

# **ENVIRONMENTAL MANAGEMENT PLAN**

## **ASIB LIMITED**

### **Project Title:**

Construction of Four (4) Storey Regional Water and Environmental Sanitation Centre Kumasi  
(RWESCK)

at

Kwame Nkrumah University of Science and Technology (KNUST)

Kumasi

**December, 2016**

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## ABBREVIATIONS

CO	Carbon Monoxide
EA	Environmental Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPC	Environmental Protection Council
KNUST	Kwame Nkrumah University of Science and Technology
LI	Legislative Instrument
NRCD	National Redemption Council Decree
OP	Operational Policies
PM	Particulate Matter
RWESCK	Regional Water and Environmental Sanitation Centre Kumasi
SMCD	Supreme Military Council Decree
VOC	Volatile Organic Carbon
WB	World Bank

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## Preamble

In the context of this document, the following agencies/organizations are deemed as follows;

World Bank	-	Project funder
Government of Ghana	-	Borrower
ASIB Limited	-	Contractor
Development Office, KNUST	-	Client, acting on behalf of the Regional Water and Environmental Sanitation Centre Kumasi (RWESCK)

The Environmental Management Plan has been prepared in view of the fact that the necessary Environmental Assessment has been conducted and permit received from the Environmental Protection Agency, Ghana. It is also deemed that land and project site have been acquired legally by the Client.

The Environmental Management Plan is consistent with the requirements of national laws, regulations and technical guidelines, as well as World Bank's safeguard policies, including the World Bank Group Environmental, Health and Safety Guidelines. The plan applies the latest available and relatively economic strategy to achieve the project's mitigation objectives.

## Executive Summary

The construction of Four (4) Storey complex for the Regional Water and Environmental Sanitation Centre Kumasi (RWESCK) is classified as a low-risk construction project. The project will mainly involve civil works in the construction of classrooms, offices and laboratories for postgraduate studies.

Following from an Environmental Assessment (EA) approved by the Environmental Protection Agency (EPA), Ghana the Environmental Management Plan (EMP) takes into account potential environmental impacts and establishes mitigation, continues monitoring and active measures to manage and/or reduce to optimal levels, social and environmental impacts of the project coupled with a step-by-step procedure for the successful management and implementation of all suggested actions. The drafting of the EMP document adopts the World Bank Operational Policies 4.01 on Environmental Assessment and Environmental Management Plan Checklist format E1485 v2 for Low-risk Topologies. The document is summarized under three (3) broad sections;

**Section I** provides a background to the project, project concept including all technical and administrative aspects and outlines legal, governance and institutional arrangement.

**Section II** follows a screening checklist of potential socio-environmental impacts. The checklist summarizes potential social and environmental impacts in a format that enables the selection of a “Yes” or “No” response to the potential impact. Potential impacts which are clearly marked “Yes” are referenced to appropriate mitigation measures.

**Section III** summarizes a monitoring plan, which can be perused by both technical and non-technical stakeholders which includes but not limited to the funder, environmental safeguard specialists, contractor, client, the Environmental Protection Agency (EPA) – Ghana, as well as the general public. The plan provides a guide to all stakeholders to independently monitor the enforcement of recommended mitigation steps and all procedures leading to the minimization of the social and environmental impacts of the project.

Overall, the Environmental Management Plan is consistent with local and international requirements such as national laws, legal frameworks, regulations, policies and technical guidelines, as well as World Bank's environmental safeguard policies. Particularly, in preparing this plan, environmental friendly technical approaches with sound economic strategies are recommended to achieve mitigation.

## SECTION I

### PROJECT CONCEPT AND DESCRIPTION, LEGAL AND GOVERNANCE ISSUES

#### 1.1 Project concept and description

The Regional Water and Environmental Sanitation Centre Kumasi (RWESCK) of the Kwame Nkrumah University of Science and Technology (KNUST) is a Centre of Excellence funded by the World Bank through a loan agreement with the Government of Ghana. One major component of the project is the construction of a building to house the Centre. The proposed construction is considered as a Postgraduate Centre, providing space mainly for research and teaching.

The construction of the Four (4) Storey building for RWESCK can be classified under the World Bank's Category C low-risk projects. Category C applies to projects with negligible to no adverse environmental impact. The site has a total area of 30,000 square meters, and a total construction area of 1,139 square meters. The project will mainly involve civil works towards the construction of a complex with a total of twelve (12) Lecture halls, one (1) Auditorium with two hundred and fifty (250) seating capacity, three (3) Laboratories, two (2) Seminar rooms, One (1) Video conference room, One (1) cafeteria, thirty five (35) Offices and two (2) Meeting rooms.

Table 1: Summary Project Description

<b>Main project divisions</b>	<b>Details of construction</b>
Principal aspect of project	Centre building consisting of offices, lecture rooms, laboratories, video conferencing room, seminar and meeting room plus cafeteria Total area of site: 30,000 m <sup>2</sup> Total area of construction: 1,139 m <sup>2</sup> Layers and floors: four layers including ground, first, second, third and fourth floors.
Aided engineering	Project site is supported with a stand-by generator with capacity of 750KVA and other ancillary facilities
Public works	Piped water supplied by Ghana Water Company Limited with merchandised borehole as supplement. Power supply via Electricity Company of Ghana
Environmental protection engineering	Solid Waste Management: collection and disposal to be managed by maintenance department, KNUST. Wastewater Management: Wastewater to be pre-treated before discharge into the sewerage system Landscaping: A sizeable area will be used for growing of grass

Through the World Bank financing, it is intended, that the following will be achieved at the end of the project;

- Adequate space for postgraduate teaching
- Laboratory space to house modern scientific equipment for water and environmental quality analyses and research
- Space for meetings and conferences

### **1.1.1 The Environmental Management Plan and Structure**

The Environmental Management Plan implements appropriate mitigation measures identified in the environmental impact assessment of the project. Its goal is to identify environmental impact, suggest mitigation steps during pre-construction, construction and operations phase and provide a continuous monitoring plan for safeguarding the environment.

The Plan includes the following:

- Identification of Impacts
- Mitigation Measures
- Monitoring Plan
- Emergency Response Plan
- Publicity and Stakeholder Participation Plan
- Capacity Building Programs
- Budget for executing plan

The plan will ensure that the Contractor and Client are conscious of the following during the project life cycle;

- Strict adherence to environmental requirements established by the Environmental Protection Agency and the World Bank
- Obtain the legal permit to execute the project
- Create environmental awareness, stimulate a responsibility and provide opportunity for capacity building and assigning roles and responsibilities to all parties
- Encourage the participation of local communities and relevant stakeholders for project buy-in
- Ensure that affected stakeholders receive the necessary compensation

### **1.2 Legal Requirements**

The Environmental Protection Agency (EPA) is the mandatory agency that oversees the environmental management and planning in Ghana. It was formally established on 30<sup>th</sup> December, 1994 (Act 490) and given the responsibility of regulating the environment and ensuring the implementation of Government policies on the environment. The erstwhile



Environmental Protection Council (EPC) was established by the Environmental Protection Council Decree 1974 (NRCD 239) and was subsequently amended by the EPC (Amendment) Decree 1976 (SMCD 58).

The EPC was mainly an advisory body to Government on issues relating to the environment. However, with the creation of a sector Ministry, it became increasingly necessary to redefine the role of the EPC, particularly since its policy formulation role moved to the Ministry. The Environmental Protection Agency Act, 1994 (Act 490) transformed the Environmental Protection Council into an Agency having, inter alia, regulatory and enforcement role(s). Other existing legislature that provides a legal backing for the operations of the EPA include the Environmental Impact Assessment Procedures (1995) on Environmental Impact Assessment (EIA) procedures and Environmental Assessment (EA) Regulations 1999 (LI 1652).

For development projects in Ghana, with a potential environmental and social impact, it is a requirement to conduct an EA and receive a formal approval from the EPA to commence project activities, thereafter prepare an Environmental Management Plan to address the necessary impact. For this reason, the plan has been prepared.

### 1.3 Governance

The general overview of the projects site, general administrative and legal framework is expressed in details below;

Table 2: Legal, governance and institutional arrangement of the project

<b>General overview of project and institutional arrangement</b>				
<b>Country</b>	Ghana			
<b>Project title</b>	World Bank Africa Centre's of Excellence Project – Construction of Four (4) Storey Regional Water and Environmental Sanitation Centre Kumasi (RWESCK) complex			
<b>Scope of project and activity</b>	Construction of offices, teaching and research space. Construction is classified as a low-risk category C project which typically will involve minimum civil-works.			
<b>Institutional arrangements (Name and contacts)</b>	World Bank Project Lead	Government of Ghana (Ministry of Finance)	Government of Ghana (NCTE)	Development Office, KNUST
	Mr. Andreas Bloom ablom@worldbank.org	Mr. Lawrence Nyanor Lnyanor@mofep.gov.gh	Prof. Mohammed Salifu salifum@ncte.edu.gh	Mrs. Grace Oppong-Peprah gracepeprah@yahoo.com
<b>Implementation arrangements</b>	World Bank's Environmental Safeguard Specialist	EPA, Ghana	Development Office, KNUST	ASIB Limited

<b>PROJECT SITE LOCATION AND DESCRIPTION OF PHYSICAL ENVIRONMENT</b>	
<b>Name of site</b>	Kwame Nkrumah University of Science and Technology (KNUST) Campus
<b>Describe site location</b>	<p>Construction site is located on KNUST campus, Kumasi, Ghana. The site is adjacent to the School of Business, behind the new College of Arts Building. It shares boundaries with Ahinsan Estate to the South and Kotei to the East. The land has a flat surface with good geological conditions.</p> <p>Attachement 1: Site Map [x] Y [ ] N Project site is attached in Annexe 1</p>
<b>Who owns the land?</b>	The acquired land belongs to KNUST and was demarcated for use by the Development Office, after approval was given by the University Management.
<b>Geographic description</b>	<p>GPS Coordinates</p> <p><i>Latitude: 06°39'59.802"N</i></p> <p><i>Longitude 01°33'55.554"W</i></p> <p>(Accuracy 1.50 metres)</p>
<b>LEGAL</b>	
<b>Identify national &amp; local legislation &amp; permits that apply to project activity</b>	<ul style="list-style-type: none"> <li>▪ Environmental Assessment Regulations 1999 (LI 1652) February 1999</li> <li>▪ Environmental Impact Assessment Procedures (1995)</li> <li>▪ Environmental Protection Agency Act 1999 (Act 490)</li> </ul>
<b>PUBLIC CONSULTATION</b>	
<b>Identify when / where the public consultation process took place</b>	The project site is within the secured and legally acquired land space of KNUST. The entire University Campus is seen as a security zone with well defined boundaries warding off encroachers. Consequently, there are no residential facilities within the confines of the project site, hence no public consultations were done apart from internal discussions between the Development Office and University Management for the siting of the construction.
<b>INSTITUTIONAL CAPACITY BUILDING</b>	
<b>Will there be any capacity building?</b>	[ ] Y or [x] N

#### 1.4 World Bank policy

The World Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally friendly, sustainable and contribute to decision making. The proposed project will involve civil works in the construction of office, teaching and research space with minimal to low adverse impact, classifying the impact of the project as Category C under the World Bank Policy on Environmental Assessment (WB OP 4.01), thus requiring an EA and EMP. The EMP summarizes the potential environmental

impact, recommends a monitoring and management plan to minimise the socio-environmental impact of the project. Compliance of the project with World Bank security policy is presented in Table 3;

**Table 3: Compliance with World Bank Security Policy**

<b>The serial number</b>	<b>Security policy</b>	<b>compliance</b>
1	The OP/BP4.01 "Environmental assessment"	The policy is enabled. The EA has been prepared, submitted to the EPA and permit has been received for commencement of project
2	The OP/BP4.04 "Natural habitat"	Policy is not enabled. Citing of project did not require excessive damage to natural habitats
3	The OP/BP4.36 "Forest"	The policy is not enabled. The project will not involve the destruction of forest reserves or destroy natural habitat
4	The OP/BP4.09 "Pest management"	Policy is not enabled. The purchase and application of pesticides in this project is strictly prohibited
5	The OP/BP4.11 The material and cultural resources	Policy is not enabled. Project site when visited was not associated with cultural relics or any ancient sites
6	The OP/BP4.37 "The dam safety "	Policy is not enabled. There is no dam project area.
7	The OP/BP4.10 "The native"	Policy is not enabled. There are no indigenous people currently living on the site. The site is a secured area legally obtained by KNUST through the Government of Ghana
8	The OP/BP4.12 The involuntary immigration	Policy is not enabled
9	The OP/BP7.50 "International waterway project"	Policy is not enabled. No international waterways exist close to the project site
10	The OP/BP7.60 "The dispute region project"	Policy is not enabled. Project site is not within any dispute region.

This project is also in compliance with the World Bank Group Environment, Health and Safety Guidelines. The guideline as well as the management plan is presented in Table 4;

**Table 4: World Bank Environmental Health and Safety Guide**

<b>The world bank "environmental, health and safety guide</b>	<b>Environmental impact assessment/environmental compliance management plan</b>
Dust or particulate matter (PM) is the most common unorganized emissions of pollutants. Some operations (such as solid material transportation and outdoor storage) and bare soil surface (including not paved roads) releases particles.	Excavated soils will be covered with geomembrane and moisture content increased as and when necessary. Surfaces will be sprinkled with water to minimise dust particles and particulate matter in the air
To the public or private wastewater treatment	Wastewater to be pre-treated before discharge

<p>system discharge of industrial waste water and living waste water, waste water produced by utilities operation or rain, meet the emissions into the pre-treatment of the wastewater treatment system and monitoring requirements.</p>	<p>into sewerage system</p>
<p>If in the most sensitive receiver, project facilities or activities generated by the noise will exceed the relevant noise index, noise prevention and control measures should be adopted.</p>	<p>Select the sound power level lower equipment; Repair of mechanical equipment installation vibration isolation device; Limit the operation of the specific equipment or time;</p>
<p>Avoid, minimize and control emissions to human health, safety and environment caused by the negative effects of atmospheric emissions.</p>	<p>Main project waste gas exhaust gasses from the paint spray paint room, paint room fuel gas and a small amount of welding fumes produced in welding process. Suggested that the spray paint and dry type activated carbon environmental protection device for the room of the lacquer that bake, paint mist through filtration + activated carbon filtration layer after filtering harmful substances in waste gas, the discharge outlets, vent stack height should be not less than 15 m, to ensure that the air exhaust emissions, reduce the influence of gas on the surrounding environment. Intermittent welding process, welding gas quantity is less, little influence on the surroundings, suggest welding gas bag filter is adopted to deal with.</p>
<p>For hazardous substances to leak prevention and control plan, training for operators to protect against leakage, implement the inspection plan, map at the scene of the emergency plan of hazardous materials distribution location and operating activities associated with the site, the required personal protective equipment and emergency training to provide a written regulations; In writing rules must be equipped with at least enough to meet the demand of spill accident preliminary processing of spill processing equipment, which lists available when necessary external equipment and manpower resources to overcome the lack of internal resources</p>	<p>For dangerous solid waste, according to the requirements about waste disposal, dedicated storage facilities, storage facilities should be far away from the dormitory, office building, canteen and sensitive areas. Hazardous waste processing by qualified unit would be done regularly.</p>
<p>Sewage treatment facilities for design, construction, operation and maintenance, make the sewage to fulfil the requirements of relevant national or international acceptance criteria</p>	<p>Reach the sewage discharged into urban sewage water quality standard (CJ), 343-2010 A grade</p>

## **1.5 Project Implementation Arrangements**

On behalf of the borrower, Development Office, KNUST will act as the client for the construction. The following arrangement is perceived to be followed during the implementation phase;

### **Pre-construction**

- KNUST will provide land for the proposed construction.
- KNUST will be required to submit to the World Bank for approval, an environmental permit for the construction.

### **Construction**

- KNUST will oversee compliance with monitoring plan
- EPA will monitor progress of the project vis-à-vis compliance with environmental safeguard and mitigation measures

### **Post-Construction**

- KNUST will ensure the use of the building for the intended purpose. Any change(s) in the use should receive the necessary permit from the EPA
- KNUST to ensure safe disposal of waste, both solid and liquid as well as wastewater

## Section II

### Screening Checklist of Potential Socio-environmental Impacts and Mitigation

#### 2.0 Environmental Screening, Assessment and Management

The table below summarizes the environmental and social screening. It provides responses to construction activities and its associated impacts.

Table 5: Environmental and Social screening checklist

<b>ENVIRONMENTAL /SOCIAL SCREENING</b>			
Will the site activity include/involve any of the following potential issues and/or impacts:	Activity and potential issues and/or impacts	Status	Requirements if Yes
	<b>1. Building rehabilitation</b> <ul style="list-style-type: none"> <li>▪ Site specific vehicular traffic</li> <li>▪ Increase in dust and noise from demolition and/or construction</li> <li>▪ Construction waste</li> <li>▪ Risk of accidents and injuries</li> </ul>	[ ] Yes [x] No	See Section <b>B</b> below
	<b>2. New construction</b> <ul style="list-style-type: none"> <li>▪ Excavation impacts and soil erosion</li> <li>▪ Increase sediment loads in receiving waters</li> <li>▪ Site specific vehicular traffic</li> <li>▪ Increase in dust and noise from demolition and/or construction</li> <li>▪ Construction waste</li> <li>▪ Risk of accidents and injuries</li> <li>▪ Soil erosion</li> </ul>	[x] Yes [ ] No	See Section <b>B</b> below
	<b>3. Individual wastewater treatment system</b> <ul style="list-style-type: none"> <li>▪ Types of wastewater treatment system</li> <li>▪ Effluent and/or discharges into receiving waters</li> </ul>	[x] Yes [ ] No	See Section <b>C</b> below
	<b>4. Historic building(s) and districts</b> <ul style="list-style-type: none"> <li>▪ Risk of damage to known/unknown historical or archaeological sites</li> </ul>	[ ] Yes [x] No	See Section <b>D</b> below
	<b>5. Acquisition of land<sup>1</sup></b> <ul style="list-style-type: none"> <li>▪ Encroachment on private property</li> <li>▪ Relocation of project affected persons</li> <li>▪ Involuntary resettlement</li> <li>▪ Impacts on livelihood incomes</li> </ul>	[ ] Yes [x] No	See Section <b>E</b> below
	<b>6. Hazardous or toxic materials<sup>2</sup></b> <ul style="list-style-type: none"> <li>▪ Removal and disposal of toxic and/or hazardous demolition and/or construction waste</li> <li>▪ Storage of machine oils and lubricants</li> <li>▪ Risk of surface and ground water pollution</li> </ul>	[ ] Yes [x] No	See Section <b>F</b> below
	<b>7. Impacts on forests and/or protected areas</b> <ul style="list-style-type: none"> <li>▪ Encroachment on designated forests, buffer and /or protected areas</li> </ul>	[ ] Yes [x] No	See Section <b>G</b> below

	<ul style="list-style-type: none"> <li>▪ Disturbance of locally protected animal habitat</li> </ul>		
	<p><b>8. Handling/management of medical waste</b></p> <ul style="list-style-type: none"> <li>▪ Clinical waste, sharps, pharmaceutical products (cytotoxic and hazardous chemical waste), radioactive waste, organ-</li> </ul>	[ ] Yes [x] No	See Section H below
	<p><b>9. Traffic and Pedestrian Safety</b></p> <ul style="list-style-type: none"> <li>▪ Site specific vehicular traffic</li> <li>▪ Site is in a populated area</li> <li>▪ Possibility of bypass access road to minimize disturbance to population</li> </ul>	[x] Yes [ ] No	See Section I below

<sup>1</sup> Land acquisitions includes displacement of people, change of livelihood encroachment on private property this is to land that is purchased/transferred and affects people who are living and/or squatters and/or operate a business (kiosks) on land that is being acquired.

<sup>2</sup> Toxic/hazardous material includes and is not limited to asbestos, toxic paints, removal of lead paint, etc.

Table 6: Environmental and Social screening mitigation checklist

ACTIVITY	PARAMETER	GOOD PRACTICES MITIGATION MEASURES CHECKLIST
<b>A. General Conditions</b>	Notification and Worker Safety	<ul style="list-style-type: none"> <li>(a) The local construction and environment inspectorates and communities have been notified of upcoming activities</li> <li>(b) The public has been notified of the works through appropriate notification in the media and/or at publicly accessible sites (including the site of the works)</li> <li>(c) All legally required permits (to include not limited to land use, resource use, dumping, sanitary inspection permit) have been acquired for construction and/or rehabilitation</li> <li>(d) All work will be carried out in a safe and disciplined manner designed to minimize impacts on neighbouring residents' environment.</li> <li>(e) Workers' PPE will comply with international good practice (wearing of helmets, as needed, masks and safety glasses and safety boots)</li> <li>(f) Appropriate signposting of the sites will inform workers of key rules and regulations to follow.</li> </ul>
<b>B. General Rehabilitation and /or Construction Activities</b>	Air Quality	<ul style="list-style-type: none"> <li>(a) During interior demolition debris-chutes above the first floor will be used</li> <li>(b) Keep demolition debris in controlled area and spray with water mist to reduce debris dust</li> <li>(c) Suppress dust during pneumatic drilling/wall destruction by ongoing water spraying and/or installing dust screen enclosures at site</li> <li>(d) Keep surrounding environment (sidewalks, roads) free of debris to minimize dust</li> <li>(e) There will be no open burning of construction / waste material at the site</li> <li>(f) There will be no excessive idling of construction vehicles at sites</li> <li>(g) Put tarps over trucks transporting fine debris materials</li> </ul>
	Noise	<ul style="list-style-type: none"> <li>(a) Construction noise will be limited to restricted times agreed to in the permit</li> <li>(b) During operations the engine covers of generators, air compressors and other powered mechanical equipment would be closed, and equipment placed as far away from residential areas as possible</li> <li>(c) Speed limit to trucks and other machineries will be imposed</li> <li>(d) In case blast to be carried out, communities will be informed on the time and duration of the blasts</li> </ul>
	Water Quality	<ul style="list-style-type: none"> <li>(a) The site will establish appropriate erosion and sediment control measures such as e.g. hay bales and / or silt fences to prevent sediment from moving off site and causing excessive turbidity in nearby streams and rivers.</li> </ul>



	Waste management	<p>(a) Waste collection and disposal pathways and sites will be identified for all major waste types expected from demolition and construction activities.</p> <p>(b) Mineral construction and demolition wastes will be separated from general refuse, organic, liquid and chemical wastes by on-site sorting and stored in appropriate containers.</p> <p>(c) Construction waste will be collected and disposed properly by licensed collectors</p> <p>(d) The records of waste disposal will be maintained as proof for proper management as designed.</p> <p>(e) Whenever feasible the contractor will reuse and recycle appropriate and viable materials (except asbestos)</p>
<b>C. Individual wastewater treatment system</b>	Water Quality	<p>(a) The approach to handling sanitary wastes and wastewater from building sites (installation or reconstruction) must be approved by the local authorities</p> <p>(b) Before being discharged into receiving waters, effluents from individual wastewater systems will be treated in order to meet the minimal quality criteria set out by national guidelines on effluent quality and wastewater treatment</p> <p>(c) Monitoring of new wastewater systems (before/after) will be carried out</p> <p>(d) Domestic wastewater will be channelled to a suitable treatment facility</p>
<b>D. Historic building(s)</b>	Cultural Heritage	<p>(a) If building is a designated historic structure, very close to such a structure, or located in a designated historic district, approval/permits from local authorities will be obtained and all construction activities will be addressed in line with local and national legislation</p> <p>(b) It will be ensured that provisions are put in place so that artefacts or other possible “chance finds” encountered in excavation or construction will be noted, officials contacted, and works activities delayed or modified to account for such finds.</p>
<b>E. Acquisition of land</b>	Land Acquisition Plan/Framework	<p>(a) If expropriation of land was not expected and is required, or if loss of access to income of legal or illegal users of land was not expected but may occur, that the bank task Team Leader will be consulted.</p> <p>(b) The approved Land Acquisition Plan/Framework (if required by the project) will be implemented</p>
<b>F. Toxic Materials</b>	Asbestos management	<p>(a) If asbestos is located on the project site, it will be marked clearly as hazardous material</p> <p>(b) When possible the asbestos will be appropriately contained and sealed to minimize exposure</p> <p>(c) The asbestos prior to removal (if removal is necessary) will be treated with a wetting agent to minimize asbestos dust</p> <p>(d) Asbestos will be handled and disposed by skilled &amp; experienced professionals</p> <p>(e) If asbestos material is to be stored temporarily, the wastes should be securely enclosed inside closed containments and marked appropriately</p>

		(f) The removed asbestos will not be reused
	Toxic / hazardous waste management	<p>(a) Temporary storage on site of all hazardous or toxic substances will be in safe containers labelled with details of composition, properties and handling information</p> <p>(b) The containers of hazardous substances would be placed in an leak-proof container to prevent spillage and leaching</p> <p>(c) The wastes will be transported by specially licensed carriers and disposed in a licensed facility.</p> <p>(d) Paints with toxic ingredients or solvents or lead-based paints will not be used</p>
<b>G. Affects forests and/or protected areas</b>	Protection	<p>(a) All recognized natural habitats and protected areas in the immediate vicinity of the activity will not be damaged or exploited, all staff will be strictly prohibited from hunting, foraging, logging or other damaging activities.</p> <p>(b) For large trees in the vicinity of the activity, it will be marked and cordoned off with a fence to protect large trees and root system to avoid any damage to the trees</p> <p>(c) Adjacent wetlands and streams will be protected, from construction site run-off, with appropriate erosion and sediment control features to include but not limited to hay bales, silt fences</p> <p>(d) There will be no unlicensed borrow pits, quarries or waste dumps in adjacent areas, especially not in protected areas.</p>
<b>H. Disposal of medical waste</b>	Infrastructure for medical waste management	<ul style="list-style-type: none"> <li>▪ Not applicable</li> </ul>
<b>I. Traffic and Pedestrian Safety</b>	Direct or indirect hazards to public traffic and pedestrians by construction activities	<p>(a) In compliance with national regulations the contractor will ensure that the construction site is properly secured and construction related traffic regulated. This includes but not limited to</p> <ul style="list-style-type: none"> <li>▪ Signposting, warning signs, barriers and traffic diversions: site will be clearly visible and the public warned of all potential hazards</li> <li>▪ Traffic management system and staff training, especially for site access and near-site heavy traffic. Provision of safe passages and crossings for pedestrians where construction traffic interferes.</li> <li>▪ Adjustment of working hours to local traffic patterns, e.g. avoiding major transport activities during rush hours or times of livestock movement</li> <li>▪ Active traffic management by trained and visible staff at the site, if required for safe and convenient passage for the public.</li> </ul>

		<ul style="list-style-type: none"><li>▪ Ensuring safe and continuous access to office facilities, shops and residences during renovation activities, if the buildings stay open for the public.</li></ul>
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## 2.1 Summary of Environmental Impacts

It is anticipated that the project will result in some potential adverse impacts in the pre-construction, construction and post-construction phases. Potential adverse environmental impacts include:

- Damage to vegetation and extinct plant species
- Emission of dust and dust particles
- Emission of NO<sub>x</sub>, CO, SO<sub>x</sub> and Volatile Organic Carbons from the burning of fuel from onsite machinery
- Noise; from the movement of trucks and the operation of light and heavy duty equipment
- Soil erosion
- Solid waste generation
- Liquid waste generation
- Wastewater from laboratories
- Wastewater from eatery/kitchen

### 2.1.1 Mitigation

#### Pre-construction and Construction Phase

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible agent/agency	Costs
Site possession	Destruction or damage to vegetation	Controlled mechanized clearing will be utilized. Clearing will not exceed 600 mm girth including removal of girth and tree stumps. Trees or plants deemed to be protected species will be salvaged or if possible, relocated. If this is not possible for any reason, special fees will be paid to local authorities for the planting of the species elsewhere. The use of dangerous organic chemicals, weedicides and crude burning will be strictly avoided	Contractor	<b>US\$ 1,152</b> (GHS4,795)

Use of land - Cutting of top-soil	Loss of fertile topsoil 150 mm deep)  Loss of sub-soil 4 m deep  Soil erosion	Top soil will be stored in a secured area within the construction site but of a reasonable distance from construction activities. The soil will be hedged and covered with geomembrane to prevent runoff and dust emissions. Top-soil to be used as filling for construction and the cut-area. The area will be landscaped with environmentally friendly plant species and/or revegetated with plants with similar vegetation characteristics to the original plants	Contractor	<b>US\$7,398.62</b>  (GHS5,778.3)  (GHS25,000.00)
Construction works	Air emissions from dust          Emission of NO <sub>x</sub> , CO, SO <sub>x</sub> and Volatile Organic Carbons (VOC) from onsite machinery fuel combustion	To curtail dust and dust particles, construction site will be sprinkled with water in the morning, afternoon, late afternoon and any period where necessary. During hot, dry and windy conditions, additional sprinkling may be employed as required.  Low-NO <sub>x</sub> burners and water injection to control NO <sub>x</sub> .  Firing only low-sulfur (<0.1% by wt.) distillate fuel oil to control SO <sub>2</sub> ;  Good combustion control to minimize CO, Particulate Matter (PM) and VOCs; Stack height of at least 45 m is recommended to facilitate dispersion	Site supervisor     Machine operator  Machine supplier and installation contractor  Machine operator	<b>US\$3,461.54</b> (GHS14,000.00)
Construction works	Noise from construction works          Noise from operation of light and heavy duty machines	Construction will be confined to normal work-hours (0800hrs to 1700 hrs). In situations where construction must be conducted outside the stated time, the public will be notified at least seven (7) working days before the proposed schedule  Acoustic enclosures for the combustion turbines to ensure that noise does not exceed 80 dB(A) at 1 m	Contractor       Machine supply and installation contractor	-

## 2.1.2 Mitigation – Operation Phase

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible agent/agency
Solid waste generation	Aesthetic issues Air quality degradation due to the generation of odour	<ul style="list-style-type: none"> <li>▪ Waste should be appropriately stored in bins or containers with tightly fitted lids</li> <li>▪ Segregation and source separation of waste</li> <li>▪ Waste should be regularly collected and disposed-off</li> </ul>	Client
Liquid waste generation	Damage to aquatic life	<ul style="list-style-type: none"> <li>▪ Pre-treatment and off-site treatment</li> <li>▪ Effluent quality analyses to meet acceptable standards prior to discharge into drains or environment</li> </ul>	Client
Wastewater from laboratories	Destruction of flora and fauna	<ul style="list-style-type: none"> <li>▪ On-site pre-treatment of wastewater</li> <li>▪ Effluent quality analyses to meet acceptable standards prior to discharge into drains or environment</li> <li>▪ Potentially toxic laboratory wastewater should be appropriately marked as toxic and stored in leak proof containers and properly disposed-off by a licensed agency</li> </ul>	Client
Wastewater from eatery	<p>Potential discharge of high concentrations of PO<sub>4</sub>, NO<sub>3</sub> and Cl<sup>-</sup></p> <p>Potential discharge of high concentrations of fats and oils</p>	<ul style="list-style-type: none"> <li>▪ On-site pre-treatment of wastewater to meet acceptable levels prior to discharge into drains or environment</li> </ul>	Client

## 2.2 Monitoring and Reporting

### 2.2.1 Monitoring plan

The monitoring plan specifies the potential impacts, why such impacts should be measured, which parameter to measure, methodology for measurement, frequency of measurement and all associated costs if applicable. It also includes a set of technical measures as specified in Table 4 in the form of a framework to monitor the overall compliance of the project to environmental safeguards. It is intended that the monitoring plan will prevent “fire-fighting” approaches, but rather become an early warning signal for remedial action.

Table 7: Monitoring plan

Potential Environmental Impacts	Proposed Mitigation Measure						
	What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency/or continuous?)	Why (Is the parameter being monitored?)	Who (Is responsible for monitoring?)	Cost (for equipment and individuals if not included in project budget)
<b>Pre-Construction Phase</b>							
Damage to vegetation	Clearing techniques and relocation procedures utilized  Record of fees to appropriate environmental agency for possible replanting or warding-off of protected plant species	Construction site  Site office file	Visual and by comparison with pre-construction aerial photo	Within one month of site possession period	For the preservation of plants and other protected plant species	EPA, Client	US\$250.00
Loss of fertile topsoil and soil erosion	Soil storage procedures and location	Construction and soil storage sites	Visual	Weekly during site preparation and construction period	To prevent soil and land degradation and To prevent possible soil deposits carried by run-off's into drains and the environment	EPA, Client	US\$150.00
Air pollution by dust	Dust level	All active construction sites	Visual	During site clearing and construction	To protect workers' health and safety  To minimize the spread of unacceptible levels of dust to receiving environment	EPA, Client	US\$300.00

<b>Construction Phase</b>							
Noise from construction	Noise level applicable limits are 80 dB[A] on-site and 65 dB[A] off-site.	At 1 meter from operating turbines and in nearest residential areas	Measurements by a licensed organization using certified and standardized measurement devices with acceptable measuring protocol	Monthly	To monitor potential health impact of noise levels on workers	EPA, Client	US\$1,200.00
Air emissions of NO <sub>x</sub> , SO <sub>2</sub> , CO, and particulate matter (PM)	Ground level concentrations: (1) NO <sub>x</sub> ; (2) SO <sub>2</sub> ; (3) PM. The applicable environmental standards are: (1) NO <sub>x</sub> : Annual average ≤ 40 µg/m <sup>3</sup> ; Max 24-hour average ≤ 150 µg/m <sup>3</sup> ; Max 30-min average ≤ 500 µg/m <sup>3</sup> (2) SO <sub>2</sub> Annual average ≤ 40 µg/m <sup>3</sup> ; Max 24-hour average ≤ 150 µg/m <sup>3</sup> ; Max 30-min average ≤ 500 µg/m <sup>3</sup> (3) PM Annual average ≤ 50 µg/m <sup>3</sup> ; Max 24-hour average ≤ 125 µg/m <sup>3</sup> ; Max 30-min average ≤ 280 µg/cscs	In adjacent residential areas and/or nearest air quality monitoring stations	Measurements by a licensed organization using certified and standardized measurement devices with acceptable measuring protocol	Once before construction, and monthly during construction	For the health and safety of workers and residents within immediate environs	EPA, Client	
Traffic management	Traffic flow within immediate surrounding of site and on site.  Free movement of construction workers on site, as well as pedestrians within the construction area	Within immediate environs of the site	Visually, by inspection	Monthly	To ensure free flow of traffic within construction area To ensure easy manouvering of construction vehicles and other vehicles to the site	Contractor, EPA, Client	



					To protect the safety of site workers and other pedestrians		
Solid and liquid waste generation	Availability of waste bins, toilet facilities and temporary drains	Construction site	Visually, by inspection	Once before construction commences	To reduce the exposure of solid waste to the open To maintain aesthetics of the construction site To reduce open dumping, crude burning and open defecation To protect the health of workers by preventing possible faeco-oral diseases	Contractor	US\$150.00
<b>Operation and Maintenance Phase</b>							
Solid, liquid waste and wastewater generation	Availability of waste bins in good physical condition, toilet facilities and drains	Construction site	Visually, by inspection	Once after construction	To reduce the exposure of solid waste to the open To maintain aesthetics at construction site To reduce open dumping, crude burning and open defecation To protect the health of workers by preventing possible faeco-oral diseases To protect flora and fauna	Site Engineer, Client	US\$200.00
	Wastewater quality	Effluent discharge points	Physico-chemical analyses of wastewater	Before and after pre-treatment			USD\$500.00

Liquefied and compressed gases	Availability of functional gas leakage detecting devices	Within building	Visually, by inspection	Demonstration before commissioning of building and annually	To ensure the early detection of leakages for evacuation and remediation	Client	US\$200
<b>Total Cost for all Phases</b>							<b>US\$2,950.00</b>

## **2.2.2 Reporting**

### **2.2.2.1 Grievance Redress Mechanism**

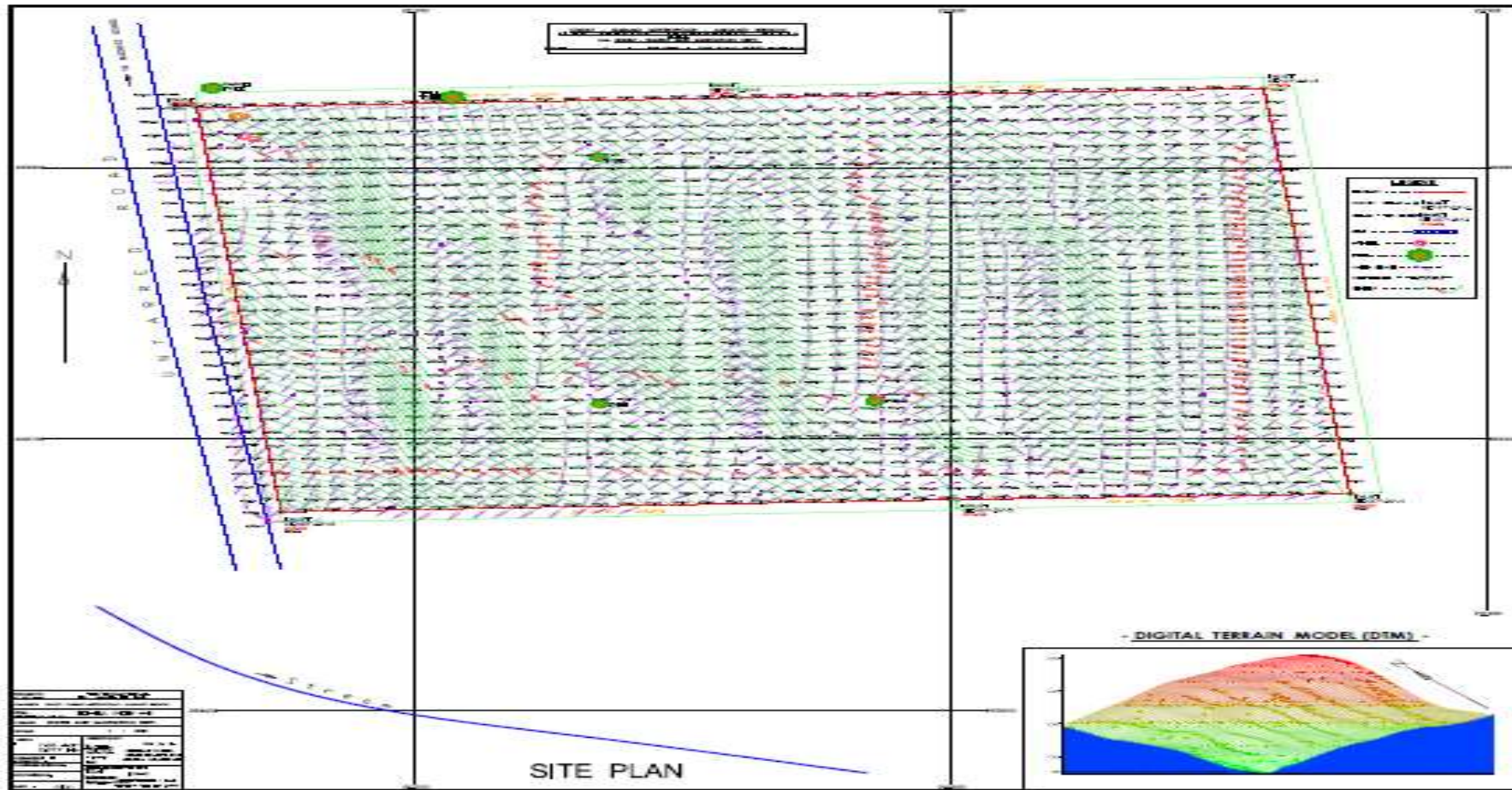
A grievance redress mechanism is recommended for addressing legitimate concerns of all stakeholders who in one way or the other, may consider themselves deprived of appropriate treatment under the project. The grievance redress mechanism would include but not limited to;

- a reporting system that includes recording and filing of grievances both verbally and in writing
- a scheduled forum to discuss and propose solutions to grievances
- a time frame to address all grievances
- designated staff of the contractor to record and report grievances to appropriate authorities within the construction firm

In the event of disputes and feud, attempts should be made to reach resolutions through dialogue among feuding factions. If an agreement is not brokered, all parties have the right to seek legal redress from the court of law.

In situations where the contractor defaults in the maintenance of environmental safeguards, sanctions should be applied per the contractual agreements. Where the contractor defaults heavily in non-compliance, the Environmental Safeguard Specialist of the World Bank should be consulted for advice.

# Annexe 1: Site Plan



## Annexe 2: Block Plan

