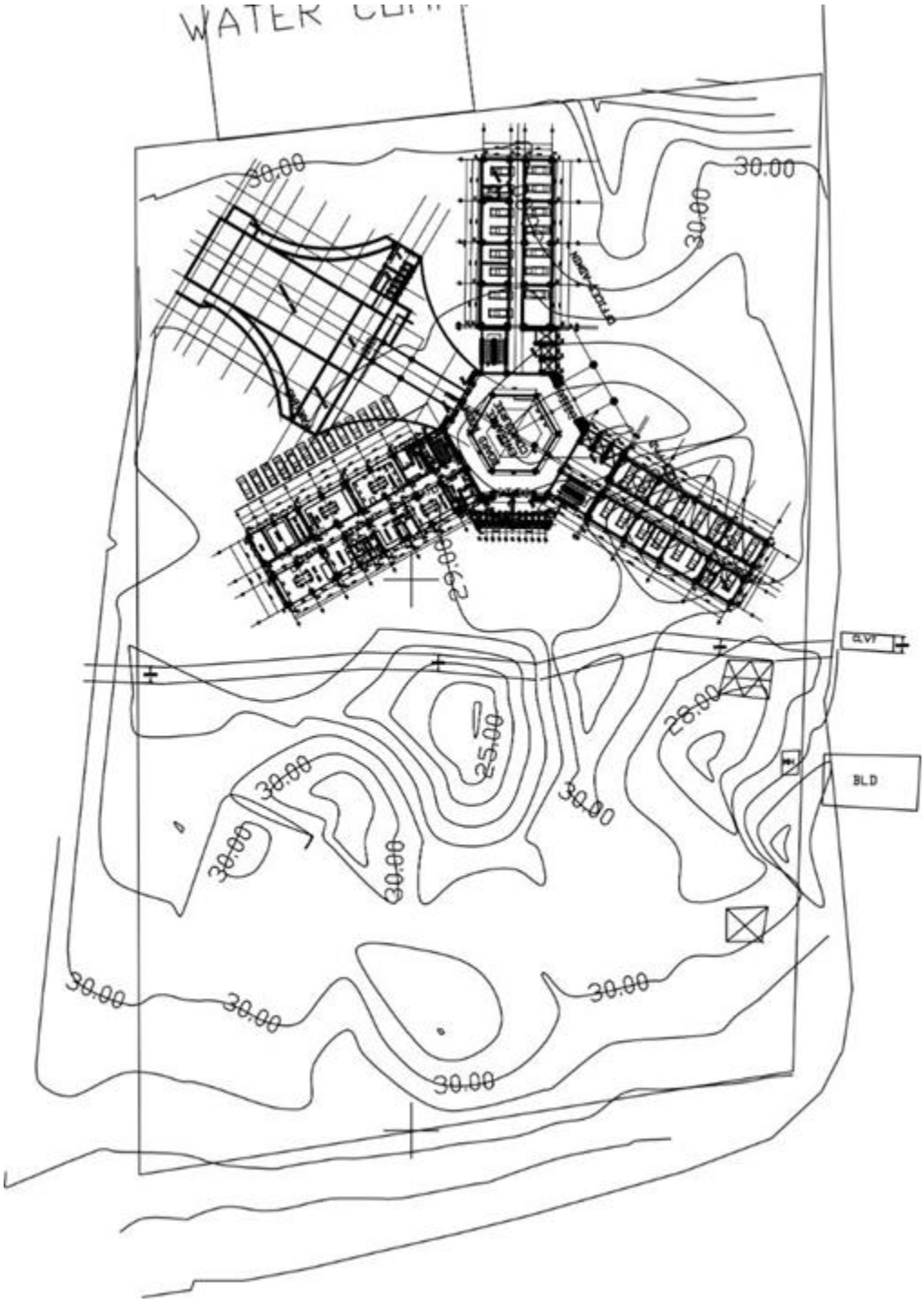


Figure 1: Location of the Site

2.2 Climate

The Cape Coast area lies within the zone of heavy seasonal rainfall. The area generally experiences two main rainy seasons. The seasons are however not distinct. There is a major rainy season that reaches its peak in May-June and a minor season between September and November. The average annual rainfall is about 1250mm. The degree of saturation of surface soils is very high in May–June, i.e during the peak of the first rainy season. The period between January to April is relatively dry and maximum desiccation of surface soils takes place.

2.3 Geology of the Area

The area of the site is underlain by rocks of the Sekondian formation which consists of sandstones, grits, shales and mudstones, nodules of limestone and siderite. The superficial soils are silty sands and clays. (Ref. 1)

2.4 Seismic Considerations

Ghana cannot be considered as a major earthquake prone area of the world. The coastal areas are however subjected to earthquakes of relatively low intensities.

A detailed seismic hazard assessment study is yet to be conducted for Ghana. A Global Seismic Hazard Assessment study conducted on a macro-scale hazard for the African region provided the Southern Ghana region with a rock peak ground acceleration of 0.16g for an annual exceedance probability (AEP) of 10% in 50 years.

Based on records of the seismic hazard, the geologic setting of Southern Ghana and ground motion estimates from other similar locations in the world with similar seismo - tectonic features, a deep rock PGA (i.e., zero-period spectral acceleration) with an annual exceedance probabilities of 10% in 50 years of 0.15 - 0.2g could be assumed for the area.

The project area is located within zone 3 of the seismic risk map of Ghana as shown in Figure 2. Definition for the Seismic Zones is shown in Table 1. It is recommended that engineering structures in zone 3 should be analysed with an assigned horizontal ground acceleration of 0.35g.

(Ref. 2). The recommended ground acceleration of 0.35g represents the average for the range 0.14 - 0.57g. A deep rock PGA of 0.2g is recommended to be used for design.

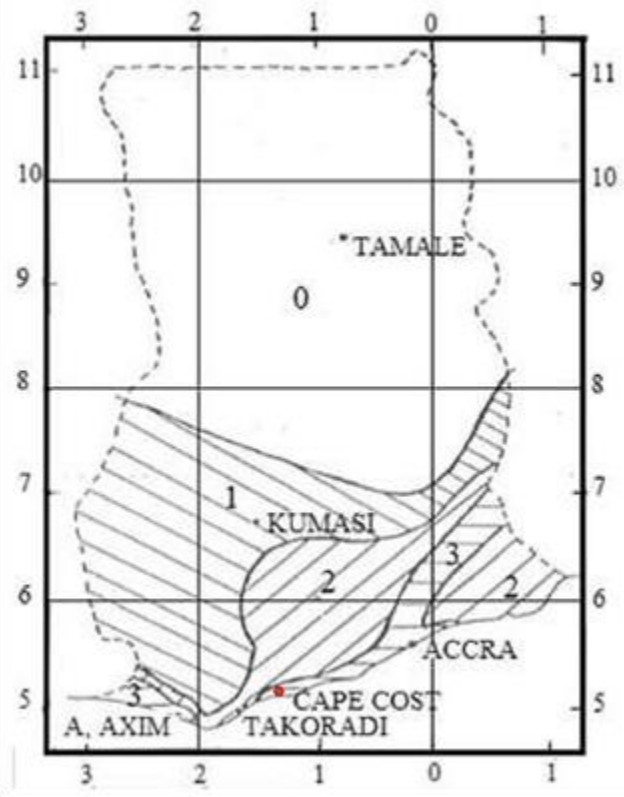


Figure 2. Seismic Risk Map of Ghana

Table 1. Definition of Seismic Zones

Seismic Zone	Assigned Horizontal Design Ground Acceleration: g
0	0
1	0.15
2	0.25
3	0.35

3.0 THE INVESTIGATION

The investigation included fieldwork and laboratory testing.

3.1 Field Work

The field work consisted of Dynamic Cone Penetrometer (DCP) Test and drilling boreholes. The field work was started on 15th February 2021 and completed on 20th February 2021.

3.2 Borehole drilling

Three (3) boreholes were drilled to establish the soil profile. The borehole drilling was conducted in accordance with BS 5930 – Site Investigations for Civil Engineering Projects.

The boreholes were drilled to a maximum depth of 9m using the FLYDISC DRILLING RIG XUL – 100 drilling equipment. Bulk disturbed samples of the soils were recovered, preserved in airtight containers and labelled as the holes were advanced.

3.3 Dynamic Cone Penetrometer Test

The in-situ strength (Bearing Capacity) of the ground medium was tested using a Dynamic Cone Penetrometer (DCP). The equipment has the following characteristics:

Weight of hammer	10kg
Weight of anvil	6kg
Height of fall of hammer	50.0cm
Cone Diameter	2.4cm
Cone Surface Area	$5cm^2$
Apex Angle of Cone	60°

This equipment also has a slotted open drive sampler capable of retrieving samples of the formation being penetrated.

Five (5) DCP tests were performed across the proposed area for the building. Additional five (5) DCP tests were performed across the area for future development. The test were done at the points as shown in Figure 3. The DCP tests were done to estimate the variation of the bearing capacity of the ground medium with depth. The number of blows required for the cone to penetrate 10cm into the ground medium was noted for various depths. The test was terminated when the number of blows required for the cone to penetrate 10cm exceeded 50 or when there was an obvious 'refusal' as indicated by a rebounding of the hammer when dropped on the anvil.

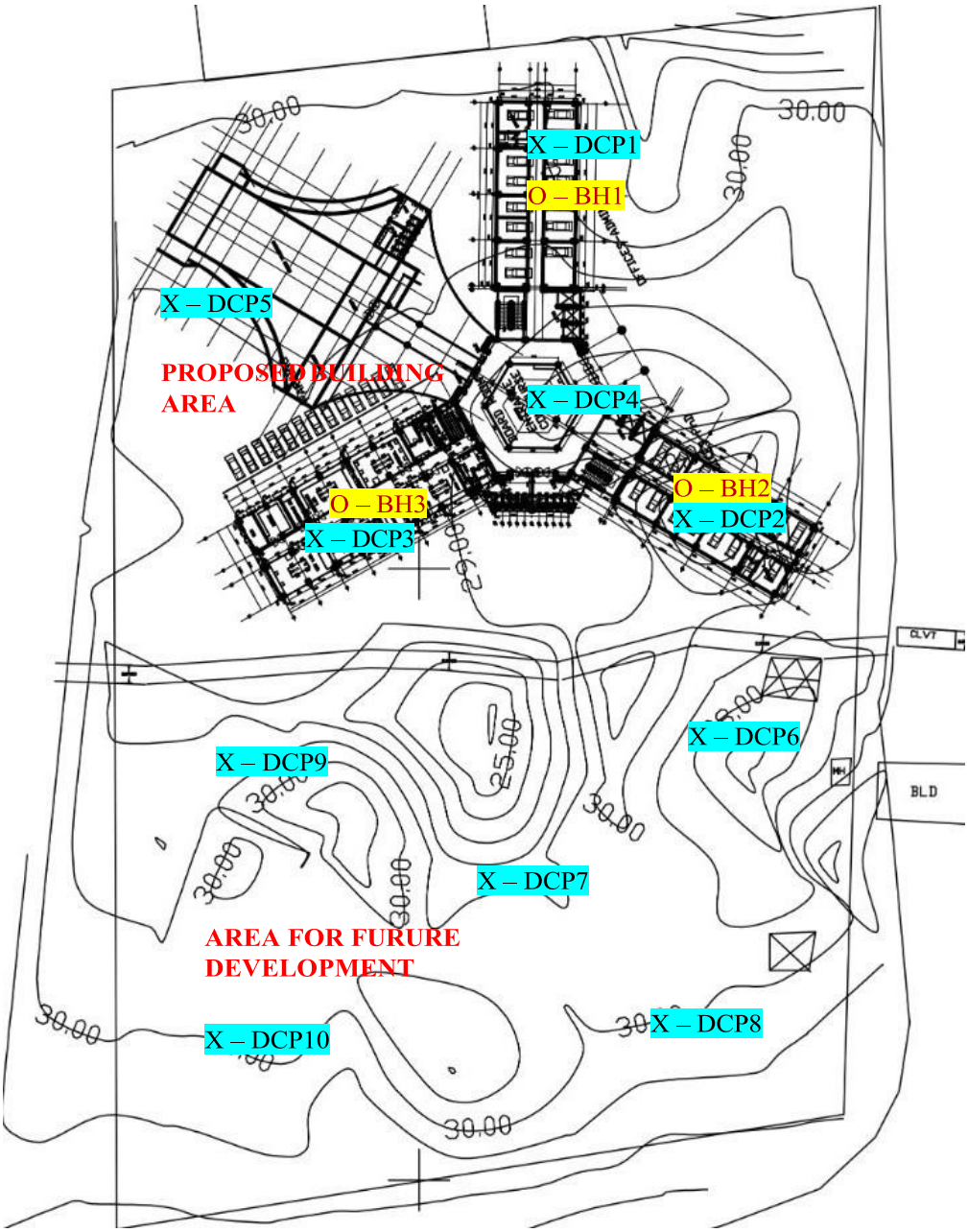


Figure 3. Location of Test Points

3.4 Laboratory Tests

The following standard engineering tests shall be performed on the soil samples retrieved from the boreholes:

- Moisture Content
- Particle Size Distribution (by Wet Sieving)
- Atterberg Limits

The tests were done in accordance with the following test methods/standard.

BS1377: Methods of Test for Soils for Civil Engineering Purposes.

ASTM D2217/GHA S7 - Sieve Analysis of Granular Soils,

ASTM D4318/GHA S6 - Determination of Atterberg Limits of Soil Fines.

Differential Free Swell (DFS) Test was also carried out on samples of the soils. The DFS test consists of the following process. Two samples of the dried soil passing the 0.425mm sieve and weighing 10g each were taken. One sample was put in a 50cc graduated glass cylinder containing distilled water and the other containing kerosene. Both samples were left for at least 24 hours and their volumes noted.

The DFS is expressed as:

$$\frac{\text{Volume of soil in water} - \text{Volume of soil in kerosene}}{\text{Volume of soil in kerosene}} \times 100\ \%$$

The DFS values were used to assess the compressibility of the soils.

3.5 Soil Profile and Soil Properties

The test pit revealed that the site has a soil profile of loose brown clayey SAND topsoil lying over loose to medium dense yellowish brown gravelly clayey SAND to a depth of about 6m The soil gradually changed into dense to very dense mottled yellow/reddish brown decomposed/weathered SANDSTONE.

The soil profile and the properties of the soil obtained from the laboratory tests are shown in Appendix A.

Water was encountered in all the boreholes. The water was encountered at depth between 1.2 – 1.8m. The water levels stabilised at 1.0 after 24 hours.

The laboratory test results on the soil samples are summarised in Table 2.

Table 2: Summary of Laboratory Test Results for Borehole Soil Samples

Sample Identification		Grading			Atterberg Limits			Swell Potential
	Moisture Content (%)	Gravel Content (%)	Sand Content (%)	Silt/Clay Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	DFS (%)
BH1 ds1 0.2 – 1.3m	4.5	3	70	27	13	10	3	0
BH1 ds2 1.3 – 3.4m	14.9	0	56	44	34	11	23	12
BH1 ds3 3.4 – 3.8m	16.2	57	25	18	38	12	26	18
BH1 ds4 3.8 – 6.3m	22.6	0	40	60	40	16	24	37
BH1 ds5 6.3 – 8.8m	16.7	0	69	31	29	17	12	0
BH2 ds1 0.4 – 2.1m	17.2	3	37	60	18	8	10	36
BH2 ds2 2.1 – 5.5m	17.8	0	62	38	35	12	23	36
BH2 ds3 5.5 – 8.7m	17.7	0	72	28	29	18	11	0
BH3 ds1 0 – 1.6m	12.0	1	62	37	Non-Plastic			0
BH3 ds2 1.6 – 6.6m	17.0	0	55	45	41	12	29	24
BH3 ds3 6.6 – 9.0m	15.3	0	73	27	24	18	6	36

The liquid limits and the plasticity indexes of the clayey SAND upper soil layers fall within Zone 4 of the Plasticity Chart (Figure 4). The highly decomposed/weathered SANSTONE fall within Zone 2 of the Plasticity Chart. The results indicate that the clayey SAND has medium plasticity and the weathered SANDSTONE has low plasticity.

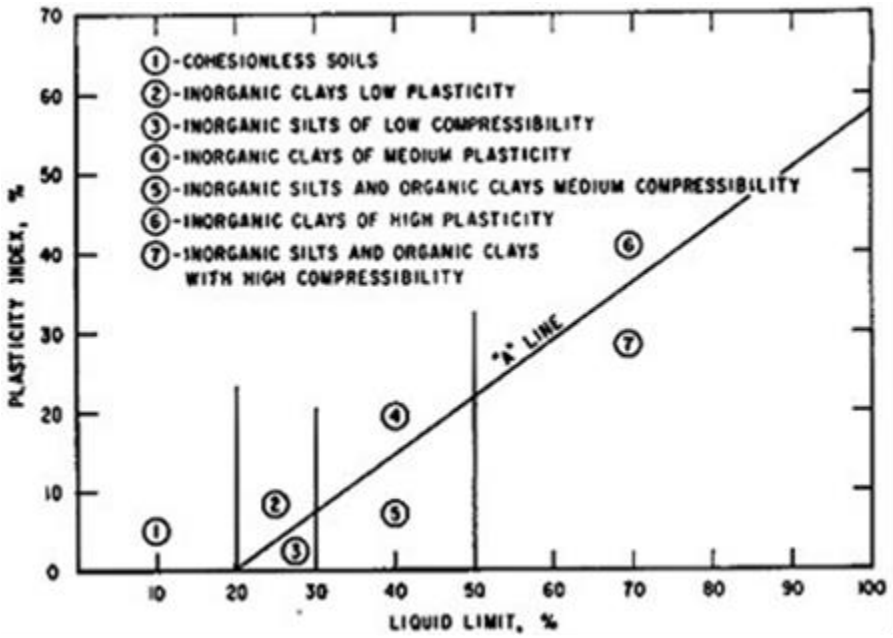


Figure 4. Casagrande Plasticity Chart.

Peck, Hansen and Thorburn (1974) related the plasticity index to the swelling potential of soils in a simple relation shown in Table 3. (Ref. 3)

Table 3. Relationship between Plasticity Index and swelling potential

Swelling Potential	Plasticity Index (%)
Low	0-10
Medium	10-20
High	20-35
Very high	35 and above

The degree of expansiveness of soils and the possible damage to light loaded structures may be quantitatively assessed from Table 4.

Table 4. Relationship between Differential Free Swell and Degree of Expansiveness

Differential Free Swell (%)	Degree of Expansiveness
Less than 20	Low
20-35	Moderate
35-50	High
Greater than 50	Very High

The clayey SAND has moderate to high potential to undergo volume change with variation in soil moisture. When the moisture within the clayey SAND vary between the dry and wet seasons, it is likely to cause alternate shrinkage and swelling of the soil. This could result in differential ground movement if the moisture distribution is not uniform.

The decomposed/highly weathered SANDSTONE has no potential to undergo volume change with variation in soil moisture.

A sample of the water collected from borehole 3 was tested to determine pH value, Sulphate Content and Chloride ion concentration in order to establish whether there is considerable amount of salts in the soil that may be aggressive to buried concrete and steel. The results of the chemical test on the water sample are presented in Table 5 and in Appendix B.

Table 5: Chemical Test Results on Water Samples

Borehole No.	PH	CI (mg/I)	SO4 (mg/l)
3	5.1	8730	928
Limits	6.85	400	300

The levels of chlorides and sulphate in the water are higher than the prescribed limits of BRE Digest Standard of maximum 400mg/l and 300mg/l respectively. The buried concrete and reinforcement steel are highly susceptible to attack by the salts. The use of admixtures that will counteract the adverse effects of the salts, during production of concrete for the substructure is recommended. A dense concrete mix is therefore recommended for construction of the structures.

The site is close to the Gulf of Guinea and the air is likely to be saline and aggressive. Reinforcement steel should not be exposed to the environment for long periods.

3.6 Estimation of Bearing Capacity of Ground Medium

The strength characteristics of the overburden granular soils may be evaluated by converting the unit resistance of the ground into either allowable bearing capacity or standard penetration (N) blow- counts.

The dynamic cone penetration r, defined as the number of blows required for advancing the cone by 10cm may be converted into unit resistance R_D of the ground in kN/m^2 or kPa using the formula

$$R_D = \frac{Ae(m+P)}{m^2 H} \quad \text{————}$$

Where 'e' is the penetration per blow in cm (i.e **e=10/r**)

Using the above parameters for the dynamic cone penetrometer used, it can be shown that

$$R_D = \frac{6250}{e}\left(kN/m^2\right)$$

Substituting 10/r for 'e'

$R_D = 625r$

For shallow foundations, the ultimate bearing capacity $\mathbf{q_{ult}}$ may be obtained from the unit R_D by the following relationship (Ref. 4)

$$q_{ult} = \frac{R_D}{20}\left(kN/m^2\right)$$

The ultimate bearing capacity may be obtained from the approximate relationship: q_{ult}

$= 30\ r\ (kN/m^2)$

The ultimate bearing capacity (q_{ult}) is the estimated load limit at which failure is expected to occur. This value is lowered by a safety factor to arrive at the allowable bearing capacity ($\mathbf{q_{all}}$) to be used for the design of the foundations. The choice of safety factor should be based on the

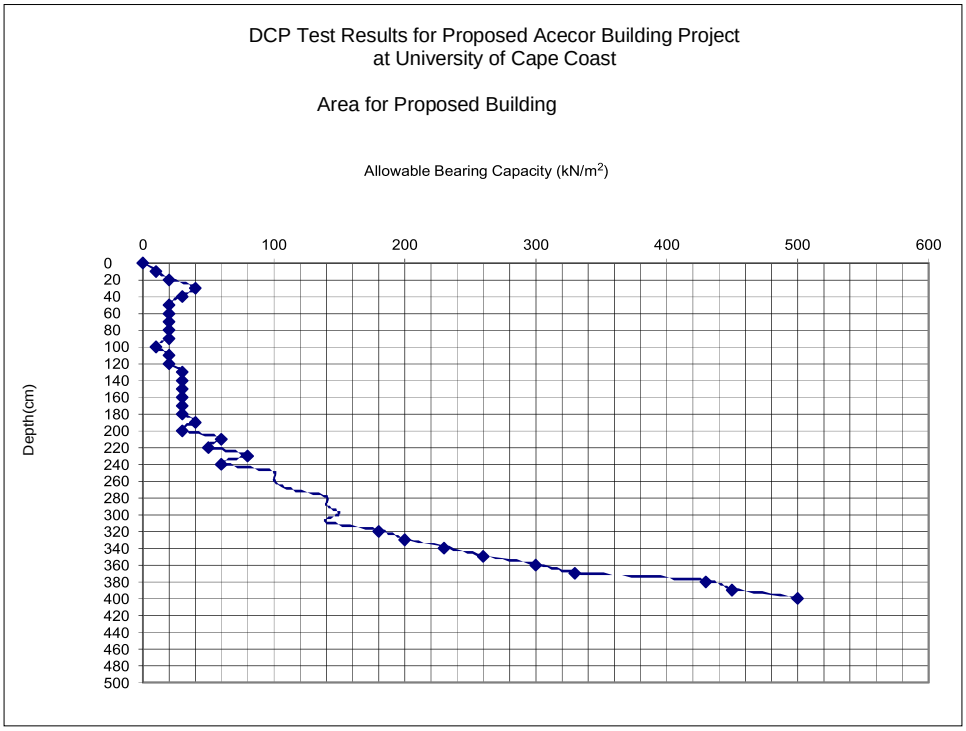
extent of subsurface investigation, reliability of the estimated loads, importance of the structure and consequences of failure. The choice of safety factor should be based on the extent of subsurface investigation, reliability of the estimated loads, importance of the structure and consequences of failure. The designer may consider a safety factor in the range 2.0 to 4.0. A safety factor of 3.0 has been applied to the minimum ultimate bearing capacity values. The estimated bearing capacities are presented in Tables 6 and 7 for the area for the proposed building and the area for future development respectively. Variation of the bearing capacities with depth has been presented in the Graphs in Figure 6 and 7. The depths has not been referenced to a specific datum.

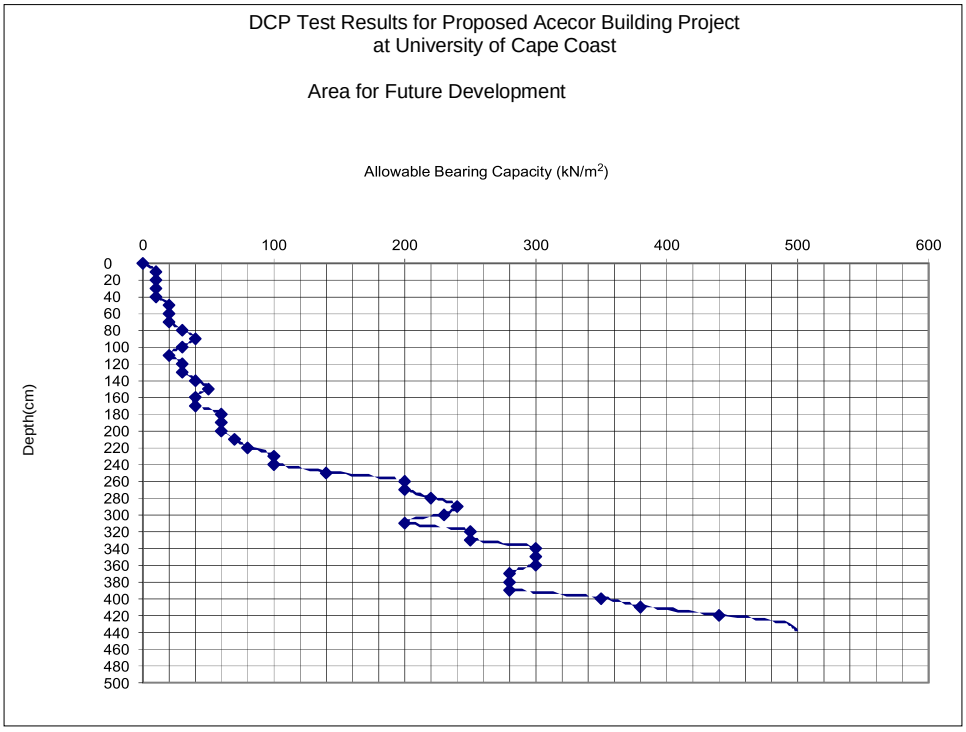
Table 6. Bearing Capacity for Proposed Building Area

Depth (m)	Ultimate Bearing Capacity q_{ult} (kN/m^2)						q_{all} (kN/m^2)
	Test 1	Test 2	Test 3	Test 4	Test 5	Minimum	
0.10	30	30	150	90	60	30	10
0.20	120	60	300	120	120	60	20
0.30	120	120	360	120	180	120	40
0.40	120	90	330	120	180	90	30
0.50	60	120	330	90	120	60	20
0.60	60	90	270	60	60	60	20
0.70	90	120	270	60	90	60	20
0.80	60	120	180	90	60	60	20
0.90	60	60	180	60	60	60	20
1.00	90	90	150	30	90	30	10
1.10	90	120	180	60	90	60	20
1.20	60	90	240	60	90	60	20
1.30	90	150	240	240	120	90	30
1.40	90	120	300	240	120	90	30
1.50	90	120	300	180	120	90	30
1.60	90	120	210	120	150	90	30
1.70	90	120	180	120	90	90	30
1.80	150	150	210	90	120	90	30
1.90	120	150	210	120	120	120	40
2.00	150	180	240	90	120	90	30
2.10	180	390	360	180	240	180	60
2.20	150	450	360	150	270	150	50
2.30	240	450	360	240	330	240	80
2.40	180	480	420	330	270	180	60
2.50	300	540	540	330	330	300	100
2.60	420	570	600	300	360	300	100
2.70	360	630	510	330	510	330	110
2.80	420	810	600	450	450	420	140
2.90	420	900	660	450	510	420	140
3.00	570	1200	690	450	450	450	150
3.10	540	1110	690	420	540	420	140
3.20	540	1200	750	660	540	540	180
3.30	750	1260	750	900	600	600	200
3.40	900	1350	1350	900	690	690	230
3.50	990	1380	1470	780	870	780	260
3.60	1020	1500	1290	900	960	900	300
3.70	1320		1290	990	1260	990	330
3.80	1410		1440	1290	1470	1290	430
3.90	1440		1380	1350	1500	1350	450
4.00	1500		1500	1500		1500	500

Table 7. Bearing Capacity for Area for Future Development

Depth (m)	Ultimate Bearing Capacity q_{ult} (kN/m^2)						q_{all} (kN/m^2)
	Test 1	Test 2	Test 3	Test 4	Test 5	Minimum	
0.10	60	30	90	30	30	30	10
0.20	30	30	60	60	30	30	10
0.30	60	30	60	90	30	30	10
0.40	180	120	60	90	30	30	10
0.50	240	120	120	120	60	60	20
0.60	180	210	180	240	60	60	20
0.70	120	180	150	240	60	60	20
0.80	90	240	150	270	120	90	30
0.90	120	300	150	270	180	120	40
1.00	150	270	90	240	150	90	30
1.10	90	270	60	390	270	60	20
1.20	90	270	90	180	270	90	30
1.30	90	210	150	180	300	90	30
1.40	120	210	210	210	390	120	40
1.50	150	210	240	210	420	150	50
1.60	120	270	330	210	450	120	40
1.70	120	270	390	240	510	120	40
1.80	180	210	390	180	450	180	60
1.90	180	240	390	300	480	180	60
2.00	180	240	330	300	510	180	60
2.10	300	210	420	450	480	210	70
2.20	360	240	390	450	450	240	80
2.30	450	360	360	510	300	300	100
2.40	540	420	420	690	300	300	100
2.50	600	660	510	750	420	420	140
2.60	600	660	750	900	630	600	200
2.70	600	750	780	1200	630	600	200
2.80	660	1050	750	1320	750	660	220
2.90	720	1050	750	870	720	720	240
3.00	690	1050	780	1020	720	690	230
3.10	810	1140	690	1050	600	600	200
3.20	750	1350	750	1080	840	750	250
3.30	900	1350	750	1050	900	750	250
3.40	990	1440	900	1140	990	900	300
3.50	990	1440	900	1320	960	900	300
3.60	960	1260	900	1380	900	900	300
3.70	960	1260	840	1380	840	840	280
3.80	990	1410	840	1470	900	840	280
3.90	1050	1350	840	1500	1020	840	280
4.00	1170	1470	1050		1080	1050	350
4.10	1260	1500	1140		1200	1140	380
4.20	1440		1320		1440	1320	440
4.30	1500		1470		1500	1470	490
4.40			1500			1500	500


DCP Test Results for Proposed Acecor Building Project
at University of Cape Coast
Area for Proposed Building
Allowable Bearing Capacity (kN/m2)
Depth(cm)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
460
480
500


DCP Test Results for Proposed Acecor Building Project
at University of Cape Coast
Area for Future Development
Allowable Bearing Capacity (kN/m2)
Depth(cm)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
460
480
500

3.7 Foundations

The nature of the sub-soils is such that shallow foundations could be considered for the proposed structures. Pad or spread footings placed at a minimum depth of 2.5m may be considered. A bearing capacity of 100kN/m^2 may be adopted for the design.

Due to the moderate to high potential to undergo volume change with variation in soil moisture, it is advised that the columns should be tied with ground beams to limit the adverse effect of any uneven ground movement that may occur.

Adoption of the low bearing capacity of 100kN/m^2 will require very wide footings. A raft foundation or strip foundation designed as inverted T-beams may be considered as other options. A modulus of sub-grade reaction of 1.2 x 10^4kN/m^3 is recommended for design of the raft foundation and strip foundation.

Alternatively, it is advised that short bored piles or caissons should be constructed to transmit the loads to the firm strata at depths greater than 4.0m. An end bearing capacity of 500kN/m^2 may be considered for the caissons. The caps for the caissons should be tied with beams.

Due to the presence of water at a shallow depth of 1.0m, it would be expedient for a pump to be provided at the site during excavation.

The soils are likely to cave in during open excavation and hinder the construction of the substructure. Measures should be taken to minimize the effect of the collapsing sides of the excavation on the works.

4.0 DISCLAIMER

The designer has the final choice of type of foundation to adopt and how deep to place the foundations after considering all factors that are likely to affect the building during the service life.

These findings are based on the conditions as revealed by the investigation. There may however be some special conditions at the site, though unlikely, which may not have been discovered through the investigation. Any special conditions observed during construction may be brought to our notice for redress.

E. N Bonne Acquah (7/3/2021)

REFERENCES:

(1) Geological Survey Dept. (1998). Geological map of Ghana with mineral deposits.

(2) BRRI (2012). The Seismic Design of Reinforced Concrete Structures.

(3) Gopal Ranjan and Rao. A.S.R. Basic and Applied Soil Mechanics

(4) Sanglerat, G. (1972). The Penetrometer and Soil Exploration. 2nd Edition

APPENDIX A – BOREHOLE LOGS

BOREHOLE LOG

GEOTECHNICAL INVESTIGATION FOR ACECOR BUILDING PROJECT AT UNIVERSITY OF CAPE COAST

CLIENT: FAS CONSULT LIMITED

BORING METHOD: PERCUSSION — **LOGGED BY: E Koranteng**

Hole Diameter: 150mm — **START DATE : 15th February, 2021**

Borehole No.: 1 (Page 1 of 2) Latitude 5.10227, Longitude -1.28471 — **END DATE : 16th February, 2021**

Depth (m)	Assumed Elevation (m)	Sample Type	Soil / Rock Description	SPT Test N-Value	SPT Test Material Recovery (mm)	Rotary Core drilling Core Run (m)	Rotary Core drilling Water Return (%)	Rotary Core drilling Total Core Recovery (%)	Rotary Core drilling RQD (%)	Moisture Content (%)	Consistency Limits Liquid Limit (%)	Consistency Limits Plastic Limit (%)	Consistency Limits Plastic Index (%)	Grading Gravel (%)	Grading Sand (%)	Grading Fines (%)	DFS (%)
0.0																	
0.1			Loose blackish SAND (Topsoil)														
0.2																	
0.3																	
0.4																	
0.5																	
0.6																	
0.7		ds1	Loose yellowish brown fine to medium grained							4.5	13	10	3	3	70	27	0
0.8			SAND														
0.9																	
1		SPT1		N=3	150												
1.1																	
1.2																	
1.3																	
1.4																	
1.5																	
1.6		ds2								14.9	34	11	23	0	56	44	12
1.7																	
1.8		▼															
1.9																	
2		SPT2		N=6	400												
2.1																	
2.2																	
2.3			Firm to stiff mottled yellow, green, grey, white,														
2.4			brown fine to medium grained clayey SAND														
2.5			with pocket sof gravel														
2.6																	
2.7																	
2.8																	
2.9																	
3		SPT3		N=21	325												
3.1																	
3.2																	
3.3																	
3.4																	
3.5																	
3.6		ds3	Medium dense to dense mottled red, brown,							16.2	38	12	26	57	25	18	18
3.7			yellow, green, grey sandy, clayey GRAVEL														
3.8																	
3.9																	
4		SPT4		N=14	225												
4.1																	
4.2																	
4.3			Stiff to hard mottled yellow, green, grey, light														
4.4			brown, dark brown clayey SAND														
4.5																	
4.6																	
4.7																	
4.8																	
4.9																	
5		SPT5		N=16	380												

LEGEND

ds - disturbed sample — LL - Liquid Limit

ud - undisturbed sample — PL - Plastic Limit

SPT - Standard Penetration Test Sample — PI - Plasticity Index

nmc - natural moisture content — DFS- Differential Free Swell

▼ Ground Water level

Notes

Refusal recorded at 7m

BOREHOLE LOG

GEOTECHNICAL INVESTIGATION FOR ACECOR BUILDING PROJECT AT UNIVERSITY OF CAPE COAST

CLIENT: FAS CONSULT LIMITED

BORING METHOD: PERCUSSION — **LOGGED BY: E Koranteng**

Hole Diameter: 150mm — **START DATE : 15th February, 2021**

Borehole No.: 1 (Page 2 of 2) Latitude 5.10227, Longitude -1.28471 — **END DATE : 16th February, 2021**

Depth (m)	Assumed Elevation (m)	Sample Type	Soil / Rock Description		SPT Test N-Value	SPT Test Material Recovery (mm)	Rotary Core drilling Core Run (m)	Rotary Core drilling Water Return (%)	Rotary Core drilling Total Core Recovery (%)	Rotary Core drilling RQD (%)	Moisture Content (%)	Consistency Limits Liquid Limit (%)	Consistency Limits Plastic Limit (%)	Consistency Limits Plastic Index (%)	Grading Gravel (%)	Grading Sand (%)	Grading Fines (%)	DFS (%)
5.0																		
5.1																		
5.2																		
5.3																		
5.4																		
5.5		ds4	Stiff to hard mottled yellow, green, grey, light								22.6	40	16	24	0	40	60	37
5.6			brown, dark brown clayey SAND															
5.7																		
5.8																		
5.9																		
6		SPT6			N=22	390												
6.1																		
6.2																		
6.3																		
6.4																		
6.5																		
6.6																		
6.7																		
6.8																		
6.9																		
7		SPT7			N=62	260												
7.1																		
7.2																		
7.3																		
7.4		ds5	Dense to very dense mottled yellow, green,								16.7	29	17	12	0	69	31	0
7.5			grey, black, brown highly weathered															
7.6			SANDSTONE															
7.7																		
7.8																		
7.9																		
8		SPT8			N=60	180												
8.1																		
8.2																		
8.3																		
8.4																		
8.5																		
8.6																		
8.7																		
8.8		SPT9			N=60	0												
8.9				End of hole														
9																		
9.1																		
9.2																		
9.3																		
9.4																		
9.5																		
9.6																		
9.7																		
9.8																		
9.9																		
10																		

LEGEND

ds - disturbed sample

ud - undisturbed sample

SPT - Standard Penetration Test Sample

nmc - natural moisture content

LL - Liquid Limit

PL - Plastic Limit

PI - Plasticity Index

DFS- Differential Free Swell

▼ Ground Water level

Notes

Referenced recorded at 7m

BOREHOLE LOG

GEOTECHNICAL INVESTIGATION FOR ACECOR BUILDING PROJECT AT UNIVERSITY OF CAPE COAST

CLIENT: FAS CONSULT LIMITED

BORING METHOD: PERCUSSION — **LOGGED BY: E Koranteng**

Hole Diameter: 150mm — **START DATE : 18th February, 2021**

Borehole No.: 2 (Page 1 of 2) Latitude 5.10187, Longitude -1.28440 — **END DATE : 19th February, 2021**

Depth (m)	Assumed Elevation (m)	Sample Type	Soil / Rock Description	SPT Test N-Value	Material Recovery (mm)	Rotary Core Drilling: Core Run (m)	Water Return (%)	Total Core Recovery (%)	RQD (%)	Moisture Content (%)	Consistency Limits: Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Grading: Gravel (%)	Sand (%)	Fines (%)	DFS (%)
0.0																	
0.1																	
0.2			Loose mottled black, yellow, green, grey														
0.3			clayey SAND														
0.4																	
0.5																	
0.6																	
0.7																	
0.8		ds1								17.2	18	8	10	3	37	60	36
0.9																	
1		SPT1	Soft mottled yellow, green, grey	N=2	0												
1.1			sandy CLAYwith pocket sof gravel														
1.2		▼															
1.3																	
1.4																	
1.5																	
1.6																	
1.7																	
1.8																	
1.9																	
2		SPT2		N=9	450												
2.1																	
2.2																	
2.3																	
2.4																	
2.5																	
2.6																	
2.7		ds2								17.8	35	12	23	0	62	38	36
2.8																	
2.9																	
3		SPT3		N=8	450												
3.1																	
3.2																	
3.3			Stiff to hard mottled yellow, green, grey														
3.4			brown, sandy CLAYwith pocket sof gravel														
3.5																	
3.6																	
3.7																	
3.8																	
3.9																	
4		SPT4		N=20	340												
4.1																	
4.2																	
4.3																	
4.4																	
4.5																	
4.6																	
4.7																	
4.8																	
4.9																	
5		SPT5		N=22	400												

LEGEND

ds - disturbed sample

ud - undisturbed sample

SPT - Standard Penetration Test Sample

nmc - natural moisture content

End of hole

LL - Liquid Limit

PL - Plastic Limit

PI - Plasticity Index

DFS- Differential Free Swell

▼ Ground Water level

Notes

Refusal recorded at 8.7m

BOREHOLE LOG

GEOTECHNICAL INVESTIGATION FOR ACECOR BUILDING PROJECT AT UNIVERSITY OF CAPE COAST

CLIENT: FAS CONSULT LIMITED

BORING METHOD: PERCUSSION — **LOGGED BY: E Koranteng**

Hole Diameter: 150mm — **START DATE : 18th February, 2021**

Borehole No.: 2 (Page 2 of 2) Latitude 5.10187, Longitude -1.28440 — **END DATE : 19th February, 2021**

Depth (m)	Assumed Elevation (m)	Sample Type	Soil / Rock Description		SPT Test N-Value	SPT Test Material Recovery (mm)	Rotary Core drilling Core Run (m)	Rotary Core drilling Water Return (%)	Rotary Core drilling Total Core Recovery (%)	Rotary Core drilling RQD (%)	Moisture Content (%)	Consistency Limits Liquid Limit (%)	Consistency Limits Plastic Limit (%)	Consistency Limits Plastic Index (%)	Grading Gravel (%)	Grading Sand (%)	Grading Fines (%)	DFS (%)
5.0																		
5.1																		
5.2			Stiff to hard motted yellow, green, grey															
5.3			brown, sandy CLAY with pocket sof gravel															
5.4																		
5.5																		
5.6																		
5.7																		
5.8																		
5.9																		
6		SPT6			N=22	380												
6.1																		
6.2																		
6.3																		
6.4																		
6.5																		
6.6																		
6.7																		
6.8																		
6.9																		
7		SPT7	Medium dense to very dense motted yellow,		N=48	340												
7.1			green, grey, black, brown highly weathered															
7.2			SANDSTONE															
7.3																		
7.4																		
7.5																		
7.6																		
7.7		ds3									17.7	29	18	11	0	72	28	0
7.8																		
7.9																		
8		SPT8			N=48	370												
8.1																		
8.2																		
8.3																		
8.4																		
8.5																		
8.6																		
8.7																		
8.8		SPT9			N=50	30												
8.9				End of hole														
9																		
9.1																		
9.2																		
9.3																		
9.4																		
9.5																		
9.6																		
9.7																		
9.8																		
9.9																		
10																		

LEGEND

ds - disturbed sample

ud - undisturbed sample

SPT - Standard Penetration Test Sample

nmc - natural moisture content

End of hole

LL - Liquid Limit

PL - Plastic Limit

PI - Plasticity Index

DFS- Differential Free Swell

▼ Ground Water level

Notes

Refusal recorded at 8.7m

BOREHOLE LOG

GEOTECHNICAL INVESTIGATION FOR ACECOR BUILDING PROJECT AT UNIVERSITY OF CAPE COAST

CLIENT: FAS CONSULT LIMITED

BORING METHOD: PERCUSSION — **LOGGED BY: E Koranteng**

Hole Diameter: 150mm — **START DATE : 16th February, 2021**

Borehole No.: 3 (Page 1 of 2) Latitude 5.10191, Longitude -1.28489 — **END DATE : 17th February, 2021**

Depth (m)	Assumed Elevation (m)	Sample Type	Soil / Rock Description	SPT Test N-Value	SPT Material Recovery (mm)	Rotary Core Drilling: Core Run (m)	Water Return (%)	Total Core Recovery (%)	RQD (%)	Moisture Content (%)	Consistency Limits: Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Grading: Gravel (%)	Sand (%)	Fines (%)	DFS (%)
0.0																	
0.1																	
0.2																	
0.3																	
0.4																	
0.5																	
0.6		ds1								12.0	Non- Plastic			1	62	37	0
0.7			Loose mpt tled black, brown, yellow, green														
0.8			fine to medium grained clayey SAND														
0.9																	
1		SPT1		N=2	0												
1.1																	
1.2																	
1.3																	
1.4																	
1.5		ds2								10.9	42	20	22	8	71	21	79
1.6																	
1.7		▼															
1.8																	
1.9																	
2		SPT2		N=6	450												
2.1																	
2.2																	
2.3																	
2.4																	
2.5		ds2								17.0	41	12	29	0	55	45	24
2.6																	
2.7			Stiff to hard mottled yellow, green, grey														
2.8			brown, clayey SAND with pocket sof gravel														
2.9																	
3		SPT3		N=7	410												
3.1																	
3.2																	
3.3																	
3.4																	
3.5																	
3.6																	
3.7																	
3.8																	
3.9																	
4		SPT4		N=16	450												
4.1																	
4.2																	
4.3																	
4.4																	
4.5																	
4.6																	
4.7																	
4.8																	
4.9																	
5		SPT5		N=25	420												

LEGEND

ds - disturbed sample

ud - undisturbed sample

SPT - Standard Penetration Test Sample

nmc - natural moisture content

End of hole

LL - Liquid Limit

PL - Plastic Limit

PI - Plasticity Index

DFS- Differential Free Swell

▼ Ground Water level

Notes

Refusal recorded at 7m

BOREHOLE LOG

GEOTECHNICAL INVESTIGATION FOR ACECOR BUILDING PROJECT AT UNIVERSITY OF CAPE COAST

CLIENT: FAS CONSULT LIMITED

BORING METHOD: PERCUSSION — **LOGGED BY: E Koranteng**

Hole Diameter: 150mm — **START DATE: 16th February, 2021**

Borehole No.: 3 (Page 2 of 2) Latitude 5.10191, Longitude -1.28489 — **END DATE : 17th February, 2021**

Depth (m)	Assumed Elevation (m)	Sample Type	Soil / Rock Description	SPT Test N-Value	Material Recovery (mm)	Rotary Core drilling: Core Run (m)	Water Return (%)	Total Core Recovery (%)	RQD (%)	Moisture Content (%)	Consistency Limits: Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Grading: Gravel (%)	Sand (%)	Fines (%)	DFS (%)
5.0																	
5.1																	
5.2																	
5.3																	
5.4																	
5.5																	
5.6																	
5.7			Stiff to hard mottled yellow, green, grey														
5.8			brown, clayey SAND with pocket sof gravel														
5.9																	
6		SPT6		N=33	370												
6.1																	
6.2																	
6.3																	
6.4																	
6.5																	
6.6																	
6.7																	
6.8																	
6.9																	
7		SPT7		N=55	270												
7.1																	
7.2																	
7.3																	
7.4																	
7.5		ds3	Very dense mottled yellow, green, grey, black							15.3	24	18	6	0	73	27	36
7.6			brown highly weathered SANDSTONE														
7.7																	
7.8																	
7.9																	
8		SPT8		N=60	270												
8.1																	
8.2																	
8.3																	
8.4																	
8.5																	
8.6																	
8.7																	
8.8																	
8.9																	
9		SPT9		N=60	240												
9.1			End of hole														
9.2																	
9.3																	
9.4																	
9.5																	
9.6																	
9.7																	
9.8																	
9.9																	
10																	

LEGEND

ds - disturbed sample

ud - undisturbed sample

SPT - Standard Penetration Test Sample

nmc - natural moisture content

LL - Liquid Limit

PL - Plastic Limit

PI - Plasticity Index

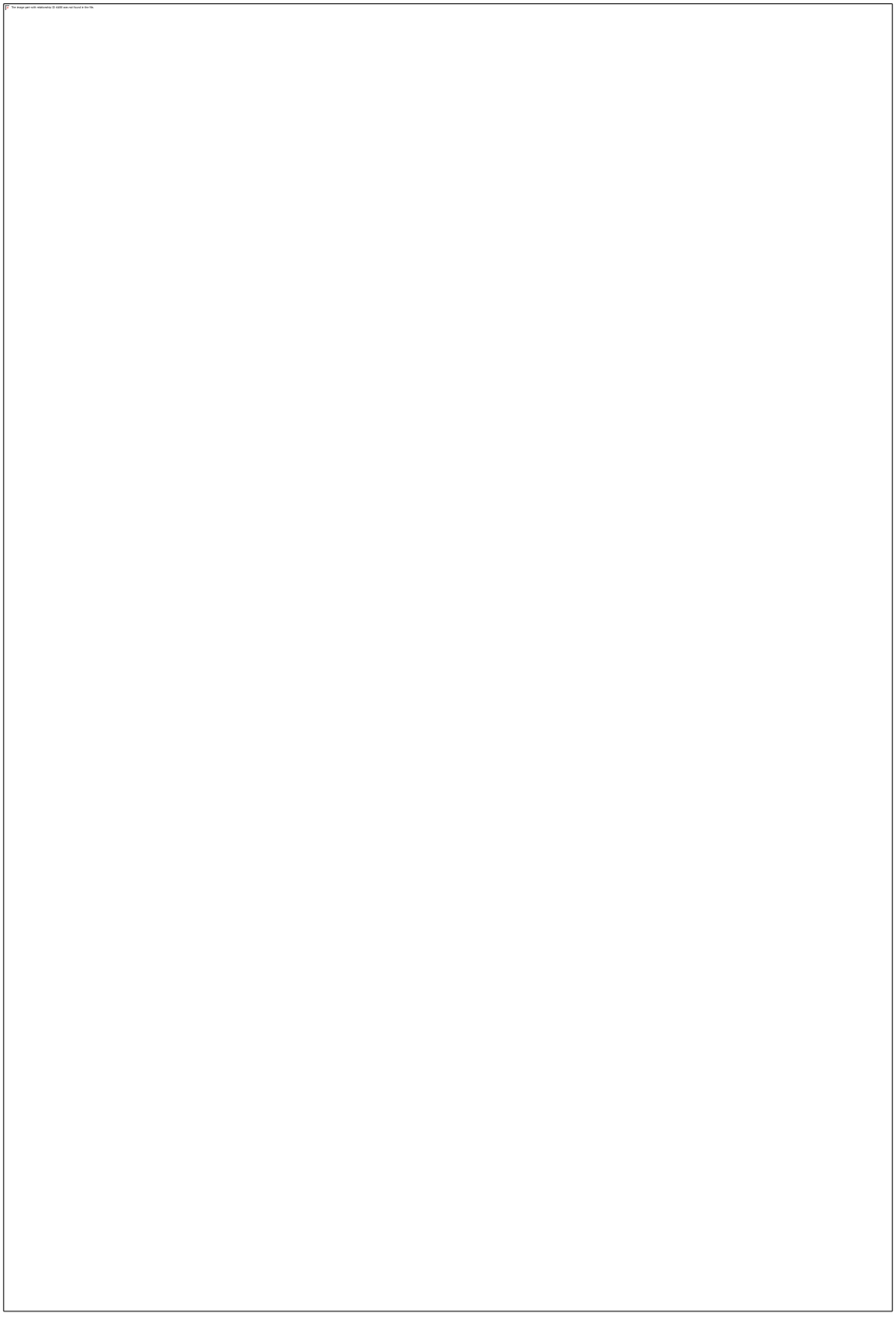
DFS- Differential Free Swell

▼ Ground Water level

Notes

Refusal recorded at 7m

APPENDIX B – CHEMICAL TEST ON WATER SAMPLE



14.6 ANNEX 6: LETTER FROM THE ESTATE DEPARTMENT OF UNIVERSITY OF CAPE COAST