SELJEN CONSULT

Environmental Impact Assessment of the proposed development of 250MW Kumasi 1 Thermal Power Plant at Anwomaso, in the Oforikrom Municipality in the Ashanti Region of Ghana

ENVIRONMENTAL SCOPING REPORT & DRAFT TERMS OF REFERENCE FOR THE EIA

OCTOBER 2021

VOLTA RIVER AUTHORITY

CORPORATE ENVIRONMENTAL POLICY STATEMENT

The Volta River Authority (herein referred to as "the Authority") is a public power utility and supplies electricity to industries and mining companies as well as distribution companies in Ghana. The Authority commits to ensuring continuous improvement of environmental performance that minimizes potential impacts of all its operations on the environment in accordance with the principles of sustainable development and complying with national and international environmental protection regulations.

In respect of the above, VRA will:

1. Make environmental considerations a priority in all business planning and decision-making and comply with relevant national and international environmental protection regulations.
2. Take reasonable steps to mitigate the impact of its actions with regard to the development, operation and management of its assets.

VRA will thus pursue the following specific objectives:

a. Develop and implement Environmental Management Systems for all its business units to:

   i. Assess environmental impact of processes, operations and products.
   ii. Focus on pollution prevention and waste reduction.
   iii. Ensure compliance with national/international environmental protection regulations.
   iv. Set annual environmental targets to ensure continuous improvements.
   v. Monitor and report on environmental performance as required to the appropriate stakeholders.

b. Ensure minimum environmental impact of VRA's projects and take adequate steps to mitigate any such anticipated adverse impacts as far as is practicable.
c. Promote environmental awareness and individual sense of responsibility among its employees through print material for distribution, safety meetings, and the corporate website which will continue to be updated, and provide adequate empowerment and training for personnel to perform environmental jobs satisfactorily.
d. Support research efforts on materials, products, processes and pollution reduction techniques that are directly related to its operations.
e. Contribute to the development of public policy and programmes that enhance environmental awareness and protection.
f. Promote open communication on environmental issues.
g. Undertake projects and programmes in collaboration with relevant agencies to preserve the Volta Lake resource, and reasonably restore/mitigate ecological imbalance caused by the creation of the lake.
h. Undertake projects and programmes to mitigate the impact on the livelihood of individuals and communities displaced or affected by VRA's developmental projects.

VRA shall design evaluation procedures for all processes that fall under this policy to ensure that these processes comply. Deficiencies, in the policy or in the evaluation procedure, shall be addressed as required. Each employee of VRA is charged to exercise his or her responsibility on behalf of VRA to assure that the intentions of this Policy Statement are diligently carried out.

Approved: Date: 18 – 6 – 2019

Emmanuel Antwi-Darkwa
CHIEF EXECUTIVE

VOLTA RIVER AUTHORITY

PROJECT NAME	KUMASI 1 THERMAL POWER PLANT PROJECT		
CLIENT NAME	VOLTA RIVER AUTHORITY		
REPORT TYPE	ENVIRONMENTAL SCOPING REPORT		
EPA REFERENCE	CE: 532703/02		
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CORE EIA TEAM OF EXPERTS

Name	Specialization/ Position	Qualification/Experience	Assigned task
Kofi Gatu	Social Assessment Expert/ Project Manager and Director of Seljen Consult	MSc (Environmental Sustainability & Management), University of Ghana, Legon-Accra. M.A. Local Government Administration & Organisation, Institute of Local Government Studies, Accra. BSc (Hons) Business Studies, University of Cape Coast, Ghana. B.A (Hons) Psychology, University of Ghana, Legon *Over 14 years' experience as a social and environmental impact assessment practitioner*.	- Project Coordinator - Liaison between Proponent and EPA - Social and Stakeholders consultation - Community interactions and socioeconomic assessment - Project document review - Quality Assurance
Emmanuel Kofi Acquah	Environmental and Social Safeguards Specialist (EIA Team Lead)	MSc (Environmental Policy and Management), University of Hull, UK, BSc (Hons) and PgD (Mining Engineering) KNUST School of Mines, Tarkwa. -*About 20 years working experience in Environmental Impact Assessment (EIAs), Environmental Management Plans (EMPs), Baseline studies, Resettlement Action Plans among others*	- Collation, analysis and review of policies, legal and administrative frameworks. - Baseline desktop studies - Review of specialist reports - Impact analysis and evaluation - Development of monitoring and management plans - Drafting of scoping and EIA reports.
Mr. Emmanuel Boateng	Health/Safety Expert	MSc, Geographical Information System with Remote Sensing. From University of Greenwich, UK, 2006 B. Sc. (Hons) Geological Engineering from KNUST, Kumasi, Ghana, 2000	- Hazard assessment - Risk assessment - Health and safety risk assessment - Health and safety impact identification, assessment and provision of mitigation measures

Name	Specialization/ Position	Qualification/Experience	Assigned task
		Nebosh National Diploma-Occupational Safety and Health, 2020-present Nebosh General Certificate – National Examination Board in Occupational Safety & Health (Nebosh) Greenwich Community College – London, UK (Sept-Dec 2006) *-Over 19 years working experience in occupational health/safety assessment as well as public health and safety management practices.*	- Health and safety management plan for the construction phase - Health and safety management framework for the operational phase
James Adomako (PhD)	Ecologist/Land use	PhD (Ecology)-Ghana, MPhil (Ecology)-Ghana, BSc Zoo/Bot. (Ghana), Cert (Diatom Taxonomy)-Univ. Co.-UK *-Over 23 years working experience in Ecological systems, Biodiversity conservation, Floral Profiling, Restoration of degraded areas, Plant Nomenclature and Classification, Landuse.*	- Classification of existing vegetation - Fauna inventory - Report on ecological findings
Sylvester Yenzanya	Emissions & Air Dispersion Modelling Expert	MPhil Mining Engineering, BSc Mining Engineering, University of Mines and Technology, Tarkwa-Ghana *-About 6 years of extensive experience in ambient air quality and noise monitoring and emissions/air dispersion modelling*	- Baseline Ambient Air Monitoring - Air quality evaluation - Emissions & Air Dispersion Modelling - Training of VRA Staff
Bright Akuinor	Noise Modelling Expert	BSc Mining Engineering, University of Mines and Technology, Tarkwa-Ghana *-About 6 years of extensive experience in Noise monitoring and modelling*	✓ Baseline ambient noise study ✓ Noise impact evaluation ✓ Noise dispersion modelling and develop a Noise Monitoring Programme.
Ishmael Lente (PhD)	Environmental Scientist and	PhD (Fisheries Sc.)-Ghana, MPhil (Marine Sc & Coastal	Review of environmental and

Name	Specialization/ Position	Qualification/Experience	Assigned task
	Health and Safety Expert	Mgt) Newcastle, MSc. (Tropical Coastal Mgt) Newcastle, BSc (Zoo/Bot)-Ghana, PgD, (Marine Ecology)-Germany *-Over 8 years working experience in Environmental and Health/Safety Assessment and Management*	health/safety reports of Ameri Power Plant. Health/Safety Assessment of Project
Anthonio Deborah	Assistant Social impact expert/ EIA Expert	MSc Environmental Sustainability and Management, Winsconsin International University College BSc Chemistry, University of Ghana *-About two years' experience in environmental/social assessment and management*	Baseline data collection Water sampling Stakeholder and community consultations

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TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

LIST OF ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
BSP	Bulk Supply Point
ECG	Electricity Company of Ghana
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESIA	Environmental and Social Impact Assessment
ESR	Environmental Scoping Report
GNGCL	Ghana National Gas Company Limited
GNFS	Ghana National Fire Service
GoG	Government of Ghana
GRIDCo	Ghana Grid Company
GS	Ghana Standards
GSA	Ghana Standards Authority
GTs	Gas Turbines
GWCL	Ghana Water Company Limited
HDPE	High Density Poly Ethylene
HIV/AIDS	Humano Immune Virus/Acquired Immune Deficiency Syndrom
I&APs	Interested & Affected Parties
IFC	International Finance Corporation
ISO	International Organization for Standardization
KNUST	Kwame Nkrumah University of Science and Technology
K1TPP	Kumasi 1 Thermal Power Plant
LI	Legislative Instrument
LP	Low Pressure
MMAs	Metropolitan and Municipal Assemblies
MMDA	Metropolitan Municipal and District Assembly
MoU	Memorandum of Understanding
MRP	Mines Reserve Power Plant
NG	Natural Gas
NITS	National Interconnected Transmission System
O&M	Operation and Maintenance
PURC	Public Utilities Regulatory Commission
RCC	Regional Coordinating Council
R&D	Research & Development
STDs	Sexually Transmitted Diseases
SHE	Safety Health and Environment
ToR	Terms of Reference
VRA	Volta River Authority

Units of Measure

dB	Decibel
dB(A)	Decibel on the A Scale
%	Percent
km	kilometer
km^2	square kilometer
μgm^{-3}	microgram per cubic meter
µS/cm	micro Siemens per centimeter
m	meter
mm	millimeter
mg/l	milligram per liter
ms^{-1}	meters per second
m^3	cubic meter
m^3/h	cubic meter per hour

EXECUTIVE SUMMARY

Introduction

The Ghana power system is currently having low voltages from Ashanti Region to the northern part of the country, and the provision of a power plant in the Ashanti Region of Ghana will help improve voltages of the Ghana power system. To resolve this, the Ministry of Energy and the Volta River Authority (VRA) plan to relocate the AMERI Power Plant, which is currently taken out of service for conditioning assessment, from its Aboadze base in the Western Region to a site adjacent to the GRIDCo K2 BSP 161kV/330kV substation at Anwomaso in Kumasi, in the Ashanti Region as the Kumasi 1 Thermal Power Plant. The Plant will be located on a 15-acre parcel of land that belongs to the Kwame Nkrumah University of Science and Technology (KNUST). This power facility is to be known as the 250MW Kumasi 1 Thermal Power Plant, hereinafter referred to as the "Project".

In accordance with the requirements of the Environmental Assessment Regulations, 1999 (LI 1652), an environmental permit is required for the relocation, construction and installation of the Plant at its new site at Anwomaso. Consequently, the VRA has registered the proposed project with the Environmental Protection Agency (EPA) in April 2021, and the Agency has requested the preparation of an environmental impact assessment of the proposed project. The preparation of an Environmental Scoping Report (ESR) with draft Terms of Reference (ToR) for the EIA is in line with the requirements of the Ghana Environmental Assessment Procedures.

Objective of the Scoping Study

The primary objective of this scoping study is to identify key adverse physical, biological and social environmental impact issues that can affect project viability and sustainability. The outcome of the scoping study is also to assist VRA/Ministry of Energy to consider the consequences of a range of actions early in the planning process, to choose the most appropriate action on environmental/social grounds.

Methodology and Approach for the Scoping Study

The methodology and approach for the scoping study included:

- Reconnaissance visit;
  - Project site inspections and trekking to confirm baseline environmental issues and conditions likely to be affected by project implementation.
- Desktop study/Literature review;
  - Collection and review of available documentation relevant to the project including project related documents, documents/reports on the existing environmental conditions as well as relevant policies, laws and regulations.
- Consultations with some identified stakeholders; and

- Report preparations.

Policy/ Legal Framework

A number of policies and legislations both national and international and relevant to the proposed project have been identified and reviewed as part of the scoping study. These include among others:

National Policy framework

- National Land Policy, 1999;
- National Environmental Policy, 2012;
- National Climate Change Policy, 2013;
- National Water Policy, 2007;
- Strategic National Energy Plan, 2006-2020;
- National Energy Policy, 2010; and
- Health, Safety and Environmental Policy for the Energy Sector, 2016.

National Legal framework

- The Constitution of the Republic of Ghana, 1992;
- Volta River Development Act, 1961 (Act 46);
- Energy Commission Act 1997, Act 541;
- The Lands Act, 2020;
- The Lands (Statutory Wayleaves) Act, 1963;
- Electricity Regulations, 2008, (LI 1937);
- Electricity Transmission (Technical, Operational and Standards Of Performance) Rules, 2008, (LI 1934);
- The National Electricity Grid Code, 2009;
- Public Utilities Regulatory Commission Act, 1997 (Act 538);
- Lands Commission Act 2008, Act 767;
- Land Use and Spatial Planning Authority (LUSPA) Act 2016, Act 925;
- Environmental Protection Agency (EPA) Act 1994, Act 490;
- Environmental Assessment Regulations 1999, LI 1652;
- Fees and Charges (Miscellaneous Provisions) Instrument 2019 (L.I. 2386);
- Hazardous and Electronic Waste control and Management Act 2016 (Act 917) and Hazardous, Electronic and other waste (Classification), Control and Management Regulations 2016, LI2250;
- Local Governance Act 2016, Act 936;
- Water Resources Commission Act 1996 (Act 522);
- Water Use Regulation (WUR) 2001, LI 1692;
- Ghana Water Company Act 1993, Act 461;
- The Fire Precaution (Premises) Regulations 2003, LI 1724;
- Factories, Offices and Shops Act 1970, Act 328;

- The Labour Act 2003, Act 651;
- Workmen's Compensation Law 1987; and
- Road Traffic Act 2004, Act 683.

The proposed project is also expected to comply with the requirements of the EPA administered Ghana Standards (GS) as follows:

- GS 1236:2019 Environment and Health Protection –Requirements for Ambient Air Quality and Point Source/Stack Emissions
- GS 1219:2018 Environment and Health Protection –Requirements for Motor Vehicle Emissions
- GS 1222:2018 Health Protection –Requirements for Ambient Noise Control
- GS 1212:2019 Environment Protection –Requirements for Effluent Discharge

Relevant International Guidelines/Standards

- IFC Performance Standards, 2012; and
- The World Bank Group EHS Guidelines for Thermal Power Plants

Project Description

The Kumasi 1 Thermal Power Plant is a 250MW (ISO) plant comprising of ten (10) 25MW (ISO) GE TM 2500+ Aero Derivative Gas Turbines (GTs), and will operate primarily on natural gas. Each train of GT and power generator is mounted on mobile platform. The plant component consists of the following:

1. Substation;
2. Gas Turbine Island;
3. Warehouse/Workshop;
4. Office and Control Building;
5. Car Park;
6. Water Treatment and Storage Tank; and
7. On-base Gas Skid.

The proposed Project will be located at Anwomaso in the Oforikrom Municipality of the Ashanti Region. The main access road to the proposed site and the existing GRIDCo Substations at Anwomaso is by a motorable asphaltic surfaced road, about 2.69km off the main Accra-Ejisu-Kumasi Highway. There are currently two main internal access routes to the proposed project site from the substation.

The power evacuation components include:

i. Equipment in prefabricated building;
ii. Mobile station service transformers;
iii. Emergency Diesel generators;
iv. 11kV medium voltage cables; and

v. All interconnecting cables with their cable trays.

The power production processes comprise of (a) Natural gas supply & conditioning; (b) Combustion; (c) Generation; and (d) Transmission. The 250 MW power to be produced will feed the 161KV GRIDCo substation at Anwomaso for evacuation of power to the national grid. The Gas Turbines runs on natural gas (NG). Each unit requires 5.5 mmscf of NG per day making a total of 55 mmscf per day for the ten (10) gas turbines. Ghana National Gas Company will supply gas to the site through a new gas infrastructure of pipelines, regasification and gas conditioning units to be constructed as a separate project.

The Kumasi 1 Power Plant requires about 7.5 m3 of demineralized water per day for operations. A dedicated water treatment and storage facility will be installed at the station. Currently there is no access to water from the Ghana Water Company Limited (GWCL) mains. The Ghana Water Company Limited (GWCL) plans to extend its water pipeline from Oduom to Anwomaso to provide potable water to the power plant site.

A contractor will be procured for the construction and installation of the power plant. VRA will be responsible for the operation and maintenance of the power plant as it already has a thirty-three (33) Operating & Maintenance team to take over the operations of the Plant in Kumasi. It is expected to take about 15 months to complete the land acquisition, permitting, the construction and installation of the Kumasi 1 Thermal Power Plant.

Alternative Considerations

The following alternatives have been considered and analysed under the proposed project:

- Energy or power supply source options;
- Site selection options;
- Water supply source options; and
- Do nothing scenario.

Environmental Baseline Conditions

The project area falls within the wet sub-equatorial climatic zone. The average minimum temperature is about 21.5^{o}C and a maximum average temperature of 30.7^{o}C. The average humidity is about 84.16% at sunrise and 60% at sunset. The project area experiences a double maxima rainfall regime in June and in September/October. The major rainy season starts from March to July with a peak usually in June. The minor season starts from September to November with a peak either in September or October.

The proposed site is on a low ridge and the topography is relatively flat with slight undulations. The existing ground surface at the project site is approximately 268 to 285 m above mean sea level. The Adote Stream drains the project area. The project site is basically agricultural land situated in a peri-urban environment. It is occupied by farms and farm re-growths with isolated trees. The major crops cultivated are cassava, maize and vegetables such as tomatoes. The farm re-growth is dominated by Panicum Maximum (guinea grass) and forbs which forms a dense thicket.

The sources of noise are vehicular traffic, loud music and noise from the community; and that of air pollution are fumes from vehicular movements, wind-blown dust and dust generation from unpaved roads in local community from movement of vehicles.

According to the 2010 Population and Housing Census, the Oforikrom Municipality recorded a population of 303,016 made up of 149,827 (49.45%) males and 153,189 (50.55%) females. The 2019 projected population is 373,055; 184,165 males and 188,890 females.

One of the dominant cultural practice in Oforikrom is the celebration of the Akwasi Dae festival, which is celebrated by the Asantes. The Asantes hold in high esteem their traditional values, attitudes and practices. There are various ethnic groups in the Municipality and this can be attributed to its strategic location and the University (KNUST), which provides teaching and learning to both Ghanaians and foreigners.

The inhabitants of Oforikrom Municipality are engaged in various economic activities, and these include providers of transport services, scrap metal and e-waste dealers, private educational institutions, hostel/hotels/guest houses operations, eatery places, retail of products, hairdressing/barbers, dress makers, millers, washing bays, financial institutions, furniture manufacturers, video/photographers, printing firms, food processors, ware housing, health service providers, chemical and pharmaceutical shops, construction work, food crop production and animal rearing, amongst others. There are about five daily markets in the Municipality. Unemployment is however an issue of concern.

The Municipality can boast of 85 pre-schools, which are all private; 109 KGs (22 public and 87 private); 114 primary schools (25 public and 89 private); 82 JHS (24 public and 58 private); 9 SHS/TVET (2 public and 7 private); and one public special school. There are seven tertiary schools in the Municipality.

The Municipality has in existence twenty-two (22) health facilities. Four (4) of the health facilities are government owned; one (1) is quasi-government and seventeen (17) privately owned. Malaria, Hypertension and Upper Respiratory Tract Infections have been the dominant reported diseases from 2018 to 2020.

According to the 2019 data from the Ghana AIDS Commission, Oforikrom Municipal is not within the top 10 districts/municipalities with high HIV infection in the country but Kumasi Metro is within the top 10 districts. The Oforikrom Municipality is however within the top 20 districts/municipalities. With regard to the prevalence rate in the adult population, the Oforikrom Municipal has 1.75% prevalence rate and Kumasi Metropolis has 1.95% prevalence rate. The Ashanti Region has 1.94% prevalence rate with estimated 76,672 living with the virus.

With regard to COVID-19 infection and transmission, the Greater Accra Region has the leading cases, and followed by the Ashanti Region.

Stakeholder Consultations

Initial consultations from been carried out with the following stakeholders:

- VRA, project proponent
- GRIDCo, Kumasi – Utility agency and power off-taker
- Oforikrom Municipal Assembly – Local government and administrative authority
- Anwomaso Traditional Authority
- Assemblyman for Anwomaso community
- Farmers affected by the project
- NVTI, Neighbouring organisation
- KNUST, Research Institution and current owner of the proposed land

Potential Environmental/Social Impacts and Risks

Potential Positive or Beneficial Impacts

Preparatory and Construction Phases

- Employment and job creation opportunities;
- Creation of business opportunities for locals/Ghanaians;
- Improvement in the local and national revenue.

Operational and Maintenance Phase

- Provision of 250MW of electric power for the Greater Kumasi area and the northern part of the country.
- Improvement in the voltage stability of the NITS.
- Significant reduction in transmission system losses.
- Improvement in the quality of supply to end users through improved network voltage control via generators.
- Continuous supply of reliable power to end users, thus reducing impact on power rationing in the Kumasi area and beyond.

- Natural gas as fuel represents a cleaner form of fossil fuel powered thermal power generation.
- Reliable power supply to support socioeconomic activities and businesses in the Kumasi area.
- Improvement in the local community infrastructure/facilities from corporate social responsibility interventions.

Potential Adverse/Negative Impacts

Preparatory/Pre-construction Phase Potential Adverse Impacts

- Air pollution
    - Fumes from vehicles/trucks; dust generation on unpaved roads from vehicular movements; construction of work camps/material storage areas
- Noise Nuisance
    - movement of vehicles/trucks, horning, construction of work camps, noise generation by survey workers.
- Waste generation and disposal/sanitation issues during surveys and work camp construction.
- Water pollution of Adote Stream from work camp construction and improper waste disposal activities.
- Anxiety/agitation of farmers and displacement of farmers.
- Non-acquisition of all relevant statutory permits and associated risks.
- Worker health/safety concerns.
- Public/community health and safety as well as traffic safety concerns.

Construction Phase Potential Adverse Impacts

- Air pollution from movement of vehicles/ trucks on unpaved roads through local communities, operation of construction equipment, light vehicles, and diesel-powered electrical generators etc.
- Noise and vibration from movement of trucks and operations of electrical generators and maintenance activities etc.
- Impact on soil resources from topsoil removal, erosion and soil contamination from fuel spills etc.
- Water pollution concerns due to fuels spills, transport of sediment into water, channel siltation from sediment loading and effect on aquatic life in the stream.
- Waste generation and disposal
    - Generation of various streams of waste including biomass, garbage, scraps, sewage/human waste, hazardous waste etc
- Security/threats and human rights abuses
- Impact on terrestrial flora and fauna:

  - Removal/loss of vegetation and faunal habitat;
  - Displacement and destruction of fauna.
- Disruption in land use
- Labour influx/job seekers and associated illicit behaviours
- Visual intrusion/ attraction
- Non-compliance with socio-cultural norms of local communities
- Construction workers agitations/issues
- Worker health/safety concerns
  - Worker injuries, bites from insects/animals, COVID-19 infections, STI transmissions
- Public/community health and safety, and security concerns
  - Increased potential for spread of infectious diseases, including HIV/AIDS and recent Covid-19.
  - Increased potential for traffic incidents/accidents on the public/community roads
  - Security/threats and human right abuses

Operational Phase Potential Adverse Impacts

- Air Pollution from Plant emissions and fumes/dust emissions from use of equipment/machinery and movement of vehicles, trucks on unpaved roads through local communities, and diesel-powered electrical generators;
- Noise and Vibration from Plant operations and movement of trucks and operations of electrical generators and maintenance activities;
- Impact on soil resources from storm runoffs and soil contamination from fuel spills;
- Water pollution concerns due to fuels spills into water, transport of sediment laden storm-runoffs from the plant site into waterbody and pollution effects on aquatic life;
- Impact on groundwater resources;
  - Ground water pollution concerns from spillage of fuel/oils.
  - Ground water abstraction to support operational activities
- Waste generation and disposal;
  - Generation of various streams of waste including garbage, scraps, sewage/human waste, etc
  - Disposal of hazardous wastes concerns
- Climate change impacts from emissions
- Water resource use/ consumption concerns
- Fuel/gas consumption concerns
- Worker health and safety concerns
- Public/community health and safety and security concerns
  - Increased potential for spread of infectious diseases, including HIV/AIDS and recent Covid-19.
  - Increased potential for traffic incidents/accidents on the public/community roads

  - Security/threats and human right abuses
- Emergency situations - Explosion/ fire risks
- Sustainability issues

Decommissioning Phase Potential Adverse Impacts

Post-construction activities

- Occupational/ public safety, accidents, traffic incidents and labour issues
  - dismantling and relocation of construction work camps, project equipment and disposal of wastes
- Soil contamination / sediment transport
  - dismantling of construction work camps and exposing soil, fuel spills from project equipment/machinery maintenance, decommissioning of fuel storage facilities and disposal of wastes
- Water contamination/ impact on aquatic organisms
  - Improper disposal of waste, storm runoffs carrying fuel spills into nearby stream
- Air pollution/Noise nuisance
  - Dismantling of construction work camps, equipment/machinery operation
- Loss of construction employment
  - Laying off workers due to cessation of construction work

Post-operational phase

- Loss of employment and labour/community agitations
  - Laying-off workers, ending contracts
- All other impacts
  - Decommissioning plan to be prepared outlining how all other impacts will be managed and EPA to issue permit for the decommissioning activities.

Draft Terms of Reference for the EIA

The draft Terms of Reference (ToR) for the EIA covers:

- Provision of a detailed Description of the Proposed Project;
- Analysis of the Need for the Project and Alternative Considerations;
- Procedures and Methods to establish and adequately describe the baseline conditions;
- Description of Existing Environmental Baseline Conditions of the Project Area;
- Analysis of Potential Environmental Impacts;
- Development of Proposed Mitigation and Management Measures;
- Development of Environmental Monitoring Measures;
- Development of Provisional Environmental Management Plan; and

- Development of a Provisional Decommissioning Plan.

Conclusion

This Environmental Scoping Report for the EIA of the proposed Project has been carried out in line with the Environmental Assessment Regulations, 1999, Legislative Instrument (LI) 1652.

The Scoping Report has identified key environmental/social and health/safety risks and impacts that may arise from the implementation of the proposed project. These identified risks and impacts will be subjected to in-depth analysis and evaluation during the EIA for the development of comprehensive mitigation, monitoring and management measures to address the likely adverse impacts on local communities and the environment in general.

The VRA and the Ministry of Energy will ensure that the Project is implemented in line with all relevant national policies, laws and standards to enhance the intended benefits of the Project and reduce potential negative impacts to acceptable levels.

1.0 INTRODUCTION

1.1 Background

The Government of Ghana (GoG) endorsed a Build, Own, Operate and Transfer (BOOT) agreement with AMERI Energy for a fast-track turnkey power generation solution in 2015. This was projected to be done through the construction of a power plant at Takoradi and the installation of 10 new GE TM 2500+ Aero Derivative Gas Turbines along with its related equipment as well as the provision of certain services related to the operation and maintenance of the power plant. The Agreement was scheduled to complete its 60-month tenure on January 31, 2021. As such the Volta River Authority as the Assignee has been mandated to perform the GoG's function including taking over the operation and maintenance of the AMERI Power Plant from February 1, 2021.

The Ghana power system is currently having low voltages from Ashanti Region to the northern part of the country. The Ghana Grid Company Limited (GRIDCo) which is the power system operator of Ghana, has indicated at several stakeholder fora that a power plant in the Ashanti Region of Ghana will help improve voltages of the Ghana power system a great deal.

The Bui Hydropower plant is the major power plant that helps in voltage support from the middle belt to the northern part of the country. As a result, in years where the Bui hydropower plant has low elevations the power system is constrained since dispatch from the Bui hydropower plant becomes limited. The Bui Hydropower plant is faced with a possible "running out of water" before the onset of the rains in the wet season from July 2021. Hence having another power plant in Kumasi and its environs is a matter of urgency to relieve Bui Hydropower plant of the burden of being the only major source of power supply for voltage stability in the northern part of the country.

The Volta River Authority (VRA) is expected to take over the AMERI Power Plant in 2021 and looking at the urgency of deploying a power plant in Kumasi for voltage stability, the AMERI Power Plant is a quicker option of having a power plant in Kumasi. The plant is currently taken out of service for the condition assessment to be carried out prior to the takeover by VRA.

The AMERI Power Plant will be relocated to a site adjacent to the GRIDCo K2 BSP 161kV/330kV substation at Anwomaso in Kumasi, near Ejisu, in the Ashanti Region. A 15-acre parcel of land is required to accommodate the AMERI Power Plant, its associated Balance of Plant, Office building and car park. Initial investigations revealed that the selected parcel of land for the proposed project belongs to the Kwame Nkrumah

University of Science and Technology (KNUST). Following the relocation of the AMERI Power Plant; the facility's name would be changed to the Kumasi 1 Thermal Power Plant.

The project is being developed as part of efforts in addressing the domestic power shortage status in Kumasi, Ghana and its main advantages are:

a) To meet the electricity demand growth of the middle belt of Ghana.
b) To optimize the power generation portfolio to improve power supply reliability.
c) The Thermal generation units can run on baseload operation, resulting in high-capacity factor.
d) Based on the favorable fuel price of LN gas, the power generation units have electricity price advantage.

In accordance with the requirements of the Environmental Assessment Regulations, 1999 (LI 1652) as outlined in section 2.2.3 of the Environmental Impact Assessment (EIA) Guidelines for the Energy Sector, Volume 1, dated September 2011; natural gas fired electric power plant with installed capacity equal or exceeding 500 kVA such as the relocation and installation of the erstwhile AMERI Power Plant at Anwomaso as the Kumasi 1 Thermal Power Plant Project requires the undertaking of an environmental assessment studies and the preparation of an Environmental Impact Assessment (EIA) Report.

Consequently, the VRA registered the proposed project with the Environmental Protection Agency (EPA) in April 2021. The EPA in a response letter referenced CE:5327/02/03 and dated May 12, 2021, which is presented as **Annex 1-1** of this report confirmed the preparation of an environmental impact assessment of the relocation of the Ameri Power Plant to Anwomaso as per the provisions of the Environmental Assessment Regulations 1999, LI 1652. This Scoping Report with draft Terms of Reference (ToR) for the EIA is in line with the requirements of the Ghana Environmental Assessment Procedures as depicted by the administrative flow chart as shown in **Annex 1-2**.

1.2 Purpose of the Scoping Study

Scoping study refers to the early, open and interactive process of determining the major issues and impacts that will be important in decision-making relating to the biophysical and social environment acceptability of the proposed project, and which must be addressed in an EIA study.

This scoping process provides the platform to initiate discussions between the project proponents, regulatory agencies and other relevant stakeholders as well as other Interested and Affected Parties (I&APs) to determine and define the feasible alternatives to mitigating any potential environmental concerns associated with the implementation

of the proposed project, in order for the proposed project to meet all applicable legislative, socioeconomic and cultural requirements.

1.3 Objectives of the Scoping Study

The primary objective of this scoping study is to identify key adverse physical, biological and social environment issues that can affect project viability and sustainability. The outcome of the scoping study is also to assist VRA/Ministry of Energy to consider the consequences of a range of actions early in the planning process, to choose the most appropriate action on environmental/social grounds.

The objectives of the study are to:

- identify the main stakeholders and inform them about the proposed project;
- solicit stakeholder concerns and suggestions;
- identify the potential biophysical, socioeconomic and cultural environmental impacts and risks associated with the proposed project;
- identify reasonable and practical alternatives to address identified environmental and social concerns for the project where necessary;
- focus on the important issues and significant impacts to be addressed by the EIA study;
- define the boundaries for the EIA study in time, space and subject matter;
- set requirements for the collection of baseline data and other relevant information; and
- establish the draft Terms of Reference (ToR) for the EIA study.

1.4 Methodology and Approach

The methodology and approach for the scoping study included:

- Reconnaissance visit;
  - Project site inspections and trekking to confirm baseline environmental issues and conditions to be affected or likely to develop from project implementation.
- Desktop study/Literature review;
  - Collection and review of available documentation relevant to the project and in particular project description information, the existing environment (biophysical, socioeconomic and cultural) conditions as well as relevant policies, laws and regulations.
- Consultations;
  - Consultations and discussions with stakeholders including relevant government institutions/regulatory agencies, traditional authorities/local communities, Non-governmental organisations and project affected persons as well as other I&APs.

- Publication of a scoping notice on the proposed project in the Daily Graphic to invite public comments.

- Report preparations;
  - Preparation of a Scoping Report and draft Terms of Reference (ToR) for the conduct of the EIA study.

1.4.1 Reconnaissance Visit

A field visit to the project area was undertaken on 9th and 10th August, 2021. Site inspections/reconnaissance surveys were carried within this period. The team of EIA experts also used the 1:50,000 topographical maps, alongside with google maps/images for ground-thruthing to confirm the actual situations on the field.

Preliminary field assessment was undertaken to obtain first-hand information and to confirm existing environmental/social issues and conditions to be affected or likely to develop from the implementation of the proposed project with respect to:

- socio-economic and cultural settings of the project area, project affected persons, local communities and relevant districts;
- bio-physical environment, including:
  - nature of the terrestrial ecology in the project area;
  - land use of the project area;
  - access routes to the project area;
  - water resources and drainage in the project area;
  - topography and relief of the project area;
  - nature of existing infrastructure and facilities at or near the project area.

1.4.2 Desktop Study/Literature Review

Collection and review of available documentation relevant to the project and in particular project description information, the existing environment (biophysical, socioeconomic and cultural) conditions as well as relevant policies, laws and regulations was carried out.

Information gathered from various documents and reports from Seljen Consult library, VRA, Oforikrom Municipal Assembly' s websites, and other internet sources, were of immense help for the scoping work. Some of the key literature reviewed include:

- The 1992 Constitution of Ghana;
- Relevant Policies, Acts and Laws of Ghana;
- Environmental Impact Assessment Guidelines for the Energy Sector (September 2011), Volume 1. Volume 2 of the Guidelines provides systematic procedures on EIS/EMP preparations for the energy sector as well as guidelines on common potential impacts and mitigation measures;

- Environmental Impact Assessment Guidelines for the General Construction and Services Sector (2011);
- Ghana Environmental Impact Assessment Procedures;
- IFC Performance Standards, 2012;
- Feasibility Study Report on the Project [i.e. AMERI Power Plant – Relocation to Anwomase (Kumasi) Report], April 2021;
- The Site Geotechnical Investigation Report [i.e. Relocation of AMERI Thermal Plant, Anwomaso, Kumasi, Geotechnical Investigation Report, Revision 00 Draft], June 20, 2021;
- Topographical and Google maps of the Project area;
- VRA SHE Standards for Contractors, January, 2013;
- Annual Environmental Report for AMERI Power Plant, 2016;
- Annual Environmental Report for AMERI Power Plant, 2017;
- Annual Environmental Report for AMERI Power Plant, 2018;
- AMERI Power Plant Decommissioning and Site Closure Plan, July 2021;
- Oforikrom Municipal Assembly Composite Budget for 2020-2023 Programme Based Budget Estimates for 2020;
- Profile of the Oforikrom Municipality obtained from OfMA in 2021.

1.4.3 Consultations

Initial consultations and discussions have been held with relevant government institutions, landowners, local community stakeholders and some project affected farmers. Information was obtained from the consultation process to confirm or otherwise information obtained from the desktop study or observations made from the field inspections.

Initial consultations have been held with the following stakeholders and the engagement outcome is provided in Chapter 6:

- Kwame Nkrumah University of Science and Technology (KNUST);
- Oforikrom Municipal Assembly;
- Ghana Grid Company (GRIDCo), Anwomaso;
- Ghana Gas Company Ltd;
- National Vocational Training Institute (NVTI);
- Assemblyman of Anwomaso Community;
- Anwomaso Traditional Authority;
- Some farmers farming at the proposed site [i.e. Project Affected Person (PAPs)].

Further consultations will be held with the following stakeholders and the details of the stakeholder responses and concerns will be provided in the EIS:

- Ghana Water Company Limited;

- Road Agencies - Ghana Highway Authority/Department of Urban Roads;
- Water Resources Commission (WRC);
- Environmental Protection Agency (EPA), Kumasi Regional Office;
- Ghana Police Service;
- Ghana Health Service;
- Electricity Company of Ghana (ECG);
- Ghana National Fire Service (GNFS);
- PAPs in the proposed project area.

1.4.4 Reporting

The data obtained from the desktop and field studies as well as literature reviews were analysed and have been presented in this Scoping Report. The format of the Scoping Report is in line with the Ghana Environmental Assessment Regulations LI 1652 of 1999 and contains information as required under Section 3.4 of the Volume 2 of the EIA Guidelines for the Energy Sector as follows:

- Executive Summary
- Introduction
- Description of Relevant Policies, Legal and Institutional Framework
- Description of the Proposed Project
- Alternative Considerations
- Brief Description of the Existing Environment
- Stakeholder Consultations
- Potential Environmental Issues and Impacts
- Draft Terms of Reference for the EIA
- Conclusions
- Bibliography
- Annexes

2.0 POLICIES, LEGAL AND INSTITUTIONAL FRAMEWORK

The Consultant has identified and initially reviewed some relevant national policies, legal and institutional frameworks that will be required to guide the proposed construction and operation of the AMERI Thermal Power Plant to ensure sustainable development and compliance with national and international regulations and these are briefly described below.

Relevant international standards include IFC Performance Standards (PS) for Environmental and Social Sustainability, IFC Environmental, Health & Safety Guidelines for Thermal Power Plants, Electric Power Transmission & Distribution.

2.1 National and Sector Policies and Plans

The relevant national and sector policies and plans identified include:

- National Land Policy, 1999;
- National Environmental Policy, 2012;
- National Climate Change Policy, 2013;
- National Water Policy, 2007;
- Strategic National Energy Plan, 2006-2020;
- National Energy Policy, 2010; and
- Health, Safety and Environmental Policy for the Energy Sector, 2016.

The review of the national and sector policies and plans is provided in **Table 2-1.**

2.2 National Legal Framework

The relevant environmental and electricity laws and regulations to guide VRA from the conceptualization stage of the project to implementation and monitoring as well as decommissioning include the following:

- The Constitution of the Republic of Ghana, 1992;
- Volta River Development Act, 1961 (Act 46);
- Energy Commission Act 1997, Act 541;
- The Lands Act, 2020;
- The Lands (Statutory Wayleaves) Act, 1963;
- Electricity Regulations, 2008, (LI 1937);
- Electricity Transmission (Technical, Operational and Standards Of Performance) Rules, 2008, (LI 1934);
- The National Electricity Grid Code, 2009;
- Public Utilities Regulatory Commission Act, 1997 (Act 538);
- Public Utilities Regulatory Commission (Amendment) Act, 2010 (Act 800);
- Lands Commission Act 2008, Act 767;

- Land Use and Spatial Planning Authority (LUSPA) Act 2016, Act 925;
- Environmental Protection Agency (EPA) Act 1994, Act 490.
- Environmental Assessment Regulations 1999, LI 1652.
- Fees and Charges (Miscellaneous Provisions) Instrument 2019 (L.I. 2386);
- Hazardous and Electronic Waste control and Management Act 2016 (Act 917) and Hazardous, Electronic and other waste (Classification), Control and Management Regulations 2016, LI2250.
- Local Governance Act 2016, Act 936.
- Water Resources Commission Act 1996 (Act 522).
- Water Use Regulation (WUR) 2001, LI 1692.
- Ghana Water Company Act 1993, Act 461.
- The Fire Precaution (Premises) Regulations 2003, LI 1724.
- Factories, Offices and Shops Act 1970, Act 328.
- The Labour Act 2003, Act 651;
- Workmen's Compensation Law 1987; and
- Road Traffic Act 2004, Act 683.

The review of the legal framework is provided in **Table 2-1.**

Table 2-1: A Summary of National and Sector Policies and National Legal Framework

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
National and Sector Policies And Plans		
National Land Policy, 1999	The National Land Policy provides for the protection of water bodies and the environment in the long-term national interest under any form of land usage be it for human settlements, industry and commerce, agriculture, forestry and mining. Key aspects of Section 4.4 (Ensuring Sustainable Land Use) of the Policy relevant to the Project are provided below: The use of any land in Ghana for sustainable development, the protection of water bodies and the environment and any other socioeconomic activity will be determined through national land use planning guidelines based on sustainable principles in the long term national interest. Land categories outside Ghana's permanent forest and wildlife estates are available for such uses as agriculture, timber, mining and other extractive industries, and human settlement within the context of a national land use plan. Unless approved by the appropriate public authority, no land use change of any kind will be countenanced. All land and water resources development activities must conform to the environmental laws in the country and where Environmental Impact Assessment report is required this must be provided. Environmental protection within the 'polluter pays' principle will be enforced.	The Kumasi 1 Thermal Power Plant Project is an industrial undertaken that has the potential of polluting water bodies such as the Adote (also spelt as Adoti in some literature) Stream and associated wetlands in the project area.

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
National Water Policy, 2007	The National Water Policy, approved in June 2007, is to provide the framework for the sustainable development of water resources in Ghana. The overall goal of the policy is to "achieve sustainable development, management and use of Ghana's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations." The relevant section of the Policy applicable to the proposed thermal plant is found in Section 2.2.4, Focus Area 4 –Water for Non-Consumptive and other uses. The key objectives of this section are to: i. ensure availability of water for hydropower generation, various industrial and commercial uses, mining operations, water transport and recreational purposes; and ii. ensure adequate protection of water sources in mining and other industrial areas. Relevant policy measures to be undertaken include: i. facilitate availability of water resources for industrial uses through sustainable resources management; ii. require industries, including mining operations, to develop and implement environmental management systems which take into account the impact of industry on the country's water resources; iii. fully implement the enacted requirements related to licensing of water uses (permits) and issuance of waste water (effluent) discharge permits; and iv. encourage development of codes of practice for efficient water use and cleaner production technologies in industrial activities.	The project will take water from Ghana Water Company Limited which has potential impacts on sustainable access to water by the Greater Kumasi area. Groundwater will be explored to augment the GWCL supplies.

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
Strategic National Energy Plan, 2006	The SNEP reiterates the sector Ministry's vision to develop an 'Energy Economy' that would ensure sustainable production, supply and distribution of high quality energy services to all sectors of the economy in an environmentally friendly manner for Ghana's future while making significant contribution to the country's export earnings. In this regard, the following broad objectives are highlighted by the policy: • Stimulate economic development by ensuring that energy plays a catalytic role in Ghana's economic development; • Consolidate, improve and expand existing energy infrastructure; • Increase access to modern energy services for poverty reduction in off-grid areas; • Secure and increase future energy security by diversifying sources of energy supply; • Enhance private sector participation in energy infrastructure development and service delivery; • Minimize environmental impacts of energy production, supply and utilization; • Strengthen institutional and human resource capacity and R & D in energy development; • Improve governance of the Energy Sector; and Sustain and promote commitment to energy integration as part of economic integration of West African states.	The proposed project is in response to the need for sustainable energy production and supply in the northern sector of Ghana to address shortfalls in the area. Identification and mitigation measures will be carried out as part of this EIA process to minimize any adverse environmental impacts.

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
National Energy Policy, 2010	The 2010 National Energy Policy outlines the Government of Ghana's policy direction regarding the current challenges facing the energy sector. The document provides a concise outline of the Government's policy direction in order to contribute to a better understanding of Ghana's Energy Policy framework. Within the context of energy sector vision, the goal of the energy sector is to make energy services universally accessible and readily available in an environmentally sustainable manner. The policy objectives to achieve this goal are to: i. Secure long term fuel supplies for the thermal power plants; ii. Reduce technical and commercial losses in power supply; iii. Support the modernisation and expansion of energy infrastructure to meet growing demands and ensure reliability; iv. Increase access to modern forms of energy; v. Improve the overall management, regulatory environment and operation of the energy sector; vi. Minimise the environmental impacts of energy supply and consumption through increased production and use of renewable energy and make energy delivery efficient; vii. Ensure cost recovery for energy supply and delivery; viii. Ensure the productive and efficient use of energy; ix. Promote and encourage private sector participation in the energy sector; and x. Diversify the national energy mix by promoting renewable energy sources nuclear and coal.	The relocation of the AMERI Power Plant to Kumasi area will increase generation capacity and increase access to energy in the Greater Kumasi area. The plant will operate principally on natural gas which is environmentally cleaner. There is a possible extension of natural gas from the Western Region to the proposed project site by the Ghana National Gas Company for sustainable fuel supplies for the thermal plant.
Health, Safety and Environmental Policy for the Energy Sector (2016)	The policy describes the elements necessary to develop, implement and maintain a high level of safety in all energy sector activities. The policy develops relevant regulations and standards, which will ensure that operators take into account relevant information about hazards, environmental effects, safety and security threats to their operations. To achieve this outcome, regulators are to ensure that, energy sector activities are carried out in an efficient manner that strives for continuous improvement of HSSE performance.	The proposed project is in line with the policy's objective to ensure that there is minimal harm to property, people and the environment.

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
National Environmental Policy, 2012	The Ghana National Environmental Policy was launched in November 2012 with the vision to manage the environment in a sustainable way to benefit Ghanaian society. The objective of this policy is to promote healthy lifestyles and reduce risk factors that arise from environmental, economic, social and behavioural causes thereby promoting healthy lifestyles in a healthy environment. The policy notes that proper management of Ghana's resources requires that efforts should be redirected into more environmentally sustainable programmes and practices. Such programmes should protect and preserve the resource base for use by present and future generations. Assessment of the potential environmental impacts of development projects and planning in advance to mitigate or eliminate these impacts will decrease environmental costs to the economy and make more cost-effective use of the country's resources. The ultimate aim of the National Environmental Policy of Ghana is to improve the surroundings, living conditions and the quality of life of the entire citizenry, both present and future. It seeks to promote sustainable development through ensuring a balance between economic development and natural resource conservation. The policy thus makes a high quality environment a key element supporting the country's economic and social development.	VRA has put in place an environmental policy that outlines various operational policies and strategies for the protection of the environment and resources. There is a monitoring system for resource utilization to safeguard all the resources and the environment.
National Climate Change Policy, 2013	The National Climate Change Policy provides strategic direction and coordinates issues of climate change in Ghana. The three objectives of the Policy are (1) effective adaptation, (2) social development and (3) mitigation. To address the adaptation issues in Ghana, five thematic areas have been prioritised. These are (1) energy and infrastructure, (2) natural resources management, (3) agriculture and food security, (4) disaster preparedness and response and (5) equitable social development.	The project will involve use of natural gas to generate energy. The power generation process will release gases such as carbon dioxide, methane and nitrous oxide.
NATIONAL LEGAL FRAMEWORK		

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
The Constitution of the Republic of Ghana, 1992	The Constitution includes some provisions to protect the right of individuals to private property, and also sets principles under which citizens may be deprived of their property in the public interest (described in Articles 18 and 20). Article 18 provides that "Every person has the right to own property either alone or in association with others." In Article 20, the Constitution describes the circumstances under which compulsory acquisition of immovable properties in the public interest can be done: "No property of any description, or interest in, or right over any property shall be compulsorily taken possession of or acquired by the State unless the following conditions are satisfied: i. The taking of possession or acquisition is necessary in the interest of defence, public safety, public order, public morality, public health, town and country planning or the development or utilization of property in such a manner as to promote the public benefit; and ii. The necessity for the acquisition is clearly stated and is such as to provide reasonable justification for causing any hardship that may result to any person who has an interest in or right over the property." Articles 268 and 269 make provision for the protection of natural resources of the country.	The proposed site for the power plant is for KNUST, which is part of Government or State land.
The Lands Act, 2020, Act 1036	The Lands Act (Act 1036) of 2020 repeals the State Lands Act (Act 125) of 1962, and other laws. The Lands Act (Act 1036) vests in the State the authority to compulsorily acquire land for public purposes via an Executive Instrument (EI) and shall ensure the prompt payment of fair and adequate compensation for the acquisition. It also declares that the Lands Commission shall act on behalf of the State with regard to the compulsory acquisition of land under the Act.	The proposed site for the Kumasi 1 Thermal Power Plant is part of KNUST lands, which has been acquired by the Government of Ghana. No compulsory acquisition of land will be necessary again under this project. However, affected farmers on the land may have to be compensated for loss of crops as appropriate.

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
The Lands (Statutory Wayleaves) Act, 1963	This Act describes the process involved in occupation of land for the purpose of the construction, installation and maintenance of works of public utility, and for creation of rights of way for such works. The provisions include among others: • The owner/ occupier of the land must be formally notified at least a week in advance of the intent to enter, and be given at least 24 hour notice before actual entry; • Any damage due to entry must be compensated in accord with the procedures established by the Minister unless the land is restored or replaced; Where a right of way must be established in the public interest, the President may declare the land to be subject to such statutory wayleave.	Due process must be used to occupy the site for the construction, installation of the thermal plant.
Volta River Development Act 1961, Act 46	The Act establishes the Volta River Authority (VRA) and defines its functions and responsibilities. Part 4, Section 17 (2) (d) of the Act authorizes the VRA to acquire land necessary "for the proper discharge of the Authority's functions." Provision has, also, been made in the Act for the payment of compensation or resettlement of affected people as may be applicable.	The VRA is the key proponent for this project, and responsible for the operation of the facility when relocated to its proposed site at Anwomaso.
Energy Commission Act 1997, Act 541	The Energy Commission Act 1997 (Act 541) sets up the Energy Commission and defines its functions as relating to the regulation, management, development and utilization of energy resources in Ghana including the granting of licenses for the transmission, wholesale supply, distribution and sale of electricity and natural gas.	The proposed power plant falls in the category of projects regulated by the Energy Commission as per the Act.
Electricity Regulations, 2008, (LI 1937)	Electricity Regulations, 2008 (LI 1937) provides for the planning, reliability and cost effectiveness of the national interconnected transmission system.	Power from the Kumasi 1 Thermal Power Plant will be evacuated into the national interconnected transmission system at the GRIDCo substation.
Electricity Transmission (Technical, Operational and Standards Of Performance) Rules, 2008, (LI 1934)	The Electricity Transmission (Technical, Operational and Standards of Performance) Rules, 2008 (LI 1934) establishes the procedures for operating the high voltage national interconnected transmission system	Power from The Kumasi 1 Thermal Power Plant will be sold out to the Ghana Grid Company (GRIDCo) as per the rules for transmission.
The National Electricity Grid Code, 2009	The National Electricity Grid Code of Ghana referred to in this document as the Grid Code, establishes the requirements, procedures, practices and standards that govern the development, operation, maintenance and use of the high voltage transmission system in Ghana. The purpose of the Grid Code is to ensure that the NITS provides fair, transparent, non-discriminatory, safe, reliable, secure and cost efficient delivery of electrical energy.	Power from Kumasi 1 Thermal Power Plant will be evacuated into the national interconnected transmission system at the GRIDCo substation.

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
Public Utilities Regulatory Commission Act, 1997 (Act 538)	The PURC Act, 1997 (Act 538) created PURC 'to provide guidelines on, and examine and approve, rates chargeable for the provision of utility services; protect the interest of consumers and providers of utility services; monitor standards of performance for provision of utility services; and promote fair competition among public utilities. The Act repeals VRA's power to set electricity rates contained in the VRA Act. It also includes the preparation of guidelines in fixing rates; a prohibition against demanding rates other than those approved by the Commission; notification to the Commission of any revision in rates; and publication of approved rates.	The operation of the proposed power plant will increase the electricity available for supply and distribution. The Kumasi 1 Thermal Power Plant will use water supplied by GWCL. The PURC will be involved with utility pricing or rates to be charged for electricity and water consumptions.
Lands Commission (LC) Act 2008, Act 767	This act provides for the management of public lands and other lands and for related matters. The Commission manages public lands and any other lands vested in the President by the Constitution or by any other enactment or the lands vested in the Commission. The act advises the Government, local authorities and traditional authorities on the policy framework for the development of particular areas to ensure that the development of individual pieces of land is co-ordinated with the relevant development plan for the area concerned. The Minister may, with the approval of the President, give general directions in writing to the Commission on matters of policy in respect of the management of public lands. The commission has the following divisions: • Survey and Mapping; • Land Registration; • Land Valuation; • Public and Vested Lands Management; and Any other Division the Commission may determine.	The Commission will be involved in the transfer of the proposed land for the Kumasi 1 Thermal Power Plant from KNUST to VRA/ Ministry of Energy as appropriate.
Land Use and Spatial Planning Authority (LUSPA) Act 2016, Act 925	The LUSPA Act 2016, Act 925 seeks to ensure the orderly and progressive development of land, town and other areas whether urban or rural for conserving and developing resources and to preserve and improve amenities thereof, and for related matters. It seeks to promote sustainable human settlements developments based on principles of efficiency, orderliness, safety and healthy growth of communities. This Act applies to both public and private institutions, which are responsible for human settlement, spatial planning and use of land, and issues development permit prior to undertaking any physical development of land within a district in which the land is situated.	LUSPA is a decentralised body at the MMDA level. The municipal assembly in which the proposed power plant is situated will be informed about the project to enable them incorporate or update their land use plans.

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
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 will issue an Environmental Permit prior to project implementation after the proponent, i.e. VRA/Ministry of Energy has followed the Environmental Assessment (EA) procedures for approval by the EPA
Environmental Assessment Regulations 1999, LI 1652	The regulations for undertakings requiring registration and issue of environmental permit may include: 1. (1) No person shall commence any of the undertakings specified in Schedule 1 to these Regulations or any undertaking to which a matter in the Schedule relates, unless prior to the commencement, the undertaking has been registered by the Agency and an environmental permit has been issued by the Agency in respect of the undertaking. 2. No person shall commence activities in respect of any undertaking which in the opinion of the Agency has or is likely to have adverse effect on the environment or public health, unless prior to the commencement, the undertaking has been registered by the Agency and an environmental permit has been issued by the Agency in respect of the undertaking. <u>Environmental impact assessment</u> 3. No environmental permit shall be issued by the Agency for any of the undertakings mentioned in Schedule 2 to these Regulations unless there is submitted by the responsible person to the Agency, an environmental impact assessment in accordance with these Regulations in respect of the undertaking.	The proposed project falls in the category for which an EIA is mandatory, as per the regulations.
Fees and Charges (Miscellaneous Provisions) Instrument 2019 (L.I. 2386)	The Fees and Charges (Miscellaneous Provisions) Instrument 2019 (L.I. 2386) provides comprehensive rates, fees and charges collectable by Ministries, Department and Agencies (MDAs) for goods and services delivered to the public. It contains the stipulated fees and charges to be paid by proponents with respect to Environmental Permits and Certificates or provides a guide for its determination.	All stipulated fees and charges shall be Paid in order to obtain the environmental permit from the EPA for project implementation.

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
Local Governance Act 2016, Act 936	This Act re-establishes and regulates the local government system and gives authority to the RCC and the Metropolitan, Municipal and District Assemblies to exercise political and administrative power in the Regions and Districts, provide guidance, give direction to, and supervise all other administrative authorities in the regions and districts respectively. The Assembly is mandated to initiate programmes for the development of basic infrastructure and provide municipal works and services as well as be responsible for the development, improvement and management of human settlements and the environment in the district.	The proposed site for the power plant is situated within the jurisdiction of the Oforikrom Municipal Assembly.
Water Resources Commission Act 1996 (Act 522)	The Water Resources Commission Act 1996 (Act 522) establishes and mandates the Water Resources Commission as the sole agent responsible for the regulation and management and the utilisation of water resources and for the co-ordination of any policy in relation to them. Section 13 prohibits the use of water (divert, dam, store, abstract or use water resources or construct or maintain any works for the use of water resources) without authority. Section 16 empowers the Commission to grant Water Rights (water use permits) to prospective users. The Act states under Section 24 that, except in accordance with the provisions of this Act or with the approval of the Environmental Protection Agency, any person who pollutes or fouls a water resource beyond the level that the EPA may prescribe, commits an offence and is liable on conviction to a fine or a term of imprisonment or both.	It is likely Section 13 of the Act [i.e. abstract or use water resources] will be triggered. Water use permit will be required for groundwater abstraction.
Water Use Regulation (WUR) 2001, LI 1692	The Water Use Regulations, 2001 (LI 1692) list such activities for which water use permit is required and this includes domestic, commercial, municipal, industrial water use among others. The Regulations also prescribe the raw water charges and processing fees to be paid by prospective water users with respect to the water use permits.	Any utilisation of raw water resources for the proposed project will require a water use permit including groundwater resources.
Ghana Water Company Act 1993, Act 461	GWCL is mandated by law, GWCL Act, 1993, (Act 461) to provide, distribute and conserve the supply of water in Ghana for public, domestic and industrial purposes.	The Kumasi 1 Thermal Power Plant will take water from the GWCL for its operations
Hazardous and Electronic Waste control and Management Act 2016 (Act 917) and Hazardous, Electronic and other waste (Classification), Control and Management Regulations 2016, LI 2250	The hazardous and Electronic waste and control ACT 2016 (Act 917) provides list of hazardous and other waste. It also provides control, management and disposal of electrical and electronic waste. Hazardous waste generally refers to waste with properties that makes it potentially dangerous or harmful to human health or the environment and they include liquids, solids or gases which cannot be treated or disposed of by common means. The Act will also ensure that harmful elements associated with hazardous and other waste products are captured and processed safely to preserve critical ecological components such as the soil, groundwater, flora and fauna.	The Act will guide the project on hazardous and electronic waste management and disposal during project implementation.

Policy and Legal Framework	Summary of core requirements	Relationship to proposed project
The Fire Precaution (Premises) Regulations 2003, LI 1724	The Fire Precaution (Premises) Regulations 2003 (LI 1724) requires all premises intended for use as workplaces to have Fire Certificates.	Fire certificate will be obtained for the operation of the power plant.
Factories, Offices and Shops Act 1970, Act 328	The Factories, Offices and Shops Act of 1970 (Act 328), as amended by the Factories Offices and Shops (Amendment) Law 1983 PNDCL 66, the Factories Offices and Shops (Amendment) Law 1991 PNDCL 275 s.1 (a), and the Ghana National Fire Service Act, 1997 (Act 537) requires all proponents to register every factory/workplace with the Chief Inspector of Factories Inspectorate Division. The Act requires all factories, offices and shops among others, notify the Chief Inspector of accidents, dangerous occurrences and industrial diseases, display at a prominent position in every factory the prescribed abstract of the Act and other notices and documentations, as well as outlines the regulations to safeguard the health and safety of workers.	The Kumasi 1 Thermal Power Plant will be registered with the Factories Inspectorate Division and any accident reported as per Act 328, 1970 during construction and operation.
The Labour Act 2003, Act 651	Section 118(1) of the Labour Act 2003 (Act 651) stipulates that it is the duty of an employer to ensure that every worker employed works under satisfactory, safe and healthy conditions. Act 651 contains a number of specific provisions relating to an employer's duty of care to its workers. These include providing and maintaining "at the workplace, plant and system of work that are safe and without risk to health" and taking "steps to prevent contamination of the workplaces by, and protect the workers from, toxic gases, noxious substances, vapours, dust, fumes, mists and other substances or materials likely to cause risk to safety or health". A worker is required to report situations that he believes may pose "an imminent and serious danger to his or her life, safety or health".	This Act is triggered for the Kumasi 1 Thermal Power Plant project. The provisions are incorporated into various policies and procedures of VRA such as environmental policy, occupational health and safety policy, Transport Policy, Risk Management Policy etc.
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.	This will apply to the project and the safety of all workers will be the responsibility of the Contractor and VRA.
Road Traffic Act, 2004 (Act 683)	The Act deals with restrictions on road use in the interest of Road safety, registration and licensing of motor vehicles and trailers, licensing of drivers of motor vehicles, test of vehicles and issuance of road use certificates and licensing of drivers of commercial vehicles. Under the Act, it is an offence for any drivers plying on the road to use a mobile phone, put a child on their lap whilst driving, put a child below the age of fifteen to sit on a passenger seat beside the driver. The Act also requires drivers to carry on their vehicles all necessary accessories like fire extinguishers and genuine driving license. Again, no driver would be allowed to drive when he or she is improperly dressed.	The project will ensure that all drivers/ operators engaged are trained or have the necessary knowledge and experience to comply with the requirements of this law.

2.3 National Institutional Framework for the implementation of the proposed Project

The proposed project falls directly under the jurisdiction of the Ministry of Energy. The key agencies whose mandates will be triggered by the implementation of the proposed Project are summarised in the table below.

Table 2-2: National Institutional Framework

Institutional Framework	Key objective /function	Relevance or relationship to Project
Ministry of Energy	The Ministry of Energy is responsible for formulating, monitoring and evaluating policies, programs and projects in the power sector. It is also the institution charged with the implementation of the National Electrification Scheme (NES) which seeks to extend the reach of electricity to all communities in the long term.	The proposed Project falls under this Ministry and the Ministry will be involved in project implementation and will be duly engaged.
Energy Commission	The Energy Commission is responsible for the regulation, management, development and utilization of energy resources in Ghana. The Commission, in addition to being responsible for technical regulations in the power sector, also advises the Minister for Energy on matters relating to energy planning and policy.	The construction and operation of the power plant will be under the technical regulation of the Energy Commission. The Commission will provide various licenses/permits including siting, construction, and operation.
Ghana Grid Company (GRIDCo)	The National Interconnected Transmission System (NITS) for electricity is owned and operated by the Ghana Grid Company (GRIDCo), which is a state-owned company. GRIDCo is responsible for transmission of electricity from facilities of wholesale suppliers to bulk customers or distribution companies and utilities in Ghana and West Africa without discrimination, among other functions.	GRIDCo is responsible for the operation and maintenance of the existing K2 BSP near the project site. Power from the Kumasi 1 Thermal Power Plant will be sold to GRIDCo into the National Interconnected Transmission System managed by GRIDCo
Electricity Company of Ghana (ECG)	Electricity Company of Ghana is a limited liability Company wholly owned by the Government of Ghana and operating under the Ministry of Energy. The Company was incorporated under the Companies Code, 1963 in February 1997. The Company is responsible for the distribution of electricity in the southern part of Ghana namely, Ashanti, Central, Eastern, Greater Accra, Volta, Oti, Western and Western North Regions.	The Low Voltage section of the associated BSP (i.e. K2 BSP at Anwomaso) is operated by ECG. ECG will play a key role in power outage management during project implementation.
Public Utilities and Regulatory Commission (PURC)	The Public Utilities Regulatory Commission of Ghana (PURC) is responsible for the economic regulation of the power sector with the mandate to provide guidelines for rates to be charged for the provision of utility services and approve rates for electricity sold by electricity distribution utilities.	PURC will regulate the pricing of the utility services provided by GRIDCo, ECG and GWCL as utility service providers under this project
Environmental Protection Agency	The EPA is the body responsible for regulating the environment and ensuring the implementation of government policies on the environment. The functions of the Agency include:	The EPA will ensure that the project follows the environmental assessment procedures, and will issue an environmental permit

Institutional Framework	Key objective /function	Relevance or relationship to Project
	▪ ensuring compliance with any laid down environmental impact assessment procedures in the planning and execution of development projects, including compliance in the respect of existing projects; ▪ promoting effective planning in the management of the environment; ▪ imposing and collecting environmental protection levies in accordance with the Environmental Protection Agency Act 1994, Act 490 or regulations made under the Act; and ▪ acting in liaison and co-operation with government agencies, District Assemblies and other bodies and institutions to control pollution and generally protect the environment.	prior to project implementation. VRA will follow and abide by EPA requirements, and comply with the environmental permit conditions during project implementation.
Local Government Authority	The Metropolitan /Municipal/District Assemblies (MMDAs) are responsible for the overall development of the metropolis/ municipality/ district as established by Acts 936 and 480. With regard to environmental management at the district level, the District Environmental Management Committees (DEMC) has been set up by law (Act 936) to among other things: ▪ Plan and recommend to the DA, strategies and activities for the improvement and protection of the environment with emphasis on fragile and sensitive areas, river courses etc.	The project is under the Oforikrom Municipal Assembly. The Assembly will play a key role in the successful implementation of the project especially with regard to providing building permits, waste management with managing encroachers and resolving grievances.
Lands Commission	The functions of the Lands Commission include amongst others; ▪ advise the Government, local authorities and traditional authorities on the policy framework for the development of particular areas of the country to ensure that the development of individual pieces of land is coordinated with the relevant development plan for the area concerned; ▪ ensure that through sound, sustainable land use planning, socio-economic activities are consistent with sound land use through sustainable land use planning in the long term national development goals; and ▪ promote community participation and public awareness at all levels in sustainable land management and development practices to ensure the highest and best use of land.	The Lands Commission will be involved in the update of the lands documents and facilitate transfer land for the project from KNUST to Ministry of Energy as appropriate.
Land Use and Spatial Planning Authority (LUSPA)	The LUSPA is the regulator for land use and spatial planning. It is the body that confirms zoning status of areas earmarked for development and provides development approvals for physical development of land within a district in the jurisdiction in which the land is situated.	LUSPA is decentralised at the MMDA level, and the project is situated within the jurisdiction of the Oforikrom Municipal Assembly. LUSPA will have to confirm any development approvals required.

Institutional Framework	Key objective /function	Relevance or relationship to Project
Ghana National Fire Service (GNFS)	The GNFS is a national institution responsible for the prevention and management of undesired fire. GNFS is responsible to ensure that the facility has a fire permit/ certificate.	The GNFS should be informed about the project and any associated premises or workplaces. The Fire Service will provide fire permit for both construction and operation of the facility.
Department of Factories Inspectorate	Regulations for health and safety of workers.	The Department of Factories Inspectorate should be informed about the project and any workplaces associated with the project for registration and permitting purposes.
Ghana National Gas Company Limited	Ghana Gas is mandated to build, own and operate infrastructure required for the gathering, processing, transporting and marketing of natural gas resources in the country. The proposed thermal plant project uses natural gas as fuel.	The Kumasi 1 Thermal Power Plant is expected to operate on natural gas from the Ghana National Gas Company.
Ghana Water Company Limited	GWCL is mandated to provide, distribute and conserve the supply of water in Ghana for public, domestic and industrial purposes.	The Kumasi 1 Thermal Power Plant is expected to use water supplied by GWCL for its operations.
Anwomaso Traditional Authority	In Ghana, people of common descent owe allegiance to a symbol of collective authority, such as the 'stool' for the Akans of southern Ghana or the 'skin' for the northern peoples. Traditional authorities play a role in the administration of the area. At the village level, family and land disputes and development issues are also traditionally dealt with by the village chief and elders. In addition to providing an important leadership role, especially in the more rural areas, chiefs act as custodians of stool/skin land, can mobilise their people for developmental efforts and arbitrate in the resolution of local disputes. Although chiefs have no direct political authority, some are appointed by the Government to District Assemblies.	The proposed thermal power project is located at Anwomaso. The chief, elders and members of Anwomaso are in closest proximity to the project site and will be most influenced.

2.4 Key Guidelines for Environmental Impact Assessment

In addition to the policies and legislations above, the following environmental guidelines will be considered:

- **Environmental Impact Assessment Guidelines for the Energy Sector (September 2011), Volume 1** ensures the sustainable use of energy resources and also contribute towards sound environmental management in the energy sector. Volume 2 of the Guidelines provides systematic procedures on EIS/EMP preparations for the energy sector as well as guidelines on common potential impacts and mitigation measures.
- **Environmental Impact Assessment Guidelines for the General Construction and Services Sector (2011)**, has been prepared to ensure the sustainable development of

the general construction and services sector and also contribute towards sound environmental management in the general construction and services sector.

2.5 Key National Environmental Quality Standards

The Ghana Standard Authority (GSA) has issued standards for the environment and health protection with ambient air quality, motor vehicle emissions, ambient noise control, effluent discharges and building as follows:

- GS 1236:2019 Environment and Health Protection –Requirements for Ambient Air Quality and Point Source/Stack Emissions
- GS 1219:2018 Environment and Health Protection –Requirements for Motor Vehicle Emissions
- GS 1222:2018 Health Protection –Requirements for Ambient Noise Control
- GS 1253:2018 Acoustics Guide for Measurement of Outdoor A-Weighted Sound Levels
- GS 1212:2019 Environment Protection –Requirements for Effluent Discharge

2.5.1 Ambient Air Quality

Ghana Standard (GS 1236: 2019) for Environment and Health Protection- Requirement for Ambient Air Quality and Point Source/Stack Emissions

The Ghana Standard on Environment and Health Protection – Requirement for Ambient Air Quality and Point Source/Stack Emissions. It specifies the requirements and methods of analysis for ambient air (see **Table 2-3**). It also specifies the requirements and test methods for point source or stack emissions based on the sources of energy as shown in **Table 2-4**.

Table 2-3: Requirement for Ambient Air Pollutants (GS 1236: 2019)

Substance (µg/m^3)	Maximum Limits	Averaging Time	Test Method
Sulphur Dioxide (SO_2)	520 µg/m^3 50 µg/m^3	1 hr 24hr	AS 358.4.10 Determination by Direct reading instrumental method
Nitrogen Oxides (Measured as $N0_2$)	250 µg/m^3 150 µg/m^3	1 hr. 24 hr.	ISO 7996 Determination by Chemiluminiscence method
Total Suspended Particulate	150 µg/m^3 80 µg/m^3	24 hr 1 yr	ASTM D4096-17 determination by High Volume Sampler Method
PM_{10}	70 µg/m^3 70 µg/m^3	24 hr 1 yr	ASTM D4096-17 determination by High Volume Sampler Method
$PM_{2.5}$	35 µg/m^3	24 hr	ASTM D4096-17 determination by High Volume Sampler Method

Substance (µg/m³)	Maximum Limits	Averaging Time	Test Method
Black Carbon	25 µg/m³ 25 µg/m³	24 hr 24 min	ASTM D6602-13 Standard practice for sampling
Benzene, µg/m³	5	1 yr	ASTM D5466 -15 determination by canister sampling method
Lead ,µg/m³	0.5 µg/m³ 1	1 yr 24hr	ISO 9855 determination by Atomic absorption method

Table 2-4: Requirements for Point source/Stack Emissions

No.	Pollutants	Maximum Limits	Test Method
1	**Solid fuels**		
a.	Sulphur Dioxide (mg/Nm³)	200	USEPA Method 6C
b.	Oxides of Nitrogen (mg/Nm³)	200	ISO 10849
c.	Particulate Matter (mg/m³)	50	ISO 9096
2	**Liquid fuels**		
a.	Sulphur Dioxide (mg/Nm³)	500	USEPA Method 6C
b.	Oxides of Nitrogen (mg/Nm³)	400	ISO 10849
c.	Particulate Matter (mg/m³)	50	ISO 9096
3	**Gaseous fuels**		
a.	Sulphur Dioxide (mg/Nm³)	100	USEPA Method 6C
b.	Oxides of Nitrogen (mg/Nm³)	320	ISO 10849
c.	Particulate Matter (mg/m³)	20	ISO 9096
4	**Electrical energy**		
a.	Sulphur Dioxide (mg/Nm³)	200	USEPA Method 6C
b.	Oxides of Nitrogen (mg/Nm³)	200	ISO 10849
c.	Particulate Matter (mg/m³)	50	ISO 9096
5	**Incinerators**		
a.	Sulphur Dioxide (mg/Nm³)	200	USEPA Method 6C
b.	Oxides of Nitrogen (mg/Nm³)	400	ISO 10849
c.	Particulate Matter (mg/m³)	70	ISO 9096
6	**Other parameters (that may apply)**		
a.	Carbon Monoxide (mg/Nm³)	100	USEPA Method 10
b.	Hydrochloric Acid (HCl) (mg/Nm³)	60	USEPA Method 0050
c.	Hydrogen Fluoride (mg/Nm³)	4	ISO15713
d.	Mercury and mercury compounds (mg/Nm³)	0.03	USEPA Method 29
e.	Particulate lead (mg/m³) (expressed as lead)	0.50	USEPA Method 29
	Note: 1) Electrical Energy usage include induction/electric arc furnaces, dryers, oven and kilns, Alumina & Iron smelting among others 2)* N represents Normal atmosphere and pressure		

2.5.2 Ambient Noise Level

Ghana Standard (GS 1222: 2018) for Health Protection- Requirements for Ambient Noise Control

This Ghana Standard specifies the requirements for acceptable ambient noise levels within categorized locations. The ambient noise levels of the classified zones shall conform to the requirements given in the table below. According to the Standards, the test method should be in accordance with the relevant test methods given in GS 1253:2018 (Acoustics- Guide for the measurement of outdoor A-weighted sound levels).

Table 2-5: Requirements for Noise Control (GS 1222: 2018)

ZONE/ Description of Area	PERMISSIBLE NOISE LEVEL IN dB(A)	
	DAY (6:00am – 10:00pm)	NIGHT (10:00pm -6:00am)
A (Residential areas)	55	48
B (Educational and health facilities, office and law courts)	55	50
C (Mixed used)	60	55
D (Areas with some light industry)	65	60
E (Commercial areas)	75	65
F (Light industrial areas)	70	60
G (Heavy industrial areas)	70	70

Noise requirements for construction activities

According to the provisions of GS 1222:2018, an entity responsible for a construction site shall ensure that the maximum noise level near the construction site does not exceed

- 75 dB (A) Leq (5 min.) in an industrial area; and
- 66 dB (A) Leq (5 min.) in other areas.

2.5.3 Effluent Quality

Ghana Standard (GS 1212: 2019) for Environmental Protection- Requirements for Effluent Discharge into Natural Water Bodies

The Environmental Protection Agency (EPA) through the Ghana Standards Authority (GSA) has issued formal standards on environment and health protection requirements. The effluent/ wastewater discharges into Natural Water Bodies provide maximum permissible concentrations for a number of parameters for various sectors. The thermal power plant and general industry standards are provided in the table below.

Table 2-6: Requirements for Effluent/wastewater Discharge

No	Parameter	Thermal Power Plant	General Industries	Test Method
1	Colour (TCU)	-	200	ISO 7887
2	Conductivity (µS/cm)	-	1500	ISO 7888
3	Temperature (° C)	≤ 3 above ambient	≤ 3 above ambient	-
4	Turbidity (NTU)	75	75	ISO 7027 (Quantitative methods)
5	pH	6.9	6-9	GS ISO 10523
6	TDS (mg/l)	-	1000	ASTM D5907
7	TSS (mg/l)	50	50	ASTM D5907
8	Nitrate as total Nitrogen (mg/l)	-	50	GS ISO 10304-1
9	BOD_5 (mg/l)	-	50	APHA 5210 method B or D
10	COD (mg/l)	250	250	ISO 6060 ISO 15705
11	Oil and grease (mg/l)	5	5	US EPA 1664
12	Phosphorus Total (mg/l)	2	2	APHA method 4500-P
13	Iron Total (mg/l)	2	-	ASTM D1068
14	Copper (mg/l)	0.5	-	ISO 8288 Flame atomic absorption spectrometric methods
15	Selenium (mg/l)	0.1	-	US EPA 7742 Atomic absorption, Borohydride reduction APHA 3113 B
16	Zinc (mg/l)	2	-	ISO 8288 Flame atomic absorption spectrometric methods
17	Chromium Total (mg/l)	0.05	-	ISO 9174 (atomic absorption spectrometric methods)
18	Arsenic Total (mg/l)	0.01	-	GS ISO 17378-2 (Hydride Generation Atomic Absorption Spectrometry)
19	Mercury (mg/l)	0.005	-	ISO 12846 (atomic absorption spectrometry (AAS)
20	Lead (mg/l)	0.1	-	ISO 8288 Flame atomic absorption spectrometric methods
21	Coliforms Total (MPN/ 100ml)	-	400	GS ISO9308-2

2.6 International Standards/Guidelines

2.6.1 IFC Performance Standards 2012

International Finance Corporation (IFC) applies the Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing.

The Performance Standards may also be applied by other financial institutions electing to apply them to projects in emerging markets. VRA may commit to meeting the requirements of the IFC Performance Standards as an international best industry practice. The eight Performance Standards are summarised in **Table 2-7**.

Table 2-7: Summary of IFC Performance Standards and Potential for Trigger under the Project

No	IFC Performance Standards	Summary of core requirements	Potential for Trigger under the project
PS1	***Assessment and Management of Environmental and Social Risks and Impacts***	Identify and evaluate environmental and social risks and impacts of the project and adopt measures to avoid and when avoidance is not possible, minimise and or compensate Project Affected People/Communities and Environmental Area of Influence. In the achievement of the above, Clients should establish an effective ESMS, which ensures stakeholders/community participation and grievance redress mechanisms.	Triggered
PS2	***Labour and Working Conditions of workers***	Management of projects should ensure workers safety, promote fair treatment, non-discriminatory and equal opportunity of workers. Management should also establish, maintain and improve the worker-management relationship, and comply with national employment and labour laws of host country.	Triggered
PS3	***Resource Efficiency and Pollution Prevention***	Avoid or minimise adverse impacts on human health and the environment through avoidance or minimisation of pollution including release of greenhouse gases from project and promote sustainable use of resources such as energy and water. Clients are also expected to ensure the use of efficient pollution abatement machinery to reduce pollution.	Triggered
PS4	***Community Health, Safety and Security***	To evaluate the risks and impacts to the health and safety of the Affected Communities during the project lifecycle and establish preventive and control measures consistent with Best International Practices and commensurate with their nature and magnitude of impacts.	Triggered
PS5	***Land Acquisition and Involuntary Resettlement***	As much as possible project siting and activities should not displace people. However, where avoidance is not possible, displacement should be minimised by alternative project design considerations. No force eviction should be undertaken by client. Land acquisition should be done in a manner as to minimise adverse social and economic impacts through the provision of compensation packages and to ensure a humane resettlement procedure, disclosure of information, consultation and participatory of PAPs. It should be the client's duty to ensure that the physical and economic wellbeing of displaced people are not worst of than their pre displaced lives.	Triggered
PS6	***Biodiversity Conservation***	All clients should identify both direct and indirect project related impacts that could potentially threaten biodiversity	Triggered

No	IFC Performance Standards	Summary of core requirements	Potential for Trigger under the project
	and Sustainable Management of Living Natural Resources	and ecosystem services. The following indicators should be used as a guide: habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution.	
PS7	***Indigenous People***	The client will identify, through an environmental and social risks and impacts assessment process, all communities of Indigenous Peoples within the project area of influence who may be affected by the project, as well as the nature and degree of the expected direct and indirect economic, social, cultural (including cultural heritage), and environmental impacts on them. Adverse impacts on Affected Communities of Indigenous Peoples should be avoided where possible. Indigenous People are defined as a social group with identities that are distinct from mainstream groups in national societies, and are often among the most marginalized and vulnerable segments of the population.	Not triggered
PS8	***Preservation of Cultural Heritage***	Client must protect cultural heritage from the adverse impacts of project activities and support its preservation. Clients should also promote the equitable sharing of benefits from the use of cultural heritage.	No evidence for trigger observed during reconnaissance visit and engagement during the scoping phase. However, ongoing studies for the EIA will also confirm this.

IFC categorizes projects to determine the level of environmental and social assessment that will be required. The proposed power plant is most likely to fall under Category B. That is a project "with potential limited adverse social or environmental impacts that are few in number, site-specific, largely reversible, and readily addressed through mitigation measures".

2.6.2 IFC EHS Guidelines

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors, and for this project the relevant specific guideline is the IFC EHS Guidelines for Thermal Power Plants.

The EHS Guidelines for Thermal Power Plants include information relevant to combustion processes fuelled by gaseous, liquid and solid fossil fuels and designed to deliver electrical or mechanical power, steam, heat or any combination of these, regardless of the fuel type. It applies to boilers, reciprocating engines, and combustion turbines in new and existing facilities. Annex A contains a detailed description of industry activities for this sector, and Annex B contains guidance for Environmental Assessment (EA) of thermal power projects.

2.6.2.1 *Air Emission Levels and Ambient Air Quality*

The air emission levels and ambient air quality guidelines recommended by IFC are that of the World Health Organization (WHO), and these are provided in the table below.

Table 2-8: WHO Ambient Air Quality Guidelines

WHO Ambient Air Quality Guidelines (also used by IFC)		
Substance or Parameter	Averaging Period	Guideline value in µg/m^3
Sulphur dioxide (SO2)	24-hour	20
	10 minute	500
Nitrogen dioxide (NO2)	1-year	40
	1-hour	200
Particulate Matter (PM10)	1-year	20
	24-hour	50
Particulate Matter (PM2.5)	1-year	10
	24-hour	25
Ozone	8-hour daily maximum	100

2.6.2.2 *IFC Ambient Noise Level Guidelines*

The ambient noise level guidelines recommended by IFC are provided in the table below (i.e. noise levels measured out of doors). The noise impact should not exceed these levels. Highly intrusive noises, such as noise from aircraft flyovers and passing trains, should not be included when establishing background noise levels.

Table 2-9: IFC Ambient Noise Level Guidelines

Receptor	One Hour L_{Aeq} (dBA)	
	Day Time (07:00 – 22:00)	Night Time (22:00 - 07:00)
Residential; Institutional; Educational	55	45
Industrial; Commercial	70	70

2.6.2.3 *World Bank Group Stack Emission Guidelines*

The World Bank Group standards for emission levels are provided:

- Particulate < 50 mg/Nm^3
- NOx Emissions ≤ 750 mg/Nm^3

- SOx ≤ 500 mg/Nm^3

2.6.2.4 *Effluents from Thermal Power Plants*

The World Bank Group Guidelines for effluent from thermal power plants is provided in the table below.

Table 2-10: Effluents from Thermal Plants

Parameter	Maximum Value (mg/l)
pH	6-9
TSS	50
Oil and grease	10
Total residual chlorine	0.2
Chromium (total)	0.5
Copper	o.5
Iron	1.0
zinc	1.0
Temperature increases	≤ 3 ^{o}C

b. The effluent should result in a temperature increase of no more than 3° C at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge when there are no sensitive aquatic ecosystems within this distance.

2.6.3 International Conventions

Ghana is signatory to a number of international and regional conventions that have been established by the United Nations or its specialized agencies and African Union to sustainably manage and/or protect the environment and workers. The ones that should be considered for the Project are:

- African Charter on Human and Peoples' Rights (adopted 1998, entered into force 2005)
- United Nations Framework Convention on Climate Change (UNFCCC);
- ILO Conventions.
  - Convention Concerning the Protection of Workers against Occupational Hazards in the Working Environment due to Air Pollution, Noise, and Vibration (ILO No. 148) 1987;

United Nations Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change (UNFCCC) provides the basis for global action to protect the climate system for present and future generations. The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other

emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership, with 189 countries having ratified.

The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.
Under the Convention, governments:

- Gather and share information on greenhouse gas emissions, national policies and best practices.
- Launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and
- Cooperate in preparing for adaptation to the impacts of climate change.

ILO Conventions

Convention Concerning the Protection of Workers against Occupational Hazards in the Working Environment due to Air Pollution, Noise, and Vibration (ILO No. 148) 1977

Article 9 of the 1977 Convention of ILO states that as far as possible, the working environment shall be kept free from any hazard due to air pollution, noise or vibration,

(a) by technical measures applied to new plant or processes in design or installation, or added to existing plant or processes; or, where this is not possible,
(b) by supplementary organisational measures.

2.7 VRA's Corporate Environmental Policy

The Volta River Authority (VRA) has a corporate environmental policy that commits to ensuring continuous improvement in environmental performance that minimizes potential impacts of all its operations on the environment. The VRA adopts the principle of sustainable development and compliance with both national and international environmental protection regulations, which is important for the proposed Kumasi 1 Thermal Power Plant Project. These principles enables VRA to adopt good international industry practices for its construction and operational activities. The Authority has an Environment Department and a Health/Safety outfit to implement all Safety Health and Environment (SHE) actions and requirements including those conditions attached to the regulatory permits for the implementation of the proposed project.

The VRA has also developed a Safety Health and Environment (SHE) manual for contractors that provides a framework for better practices and continual improvement in the wellbeing of construction workers and for the elimination of injuries and fatalities through VRA's engagement in construction. The use of this manual will ensure that the construction and installation of the Kumasi 1 Thermal Power Plant is carried out efficiently and effectively in a duty of care and safe environment.

3.0 DESCRIPTION OF THE PROPOSED PROJECT

This Chapter provides a description of the proposed Project, and the project information provided under this chapter is obtained mainly from the Feasibility Study Report for the proposed Project, the 2016, 2017 and 2018 Annual Environmental Reports, and the 2019 Environmental Management Plan (EMP) of the AMERI Power Plant at its Aboadze site near Takoradi in the Western Region.

3.1 Justification and Benefits of the Project

The Ghana Grid Company Limited (GRIDCo) who is the power system operator of Ghana, has indicated at several stakeholder fora that a power plant in the Ashanti region of Ghana will help improve voltages of the Ghana power system a great deal and especially in the Greater Kumasi area.

Currently, Kumasi and the rest of the northern part of the country are experiencing very frequent power interruptions due to low voltages and other power transmission bottle necks in the Kumasi area. This situation is not only affecting power transmission and distribution in Kumasi and Northern Ghana but also impeding the export of power to SONABEL in Burkina Faso. The situation has been aggravated due to the inability of the Bui power plant to operate at the desired level during peak and off-peak period due to insufficient inflows.

Relocating the AMERI Power Plant to Kumasi will also be the quickest solution to the challenges faced by the grid. This project would reduce transmission losses from 132.5 MW (3.74 % of total generation) to 107.6 MW (3.1 % of total generation) as stated in the 2020 Electricity Supply Plan for the Ghana Power System. This is a significant reduction of about 25MW (0.64% of total generation) in transmission losses.

The following benefits/opportunities are expected to be realized from the possible implementation of the proposed project in the area:
1. Improvement in the voltage stability of the NITS
2. Significant reduction in transmission system losses.
3. Improvement in the quality of supply to end users through improved network voltage control via generators.
4. Continuous supply of reliable power to end users

3.2 Location of Proposed Project Site

The proposed site located at Anwamaso, in the Oforikrom Municipality lies between latitudes 6°41'24"N and 6°42'20"N and longitudes 1°31'12"W and 1°30'36"W. The site is

approximately 15 acres. The site plan is provided in **Annex 3-1** and the site coordinates are provided in the table below.

Table 3-1: Site Coordinates

Ref. Point	Latitude	Longitude
Point 1	6°41'44.96"N	1°31'9.57"W
Point 2	6°41'53.31"N	1°31'4.92"W
Point 3	6°41'49.19"N	1°31'0.01"W
Point 4	6°41'41.89"N	1°31'4.62"W

The proposed site currently belongs to the Kwame Nkrumah University of Science and Technology (KNUST). The proposed site is situated between GRIDCo's 161kV and 330kV transmission line right-of-way. It is bounded on the south by 161kV and 330kV substations of GRIDCo, north and west by farmlands and on to the east by farmland/National Vocational Training Institute (NVTI) Complex of the Ministry of Education as shown in **Figure 3-1.**

Figure 3-1: A Google Earth Map showing the Proposed Project Site with existing facilities

3.3 Accessibility

The main access road to the proposed site and the GRIDCo Substations at Anwomaso is by a motorable asphaltic surfaced road, about 2.69km to the substation, off the main Accra-Ejisu-Kumasi Highway. The road, approximately 6m driveway is completed with necessary road furniture.

There are currently two main access routes to the proposed project site. One access route is to the right of the GRIDCo/ECG substations, where the 330 kv transmission line enters the substation (see **Plate 3-1**). This route is mainly concrete and wide enough to take two cars in opposite direction. VRA plans to construct this as its main access road to the project site.

The other route is to the left of GRIDCo substation (see **Plate 3-2**), where the 161 kv transmission line enters the substation. The route lies towards the NVTI structures. The route starts from the main township road as a concrete road up to the GRIDCo substation, and after the substation it is not paved, and with potholes. It is a single lane and cannot accommodate two cars in opposite direction.

Plate 3-1: One access route to project site along the GRIDCo 330 kV Substation (right side of substation)

Plate 3-2: The other access route to project site between the GRIDCo 161 kv line and NVTI structures (left side of substation)

3.4 Main Features and Proposed Layout of the Plant

The Kumasi 1 Thermal Power Plant is a 250MW (ISO) plant comprising of ten (10) 25MW (ISO) GE TM 2500+ Aero Derivative Gas Turbines (GTs), and will operate primarily on natural gas. Each train of GT and power generator is mounted on mobile platform.

The proposed layout of the plant as shown in **Figure 3-2** consists of the following:
1) A – Substation
2) B – Gas Turbine Island
3) C – Warehouse/Workshop
4) D – Office and Control Building
5) E – Car Park
6) F – Water Treatment and Storage Tank
7) G – On-base Gas Skid

Figure 3-2: The proposed layout of the Kumasi 1 Thermal Power Plant

3.4.1 Power Evacuation Infrastructure/Substation

The Thermal Power Plant has ten GE TM2500 Gas Turbine Generators (GTGs) with a total installed capacity of 250MW. Each generator has a rated capacity of 29.111MVA, 11.5kV, 50Hz. The power evacuation components include"

vi. Equipment in prefabricated building;
vii. Mobile station service transformers;
viii. Emergency Diesel generators;
ix. 11kV medium voltage cables; and
x. All interconnecting cables with their cable trays.

Other equipment include:

i. Three Phase Transformers;
ii. Surge Arrestors;
iii. Three Phase Circuit Breakers;
iv. Current Transformers;
v. Inductive Voltage Transformers;
vi. Three Phase Double Break Disconnects;
vii. Three Phase Centre Break Disconnects with Earthing Switch;
viii. Capacitive Voltage Transformers;
ix. Three Phase Busbars; and
x. Three Phase Earthing Switches.

The Thermal Power Plant 250 MW power will feed the 161KV GRIDCo substation at Anwomaso for evacuation of power to the national grid.

Currently, the GRIDCo substation at Anwomaso consist of a 161kV substation and a 330kV substation both with breaker-and-a-half configuration. The 161kV substation has three step down transformers which serves the ECG substation adjacent to the GRIDCo 161kV substation. The 330kV substation has two auto transformers which steps down voltage from the 330kV transmission lines to feed the 161kV substation. The 161kV substation has six (6) bays and GRIDCo has given an indication of the availability of two free bays for use by the Kumasi 1 Thermal Power Plant for power evacuation into the national grid.

The existing AMERI plant and substation equipment together with the prefabricated buildings, Mobile station service transformers, Emergency Diesel generators, 11kv medium voltage cables, all interconnecting cables with their cable trays will have to be decommissioned at Aboadze, transported, installed and commissioned to feed power into the existing 161kV GRIDCo substation at Anwomaso. VRA will obtain a separate

permit from the EPA for the decommissioning of the AMERI Power Plant at its Aboadze site prior to relocation to its new site at Anwomase.

3.4.2 Gas Turbine Island

The Gas Turbine Island will house the ten GE TM2500 Gas Turbine units. Each unit has a dedicated Balance of Plant (BOP) and an on-base gas skid. The BOP comprises of a lube oil skid and water wash equipment. There will be five (5) emergency diesel generator sets with each one dedicated to two (2) gas turbines.

3.4.3 Office and Control Building

A multipurpose office building which will have offices, a kitchenette and washroom facilities for the Plant Manager and staff as well as a control room will be constructed. A two (2) Storey Office/Control room building with a total floor area of about 600m^2 will be constructed for the 250MW Power Plant.

3.4.4 Workshop/Warehouse

A workshop/warehouse is almost an integral part of a thermal power plant. This facility is needed for the storage of spare parts and consumables and for carrying out repair works. A 90m.sq workshop/warehouse building will be constructed for the plant. The facility will either be made of brick and concrete or will be prefabricated.

3.5 Water Tank and Water Supply Requirements

Process water (demineralized water) is required for water injections to wash critical plant components such as the Gas Turbines and the Compressors. Unprocessed water is also required for service applications and firefighting on site. The Kumasi 1 Power Plant requires about 7.5 m3 of demineralized water per day for operations. Thermal power plant operations and maintenance requires storage of water in sufficient quantities for station firefighting and dedicated water supply.

A dedicated water treatment facility will be installed at the station. The proposed water supply facilities include:

i. 40 m^3/h containerized water treatment plant;
ii. 2 x 100 m^3 demineralized water storage tank;
iii. 3 x 300 m^3 raw water tanks; and
iv. 1000 m^3 water storage tank for station's firefighting system.

Currently there is no access to water from the Ghana Water Company Limited (GWCL) mains. GRIDCo depends on ground water mechanized borehole for the substation. The Ghana Water Company Limited (GWCL) proposes to lay a new 150mm (6-inch) diameter HDPE dedicated line from Oduom to Anwomaso to provide potable water to the power

plant site at Anwomaso. The approximate length of the dedicated 6-inch pipeline will be 3km. GWCL will obtain a separate EPA permit for this subproject activity.

3.6 Fuel Supply Requirements

The GE's TM 2500+ Aero Derivative Gas Turbines runs on natural gas (NG). Each unit requires 5.5 mmscf of NG per day making a total of 55 mmscf per day for the ten (10) gas turbines. New gas infrastructure is required to ensure the operation of the thermal power plant. These include:

i. Pipelines;
ii. Regasification; and
iii. Gas conditioning units.

Ghana National Gas Company Limited is currently extending a pipeline from Prestea to Dawusaso. Further extension of the gas pipeline would be made to Nyinahin and then to the site at Anwomaso. The 330kV transmission line Right-of-Way (RoW) would be used for the construction of the gas pipeline. The On-base Gas Skid at site would be fed with gas from the pipeline and distributed to the various gas handling facilities of each gas turbine units.

3.7 Production Processes

The power production processes comprise of

- Natural gas supply & conditioning;
- Combustion;
- Generation; and
- Transmission.

The production processes are described in **Table 3-2**. The flow diagram of the production processes is provided in **Figure 3-3**.

Table 3-2: Description of the Power Production Processes

Process Stage /Unit Operation	**Description of process stage / unit operation**
Natural Gas Supply & Conditioning	The Kumasi 1 Power Plant will operate in a simple cycle mode. In this operation, natural gas will be received from the Ghana National Gas Company Ltd. The gas is then conditioned to the right temperature and pressure at the gas conditioning module attached to each gas turbine and sent to the combustion chamber.

Process Stage /Unit Operation	Description of process stage / unit operation
Combustion	The compressor draws atmospheric air through the air inlet filters into the compressor. The hot air is introduced into the combustion chamber of the combustor at the same time as the pre-heated fuel from the fuel selection skid. The air-fuel mixture is ignited and the resultant combustion produces heat and exhaust gas. The efficiency of combustion is dependent upon the type of burners and the air-fuel ratio.
Generation	The resultant mass flow of the exhaust gas, which is appropriately directed unto the gas turbine blades, provides the necessary force to turn the gas turbine, which is in turn coupled to a generator through a shaft for power generation. The exhaust gas is then discharged into the atmosphere through the stack alongside the heat. The temperature of exhaust gases discharged to the environment varies but approximates 565°C during a simple cycle bypass operation.
Transmission	Power generated will be transmitted to the grid through two 161 KV circuits

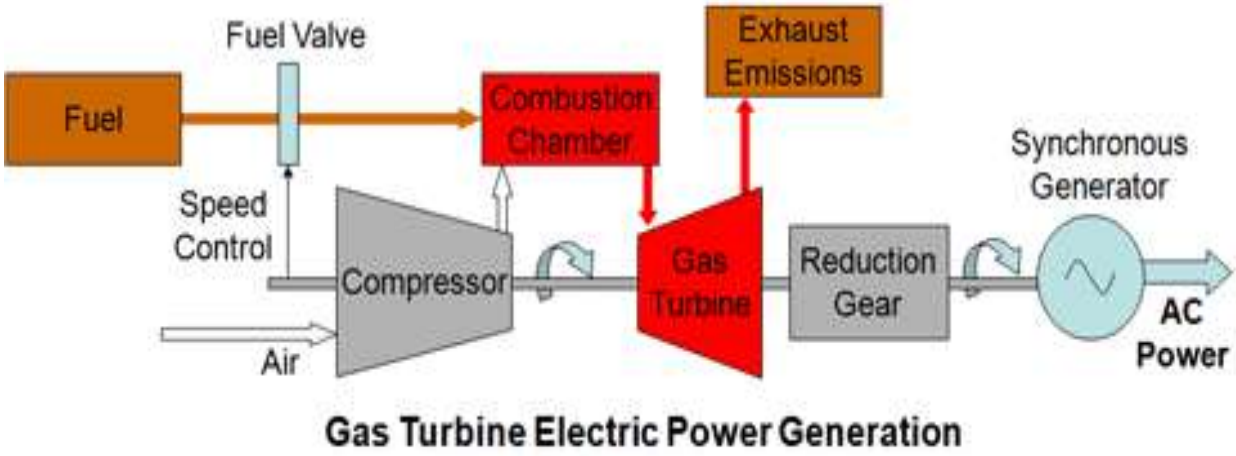


Figure 3-3: Production process flow diagram

3.8 Access Roads

All roads required for maintenance and operational access are expected to be designed appropriately for the site conditions and will be properly defined, excavated, trimmed, compacted and surfaced as required.

3.9 Site Drainage

The site shall be designed to effectively drain off storm water to avoid flooding. Adequate and appropriate type drainage channels shall be provided to ensure that the site is safe from flooding.

3.10 Operation and Maintenance (O & M) Requirements

The VRA already has an O&M team to take over the operations of the plant in Kumasi. The team to operate the Power Plant will consist of thirty-three (33) man operating and maintenance crew. Sixteen (16) out of the 33 will be operators who will run four shift system. All the Operators will be supervised by one operations Engineer. The remaining seventeen (17) will be maintenance crew consisting of three sections (i.e. Mechanical-7, Electrical-5 and C&I-4) with their respective supervisors. The Plant will have a Plant Manager and some administrative staff to manage and support the work of the O&M team.

3.11 Project Schedule and Management

A contractor will be procured for the construction and installation of the power plant. VRA will be responsible for the operation and maintenance of the power plant as indicated above. The project implementation schedule is provided in **Table 3-3**. It is expected to take about 15 months to complete the surveys, land acquisition, permitting, and the construction and installation of the Kumasi 1 Thermal Power Plant.

Table 3-3: Project Implementation Schedule

		Time Schedule in Months														
Activities	**Duration**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Survey	1 month															
Land acquisition	3 months															
Gas infrastructure *	9 months															
Geotechnical investigations	3 months															
Permit/license acquisition	14 months															
Civil works	6 months															
Water supply infrastructure*	6 months															
Decommissioning of water storage and treatment plant*	2 months															
*Decommissioning and transportation of plant	3 months															
Installation of plant	6 months															
Installation of water storage and treatment plant	3 months															
Power evacuation infrastructure	6 months															

* Separate EPA permits to be obtained for such activities

4.0 ALTERNATIVE CONSIDERATIONS

The Ghana power system is currently having low voltages from Ashanti Region to the northern part of the country. Hence having another power plant in Kumasi and its environs is a matter of urgency to augment the Bui Hydropower plant, which is the only major source of power supply for voltage stability in the northern part of the country.

The alternatives considered to address the power supply challenges in the Ashanti and the northern part of the country included:

- Energy/Power source options;
- Developing a new thermal power plant as against use of an existing plant;
- Site selection options;
- Water supply source options; and
- No Action Option.

4.1 Alternative Energy/Power Sources

The alternative energy/power sources considered are discussed in the table below.

Table 4-1: Alternative Energy/Power Sources

Options	Potential Environmental Implications	Potential Socioeconomic Implication	Conclusion /Preferred Option
ENERGY/POWER SOURCES			
Thermal	**Advantages** 1. Environmentally, natural gas thermal plant in this case has the lowest air emissions compared to petroleum or coal. It is considered a very clean and safe fossil fuel. 2. Natural gas can easily be preserved. It can be stored and transported through pipelines, small storage units, cylinders or tankers on land and sea. **Disadvantages** 1. It pollutes the atmosphere due to production of greenhouse gases though low. 2. Leaks of natural gas and oil spills are tremendously dangerous. Such leaks may cause explosions, fire or serious pollution. 3. Thermal plants add to the thermal burden of the earth.	**Advantages** 1. Less initial cost as compared to other generating plants. 2. It requires less space as compared to Hydro and solar power plants. 3. Thermal power plant construction and operation creates employment opportunities for both skilled and unskilled people particularly for those from the local communities. **Disadvantages** 1. The global price of natural gas could be very unstable. 2. Though the initial cost is less, the running cost for a thermal plant is comparatively high due to fuel, maintenance etc.	Thermal plant is the preferred option in this case because it reduces Ghana's reliance on hydro power that has proven to be limited over the years. The Bui Hydropower facility is the only major source of energy /power supply for voltage stability in the northern part of the country. There is the need for the country to diversify its energy mix for the northern part of the country

Options	Potential Environmental Implications	Potential Socioeconomic Implication	Conclusion /Preferred Option
Solar Power	**Advantages** 1. PV panels provide clean– green energy. During electricity generation with PV panels, there are no harmful greenhouse gas emissions thus solar PV is environmentally friendly. 2. Solar power is a renewable source of energy. 3. Produces no health-damaging air pollution or acid rain. 4. The power plants, once in place, do not create any waste by-products in their conversion. **Disadvantages** 1. Electricity generation depends entirely on a countries exposure to sunlight; this could be limited by the availability of regular sunshine. 2. Large areas of land are required to capture the suns energy. Collectors are usually arranged together especially when electricity is to be produced and used in the same location.	**Advantages** 1. Solar jobs come in many forms, from manufacturing, installation, monitoring and maintaining solar panels, to research and design, development, cultural integration, and policy jobs. 2. Solar energy has the ability to avoid the politics and price volatility that is increasingly characterizing fossil fuel markets. 3. Solar energy is energy supplied by nature – it is thus free and abundant. 4. Solar energy can be used in remote areas where it is too expensive to extend the electricity power grid. **Disadvantages** 1. Solar panels are bulky, less efficient and expensive. 2. Solar electricity storage technology has not reached its potential yet as solar energy supply is constant. 3. The cost involved in installing solar panels and storing of energy generated is very high.	through the building of thermal plants to deliver adequate power to meet the increasing demand and ensure reliable electricity in the Ashanti Region and the northern part of the country.
Wind Power	**Advantages** 1. Wind energy is friendly to the surrounding environment, as no fossil fuels are burnt to generate electricity from wind energy. 2. Wind turbines can also share space with other interests such as the farming of crops or cattle. 3. Wind power is a renewable energy source. 4. Produces no health-damaging air pollution or acid rain. 5. The power plants, once in place, do not create any waste by-products in their conversion.	**Advantages** 1. Wind turbines are a great resource to generate energy in remote locations, such as mountain communities and remote countryside. 2. Wind energy has the ability to avoid politics and price volatility that is increasingly characterizing fossil fuel markets 3. Wind power construction and operation creates jobs and provides income for both skilled and unskilled people,	

Options	Potential Environmental Implications	Potential Socioeconomic Implication	Conclusion /Preferred Option
	Disadvantages 1. Wind turbines generally produce a lot less electricity than the average fossil fuelled power station, requiring multiple wind turbines to be built in order to make an impact. This may disrupt land cover 2. Wind turbine construction can be very costly to surrounding wildlife during the building process.	particularly, those from the local communities. 4. Wind energy is energy supplied by nature – It is thus free and abundant **Disadvantages** 1. The wind velocities in the area can be sporadic and doesn't blow well at all locations. Research and maps are needed to identify the optimal locations, these may be costly. 2. Transmission of electricity from remote wind farms can be a major hurdle for utilities since many wind turbines are not located around urban centers. 3. The storage of excess energy from wind turbines in the form of batteries, hydrogen or other forms still needs research and development to become commercially viable	
Nuclear Power	**Advantages** 1. Production of electric energy is continuous. 2. The plant itself does not give off greenhouse gasses **Disadvantages** 1. Special precautions must be taken during the mining, transporting and storing of the uranium, as well as the storing of any waste product to prevent it from giving off harmful levels of radiation. 2. Accidental release of harmful radiation is one of the biggest drawbacks of nuclear energy. 3. There is generation of nuclear waste and managing it is difficult as it takes many years to lose its radioactivity and danger.	**Advantages** 1. With little fuel, large amounts of energy are obtained. 2. Nuclear power plant construction and operation creates employment opportunities and income for both skilled and unskilled people particularly for those from the local communities. **Disadvantages** 1. Plant construction is highly politicized. 2. Nuclear Power Plant Accidents can cause health problems and radiation. 3. It requires large capital cost and the repay of the	

Options	Potential Environmental Implications	Potential Socioeconomic Implication	Conclusion /Preferred Option
		construction of the nuclear plant is significantly more expensive.	
Hydro power	**Advantages** 1. When in use, electricity produced by dam systems do not produce greenhouse gases. They do not pollute the atmosphere. 2. The power plants, once in place, do not create any waste by-products in their conversion. 3. Hydro Power is a renewable energy source 4. Produces no health-damaging air pollution or acid rain **Disadvantages** 1. The flooding of large areas of land means that several communities and properties may be displaced as a result. The natural environment and property of the affected persons are destroyed. 2. The building of large dams can cause serious geological damage. e.g. earthquakes 3. Building large dams can cause damage to water courses which affects people and wildlife and it can be difficult to find the right site. 4. Hydro power plants output are highly dependent on rain falls	**Advantages** 1. The lake's water can be used for irrigation purposes. 2. The lake that forms behind the dam can be used for water sports and leisure/pleasure activities. 3. Hydroelectric energy is more reliable than wind or solar power. 4. Hydro energy has the ability to avoid politics and price volatility that is increasingly characterizing fossil fuel markets 5. Hydro power construction and operation creates jobs and provides income for both skilled and unskilled people, particularly, those from the local communities. 6. Hydro energy is energy supplied by nature – It is thus free and abundant **Disadvantages** 1. Dams are extremely expensive to build and must be built to a very high standard. 2. Flooding of available land that could be used for agriculture. 3. People living in villages and towns that are in the valley to be flooded, must move out. This means that they lose their farms and businesses. 4. Transmission of electricity from remote hydro power plants can be a major hurdle for utilities since many hydro power dams are not located around urban centers.	

Options	Potential Environmental Implications	Potential Socioeconomic Implication	Conclusion /Preferred Option

4.2 Developing a new Thermal Power Plant as against the use of an existing Plant

The VRA also considered the development of a completely new thermal power plant in Kumasi as against the use of an existing and out-of-service thermal power plant such as the AMERI Power Plant. The development of a completely new thermal power plant will have a huge capital outlay (involving procurement of a completely new power plant from outside the country, transporting to the country, construction/installation cost) take a much longer time to secure funding, longer time to carry out feasibility and environmental/social assessment studies, other permitting studies, and construction of the power plant. This is obviously a long term project and not a quick fix solution required to address the current power supply challenges in the Ashanti Region and the northern part of the country.

The option of relocation of the AMERI Power Plant from its Aboadze base in the Western Region to the Ashanti Region was considered. The AMERI Power Plant has been in use for some time in the country, and therefore its environmental impacts at its current base at Aboadze are fairly known. The operational and environmental performance monitoring results of the Plant at its current base are also known, and these provide a good background information to inform decision making when relocated to the Ashanti Region. It will also not involve a huge capital outlay as there is no procurement of a power plant but will involve decommissioning, relocation and construction/installation and possible replacement of worn-out parts of the existing plant. The cost/duration of EIA preparation for a new power plant are much higher/longer than the cost of preparing an EIA for an existing power plant that already has an EMP in place and will only have to be relocated to a new site. For a quick fix solution to the current power challenges experience in the Ashanti and northern part of the country, the most obvious feasible option is the relocation of the existing AMERI Power Plant.

4.3 Site Selection Options

Various sites were considered for the location of the AMERI Power Plant. As part of the site assessment, the following environmental/social and technical issues were considered for the selection of a suitable site for the project:

i) availability of power evacuation infrastructure
ii) availability of water for plant operation (e.g. cooling for combined cycle operation)
iii) access to land for gas pipeline infrastructure
iv) other constraints such as socioeconomic use of land and environmental concerns.

The following major sites were assessed to aid in the selection process:

- **Site 1 – Kumasi Area GRIDCo Substation:** Two locations considered as
  - Site 1.A – Area within GRIDCo Right of Way
  - Site 1.B – VRA Emergency Power Plant
- **Site 2 – GRIDCo K2BSP Substation:** Two key locations considered
  - Site 2.A – Area within existing GRIDCo Substation land acquisition
  - Site 2.B – Area used by KNUST for Plant Research
- **Site 3** –GRIDCo Substation in Obuasi

4.3.1 Site 1 – Kumasi Area GRIDCo Substation

The GRIDCo Kumasi Area Substation is situated in Nhyieso, close to the Georgia Hotel. Two (2) locations were identified that could be used for the development of a thermal power plant.

4.3.1.1 *Site 1.A – Area within GRIDCo Right of Way*

Site1.A is a 5.83 acre piece of land that falls within the GRIDCo Right-of-Way for its 161kV pylons. It is near the Kumasi Area Substation. There is minimal vegetation on the land and portions of the land has been graded to be used by an unidentified private entity. The following challenges were identified:

1. There are oxidation ponds used by the Komfo Anokye Teaching Hospitalfor the treatment of their waste water, which would have to be relocated to allow for the site to be used for the development of a thermal power plant
2. There are private enterprises situated within the GRIDCo Right of Way that would also have to be relocated for the construction of the gas pipeline infrastructure.

4.3.1.2 *Site 1.B – VRA Emergency Power Plant*

This site currently accommodates VRA's emergency diesel generators. The estimated area of land available at the site is about 2 acres with about half of that available area used for a tank farm. The site also has an 11kV distribution line for evacuation of electricity from the 20MW diesel generator sets. There is an existing pipeline from Ghana Water Company that provides municipal water to the site. The challenges at the site include:

1. Routing a gas pipeline to the site would be challenging due to the market and other settlements around the site.
2. The 11kV evacuation infrastructure would have to be upgraded to safely and reliably send power to the nearby GRIDCo substation.

4.3.2 Site 2 – GRIDCo K2BSP Substation

The GRIDCo K2BSP Substation is situated in Anwomaso, a suburb close to Kwame Nkrumah University of Science and Technology. At this site, two main locations that could be used for the development of a thermal power plant were considered.

The substation is one of GRIDCo's 330kV substations feeders from the 330kV substations in Pokuase, Aboadze and Kintampo. The substation has both 20MVAR capacitor banks and reactors for regulation of voltages.

There is currently no access to municipal water at the substation so a borehole has been dug and it provides water for use by staff of GRIDCo at the substation. The Right-of-Way of the 330kV pylons is wide enough to accommodate a gas pipeline to supply fuel to a thermal plant that would be developed on any of the identified sites in this area.

4.3.2.1 *Site 2.A – Area within existing GRIDCo Substation land acquisition*

This site forms part of the land acquired for the construction of the GRIDCo K2BSP substation. Part of the land, about 6.7 acres, is fallow with no visible signs of economic or social use. Another part of the land, about 4.5 acres is currently used by the youth in the Anwomaso community as a football park. The challenge that were identified on site was the lack of a source of municipal water.

4.3.2.2 *Site 2.B – Area used by KNUST for Plant Research*

This is a 15 acre parcel of land that is currently used by the Faculty of Agriculture at KNUST for plant research. This site currently has minimal vegetation. The challenges on the site include:

1. No municipal water supply. However boreholes can be sunk to provide for use at the proposed site.
2. The land is currently used by KNUST for teaching purposes, and there are some few farmers farming on part of the land.

4.3.3 Site 3 – GRIDCo Substation in Obuasi

This site lies adjacent the old GRIDCo Substation within the Obuasi Township. The power evacuation infrastructure operates at 161kV, 34kV and 11kV voltage levels and it provides electricity to the Obuasi Township and for the mining activities of Anglogold Ghana Limited. The challenges at the site include:

i) route for a gas pipeline to the site would be quite challenging due to the mountainous terrain and the urban development close to the site.
ii) access to the site for haulage of plant equipment would be quite challenging due to the urban development close to the site.

4.3.4 Ranking of Sites

The identified sites were ranked based on the following criteria:
i) Power evacuation infrastructure
ii) Availability of right of way for a gas pipeline
iii) Size and current use of land
iv) Availability of water
v) Access to the site for haulage of plant equipment

A mark of 1 to 3 was awarded, for each criterion, to each site. A mark of 3 for each criterion indicates that the site has no visible constraints. A mark of 2 indicates that the site has minimal constraints with respect to that criteria. A mark of 1 indicates that the site has a lot of constraints and resolving those issues is expected to be quite challenging. **Table 4-1** below are the marks awarded to each site.

The ranking of the sites, from the best site to the worst site, are as follows:
(1) Site 2.A – GRIDCo Substation land in Anwomaso
(2) Site 2.B – KNUST Land near GRIDCo Substation in Anwomaso
(3) Site 1.B – VRA's Emergency Diesel Generator Site
(4) Site 1.A – Location 1 at Kumasi Area GRIDCo Substation
(5) Site 3.A – Site adjacent Obuasi GRIDCo Substation

It can be noted from the ranking that the best two sites are located close to the GRIDCo Substation in Anwomaso.

4.3.5 Final site selection

It was decided at a meeting, on February 26, 2021, in Kumasi between VRA and other stakeholders including the Ministry of Energy, GRIDCo and Ghana Gas that the AMERI Power Plant would be moved to a site (Site 2.B, area used by KNUST for plant research) adjacent to the GRIDCo K2BSP 161kV/330kV substation at Anwomaso in Kumasi, in the Ashanti Region.

Table 4-2: Ranking of identified sites

Criteria	*Site 1.A*	*Site 1.B*	*Site 2.A*	*Site 2.B*	*Site 3.A*
Power Evacuation Infrastructure	**2** (Power evacuation at 161Kv possible)	**1** (Existing power evacuation at 11kV, upgrade required to evacuate power at 161kV	**3** (Power evacuation at 161kV and 330kV possible)	**3** (Power evacuation at 161kV and 330kV possible)	**2** (Power evacuation at 161kV possible)
Gas Pipeline Route	**2** (161kV Right-of-Way available for a gas pipeline however relocation of settlers would be required)	**1** (Gas pipeline to this site would require relocation of settlers and would be challenging due to the proximity of site to urban development)	**3** (161kV and 330kV Right-of-Way available for gas pipeline route)	**3** (161kV and 330kV Right-of-Way available for gas pipeline route)	**1** (Gas pipeline to this site would be challenging due to the complexity of the terrain and the proximity of the site to urban development)
Current Use of Land	**2** (settlers and business enterprises on site would have to be relocated)	**3** (site is already prepared and accommodates VRA's Emergency Diesel Generators)	**2** (No visible economic use of land. Part of land used as a football park by community)	**2** (site is used by KNUST for farming)	**2** (No visible economic use of land)
Availability of Water	**1** (No visible source of water)	**3** (Municipal water is available on site)	**2** (Municipal water is not available however, it is possible to sink boreholes for water)	**2** (Municipal water is not available however, it is possible to sink boreholes for water)	**3** (Municipal water is available on site)
Access to Site for haulage of Plant equipment	**3** (Access to the site is good, no Visible challenge identified)	**3** (Access to the site is good, no visible challenge identified)	**3** (Access to the site is good, no visible challenge identified)	**3** (Access to the site is good, no visible challenge identified)	**1** (Access to the site would be challenging due to the urban development close to the site)
TOTAL	**10**	**11**	**13**	**13**	**9**

4.4 Water Supply Source Options

Two water supply source options under consideration are

- Ghana Water Company Limited (GWCL)
- Groundwater.

The table below provides a brief analysis in terms of the potential environmental and socioeconomic implications of each option, and the preferred proposal.

Table 4-3: Analysis of water supply options

Options	Potential Environmental Implications	Potential Socioeconomic Implication	Conclusion /Preferred Proposal
WATER SUPPLY SOURCES			
1. Ghana Water Company Limited (GWCL)	**Advantages** 1. Water supplied may be free from contaminants and toxins 2. Relatively cleaner effluent will be produced from the facility **Disadvantages** 1. It may be contaminated when water pipes burst; 2. Using water from GWCL may adversely affect supply to communities.	**Advantages** 1. Less sophisticated water treatment plant will be required for the production of demineralized water since the raw water source is relatively clean **Disadvantages** 1. Increased competition for water supplied to the populace/ residents. 2. Regularity of supply may be an issue since supply to the municipalities will be a priority. 3. GWCL may rather supply the plant at the expense of the populace. 4. The cost for water supply maybe high	The project should consider both GWCL source and augment with groundwater. The existing GRIDCo facility uses borehole. The distance from the site to the GWCL mains is just about 3km.
2. Groundwater	**Advantages** 1. Water is not lost by evaporation. 2. It is a renewable resource. **Disadvantages** 1. There is a risk of withdrawing groundwater from aquifers faster than it is replenished because large volumes of water may be needed.	**Advantages** 1. Groundwater supply can be removed as needed year round. 2. More ethical since competition with communities is less. **Disadvantages** 1. High cost of pumping groundwater.	

Options	Potential Environmental Implications	Potential Socioeconomic Implication	Conclusion /Preferred Proposal
	2. The water table may be significantly impacted.	2. Risk of over abstraction	

4.5 No Action Option

If no action is taken to address the power supply challenges in the Ashanti region and beyond, the challenges associated with the grid will persist and worsen. There will not be a reduction in transmission losses which the project would have brought. The implementation of the project would reduce transmission losses from 132.5 MW (3.74 % of total generation) to 107.6 MW (3.1 % of total generation) as stated in the 2020 Electricity Supply Plan for the Ghana Power System. This is a significant reduction of about 25MW (0.64% of total generation) in transmission losses, and this will not materialise if no action is taken.

The other benefits/opportunities expected to be realized from the possible implementation of the proposed project in the area will also not happen. There will not be any improvement in the voltage stability of the NITS; there will not be any improvement in the quality of supply to end users through improved network voltage control via generators; and there will not be any reliable power to end users.

The country will lose out on the numerous benefits to be derived therefrom, such as promoting socioeconomic activities and wellbeing, increased business investment as a result of reliable power supply among others. Continuous power challenges can cripple the local economy in the affected areas, create unemployment as businesses will have to lay off workers because of inadequate energy to support and sustain economic and business activities. The employment opportunities that the project will bring to the area will not materialize. The extension of the GWCL mains to the project site which the local communities can benefit from will also not happen in the short to medium term.

There will be no additional emission of noxious gases into the atmosphere from a government owned thermal power plant. However, this will be negated with the use of various diesel generators as some businesses and organizations who can afford will go for diesel generator sets to support their business operations.

The no action option is not a preferred option at all as the power challenges will not only persist but become worse and affect the socioeconomic, wellbeing and livelihood activities in the affected area in general.

5.0 BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

This chapter presents a brief environmental and social baseline information of the project area. The project area of influence include the project site and its immediate environs including the Anwomaso community and the larger area which covers the Oforikrom Municipality. The environmental and social baseline information is obtained through literature reviews, publicly available information and observations made during the field visits.

The key literature reviewed include the:

- Medium-Term Development Plan (MTDP)/Profile of the Oforikrom Municipal Assembly;
- District Analytical Reports from the 2010 Population and Housing Census published by the Ghana Statistical Service; and
- Feasibility Study Report for the Relocation of the AMERI Power Plant from its Takoradi Base to Anwomaso.

The chapter is subdivided into three major headings as follows:

- Physical Environment
- Biological Environment
- Social Environment

5.1 Physical Environment

5.1.1 Climate

The study area falls within the wet sub-equatorial climatic zone. The average minimum temperature is about 21.5^{o}C and a maximum average temperature of 30.7^{o}C. The average humidity is about 84.16% at sunrise and 60% at sunset. The project area experiences a double maxima rainfall regime (214.3mm in June and 165.2mm in September/October). The major rainy season starts from March to July with a peak usually in June. The minor season starts from September to November with a peak either in September or October. August is usually cool and dry. The main dry season occurs in December to March during which the desiccating harmattan winds blow over the area.

The rainfall in the Kumasi area is characterized by two rainy seasons. The first major rainfall season starts from March and ends in July with the highest values recorded in May or June, while the second rainfall season starts from September and ends in November with October recording the highest rainfall. The mean annual rainfall is between 1600 mm and 1800 mm. December, January and February, and July, August and early September, are generally much drier than the remaining months (Ghana Meteorological Agency, 2016).

5.1.2 Topography/Relief

Oforikrom Municipality lies within the plateau of the South – West physical region which ranges from 230-300 meters above sea level. The topography is generally undulating for the municipality. The proposed site is on a low ridge with the surrounding land sloping gently down to the south and south-west. The existing ground surface at the project site is approximately 268 to 285 m above mean sea level.

5.1.3 Drainage

The Municipality is traversed by water bodies such as Susan, Wiwi, Saman, Aboabo and Adote. The list of water bodies in the Municipality is provided in the table below. However, human activities such as construction of housing and improper waste disposal have impacted negatively on these water bodies and is increasingly leading to their extinction and inability to support living organisms in them.

Table 5-1: ***List of Water Bodies within the Municipality***

S/N	Water Bodies	Location
1	Susan	Susanso, Susaakye, Bomso, Anloga (Nkasem)
2	Wiwi	Ayigya, Kentikrono
3	Saman	Kokoben
4	Bobo	Tech
5	Oda	Kodiekrom, Deduako, Apemso
6	Tawiah	Anwomaso (Primary)
7	Subiri	Oduom, and Anwomaso
8	Adote	Nana Serwaa (Anwomaso High Tension)
9	Aboabo	Oforikrom

Source: OfMA NADMO Department 2021.

Drainage at the proposed site occurs by natural sheet flow towards the south/south-west, with some local depressions at low elevations. The proposed site is within 200m from a stream called Adote (also spelt Adoti) Stream.

5.1.4 Geology

Geologically, Kumasi (Greater Kumasi) falls within the Lower Birimian which consists of dark grey slatey phyllites, phyllites and "sandy" (probably ashy) phyllites and greywackes. All gradations between these exist and different rock types are often intimately interbedded. The greywackes vary from fine grained to medium grained and all have metamorphosed and recrystallized. Near the contacts with the granite batholith, metamorphism has produced biotite, staurolite, garnet and kyanite schists. The rocks are deeply weathered and fresh outcrops of phyllite are never seen (Murray, 1961). The geology of Oforikrom Municipality is dominated by Middle Precambrian Rocks.

5.1.5 Soil

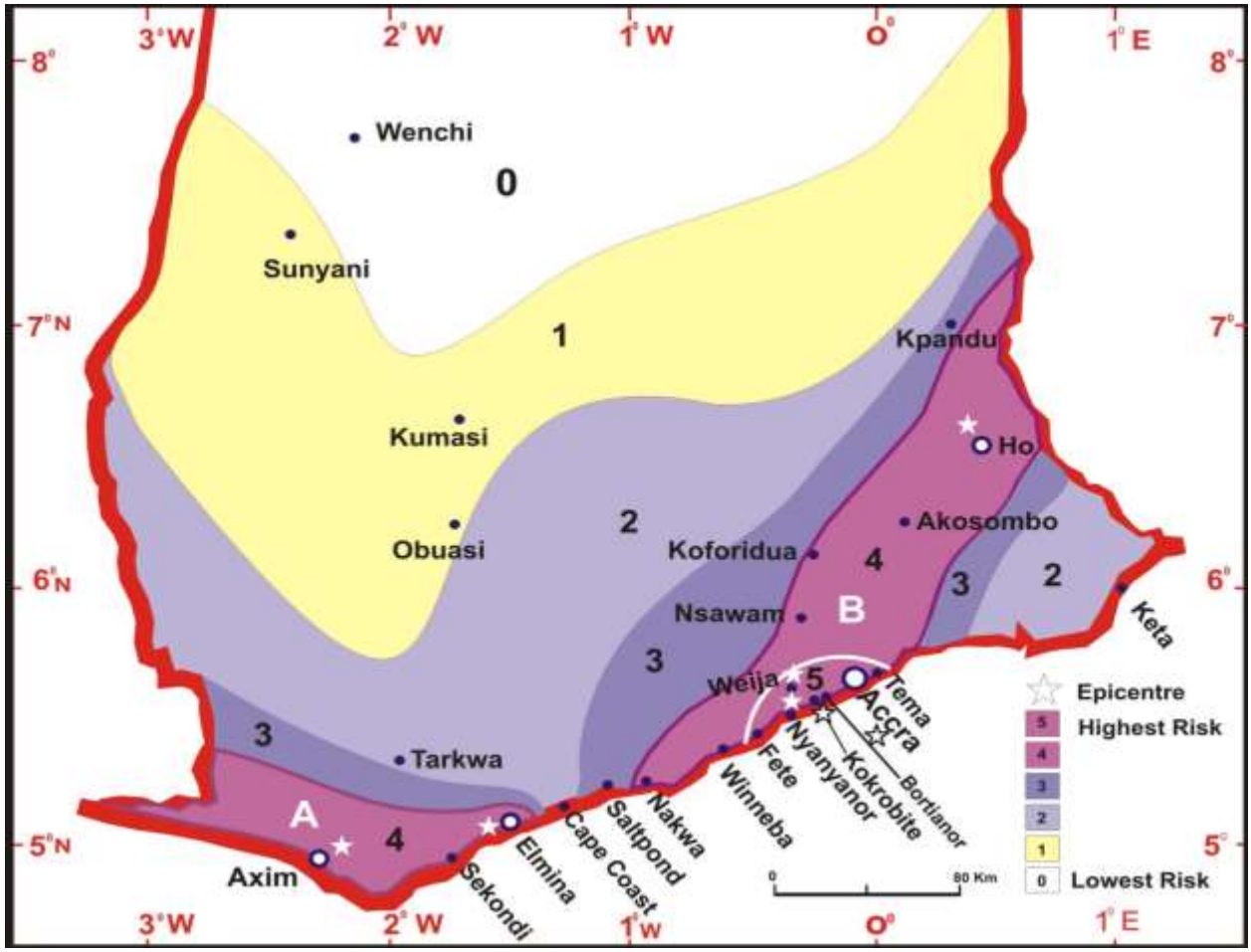
The major type of soil constituting the top soil of the Municipality is the Forest Ochrosol. This soil type is comprised of Oforikrom - Offin Compound Association; Bomso – Offin Compound Association; Nhyanao - Tinkong Association; Bomso – Suko Simple Association; Bekwai – Oda Compound Association and Bekwai – Akumadan – Oda Compound Association. Forest Ochrosol is endowed with the nutrient mostly needed to sustain the cultivation of food crops such as vegetables, plantain and cassava. The presence of this type of soils has sustained the cultivation of food crops notably at the periphery of the Municipality.

5.1.6 Seismicity and Earthquake Zoning

Ghana is not located close to any of the world's well-known seismic zones. Generally, Ghana is a stable land mass, and features very low seismic activity. However, significant earthquake activity has been reported in southern Ghana, especially the coastal region of the country, that is, along the Gulf of Guinea, where earthquakes up to magnitude 5.5 to 6.5 on the Richter-scale have been historically recorded (in 1906 and 1939) and occur on repetitive periods of between 50 and 140 years.

Seismic activity in southern Ghana is believed to be caused by movement along two active fault systems; the Akuapim Fault along the Akuapim mountain range which trends approximately NE-SW and is located about 20km west of Accra and the Coastal Boundary Fault which lies some 3km offshore and runs almost parallel to the coastline in the vicinity of Accra.

Figure 5-1 shows the seismic risk map of southern Ghana (Kutu, 2013). The earthquake zoning is related to the probability of occurrence. Zone 0 areas have the least occurrence of earthquakes and zone 5 areas have the most. This means that the higher the zone the more likely the areas under it will experience higher earthquake loads. According to the seismicity map of southern Ghana, the Kumasi area lies in Zone 1 of the seismic risk assessment map, which is located further away from the seismically active parts of Ghana, and is generally a lower seismic hazard zone. The Ghana Geological Survey Authority (GGSA) recommends peak ground acceleration values of 0.05 g to 0.10g for Zone 1.



Source: Kutu (2013)

Figure 5-1: Seismic Risk Map of Southern Part of Ghana

5.1.7 Ambient Air Quality

Prior to establishment of Kumasi 1 Thermal Power Plant, an assessment of the background air quality scenario is imperative. Preliminary assessment of the ambient levels of pollutants such as TSP, PM10, $PM_{2.5}$, $PM_{1,}$ NO_2, SO_2 and CO have been carried out as part of the scoping exercise on site and at surrounding receptors at Anwomaso using a highly flexible state-of-the-art air quality monitor (SIRA Certified OSIRIS TURNKEY INSTRUMENT/various gas meters using models of CROWCON.

Measurements of gaseous pollutants; NO_2, CO and SO_2 were obtained by using models of CROWCON: Nitrogen Dioxide meter, Carbon Monoxide meter and Sulphur Dioxide meter respectively. Gaseous concentrations levels were determined from measurements of data taken at intervals of 30 minutes continuously for 8 hours each day and night at the sampling site.

The monitoring dates are from 16th to 22nd of August, 2021. On August 22, 2021, a bushfire was observed in a farm. Burning of the bush was about 300 m away (northwest) from the monitoring point. The various dust concentrations measured in this initial baseline survey are presented below. There were elevated figures above the Ghana Standards for TSP, PM10 and PM2.5 for measurements carried out during the daytime on 17th August, 2021.

Table 5-2: Particulate Matter at Substation 1 - During the Day and Night

Particulate Matter and VOC (µg/m³)						
Location (Transformer Yard) Substation 1 (161kv)			6°41.711 N, 1°31.190 W			GS 1236:2019
Parameter	Day 16/08/20211	Night 16/08/2021	Parameter	Day 17/08/2021	Night 17/08/2021	
TSP	87.4	69.2	TSP	208.4	96.3	150
PM 10	54.1	39.2	PM 10	136.6	63.0	70
PM 2.5	20.8	12.89	PM 2.5	74.06	19.37	35
PM 1	-	4.32	PM 1	37.62	6.26	-
VOC	-		VOC	0.20	0.10	-

An initial survey indicated the existence of CL_2 and CO_2 predominance, as CO_2 naturally occurs in the atmosphere. The VOC encountered is Butane**.** The Cl2 and NO2 concentrations in ppm are shown in **Table 5-3**.

*Table 5-3: **Gases Measured at Substation 1- During the Day and Night***

Gases			
Location (Transformer Yard) Substation 1 (161kv)		6°41.711 N, 1°31.190 W	
Day		Night	
Cl_2 (ppm)	NO_2 (ppm)	Cl_2 (ppm)	NO_2 (ppm)
0.06	0.02	0.09	0.10
0.05	0.10	0.13	0.20
0.04	0.00	0.10	0.10
0.05	0.00	0.11	0.10
0.07	0.10	0.10	0.20
0.11	0.10	0.13	0.10
0.09	0.02	0.10	0.20
0.08	0.10	0.14	0.10
0.05	0.15	0.13	0.10
0.60	0.03	0.11	0.02
0.08	0.04	0.10	0.20
0.07	0.10	0.08	0.03

The prevailing wind directions are NNW, NW and WNW with the respective percentage dominance of 13.33%, 46.67% and 40.00% of the project area. The wind speed measured during the initial monitoring period used for the windrose diagram 0 m/s to 4.5 m/s provided in **Figure 5-2**.

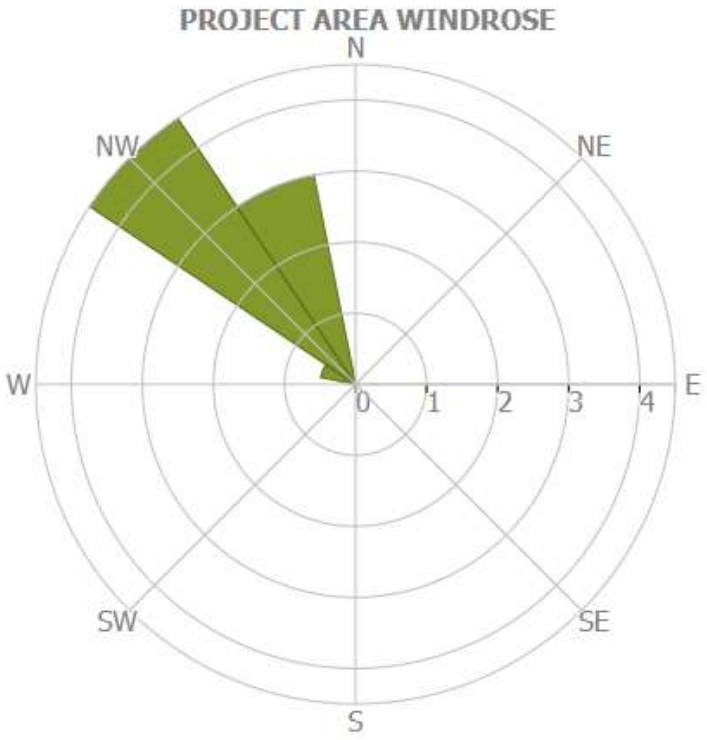


Figure 5-2: The Windrose Diagram for Project Area

5.1.8 Ambient Noise Issues

Sample noise levels were measured at Awomaso primary school on 18th August, 2021 using a CASTLE- SONUS Sound level meter. The results are in **Table 5-4**. The baseline result from the initial monitoring were below the GSA and WHO limit. A much detailed noise assessment will be presented in the EIS. The noise sources are vehicular traffic, loud music and noise from the community.

Table 5-4: ***Noise Levels at Anwomaso*** *Primary school-Day Monitoring*

NOISE (dBA)						
LAF	LAeq	LAmax	CpK	Lep	LAE	Monitoring date
55.7	59.7	74.9	97.2	59	81.6	Day: 18/08/2021
42.2	49.3	70.2	91.3	48.1	67.5	Night: 18/08/2021

Legend

L_{eq} is the equivalent continuous sound level – the sound pressure level of a steady sound having the same energy as a fluctuating sound over a specified measuring period. It can be considered similar to an average level. The LAeq value is the A-weighted Leq.

LAMax (dBA) is the maximum instantaneous value recorded over the monitoring period including A-weighting.
LAmax : A-weighted, maximum, sound level - maximum is not peak
LAF : is A-weighted, sound level, measured with a fast time constant.
LAeq is Level A-weighted equivalent.
L_{ep}, is personal noise exposure level.
Cpk : is C-weighted, peak, sound level
LAE : A-weighted, sound exposure level.

5.2 Biological Environment

5.2.1 Vegetation and Fauna

Reconnaissance walks through the study area and along the external boundaries were undertaken to obtain an overview of the extent, topography and complexity of the vegetation. The project site is situated at Anwomaso in the Oforikrom Municipality of the Greater Kumasi Metropolitan Area. It occurs in the Moist Semi-deciduous Forest type (North-West subtype) of Ghana. This forest type is the most extensive in Ghana (Hall and Swaine, 1981). Typically, a three-tier tree structure is evident in undisturbed Moist Semi-deciduous forest, with some tree species exceeding 50 m in height. Some of the characteristic species of the Moist Semi-deciduous forest are *Leptaspis cochleata, Celtis milodbraedii, Culcasia angolensis, Nesogordonia papaverifera, Griffonia simplicifolia* and *Baphia nitida*. This forest type is the most productive in the forest zone, the soils being ideal for most forest zone crops. As such cocoa and other food crop farms are widespread in this forest type.

The project site is basically agricultural land situated in a peri-urban environment. It is occupied by farms and farm re-growths with isolated trees. The major crops cultivated are cassava, maize and vegetables such as tomatoes. The farm re-growth is dominated by Panicum maximum (guinea grass) and forbs which forms a dense thicket. Some of the isolated trees observed on the site are *Morinda lucida*, *Alstonia boonei*, *Lecaniodiscus cupanioides* and *Albizia zygia*. The invasive species, *Chromolaena odorata*, is the most common shrub at the site.

Interviews with the farmers met on the project site indicated that the site was poor in fauna. The farmers reported the most common animals on the site to be **Mammalia:** *Thryonomys swinderianus* (cane rat), *Xerus erythropus* (ground squirrel) and *Cricetomys gambianus* (giant rat); **Aves*:*** *Milvus aegyptius* (Yellow-billed Kite), *Bubulcus ibis* (Cattle egret) and *Corvus albus* (Pied crow); Reptilia: *Naja melanoleuca* (Black cobra), *Bitis gabonica* (Gaboon viper) and *Philothamnus* spp. (Green tree snakes).

The Yellow-billed kite (*Milvus aegyptius*) and the Cattle egret (*Bubulcus ibis*) are of national conservation importance, both listed as "Completely Protected" on the Wildlife Conservation Regulation. The two species were however widespread in the immediate

surroundings of the project area and are considered 'feeding visitors' to the project area. There were no signs indicating that the species breed in the area. The paucity of the fauna in the project area was ascribed to the cultivation and noise. The impacts of the project on the fauna is expected to be minimal.

Plate 5-1: A vegetable farm (tomatoes) at the project site

Plate 5-2: A cassava farm at the project site

Plate 5-3: Farm re-growth dominated by Panicum maximum

5.2.2 Aquatic Biology

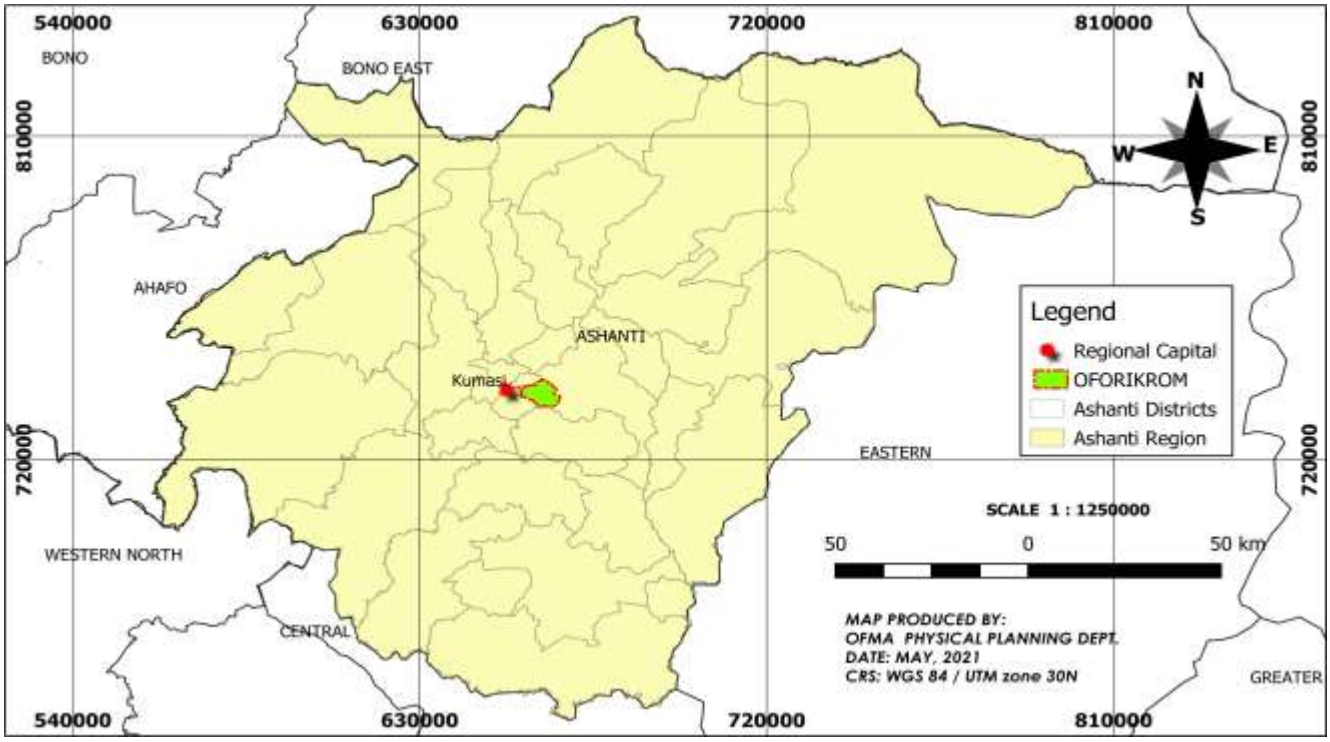
The Adote Stream traverses near the project site. The stream is generally seasonal in character, and has low depressions around which has become a wetland sort of, making access to the stream channel difficult during the scoping field visit. Fishing in the stream is not a known activity. Literature on the aquatic life of the stream was not sited during the scoping exercise. The EIA will carry out further investigations on the aquatic life of the stream.

5.3 Social Environment

This section provides a general socioeconomic and cultural overview of the Oforikrom Municipality, the project district and the land-use of the project site and surrounding areas.

5.3.1 Location and Size

The Municipality is located between Latitude 6.42°986N and 6.38°582N and Longitude 1°29'58.33'W and 1°36'8.29°E and elevated 240 to 300 meters above sea level. The Municipality shares boundaries with Ejisu to the East, Bosomtwe DA to the South, Asokwa MA to the South West, Asokore Mampong to the North and KMA to the West. Oforikrom Municipal Assembly is approximately 270km north of the national capital, Accra. It has a surface area of approximately 4,978.47 hectares (49.78 kilometres square) which is about 0.0192 percent of the total land area of Ashanti Region. The capital of the Municipality is Oforikrom. **Figure 5-3** is a map of the Municipality in the regional context, and **Figure 5-4** is the political/administrative map of the Municipality



(Source: OfMA-Planning Unit, August 2021)

Figure 5-3: Location map of Oforikrom Municipality in the Regional Context

(Source: OfMA-Planning Unit, August 2021)

Figure 5-4: Map of Oforikrom Municipality

5.3.2 Population

According to the 2010 Population and Housing Census, the Municipality recorded a population of 303,016 made up of 149,827 (49.45%) males and 153,189 (50.55%) females. The 2019 projected population is 373,055; 184,165 males and 188,890 females. The most densely populated community is Ayigya with projected population 67,604, whilst the least densely populated is Bebre with projected population of 2,667.

5.3.3 Culture

The culture of the people of Oforikrom is manifested in their way of life. These include inherited ideas, beliefs, values, knowledge and skills. One of the dominant cultural practice in Oforikrom is the celebration of the Akwasidae festival, which is celebrated by the Asantes. Since culture is dynamic, some practices of the people have undergone major changes over the years such as "Bragoro" and as such has far reaching implications on development. The Asante's hold in high esteem their traditional values, attitudes and practices. This is profound in their celebration of Akwasidae, the organization of marriage ceremonies, funerals etc. The Akwasidae is held regularly at 40 days' interval on Sundays and nine times in a year. Every forth "Akwasidae" is celebrated as "Adaekese" which is celebrated twice in a year. This ceremony gives the Asantes the opportunity to celebrate their past leaders and heroes. It attracts people from all walks of life, especially those in the Diaspora. Thus, it also serves as a means of foreign exchange earnings through tourism.

There are various ethnic groups in the Municipality and this can be attributed to its strategic location and the University (KNUST), which provides teaching and learning to both Ghanaians and foreigners.

5.3.4 Gender Profile

In the Municipality, it can be realised that both males and females are engaged in economic activities. Activities such as carpentry work, barbering, farming, photography, transport services are male dominated while petty trading, hawking, dress making, catering, etc. are female dominated. Both sexes can be seen to have equal opportunity to own land and property in the Municipality however when it comes to leadership positions such as at the Assembly level, females are poorly represented. Out of the fifteen (15) electoral areas in the Municipality, there is only one (1) female Assembly member representing the electorates.

5.3.5 Security

The Oforikrom Municipal Assembly falls under the jurisdiction of three (3) Police Administrations or Districts: namely, Domebra (under Ejisu Municipality), KNUST and

Oforikrom (which falls under Zongo "B" District- KMA). This situation affects the efficient and effective management as well as reporting on security issues in the Municipality. Efforts are being made through the Regional Police Commander and the Regional Security Council to bring the various commands within the Municipality under one command.

The KNUST District Police Command which serves as the Municipality's main command has staff strength of nine-one (91) personnel for its various operational demands. The personnel are however not evenly distributed. Many of the inspectorate rank are working in the areas of MTTD and CID. The District has a total of eighteen (18) Detectives who are responsible for crime detection in the MA. They are assisted by three (3) aides. The District also has a total of forty-four policewomen.

5.3.6 Economic Activities

Inhabitants of Oforikrom MA are engaged in various economic activities. These include; providers of transport services, scrap metal and e-waste dealers, private educational institutions, hostel/hotels/guest houses operations, lottery businesses, restaurants/bars, retail of products, hairdressing/barbers, dress makers, millers, washing bays, financial institutions, auto mechanics, furniture manufacturers, video/photographers, bridal houses, waste management, printing firms, food processors, ware housing, health service providers, chemical and pharmaceutical shops, construction work, food crop production and animal rearing, amongst others.

Unemployment is however an issue of concern. The predominant sex adversely affected are females between the ages of 13-40 years. Measures put in place by the MA are skill trainings which includes yoghurt preparation, soap making, sobolo making etc. by the Social Welfare and Community Development and the Department of Agriculture.

Agriculture

Subsistence agriculture is the main type of agricultural practiced in the municipality. It focuses on the cultivation of vegetables such as carrot, cabbage, lettuce, green pepper and spring onions; rice as well as rearing of birds and livestock such as chicken, goat, sheep, cattle, pigs, fish farming on a very small scale. These could be found in and around KNUST campus and in low lying areas within the Municipality. Rice farming is undertaken specifically at Appiadu and other pockets in the municipality.

Agricultural activities have been reduced to subsistence basis due to the growing competition for land and importation of agricultural produce from adjoining districts and other parts of the country at relatively cheaper prices. Vegetable farmers have limited access to suitable lands thus, making them prone to floods because of the areas in which they cultivate.

Poultry production is also a very popular enterprise in the Municipality with about forty-five (45) poultry farms identified. Notable among these farms include Genesis farms, Osvic farms and Ben J farms located at Appiadu, Deduako and Kodiekrom respectively.

Markets and Agro-processing

There are about five daily markets in the Municipality. These include the Onion market, Ayigya market, Kentinkrono market, Anwomaso market and Anloga market. The list of agro-processing currently on-going in the Municipal includes; Gari processing - Anloga, Palm kernel oil – Anloga (Ghana bar), Palm kernel – Oforikrom, Soya bean meal/oil – Boadi, Soya bean meal/oil – Apemso and Palm kernel oil – Ayigya Zongo.

5.3.7 Education

The Municipality can boast of 85 pre-schools, which are all private; 109 KGs (22 public and 87 private); 114 primary schools (25 public and 89 private); 82 JHS (24 public and 58 private); 9 SHS/TVET (2 public and 7 private); and one public special school.

There are seven tertiary schools in the Municipality and these include: Kwame Nkrumah University of Science and Technology, University College of Management Studies at Ayeduase, Multimedia Institute of Ghana at Oforikrom, Valley View University at Oduom, Jackson College of Education at Ayeduase, Knutsford University College at Bomso, and Christ the Teacher College of Education at Appiadu.

5.3.8 Health Facilities

The Municipality has in existence twenty-two (22) health facilities. Four (4) of the health facilities are government owned; one (1) is quasi-government and seventeen (17) are privately owned health facilities. The list of these facilities is presented below

Table 5-5: List of Health Facilities

S/N	NAME	STATUS/TYPE	LOCATION
1	Ayeduase Health Center	Government	Ayeduase
2	Aninwaah Medical Centre (Emena Hospital)	Private	Emena
3	Graceland Hospital	Private	Appiadu
4	Ahmadiyya Homeopathic Acupuncture and Herbal Clinic	Private	Boadi
5	Tawheed Naturopathic Clinic	Private	Boadi
6	Anwomaso Health Center	Government	Anwomaso
7	Asbury Hospital	Private	Anwomaso
8	Vibro Maternity Home	Private	Anwomaso
9	Peace and Love Hospital	Private	Oduom
10	Kumasi Comfort Maternity Home	Private	Oduom
11	Kentinkrono CHPS Compound	Government	Kentinkrono

12	Nykon Clinic	Private	Kentinkrono
13	KNUST Hospital	Quasi-Government	KNUST
14	Bomso Clinic	Private	Bomso
15	Kumasi Church of Christ Clinic	Private	Bomso
16	Victory (Kumasi) Maternity Home	Private	Ayigya
17	Yentumi Boaitey Memorial Hospital	Private	Bomso
18	Anloga CHPS Compound	Government	Anloga
19	Florence Maternity Home	Private	Anloga
20	New Life Maternity Home	Private	Oforikrom
21	Queen Victoria Maternity Home	Private	Anloga
22	Anwiam Clinic	Private	Oforikrom

(Source: OfMA Department of Health, 2021)

5.3.9 Diseases and Major Causes of Death

Top 10 Diseases

The top 10 diseases reported at OPDs from 2018 to 2020 is provided in the table below.

Table 5-6: ***Top 10 OPD Cases***

No.	2018			2019			2020		
	DISEASE CONDITION	**NO.**	**%**	**DISEASE CONDITION**	**NO.**	**%**	**DISEASE CONDITION**	**NO.**	**%**
1	Malaria	31,175	25	Malaria	37,317	22	Rheumatism & Other Joint Pains	11,864	16
2	Hypertension	12,831	10	Upper Respiratory Tract Infections	19,158	11	Hypertension	7,813	11
3	Upper Respiratory Tract Infections	9,728	8	Rheumatism & Other Joint Pains	11,202	7	Upper Respiratory Tract Infections	7,344	10
4	Rheumatism & Other Joint Pains	7,013	6	Hypertension	10,641	6	Malaria	6,382	9
5	Acute Urinary Tract Infection	4,518	4	Acute Urinary Tract Infection	8,004	5	Intestinal Worms	5,552	8
6	Intestinal Worms	3,744	3	Skin Diseases	7,013	4	Skin Diseases	5,033	7
7	Skin Diseases	3,673	3	Intestinal Worms	5,477	3	Acute Urinary Tract Infection	4,761	6
8	Diabetes Mellitus	3,497	3	Diarrhea Diseases	3,882	2	Pregnancy Related Complications	2,288	3
9	Anaemia	2,375	2	Ulcer	2,547	1	Anaemia	2,054	3

10	Acute Eye Infection	2355	2	Preg. Related Complications	1,970	1	Gynecological conditions	1,969	3
	All other conditions	44,187	35	All other Diseases	63,482	37	All other Diseases	18,361	25
	TOTAL	**125,096**	**100**	**TOTAL**	**170,693**	**100**	**TOTAL**	**73,385**	**100**

(Source: OfMA Department of Health, 2021)

Top 10 Causes of Death

The top 10 causes of death is shown in **Table 5-7.** Hypertension is the leading cause of death in the Municipality, and is followed by Diabetes.

*Table 5-7: **Top 10 Causes of Deaths***

	CONDITIONS	PERCENTAGE
1	Hypertension	43.2
2	Diabetes Mellitus	12.6
3	Multiple Organ Failure	7.4
4	Anaemia	7.4
5	CVA	4.2
6	Diseases of the nervous system	4.2
7	Liver Disease	3.2
8	Kidney Disease	2.1
9	Pneumonia	2.1
10	Prostate Disease	2.1
	Others	11.6
		100.0

(Source: OfMA Department of Health, 2021)

5.3.10 HIV/AIDS Prevalence in the Project Area and COVID-19

HIV/AIDS Prevalence

Ghana's HIV status data for persons living with HIV from the Ghana AIDS Commission as at 2019 stands at 342,307 in total, and this is made of 122,321 males and 219,986 females living with HIV. The national prevalence rate in the country is pegged at 2.0%.

According to the 2019 data from the Ghana AIDS Commission, the top 10 districts/ municipalities with the highest HIV prevalence were Ayawaso Central 23,075; Kumasi 13,672; Okai Koi North 12,532; Kwadaso 9,495; La-Nkwantanang-Madina 5,982; Asokore Mampong 5,932; La-Dade-Kotopon 5,924; Accra Metro 5,710; Ga South 4,725; Berekum 4,450.

The Oforikrom Municipal is not within the top 10 districts/municipalities with high HIV infection in the country but Kumasi Metro is within the top 10 districts. The Oforikrom Municipality is however within the top 20 districts/municipalities, i.e. Oforikrom 3,519. With regard to the prevalence rate in the adult population, the Oforikrom Municipal has 1.75% prevalence rate and Kumasi Metropolis has 1.95% prevalence rate. The Ashanti Region has 1.94% prevalence rate with estimated 76,672 living with the virus.

COVID-19 Update for the Year 2020
Total Samples Taken – 5,901
Positives Recorded – 885
Deaths Recorded – 12

5.3.11 Information and Communication Technology

Telecommunications services play a major role in the daily activities of all citizens of Oforikrom in addition to its significant impact on businesses. Oforikrom has two types of telecommunication networks namely the mobile networks and the fixed line system. There is only one fixed line operator, which is Vodafone Ghana Ltd. There are four mobile telecommunications network companies operating in the Municipality and these are Vodafone, AirtelTigo, MTN and Glo, and these provide variety of services.

The available networks/connectivity is provided below.

1. MTN - 4G/3G/2G/GSM
2. VODAFONE - 4G/3G/2G/GSM
3. AIRTELTIGO - 3G/2G/GSM
4. GLO - 2G/GSM

There are four radio/TV stations in the Municipality and these include: Nhyira Fm, Luv Fm, Focus Radio, and Tek TV. There are about 18 information centers scattered across the Municipality

5.3.12 Solid Waste Management

Oforikrom has two main methods for collecting and disposing off solid waste. These are the house-to-house collection and the communal collection points. The main contractors for the collection of waste within the Municipality are Zoomlion Ghana Ltd. and Asadu Company which are located at Oforikrom and Nsenie respectively. The house-to-house collection is carried out by compactor trucks and tricycles that move from house to house. The frequency of emptying the household bins is usually once a week depending on the area. The charges for house-to-house collection ranges from GH¢20.00 to GH¢60.00 per household bin and based on the classification of the area. However, it is worth noting

that the amount paid for the house-to-house collection is reviewed annually during the fee fixing resolution.

Communal collection on the other hand is whereby a skip container is placed at a vantage point within the community and community members commute there to dispose of their waste at a fee. The introduction of the 'Pay as you Dump' system has addressed the bottlenecks that hitherto were being faced by the community collection system. The table below shows the number of skip containers acquired by the Assembly and their locations.

Table 5-8: List of Skip Containers Sites

S/N	Community	Number of Containers
1.	Anloga onion market	1
2.	Anloga/ Susankyi	1
3.	Bomso	1
4.	Ayigya Zongo	1
5.	Oduom- Asadu main office	1
6.	Nsenie	1
7.	Kentikrono	1
8.	Boadi	1
9.	Bebre	1
10.	Appiadu	2
11.	Emena	1
12.	Deduako	2
13.	Kotei	1
14.	Ayeduase	2
15.	Kokoben	1
16.	Mesuem	1
17.	Ayigya Ahenbronum	1
18.	Anwomaso	1
19.	Oforikrom near the M/A school	2
20.	Aprade	2
21.	Anloga junction	2
Total		**27**

Source: OfMA Environmental Health Unit, 2021

Unapproved disposal methods prevailing in the Municipality include burning of waste in the open and disposal into drains and rivers during rainfall. About 10 percent of households dispose their waste improperly. This phenomenon partly explains the poor and filthy environmental condition that has engulfed certain communities in the Municipality. The Municipality currently has no final disposal site of its own. Refuse collected within the Municipality are sent to Oti landfill site under Asokwa Municipal Assembly.

5.3.13 Land-use of the Project Area

The project site is basically agricultural land, partly occupied by farms and farm re-growths with isolated trees. The major crops cultivated on the farms are cassava, maize, plantain and vegetables such as tomatoes. The surrounding land use is for farming, GRIDCo substation, and Vocational Training Institute buildings which are currently uncompleted. Specifically, the proposed site is bounded on the south by 161kV and 330kV substations of GRIDCo; north and west by farmlands and on to the east by farmland/National Vocational Training Institute (NVTI) Complex of the Ministry of Education (as previously shown in **Figure 3-1).**

6.0 STAKEHOLDER CONSULTATIONS AND PUBLIC INVOLVEMENT

Stakeholder participation during project planning and implementation is recognized as an integral part of environmental and social management for projects. It should be a two-way flow of information and dialogue between project proponents and stakeholders and should start at an early stage that can help shape project design.

6.1 Key Objectives of Stakeholder Consultations

The main objective of stakeholder consultations is to discuss the proposed project's environmental and social implications and to identify appropriate mitigation measures for adverse impacts. Specifically, the consultations will seek to achieve the following objectives:

- To provide relevant information about the proposed project to stakeholders;
- To provide opportunities for stakeholders to discuss their concerns and offer recommendations;
- To gain insight on the role of each stakeholder in the implementation of the environmental and social safeguards as well as structures in place for the management of the proposed facilities;
- To provide and discuss with stakeholders the design options considered to reduce anticipated impacts;
- To identify and verify significance of environmental, social and health impacts; and
- To inform the process of developing appropriate mitigation and management options.

6.2 Stakeholder Identification Criteria

Stakeholder identification process for the proposed project is based on an appreciation of the interest and influence of various organizations/institutions/ communities/ persons or groups in relation to the project. The main criteria used to identify stakeholders is that relevant stakeholders should fall under one or more of these groupings as follows:

- Funding agencies;
- Project proponents;
- Regulatory bodies/institutions;
- Utility agencies/companies;
- Relevant government institutions;
- Local government and administrative authorities;
- Traditional authorities;
- Local/ nearby communities within project area of influence;
- Project affected persons;
- Neighbouring organizations;
- NGOs/CBOs/CSOs;

- Technical Experts/Consultants/Contractors;
- The Media; and
- The General Public/Citizenry.

6.3 Stakeholder Groups and their Key Roles for the Proposed Project

The identified stakeholder groups and their roles as relevant to the proposed project are presented in the table below.

Table 6-1: Stakeholders and their Roles

No.	Stakeholder Group	Examples of Stakeholder(s) identified	Key Role of Stakeholder and Remarks
1	Funding agencies	Government of Ghana (GoG) / Ministry of Finance/ International Funding Agencies	• To provide funds for project implementation or implementation of a subproject activity or associated facility. • In case International funding agencies come up along the line, these agencies may have their own environmental/ social safeguard policies and requirements that will have to be complied with during project implementation.
2	Project Proponents	• Ministry of Energy • Volta River Authority (VRA)	• Accountable entities responsible for successful implementation of proposed relocation, construction and installation of the Kumasi 1 Thermal Power Plant, including planning, design, construction, operation and maintenance of the power plant. • Project proponents must take into consideration requirements of any international funding agencies that may be involved in due course.
3	Regulatory Agencies/ Bodies	Environmental Protection Agency (EPA)	• Responsible for regulating the environment. • The Agency will issue an environmental permit for construction and operation of the proposed project, and will monitor project to ensure compliance to the permit conditions and adherence to the Environmental Assessment Regulations, 1999.
		Energy Commission	• Regulator of the energy sector in general, which includes proposed project. • To issue various permits/ licences for project implementation including: 1. Project Registration Certificate 2. Siting Permit 3. Construction Permit 4. Commissioning Permit 5. Operations Approval or Permit

No.	Stakeholder Group	Examples of Stakeholder(s) identified	Key Role of Stakeholder and Remarks
		Ghana National Fire Service (GNFS)	• National institution responsible for the prevention and management of undesired fires. • To provide fire permit /certificate for project facilities during construction and operation
		Water Resources Commission	• To provide water use permit in case of raw water abstraction from groundwater sources during project implementation.
		Department of Factories Inspectorate	• Regulator for health and safety of workers and workplaces in general. • To issue facility/project registration certificate or approval • Factories Inspectorate will monitor safety of workers at project sites.
4	Utility Agencies/ companies	GRIDCo,	• Off-take of the power produced by VRA. • Interested in the power infrastructure aspect of project. • GRIDCo responsible for power transmission. • Has a substation (K2 BSP) close to the proposed site.
		ECG	• ECG responsible for power distribution in the southern sector of Ghana. • Shares facility with GRIDCo at the K2 BSP at Anwomaso near the project site.
		Ghana Water Company Ltd (GWCL)	• Responsible for the extension of water supply to the project site to meet operational needs. • Responsible for provision of potable water for urban areas.
		Ghana National Gas Company Limited	• To be responsible for provision of natural gas to the project site.
5	Other Government Institutions	Lands Commission	• To be involved with approval of site plan for project site, and transfer of project land from KNUST to Ministry of Energy/VRA. • The Lands Valuation Division of the Commission may be involved with the valuation of affected properties or approval of valued properties for compensation purposes in project areas.
		Minerals Commission	• Responsible for ensuring the protection of the country's mineral resources and regulating the efficient exploitation of the resource.
		Ghana Police Service	• To be involved with the provision of security and maintenance of law and order in project areas during implementation.

No.	Stakeholder Group	Examples of Stakeholder(s) identified	Key Role of Stakeholder and Remarks
		Labour Department	• To enforce labour laws and regulations including the Workmen Compensation law that applies to project implementation issues associated with workers.
		Labour Commission	• The Commission exists to develop and sustain a peaceful and harmonious industrial relations environment through the use of effective dispute resolution practices within the context of the law, promotion of cooperation among the labour market players and mutual respect for their rights and responsibilities.
		Ghana Standards Authority	-Responsible for the management of the nation's quality infrastructure embracing the three (3) pillars of metrology, standardisation and conformity assessment (i.e. Testing, Inspection and certification). -Responsible for Calibration, Verification and Inspection of Weights, Measures and Weighing and Measuring Instruments -Promoting Quality Management Systems in Ghana. -Develops Environmental Standards for ambient air quality, noise control and effluent discharges, and makes available hardcopies of these Standards to the general public at a fee.
		National Museums and Monuments Board:	Responsible for ensuring the protection and proper storage of all archaeological finds.
6	Local Government and Administrative Authorities	• Ashanti Regional Coordinating Council • Oforikrom Municipal Assembly (OfMA)	• Responsible for the political administration and development of the project area and local communities within the Municipality. • To provide business registration/operating license for firms and companies working within their jurisdiction. • Land Use and Spatial Planning Department to provide development approvals and building permits for project facilities, structures and buildings.
7	Traditional Authorities	• Kumasi Traditional Council • Anwomaso Traditional Authority	• Traditional Authorities have traditional/ cultural oversight of local communities in the project area. • Traditional Authorities facilitate development and resolution of conflicts/ disputes among community members.

No.	Stakeholder Group	Examples of Stakeholder(s) identified	Key Role of Stakeholder and Remarks
8	Local communities	Anwomaso	• Nearby community to the project site • Likely or possible recipient of project adverse impacts
9	Project affected Persons (PAPs)	Farmers/ Owners of crops grown at the project site	These are individuals or persons that will lose their crop (e.g. plants/crops) because these crops are located on the propose site or close to proposed site.
10	Neighbouring organisation	NVTI	Have uncompleted and uninhabited properties near the project site, and are likely recipient of project adverse impacts.
11	Research Institutions/ University	KNUST	• Owners/lease holders of proposed project site. • Could share relevant information on project land ownership and land users with Consultant/VRA.
12	NGOs/ CBOs/ CSOs	(To be confirmed during engagement with Energy Commission/ VRA and Municipal Assembly)	• May have interest in the Project or in the environment or community where the project will be undertaken or other aspects of project production and operational activities. • May have interest in the proposed project and affected resource users/ persons in the project area.
13	Mass media –	Print and Electronic media in the Kumasi area, e.g. Graphic Corporation, New Times Corporation, Chronicle, Daily Guide etc	• Responsible for information dissemination, communication and education of the general public and local communities through electronic and print media
14	General Public/ Citizenry	Every Ghanaian in Kumasi area or in the country	• Public interest role

6.4 Stakeholders to be engaged for the EIA Assignment

The following stakeholders will be directly engaged as part of the preparation of the EIA report:

Project Proponents
- Ministry of Energy
- VRA

Regulatory Agencies/Bodies
- Energy Commission

- EPA
- Ghana National Fire Service
- Department of Factories Inspectorate
- Water Resources Commission
- Minerals Commission

Utility Agencies
- GRIDCo
- ECG (at the K2 BSP substation)
- Ghana Water Company Limited
- Ghana National Gas Company Limited

Local Government and Administrative Authorities
- Oforikrom Municipal Assembly

Traditional Authority/Local Community
- Anwomaso Traditional Authority
- Anwomaso community

Project Affected Persons
- Farmers that are likely to be affected by the project

Neighbouring Organisation
- NVTI

Research Institution/Landowners
- KNUST

6.5 Stakeholder Engagement Strategy

6.5.1 Methods of Engagement

For an effective stakeholder/community engagement process, there is the need for communicating project goals, activities, outcomes and impacts to various stakeholders using varied and appropriate methods of engagement. The main methods of engagement with stakeholders for this EIA preparation will include:

- Letters/Emails
- Meetings
    - Face-to-face meetings
    - Virtual meetings
- Phone calls
- Courtesy visits

- Public forum
- Focus group discussions
- Socioeconomic surveys
- Local FM Stations/Newspapers

Notice of any public forum will be by radio/FM stations and invitation letters. The EIA team will support the presentation and answer questions related to the EIA studies and is to be supported by the VRA Team where necessary.

The methods of engagement for the identified stakeholders to be consulted during the Scoping/EIA preparations are provided in the table below.

Table 6-2: Methods of engagement for identified stakeholders for the Scoping/EIA preparation

Identified stakeholders to be engaged	Methods of engagement

<u>Project Proponents</u>
• Ministry of Energy
• VRA
 	
<u>Regulatory Agencies/Bodies</u>
• Energy Commission
• EPA
• Ghana National Fire Service
• Department of Factories Inspectorate
• Water Resources Commission
 	
<u>Utility Agencies</u>
• GRIDCo
• ECG (at the K2 BSP substation)
• Ghana Water Company Limited
• Ghana National Gas Company Limited
 	
<u>Local Government and Administrative Authorities</u>
• Oforikrom Municipal Assembly
 	
<u>Neighbouring Organisation</u>
• NVTI
 	
<u>Research Institution/Landowners</u>
• KNUST
	• Letters/Emails
	• Meetings
	  ○ Face-to-face meetings
	  ○ Virtual meetings
	• Phone calls
	• Newspapers

<u>Traditional Authority/Local Community</u> • Anwomaso Traditional Authority • Anwomaso Community • Domeabra Community	• Letters • Meetings ○ Face-to-face meetings • Courtesy visits • Public forum • Focus group discussions • Local FM Stations

Project Affected Persons • Farmers farming on the project land and adjacent areas that are likely to be affected	• Meetings ○ Face-to-face meetings • Phone calls • Focus group discussions • Socioeconomic surveys

6.5.2 Language

The English Language will be used during engagement with institutions or organisations. The Asante Twi will be used mainly during engagement with the farmers, Anwomaso Traditional Authority and Anwomaso community.

6.5.3 Project Information to be shared with Stakeholders

The Consultant has prepared a Background Information Document (BID) on the proposed Project to be shared and or discussed with stakeholders during the consultations. A copy of the BID is attached as **Annex 6-1.**

6.5.4 Evidence of Engagement and Use of a Stakeholder Engagement Form

The Consultant will take pictures of the engagement/meetings where possible, and also collect some basic information of persons to be consulted including name, position/designation, and contacts/address among others. A sample of the stakeholder engagement form to be used is provided in **Annex 6-2**. Minutes of the meetings will be recorded and documented.

6.5.5 COVID-19 Protocols

With the current global outbreak of the new corona virus (COVID-19), the Consultant will strictly adhere to the COVID-19 protocols in all its consultations/engagement and field work. The key protocols to be followed include wearing of nose masks by consultants and stakeholders to be engaged, hand washing and use of sanitizers and observance of social distancing. Virtual meetings will be employed with public sector stakeholders where convenient to minimise face-to-face meetings if possible. In view of the need to follow the COVID-19 protocols, large gathering will be minimized as much as possible. Any open or public forum will strictly follow the COVID-19 protocols.

6.6 Outcome of Consultations carried out during the Scoping Exercise

The EIA Consultant and VRA have engaged some stakeholders including farmers at the project site, GRIDCo, KNUST, OfMA, Ghana Gas, NVTI among others as part of project preparation and scoping. A summary of the outcome of the consultations is provided in **Table 6-3. Plates 6-1 to 6-7** show some pictures of the engagement/meetings**.**

Plate 6-1: ***Engagement with the Assemblyman of Anwomaso***

Plate 6-2: Meeting with the Linguist of Anwomaso

Table 6-3: Summary outcome of initial consultations during the reconnaissance visit

Stakeholder	Contacted Person	Designation	Mobile Phone contact	Date	Issues/ Concerns and Suggestions
Project Affected Persons/ Farmers	Kwame Yamoah	Farmer	0243428555	9th August, 2021	• The farmers do not have any objection to the project. • The farmers want compensation for the crops they will lose. • Some farmers stated that they have gone for loans to cultivate the land. They will therefore need the compensation to settle their debt. • Some farmers want to be employed by the project, as some of them are artisans such as masons.
	Esther Ansong	Farmer	0241506177		
	Afia Sarpong	Farmer	0247084640		
	Mary Aliruba	Farmer	-		
	Adwoa Pinaman	Farmer	-		
	Comfort Mensah	Farmer	0551232912		
GRIDCo	Bernard Gyan	Network & Maintenance Manager	0204305007	9th August, 2021	• The technical staff engaged did not object to the project. • Their main concern was safety. They are very particular about neighboring activities and the safety distances away from their facility. • Though the technical staff did not see it necessary to compensate farmers, the Administrative officer for GRIDCo stated clearly that compensation of farmers will have to be done. He shared a previous experience were GRIDCo had to compensate farmers during the execution of GRIDCo project in Anwomaso.
	Lorence Doe	Planning & Business Support Manager	0243755694		
	Joseph Safo	Administrative Officer	0244463933		
KNUST	James Oberko	Senior Assistant Registrar, Public Affairs	0208139778	10th August, 2021	• The KNUST staff engaged were happy about the project as they expect the project to resolve their current poor electricity supply situation (e.g. frequent light out & low current during peak times). • The Head of Maintenance Unit anticipates that this project will be of great benefit to the University. She lamented that the growing population of the University is causing damages to their transformers and other electrical equipment causing the University to spend a lot on repair woks.
	Harriet Ashon	Head of Maintenance Engineering Unit	02444461700		

	Isaac Daniels	Quantity Surveyor at the Development Office	0557275956		• The situation could worsen as the students' population continue to increase, and also KNUST expects to execute more power consuming projects in future. Hence, they are glad the power project is coming on. • The officers wants a dedicated transmission station and line when the project is completed. • When the Consultant asked how they plan to manage the farmers on the project land, they confirmed that the project land belongs to KNUST. • The officers indicated that the Project should officially inform KNUST to assist in getting the farmers off the land when ready to use the proposed site for the project.
	Baba Akurugu	Laborer at the Development Office	024626298441		
Oforikrom Municipal Assembly	Madam Irene Godi	Municipal Development Planning Officer	024 336 4458	10th August, 2021	• The Municipal Development Planning Officer made it known that they have not been officially informed about the proposed project. • She stated that she has no objection to the project. • However, she was concerned about the how the project was going to ensure the safety of the neighboring community.
	Mr. Asante Kweku Adjei	Municipal Physical Planning Officer	050 977 2929		• Mr. Asante Kweku Adjei made some references to their drawing records to confirm the original plan for the proposed land for the project. He confirmed that it has been earmarked as an educational zone for KNUST. Hence OfMA does not have plans for the land as a Municipality. • He concluded that if KNUST is providing the land then they have no objections.
NVTI	Mr. Benjamin Sekyi	Project Manager	055 278 8431	9th and 18th August	• According to the Project Manager, the school project is due for completion this year. However, this is not likely and hope to finish the school project next year. • His concern was the safety of students, teachers and other staff who will be using the facility when in operation.

Anwomaso Community	Hon. Frank Frimpong	Assemblyman	024 44 87 991	10th August, 2021	• The **Assemblyman** recounted his bad experience with Gridco. According to him, the transport of heavy Gridco equipment caused damages to their bridges. Gridco did not repair the bridges. This damages almost claimed the life of an old woman. He stated that he does not want to experience a similar situation with VRA because of this project. • The **Assemblyman** lamented about Gridco's unconcern about supporting the community. He expects Gridco to provide basic support like street lights for the community. *He is however hoping that VRA will be different.*
Anwomaso Community	Okyeame Boakye	Linguist	024 64 58 187	10th August, 2021	• Okyeame Boakye, the **Linguist**, welcomed the project because he anticipates that it is will benefit Ghana. He said he is unemployed and has to stay home. He is however unhappy about the unemployment situation in the community. He expressed his desire to be gainfully employed by the project. He is hoping that this project will create jobs for people in the community.
Anwomaso Community	Nana Akosua Gyaamah	Queen Mother	024 00 20 363	10th August, 2021	• Nana Akosua Gyamaah, the **Queen Mother**, recounted their past engagement with VRA about ten (10) years ago. According to her, VRA together with KNUST officially came for about 41 acres of land. Together with KNUST, the community transferred ownership of the land to VRA. VRA also made several promises to the community. VRA promised to pay the chief monthly, exempt the Chief from paying electricity bills, and provide support to the community. They have since not heard from VRA. Instead GRIDCO had been using part of this land without fulfilling VRA's promises. She stated that she cannot hold GRIDCO responsible for the promises VRA made. • On behalf of the chiefs, the Queen said they will like to meet VRA to address these concerns. Failure to address their concerns will result in serious demonstrations against the Project to draw media attention. • She confessed that the project seems good and they are willing to welcome it. However, the needful will have to be done.

					• She asked if farmers who are currently using the land will be compensated. She said the project should ensure that the farmers will be compensated. • She finally expressed the fear of potential environmental impacts of the project on the community.
Anwomaso Community	Nana Opoku	Gyase Hene	0243978101	14th August, 2021	• He is optimistic that the Plant will help improve power supply in the greater Kumasi area. • Lamented about the fact that KNUST has taken a greater part of their land. • He advocated for jobs for the youth in the community. • On CSR, he suggested that the Palace should be completed; need for street lights between Anwomaso and neighboring communities; provision of tarred roads, clinic and schools in the community. • He concluded by requesting for a community durbar.

Plate 6-3: Engagement with the Head of Maintenance Engineering, KNUST

Plate 6-4: Engagement with the Development Department (Quantity Surveyor & 2 Assistants)

Plate 6-5: Engagement with the Senior Assistant Registrar of KNUST

Plate 6-6: Engagement with the Physical and Development Planning Officers at OfMA

Plate 6-7: Engagement with Nana Gyase Hene (left) of Anwomaso

7.0 POTENTIAL ENVIRONMENTAL ISSUES AND IMPACTS

The identification of potential key issues and impact at the scoping stage has been greatly facilitated by the project scope, literature/project documents review, field visits, as well as the stakeholder consultations and the concerns raised. The construction and operation of the proposed project may result in a number of potential impacts on the physical, biological and social environments. These potential impacts could be positive or negative.

7.1 Project Area of Influence

According to the IFC Performance Standard 1, the area of influence encompasses, as appropriate:

- The area likely to be affected by: (i) the project (e.g. project sites, immediate airshed and water shed or transport corridors) and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.
- Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable (e.g. railways, roads, transmission lines, pipelines, warehouses, logistics terminals).
- Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted (e.g. incremental contribution of gaseous emissions to an airshed, reduction of water flows in a watershed due to multiple withdrawals, increases in sediment loads to a water shed, interference with migratory routes or wildlife movement, or more traffic congestion and accidents due to increase in vehicular traffic on community roadways).

This EIA study refer to the project Area of Influence (AOI) as the area where air/water resource or land is required for construction of any component of the Project and the actual project footprint; and the surrounding vicinity and environment/ institutions where the Project can affect receptors even if there is no direct project activity taking place.

The geographical, biophysical environment, socio-economic/cultural and institutional influences of the project are foremost identified and briefly described hereunder.

7.1.1 Geographical Area of Influence

The immediate geographical area of concern covers the 15 acre project site and its immediate environs, where the neighbouring local communities are located. The larger geographical area of influence is the Oforikrom Municipality of the Ashanti Region of Ghana as well as all communities likely to be impact by the noise/air dispersion from the plant operations.

7.1.2 Environmental Media Influence

The main environmental media to be influenced are:

- The land/landscape of the Project site;
- The flora/fauna of the Project site;
- The soil resources at the Project site;
- The Adote Stream which traverses near the project site;
- The groundwater resources at and around the Project site; and
- The ambient air environment around the project site and also as far as the emissions/noise pollution can reach.

7.1.3 Socio-economic Influence

The proposed project has a bearing on the economic and socio-cultural conditions of the Greater Kumasi Metropolitan Area (GKMA), and the northern part of the country as a whole. The immediate community and people to be affected by the proposed project is Anwomaso community and the project affected farmers who farm at the site. Other nearby communities likely to be affected will be confirmed from the emissions/noise dispersion modelling to be carried during the EIA.

7.1.4 Institutional Influence

The major institutions to be influenced or involved in the proposed project include:

- Ministry of Energy;
- Ministry of Local Government and Rural Development;
- Environmental Protection Agency;
- KNUST;
- Energy Commission;
- VRA;
- GRIDCo and ECG;
- Lands Commission;
- GWCL;
- NVTI;
- Ghana National Gas Company Ltd;
- Department of Factories Inspectorate;
- Ghana National Fire Service;

- Water Resources Commission;
- Oforikrom Municipal Assembly; and
- Anwomaso Traditional Authority.

7.2 Project Activities of Environmental/Social Concern

7.2.1 Preparatory/Pre-construction Phase Activities

Preparatory phase activities include among others:

- Procurement of labour, equipment/materials;
- Feasibility studies and survey works;
- Land acquisition;
- Stakeholder consultations;
- Setting up work camp/site office and storage areas;
- Initial transport of materials/equipment to site;
- Statutory permitting activities -EPA, Energy Commission, GNFS, Factories Inspectorate Division and the Municipal Assembly.

7.2.2 Constructional Phase Activities

Constructional phase activities include among others:

- Procurement of labour, equipment/ materials
- Site clearing;
- Construction and/or repair of access roads;
- Transportation of materials and equipment;
- Earthworks and excavations
- Civil works;
- Installation works;
- Mechanical and electrical works;
- Disposal of construction spoil and waste in general;
- Testing and commissioning of the proposed thermal power plant.

7.2.3 Operational and Maintenance Phase Activities

Operational phase activities include:

- Procurement of labour, equipment/spare parts and materials;
- Plant operations and maintenance;
- Maintenance of water and gas supply pipelines;
- Equipment maintenance and management;
- Maintenance of powerhouse/switchyard station, offices and warehouse;
- Materials handling and storage, including hazardous chemicals and fuels;
- Site protection and security services;
- Storm water and runoff management; and

- Waste management including solid and liquid waste.

7.2.4 Decommissioning Phase Activities

The major activities will include:

Post-construction phase activities

- Demobilization of equipment after construction;
- Termination of construction workforce/labour employment contracts;
- Decommissioning of work camp/storage sites;
- Disposal of wastes.

Post-operational phase activities

- Relocation or removal of plant components/site facilities;
- Decommissioning of other associated facilities;
- Laying off or termination of workforce employment contracts;
- Disposal of wastes.

7.3 Identification of Potential Environmental/Social Impacts

The potential environmental and social impacts/effects identified at this scoping stage from the preparatory, construction, and operation/maintenance phases have been categorised into positive/beneficial impacts and adverse/negative impacts.

7.3.1 Potential Positive or Beneficial Impacts

The potential positive or beneficial impacts include:

Preparatory and Construction Phases

- Employment and job creation opportunities;
    - Engagement of skilled and unskilled labour during construction phase.
- Creation of business opportunities for locals/Ghanaians and improvement of local economy;
    - Ghanaians may take up the business of supplying some needed construction materials, equipment/machinery, mechanical and electrical fittings etc
    - The contractor may procurement of some construction materials such as sand, water, chippings, cement, food etc locally
- Improvement in the local and national revenue
    - Taxes of workers and construction firm will accrue to the State.
    - Indirect tax/VAT on goods and services will also accrue to the State

Operational and Maintenance Phase

- Employment generation

  - Engagement of skilled and unskilled labour during the operation phase
- Provision of 250MW of electric power for the Greater Kumasi area and the northern part of the country
- Improvement in the voltage stability of the NITS
- Significant reduction in transmission system losses.
- Improvement in the quality of supply to end users through improved network voltage control via generators.
- Continuous supply of reliable power to end users, thus reducing impact on power rationing in the Kumasi area and beyond.
- Natural gas as fuel represents a cleaner form of fossil fuel powered thermal power generation. Particulate matter (PM) and SO_2 emissions from natural gas firing thermal plants are negligible (USEPA, 1995).
- Reliable power supply to support socioeconomic activities and businesses in the Kumasi area.
- Improvement in the local community infrastructure/facilities from corporate social responsibility interventions.

7.3.2 Potential Adverse/Negative Impacts

7.3.2.1 *Preparatory/Pre-construction Phase Potential Adverse Impacts*

Physical Environment

The likely impact issues to arise during the preparatory phase include:

- Air pollution
  - Fumes from vehicles/trucks; dust generation on unpaved roads from vehicular movements; construction of work camps/material storage areas
- Noise Nuisance
  - movement of vehicles/trucks, horning, construction of work camps, noise generation by survey workers
- Water pollution concerns from improper disposal of wastes by field teams;
- Waste generation and disposal/sanitation issues;
  - Generation of waste including garbage, sewage/human waste, etc
  - Improper disposal of wastes will create unsightly conditions and a public health threat

Biological Environment

- Disturbance of fauna during survey and field investigation activities at the project site
- Water pollution from survey activities/waste disposal activities etc can impact on any aquatic life in the Adote stream.

Social Environment

- Anxiety/agitation on the part of affected farmers and local people

  - Affected farmers are in expectation of receiving some compensation
  - Local people can agitate on accidents/incidents occurring as a result of the project
- Displacement of farmers
  - Farmers on the project site will have to relocate or find new farmlands
- Risk of not acquiring all relevant statutory permits
  - The project may not likely acquire all statutory permits before commencement due to the urgency of the project and the government interest.
- Worker health/safety concerns
  - Worker injuries, bites from insects/animals, COVID-19 infections occurring during surveys/field investigations etc
- Public/community health and safety concerns
  - Increased potential for spread of infectious diseases, including HIV/AIDS and Covid-19.
  - Potential for traffic incidents/ accidents on the public and community roads

7.3.2.2 *Construction Phase Adverse Impacts*

Physical Environment

The likely impact issues to arise during the construction phase include:

- Air pollution from movement of vehicles/ trucks on unpaved roads through local communities, operation of construction equipment, light vehicles, and diesel-powered electrical generators;
- Noise and vibration from movement of vehicles/trucks and operations of electrical generators and maintenance activities;
- Impact on soil resources from site clearance, topsoil removal due to earthworks/excavations; exposure of soil leading to erosion during rainfalls/by storm runoffs and wind action; soil contamination from fuel spills;
- Water pollution concerns due to fuel spills, transport of sediment into water body, changes in stream flows due to channel siltation from sediment loading etc;
- Waste generation and disposal;
  - Generation of various streams of waste including biomass, garbage, scraps, worn-out tyres, sewage/human waste, spent lubricating oil, rubber seals, concrete debris, food wastes, disused packaging materials etc
  - Disposal of hazardous and non-hazardous waste concerns

Biological Environment

- Impact on terrestrial flora and fauna:
  - Destruction and loss of vegetation/habitat from site clearing and removal of largely common vegetation in the area. Limited fauna habitat may be impacted leading to displacement of some fauna.
- Impact on aquatic/water ecology

- Though the Adote stream is seasonal, effect of water pollution can affect any aquatic life in the Adote stream. There is no fishing in the strem.

Social Environment

- Disruption in land use
  - Current land use largely for farming and plant research will change and be converted into a thermal power production site
- Labour influx/job seekers and illicit behavious
  - Job seekers will throng the area to look for some construction jobs or be taken as labourers
  - These job seekers and those employed may put pressure on the community facilities and resources, and the non-locals may not abide by sociocultural norms in the area creating conflict or tension.
- Visual intrusion/ attraction
  - Site clearance and construction activities that are in public view attract local people and commuters alike.
  - Poor housekeeping practices at the site may also reduce the aesthetic value of the proposed site.
- Non-compliance with socio-cultural norms of local communities
  - The tendency for non-local employees not to conform or abide by the socio-cultural norms of local communities is high, unless they are sensitized appropriately
- Labour agitations/issues
  - Construction workers can lay down their tools if their condition of service is not good and this can affect project implementation timelines; can result in prolong and costly grievance redress cases; can pose a security threat as well etc
- Worker health/safety concerns
  - Worker injuries, bites from insects/animals, COVID-19 infections, STI transmissions; accidents could result in fatalities, dust/fumes inhalation can cause respiratory problems, noise nuisance can cause hearing challenges etc
- Public/community health and safety, and security concerns
  - Increased potential for spread of infectious diseases, including HIV/AIDS and recently Covid-19. Short term migration increases the chances of sexual relationship with multiple partners, thus becoming a critical factor in the propagation of HIV/AIDS and other STDs. The movement of workers from one village, town or city to another during the construction stage makes them susceptible to irresponsible sexual behaviour and thus encourage prostitution in the community.
  - Improper disposal of sanitary waste is a community health threat.

- Dust inhalation can cause respiratory diseases; dust nuisance can dirty washed clothes on drying lines in the community and also dirty windows of residences and offices nearby; noise nuisance can affect the peaceful resting and relaxation of people; cause hearing challenges etc
- Potential traffic incidents/accidents on the public/community roads from transportation of material, equipment/machinery and plant components to site can cause loss of life/death, damage to vehicles and properties, cause traffic congestions, which bring about delays, stress etc. Any unattended breakdown of project vehicles/trucks on the roads can induce traffic incidents. The potential for vehicular traffic conflict situations exists especially at the points where access road joins the main roads.
- Security/threats and human right abuses – theft of project property by both workers and job seekers; project site security personnel can abuse the human rights of trespassers and residents alike; workers coming to work and going out after close of work can be attacked or robbed on the way.

7.3.2.3 *Operational Phase Potential Adverse Impacts*

Physical Environment

The likely impact issues to arise during the operational phase include:

- Air Pollution from Plant emissions and fumes/dust emissions from use of equipment/machinery and movement of vehicles, trucks on unpaved roads through local communities, and diesel-powered electrical generators;
- Noise and Vibration from Plant operations and movement of trucks and operations of electrical generators and maintenance activities. Principal sources of noise in thermal power plants include the engines and turbine generators and auxiliaries; reciprocating engines; fans and ductwork; pumps; compressors; condensers; precipitators, including flappers and plate vibrators; piping and valves; motors; transformers; and circuit breakers etc;
- Impact on soil resources due to erosion from storm runoffs and soil contamination from fuel spills;
- Water pollution concerns due to fuels spills into water, transport of sediment laden storm-runoffs from the plant site into water;
- Impact on groundwater resources;
    - Ground water pollution concerns from spillage of fuel/oils.
    - Ground water abstraction to support operational activities
- Waste generation and disposal;
    - Generation of various streams of waste including garbage, scraps, sewage/human waste, etc
    - Disposal of hazardous wastes concerns

- Climate change impacts from emissions and associated cumulative impacts
    - Emission of noxious gases into the atmosphere. These include sulphur dioxide (SO_2), nitrogen oxides (NOX), particulate matter (PM), carbon monoxide (CO), and greenhouse gases, such as carbon dioxide (CO_2).
    - Carbon dioxide, a major greenhouse gase (GHG) under the UN Framework Convention on Climate Change, is emitted from the combustion of fossil fuels.
    - Fugitive emissions of natural gas will introduce methane, another potent GHG, into the atmosphere.

Biological Environment

- Impact on aquatic/water ecology
    - Effect of water pollution on aquatic life;
    - Effect of increased pollution on the Adote stream and downstream water resources.

Social Environment

- Water resource use/ consumption concerns due to production/operational activities.
    - About 7.5 m3 of demineralized water per day is required for operations.
- Fuel/gas consumption concerns from production activities.
    - A total of 55 mmscf per day of natural gas is required for the ten (10) gas turbines.
- Worker health and safety concerns
    - Worker injuries from handling of equipment/machinery, electrical installations, slips and falls etc
    - Major accidents from electrocution/traffic/ explosions and fire outbreak leading to loss of life
- Public/community health and safety and security concerns
    - Increased potential for spread of infectious diseases, including HIV/AIDS and recent Covid-19.
    - Increased potential for traffic incidents/accidents on the public/community roads
    - Security/threats and human right abuses
- Emergency situations - Explosion/ fire risks leading to loss of property and human life
- Sustainability risk
    - Lack of maintenance affecting efficient and effective operation of the Plant
    - Lack of funds to carry out maintenance and rehabilitation work
    - Emergency situations and equipment/plant failure

7.3.2.4 *Decommissioning Phase Potential Adverse Impacts*

Post-construction activities

- Occupational/ public safety, accidents, traffic incidents and labour issues

  - dismantling and relocation of construction work camps, project equipment and disposal of wastes
- Soil contamination / sediment transport
  - dismantling of construction work camps and exposing soil, fuel spills from project equipment/machinery maintenance, decommissioning of fuel storage facilities and disposal of wastes
- Water contamination/ impact on aquatic organisms
  - Improper disposal of waste, storm runoffs carrying fuel spills into nearby stream
- Air pollution/Noise nuisance
  - Dismantling of construction work camps, equipment/machinery operation
- Loss of construction employment
  - Laying off workers due to cessation of construction work

Post-operational phase

- Loss of employment and labour/community agitations
  - Laying-off workers, ending contracts
- All other impacts
  - Decommissioning plan to be prepared outlining how all other impacts will be managed and EPA to issue permit for the decommissioning activities.

7.4 Identification of Potential Health/Safety Hazards/Risks

The potential health/safety hazards/risks for the proposed project have been identified and discussed in **Table 7-1**.

Table 7-1: Potential Health and Safety Hazard/Risk for the Installation of the Kumasi 1 Thermal Power Plant Project

NO.	Work Activity of Concern	Task Element	Potential Hazard
Pre-Construction Phase			
1	Survey works	Site acquisition, site reconnaissance inspections and feasibility studies.	Consultants, surveyors and other workers carrying out feasibility studies and survey works may be exposed to injury and bites from dangerous reptiles, animals such as scorpions, bees, ants, etc. at the site.
			Possible agitation by chiefs and people of the projected affected community (Anwomanso) may arise and potential attacks on workers if due diligence is not followed to acquire and occupy the site.
2.	Construction and/or repair of access roads	Use of machinery to construct and repair create and repair the access road	Generation of dust and noise Personal injuries from manual handling and general tooling.
3.	Sourcing and Storage of Construction Materials and setting up work camps	Sourcing construction and other materials (e.g. gravels, sand, etc.)	Generation of dust. Excessive vibration and noise at quarry sites.
			Accidents & Incidents (Personal injuries from manual handling, trips, falls etc.)
		Allocation of space for storage of construction materials and equipment	Resistance of local community/ general public to the project due to denial of access to otherwise 'free' and open areas and use of hoarded areas for packing construction materials and equipment.
		Use of heavy machinery including trucks	Emission of fugitive gases, generation of excessive noise, vibration, accidental spillage or leakage of lubricants into waterbody and or soil
			Accidents & Incidents (Injuries from improper use of equipment)
		Setting up work camps Storage of construction materials & equipment	Poor location of camp sites and storage of materials (e.g. sand, gravel, cement, concrete mixers, etc.) leading to leaching of chemicals into food, water, etc.
			Sediment/leachate transport into drains and other water bodies from exposed surfaces due to harsh weather.
			Injuries and possible fatalities from poor manual handling, falling objects, improperly stacked materials & equipment.

NO.	Work Activity of Concern	Task Element	Potential Hazard
			Poor security measures leading to theft of materials and equipment
4.	Haulage of equipment and Materials and Traffic Management	Transporting construction materials e.g., aggregate, sand, cement, rebar etc. to site	Road traffic accident to other road users and personal injury
			Emissions of fugitive gases, generation of excessive dust and noise. Leakage of oil from poorly serviced /conditioned trucks leading to contamination of soil/ local water bodies and toxic harm to microbes.
		Transporting wide load equipment (Thermal plant equipment-gas turbines, generators, transformers, etc.) through Anwomaso and Domeabra township where there are MV lines crossing the roads.	Road traffic accident to other road users and personal injury
			Emissions of fugitive gases, generation of excessive dust and noise. Leakage of oil from poorly serviced /conditioned trucks leading to contamination of soil/ local water bodies and toxic harm to microbes.
			Falling equipment, electrocution, personal injury, cuts, bruises and damage to property etc.
		Offloading construction materials and equipment at the site close to existing energised overhead conductors.	Emissions of fugitive gases, generation of excessive dust and noise. Leakage of oil from poorly serviced /conditioned trucks leading to contamination of soil/ local water bodies and toxic harm to microbes.
		Use of tramming dozers, vibratory rollers/compactors and 360 excavators to work area.	Personal injury, entrapment from movable parts, swinging of boom
		Safe Movement of vehicles and pedestrians	Injury to persons or damage to property, equipment
			Traffic/congestion of construction vehicles at any given time at the site.
		Deliveries of materials to construction site.	Emissions of fugitive gases, generation of excessive dust and noise. Leakage of oil from poorly serviced /conditioned trucks leading to contamination of soil/ local water bodies and toxic harm to microbes.
		One-way Traffic Routes	Traffic/congestion of construction vehicles at any given time at the site.
		Vehicles/plant Certification/competence	Breakdown at unsafe locations, accidents, personal injury.
5.	Land/Site Clearance and Preparation	Hoarding of site (a temporary board/corrugated sheet fence erected round a building site)	Agitation/ protests due to denial of access to area for use as usual thoroughfare.
			Falling objects, manual handling, hand/arm vibration, cuts & personal injury

NO.	Work Activity of Concern	Task Element	Potential Hazard
		Site clearing for the construction of proposed thermal power plant	Injury from cutting trees and vegetation, eye injury, knock from falling branches
			Generation of excessive dust and noise.
		Use of plant & equipment.	Emissions of fugitive gases, generation of excessive dust and noise. Leakage of oil from poorly serviced /conditioned trucks leading to contamination of soil/ local water bodies and toxic harm to microbes
			Falling objects, manual handling, hand arm vibration, cuts & personal injury
		Excavation in close proximity to existing Towers and 161kV and 330kV high tension lines.	Damage to cables or pipes, electrocution, personal injury etc.
Construction Phase			
1.	Regular Haulage of Equipment and Materials to Project Site and Traffic Management	Transporting construction materials e.g. aggregate, sand, cement, rebar etc. to site	Road traffic accident, other road users and personal injury
			Breakdown of trucks and attendant traffic problems
			Poor parking arrangements at project sites causing congestion
			Use of vehicles in poor condition
			Emissions of fugitive gases, generation of excessive dust and noise. Leakage of oil from poorly serviced /conditioned trucks leading to contamination of soil/ local water bodies and toxic harm to microbes
		Offloading construction materials and equipment at the site close to existing energised overhead conductors.	Falling equipment, electrocution, personal injury, cuts, bruises and damage to property etc.
		Use of tramming dozers, vibratory rollers/compactors and 360 excavators to work area.	Personal injury, entrapment from movable parts, swinging of boom
		Safe Movement of vehicles and pedestrians	Potential risk to the safety of the general public.
		Deliveries of materials to construction site.	Traffic/congestion of construction vehicles at any given time at the site.
		One-way Traffic Routes	Traffic/congestion of construction vehicles at any given time at the site.

NO.	Work Activity of Concern	Task Element	Potential Hazard
		Vehicles/plant Certification/competence	Breakdown at unsafe location, accidents
			Damage to property, personal injury
2.	General Construction-Earthworks	Setting out of foundations for Thermal Plant (Gas Turbines), auxiliary, earthing transformer, steel frame columns/members, transformers, firewalls, etc. Use of hand tools, Excavation of concrete pad foundations for the power plant Excavation and laying of pipelines for gas/fuel and water supply Securing the area/zone of excavation Management of Flooding and Strom Water from the excavation activity Excavation for 161kV and 330kV Towers for power evacuation. Excavation along existing overhead High tension lines routes Site plant operations, excavation works and haulage of spoil, materials & equipment	Manual handling, cuts, slips and trips of digging tool, musculoskeletal, falls into pit and minor injuries.
			Flooding
			Managing hazardous material from the excavated soil
			Electrocution etc.
			Noise and vibration nuisance
			Generation of dust and emission of gases
			Generation of construction spoils and wastes
			Flooding/ Storm water management
			Sanitation problems from-Poor housekeeping at the project site. Improper disposal of waste (construction waste, food waste, polythene bags, drinking water sachets, etc.)
			Public health concerns- Open or improperly covered trenches may also result in stagnant water and breeding grounds for mosquitoes, leading to malaria infestation
			Exposure to sharp objects including used hypodermic needles and drugs leading to Tetanus and HIV infection
		Confined space working	Toxic Atmosphere, Oxygen Deficiency, Excessive Heat, Explosive/Flammable Atmosphere, Flowing Liquid or Free Flowing Solids.

NO.	Work Activity of Concern	Task Element	Potential Hazard
		Working close to existing HV & MV overhead conductors or underground cables.	Contact with live conductor from truck bucket tipping load, personal injury &` electrocution.
3.	Civil Construction Works	Use of plant/Equipment (concrete mixer, concrete poker/vibrator, hand tools-shovels, float wheel burrows) for concrete works.	Manual handling, vibration, cuts and personal injury, inhalation of cement dust, skin irritation/burns from cement/wet concrete.
		Mixing of concrete at the site, if applicable	Slips, Trips and Falls into excavations
		Moving/transporting concrete in wheel burrows to excavated foundations for construction of power, auxiliary and earthing transformer, steel frame columns/members, buildings, firewall, security gatehouse etc.	Contact with wet concrete, burns, eye & personal injury
			Health impacts from emission of fugitive gases, generation of excessive noise, vibration.
			Accidental spillage or leakage of lubricants into local waterbody and/ or soil
		Concrete blinding of excavated foundations for construction of GIS, power, auxiliary and earthing transformer firewall, transmission towers, switchyards, capacitor banks, voltage transformers, busbars, steel columns etc.	Emissions of fugitive gases, generation of excessive dust and noise. Leakage of oil from poorly serviced /conditioned trucks leading to contamination of soil/ local water bodies and toxic harm to microbes
		COSHH (Control of Substances Hazardous to Health) Assessment-(Handling/contact with cement/cement dust, mould oil, antirust paint, curing agent for concrete, marking spray paint, chemical resin, diesel, hydraulic oil, etc.).	Burns, skin, eye and respiratory irritation & exposure to toxicity.
		Form work/shutters for equipment, transmission tower, construction of power, auxiliary and earthing transformer firewall, (GIS), switchyards, capacitor banks, voltage & current transformers, busbars, steel columns etc.	Manual handling, cuts, trips, falls & personal injury from erection of formwork.
			Falling materials whilst striking the formwork
			Health impacts from emission of fugitive gases, generation of excessive noise, vibration
			Accidental spillage or leakage of lubricants into local waterbody and/ or soil

NO.	Work Activity of Concern	Task Element	Potential Hazard
		Form work/shutters for drains, cable ducts, control buildings and security gatehouse.	Manual handling, Trips, falls, cuts and minor injuries
			Health impacts from emission of fugitive gases, generation of excessive noise, vibration
			Accidental spillage or leakage of lubricants into local waterbody and/ or soil
		Steel fixing (rebar) of equipment, transmission tower, control building, security gatehouse structures.	Manual handling, trips, falls, cuts, minor injuries, health impacts from emission of fugitive gases, generation of excessive noise, vibration
			Accidental spillage or leakage of lubricants into local waterbody and/ or soil
		Concreting/construction of equipment, GIS, transmission towers, control buildings, security gatehouse, drains etc.	Manual handling, skin and eye damage, burns as a result of scabbling and blowing out
			Health impacts from emission of fugitive gases, generation of excessive noise, vibration
			Accidental spillage or leakage of lubricants into local waterbody and/ or soil
		Construction of 161kV double circuit underground cable/overhead line	Trips, slips, falls into trench, personal injury etc.
			Health impacts from emission of fugitive gases, generation of excessive noise, vibration
			Accidental spillage or leakage of lubricants into local waterbody and/ or soil
		Working at height during formwork for construction of GIS, control buildings, security gatehouse, steel frames-columns/members etc.	Falling objects/materials, falls from height, Collapse of access equipment, Overturning of access equipment, manual handling & personal injury.
		Assembling of transmission towers steel frames - columns/members on the ground.	Manual handling, trips, falls, cuts and minor injuries
			Health impacts from emission of fugitive gases, generation of excessive noise, vibration
			Accidental spillage or leakage of lubricants into local waterbody and/ or soil
		Construction of control building, security gatehouse	Fall from height, falling objects, manual handling, major injury, entrapment, cuts, & risk of death from falls at height.

NO.	Work Activity of Concern	Task Element	Potential Hazard
		General movement of workers on the construction site.	Health impacts from emission of fugitive gases, generation of excessive noise, vibration
			Accidental spillage or leakage of lubricants into local waterbody and/ or soil
		Construction of wooden trusses and roof works.	Trips, falls, cuts, manual handling, work at height, personal injury,
			Manual handling, trips, fall, noise, hand/arm vibration & personal injury.
		Backfilling and compaction around constructed concrete foundations, access roads, substation yard with excavated or burrow fill materials.	Destabilizing compact soils, removal of top soil increasing the potential of soil erosion
		Use of disc cutters/abrasive wheels	Bursting of wheel or disc, Contact with wheel or disc, Entanglement, Fire
			Dust, Vibration, & Noise generation
		Fence wall construction	Trips, falls, cuts manual handling & personal injury
			Health impacts from emission of fugitive gases, generation of excessive noise, vibration
			Denial of local community/ general public access to otherwise 'free' and open areas and resistance of local community to project
		Construction waste Management including Disposal	Manual handling, trips, falls, slips & personal injury
			Construction spoil and other waste nuisance
			Pollution and public safety issues
		Pavement works construction.	Manual handling, back aches, trips, falls, cuts and personal injuries
			Health impacts from emission of fugitive gases, generation of excessive noise, vibration
			Construction spoil and other waste nuisance
		Gravelling of substation	Manual handling, back aches, trips, falls, cuts and personal injuries
		Grading and revegetation of the perimeter of the project site.	Poor manual handling, back aches, trips, falls, cuts and personal injuries
		General fitness of workers reporting for duty.	Accidents & Incidents (Personal injury)
			Working at exposed location, dehydration, wet weather, lightning strike
		General outdoor site work.	Poor security conditions may lead to theft of materials and equipment
			Unhealthy relationship with community members

NO.	Work Activity of Concern	Task Element	Potential Hazard
		Confined space working	Toxic Atmosphere, Oxygen Deficiency, Excessive Heat, Explosive/Flammable Atmosphere, Flowing Liquid or Free Flowing Solids.
4.	Electrical and mechanical Works	Installation of steel frame columns/members.	Manual handling, lifting operation, falling objects, cuts, trips, falls and personal injury
		Installation of circuit breakers, relays, transformers, GIS switchgears, capacitor banks etc.	Health impacts from emission of fugitive gases, generation of excessive noise, vibration
			Accidental spillage or leakage of lubricants into local waterbody and/ or soil
		Installation of current & potential transformers, isolators, conductors, insulators, busbars, lightning arresters, overhead conductors, HV cables, earthing, etc.	Hazards from induced voltages and currents and possible electrocution from accidental contact with live wires from working on conductors which may run parallel to an in-service HV line/near the 330 kV and 161 kV lines
		Installation of protection and control panels	
		Stringing of 161kV conductors on transmission towers	Falling from height, manual handling, falling objects
		Connection of 161kV power lines, 330kV power lines, ground wire to other installed plant elements/equipment.	Manual handling, falling objects, cuts & minor injuries
		COSHH (Control of Substances Hazardous to Health) Assessment-(Handling/contact with transformer oil, gases for GIS, paints etc.).	Burns, skin, eye and respiratory irritation & exposure to toxicity.
			Accidental spillage or leakage of lubricants into local waterbody and/ or soil
5.	**General outdoor site work**	General tooling and equipment to carry out works.	General fitness of workers reporting for duty.
			Improper use or tool or equipment, damage to tool or equipment & personal injury.
			Working at exposed location, wet weather, lightning strike
			Poor security conditions leading to theft of materials and equipment
			Accidents & Incidents (Personal injury)

NO.	Work Activity of Concern	Task Element	Potential Hazard
6.	Testing and commissioning of the proposed thermal power plant	Testing of installed equipment	Personal injury and electrocution
7.	**Decommissioning of work camps**	Clean up activities, waste collection and disposal	Trips, falls, cuts, manual handling & personal injury
Operational Phase			
1.	Operation and Maintenance	Equipment maintenance and management	Risk of Fires & Explosion
			Risk of Flooding
		Maintenance and provision of security for substation	Safety of workers and break into the facility
		Materials handling and storage, including hazardous chemicals and fuels.	Burns, skin, eye and respiratory irritation & exposure to toxicity.
			Accidental spillage or leakage of lubricants into local water body and/ or soil
		Maintenance of water and fuel (including gas) supply pipelines	Personal injuries
		Maintenance/management of power evacuation network	Electrocutions
			Risk of fires and explosions
		Effluent/waste management including solid and liquid waste discharges	Exposure to insanitary conditions
			Pollution from oil spillage and leakages
		Health and Safety Reviews and Monitoring	Work stress on health and safety officers
			Exposure of workers to emissions and personal injuries.

7.5 Potential Impact Evaluation Approach for the EIA

The potential environmental/social impacts and issues identified at the scoping phase will be subjected to in-depth evaluation and analysis during the EIA phase to enable the development of comprehensive mitigation, monitoring and management measures to address the likely adverse impacts on local communities and the environment in general. This will also include the evaluation of the hazards/risks identified and discussed.

7.5.1 Impact Identification and Characterization

The impacts will be described in terms of their characteristics, including the impact's type and the impact's spatial and temporal features (namely extent, duration, scale and frequency). The definitions of the terms to be used are described in **Table 7-2.**

Table 7-2: Impact Characteristics

Characteristic	Definition	Terms
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	**Direct** - Impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected). **Indirect** - Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land). **Induced** - Impacts that result from other activities (which are not part of the Project) that happen because of the Project. **Cumulative** - Impacts that arise because of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect.
Duration	The time period over which a resource / receptor is affected.	**Temporary** - (period within 1 year - negligible/associated with the notion of reversibility) **Short term** - (period of up to 2 years i.e. construction period or production ramp up period) **Medium term** -(period of more than 2 years to 5 years) **Long term** - (period of more than 5 years and less than 20 years i.e. life of facility/plant) **Permanent** - (a period that exceeds the life of facility – i.e. irreversible. Or may last for a very long time)

Characteristic	Definition	Terms
Extent	The reach of the impact (i.e. physical distance an impact will extend to)	**On-site** - impacts that are limited to the Project site. **Local** - impacts that are limited to the Project site and adjacent properties. **Regional** - impacts that are experienced at a regional scale, i.e. beyond adjacent properties, covering the Metropolis/Municipalities/ Districts and beyond **National** - impacts that are experienced at a national scale. **Trans-boundary/International** - impacts that are experienced outside of Ghana
Scale	Quantitative measure of the impact (e.g. the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.). or the professional viewpoint of the measure of impact	Quantitative measures as applicable for the feature or resources affected/ professional viewpoint of expert as applicable for the feature or resource in terms of severity of impact measure (i.e. minor, moderate, severe).
Frequency	Measure of the constancy or periodicity of the impact.	No fixed designations; intended to be a numerical value or a qualitative description, e.g. intermittent.
Likelihood	Characteristic that pertains to unplanned events determined either qualitatively or quantitatively estimated on the basis of experience and/or evidence that such an outcome has previously occurred.	**Unlikely** – The event is unlikely but may occur at some time during normal operating conditions. **Possible** – The event is likely to occur at some time during normal operating conditions. **Likely** - The event will occur during normal operating conditions (i.e., it is essentially inevitable).

7.5.2 Determining Impact Magnitude

Once an impact's characteristics are defined, the next step in the impact assessment phase is to assign each impact a 'magnitude'. Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- extent;
- duration;
- scale; and
- frequency.

Magnitude (from small to large) is in practice a continuum, and evaluation along the spectrum requires the exercise of professional judgement and experience. Each impact is

evaluated on a case-by-case basis, and the rationale for each determination is noted. The universal magnitude designations, for negative effects, are: negligible, small, medium and large. The magnitude designations themselves are universally consistent, but the definition for the designations varies by issue. In the case of a positive impact, no magnitude designation has been assigned as it is considered sufficient for the purpose of the impact assessment to indicate that the Project is expected to result in a positive impact.

7.5.3 Determining Receptor Sensitivity

The other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. As in the case of magnitude, the sensitivity designations themselves are universally consistent, but the definitions for these designations will vary on a resource/receptor basis. The sensitivity of receptor used is low, medium and high as shown in the table below.

Table 7-3: Sensitivity Criteria

Value / Sensitivity	Low	Medium	High
Biological and Species Value / Sensitivity Criteria			
Criteria	Not protected or listed as common / abundant; or not critical to other ecosystem functions (e.g. key prey species to other species).	Not protected or listed but may be a species common globally but rare in Ghana with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline.	Specifically protected under Ghana legislation and/or international conventions e.g. species listed as rare, threatened or endangered e.g. IUCN
Socio-Economic Sensitivity Criteria			
Criteria	Those affected are able to adapt with relative ease and maintain pre-impact status.	Able to adapt with some difficulty and maintain pre-impact status but only with a degree of support.	Those affected will not be able to adapt to changes and continue to maintain-pre impact status.
Physical Sensitivity Criteria			
Criteria	The resource remains unaffected and maintains pre-impact status.	Pre-impact status is temporarily altered. May be restored over time naturally or through specific interventions.	Pre impact status is permanently altered by the development. Receptor or resource is held in high-esteem by stakeholders

7.5.4 Assessing Significance

Once magnitude of impact and sensitivity of a receptor have been characterised, the significance can be determined for each impact. The impact significance or severity rating will be determined, using the matrix provided in **Table 7-4.** The definitions or explanations of the impact significance assessment rating is provided in **Table 7-5.**

Table 7-4: Impact Significance Rating Matrix

		Sensitivity / Vulnerablity of Resource / Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	**Negligible**	**Negligible**	**Negligible**
	Small	**Negligible**	**Minor**	**Moderate**
	Medium	**Minor**	**Moderate**	**Major**
	Large	**Moderate**	**Major**	**Major**

Table 7-5: Definition of the Impact Significance/Severity Assessment Rating

Rating	Impacts
Negligible	• Impacts that are hardly distinguishable from background conditions and expected development in a no-project situation • Impacts very unlikely to happen
Minor	• Impacts of low intensity, limited in scale (site-specific) and low/medium duration (temporary) • Impacts unlikely to happen and/or the sensitivity of receiving environment is very low and/ or project designs have installed sufficient control mechanisms • impacts can be mitigated and minimized to a negligible level through adoption of best practice, continuous improvement and optimization measures
Moderate	• adverse impacts on people and/or environment of medium intensity, which may have a regional spatial scale of influence or a long term duration • impacts that are measurable and able to change some characteristics of the receptor/ resource, but not to generate irreversible, unprecedented or multiple adverse effects or damage • impacts can be avoided, managed and/or mitigated with relatively uncomplicated accepted measures
Major	• significant adverse impacts on human populations and/or environment, high in intensity and/or spatial extent (e.g. large geographic area, large number of people, transboundary impacts, cumulative impacts) • permanent and/or irreversible impact • areas impacted include areas of high value and sensitivity (e.g. valuable ecosystems, critical habitats) • impacts may give rise to significant social conflict • impact may not always be reduced by implementing mitigation measures. In this case, further options have to be considered in order to avoid any critical significance driven by project (analysis of alternative strategy). Therefore, significant resources or fundamental changes in the activities and systems are required where necessary.

8.0 DRAFT TERMS OF REFERENCE (TOR) FOR THE EIA

This Chapter provides the draft terms of reference for the EIA study to be carried out for the Kumasi 1 Thermal Power Plant Project.

8.1 Sources of Issues to be addressed in the EIS

The main issues to be addressed in the Environmental Impact Statement (EIS) will include:

- Potential issues and impacts identified during the scoping study;
- Stakeholder and community concerns;
- EPA review comments on the Scoping Report; and
- Other matters as provided under Part II of LI 1652 under regulation 12.

8.2 Purpose and Aim of the EIA

The EIA will seek to address the identified significant potential adverse physical, biological and social impacts at the various project phases. The positive impacts which have been identified by scoping of the Project shall further be consolidated in measurable terms during the EIA. The EIA ultimately aims at fulfilling all the legal obligations as contained in Legislative Instrument 1652 to meet the conditions for obtaining an environmental permit from the EPA for Project implementation.

8.3 Objectives of the EIA

The broad objective of the EIA is to identify environmental, safety and social impacts, likely to arise as a result of undertaking the Project and design mitigation measures to address the identified potential impacts.

Specific objectives of the EIA include:

- Provide adequate description of the Project;
- Identify activities of environmental/safety and social concerns;
- Establish the baseline physical, biological and social conditions of the Project area;
- Evaluate and predict potential adverse physical, biological and social impacts and risks including health/safety on the environment and local communities during construction and operation;
- Advise on appropriate mitigation and monitoring measures against potential adverse impacts; and
- Assess socio-economic and cultural benefits and disadvantages associated with the Project for an informed decision to be made on the level of environmental compromises and permitting by relevant stakeholders.

8.4 Scope of Work and Methodology

The scope of work and methodology for the EIA in summary will cover the following:

8.4.1 Detailed Description of the Proposed Project

Detailed description of the Project shall be provided to give adequate information for all stakeholders to understand and appreciate the project scope and components as well as the production processes. Project description shall cover the location, boundary, scale, size, design, layout, process flow chart, Project activities at the preparatory, construction and operation phase activities, as well as the various utility requirements needed, waste management issues for the Project and the overall project implementation management and schedule. The various materials and labour requirements as well as equipment/machinery to be used will be confirmed under this section. Proposed methods of the energy production, rate of production, efficiency factors shall also be detailed.

Methodology to be used

Two main methods will be used to adequately describe the project and these include (i) project documents/literature review and (ii) consultations with VRA. The following key documents will be reviewed among others:

- Project feasibility study report.
- Annual Environmental Reports of the AMERI Power Plant at its Aboadze site.
- Environmental Management Plan of the AMERI Power Plant at its Aboadze base in the Takoradi area.
- Decommissioning Plan of the AMERI Power Plant at its base at Aboadze area.

The EIA Consultant will adequately engage VRA, the proponent, on the project to obtain information on the project that are not available in the project documents.

8.4.2 Analysis of the Need for the Project and Alternative Considerations

The importance and need of the Project on the socio-economic fortunes of the Greater Kumasi Metropolitan Area and the northern part of the country shall be discussed and justified. The various alternatives and their viability to the Project, especially, with regard to site selection options, selection of access routes, sources of water supply will be examined. The environmental criteria for the preferred option shall also be examined. The no action option scenario where the Project is not allowed and its effects on the biophysical and socio-economic conditions of the Kumasi area, northern part of the country and the national economy will also be examined.

Initial analyses have been carried out in this scoping report and further analysis will be carried out and confirmed in the EIA report through further engagement with VRA Engineering and Environmental teams.

8.4.3 Description of the Policies, Legal and Institutional Framework

All the relevant national and international policies, legislations/regulations, guidelines and standards on Thermal power plant applicable to this project shall be identified and reviewed as part of the EIA. Two main methods will be used to identify all relevant and applicable policies and laws and these include

(i) extensive literature search and reviews of previous EIA reports on thermal power plants; EMP of AMERI Power Plant among others.

(ii) (ii) direct and indirect consultations with stakeholders in the energy/power sectors, utility sectors, environmental protection sectors, local government and traditional authorities among others.

Initial identification and reviews of the relevant policies, laws and standards/guideline have been carried out as part of the scoping exercise and presented in this scoping report. Other policies and laws identified during the consultation and literature review processes of this EIA will be reviewed and included in the EIS.

8.4.4 Baseline Studies and Analysis

Adequate description and analysis of the existing physical, biological and social environment shall be carried out. The baseline information or data will be obtained from two main approaches, namely secondary data and primary data sources. The secondary data will be obtained from literature search and reviews; and the primary data from field investigations to be carried out by the EIA Consultant.

Secondary data will be obtained for the following baseline information:

- Climatic conditions
- Soil/Geology and Seismicity
- Topography/Relief of the project area
- Water resources/hydrology
- Socio-economic profile of the Oforikrom Municipality
- Community/public health and safety information of the project area

Field investigations will be carried out for the following baseline information:

- Ambient air quality
- Ambient noise levels
- Surface water quality
- Terrestrial ecology

Ambient Air Quality Monitoring and Emission Dispersion Modelling

The Consultant will carry out ambient air quality monitoring at the project site and its immediate environs to determine the existing concentration levels of at least, the following air quality parameters:

- ✓ Nitrogen Dioxide (NO_2),
- ✓ Sulphur Dioxide (SO_2)
- ✓ Carbon Monoxide (CO)
- ✓ Particulate Matter (PM_{10}, $PM_{2.5}$)
- ✓ Total Suspended Particles (TSP).
- ✓ VOCs
- ✓ Petroleum Hydrocarbons (PHCs).

Results obtained are to be compared to the Ghana Standards and or the World Health Organization Standards, which have been discussed under Chapter 2 of this report. Ambient air quality baseline parameters will be undertaken at the site for at least 15 to 20 days period per the Ghana EPA recommendation to generate adequate data to characterize the area and also reliable background concentrations for input into the emission dispersion model.

The monitoring locations will be geo-referenced using an appropriate GPS instrument. The monitoring will be done using a highly flexible state-of-the-art air quality monitor (SIRA Certified OSIRIS TURNKEY INSTRUMENT/ various gas meters using models of CROWCON. The ambient concentrations are recorded at 1-minute interval for the period of monitoring, from which hourly concentrations will be calculated and daily average concentration determined.

Measurement of meteorological parameters

The meteorological parameters will be measured using a Kestrel to support and confirm the 30 years historical data for real-time measurements to be obtained from Ghana Meteorological Department. The Weather Transmitter measures air temperature, relative humidity, wind speed, wind direction, barometric pressure and precipitation all simultaneously and data logged at 1-minute interval.

Siting of ambient air quality station

The equipment will be sited downstream (wind direction) of the proposed project site and or within the nearest community or sensitive receptors. The proposed sampling points determined during the reconnaissance visit to the project site is provided in **Annex 8-1.**

Emissions & Air Dispersion Modelling

The proposed power plant activities will cause continuous increases in emissions of criteria pollutant into the micro-environment (i.e., near-field). Sources that require inventorisation for this project range from emissions from the combustion process. The qualities of the gas will be obtained from VRA and used for the analysis.

Dispersion Modeling Analysis

Essentially, near-field impacts will be analysed using an acceptable air quality model. The near-field analysis will provide a comparison of modelled pollutant concentrations to the Ghana Standards on Ambient Air Quality. Near-field impacts within 10 kilometre (km) of the proposed project site's surface facilities will be assessed by modelling projected emission rates. The model will run with suitable stack diameter and exit velocity based on the plant capacity. Then, if modelled concentrations are over the ambient standards for Ghana, new scenarios will be modelled with increased stack heights.

Meteorological Data

A 30 years meteorology (12-km receptor grid) data will be purchased from Ghana Meteorological Services. These datasets will be processed in addition to the surface characteristic data obtained from a measurement that will be carried out at the proposed facility site for 20 days.

Receptor Grid

The receptor grid, or network, defines the locations of predicted air concentrations that will be used to assess compliance with the relevant Ghana Standards. The following comprehensive fine and coarse receptor network will be used for the analysis:

- 20-meter (m) spaced receptors along the project property boundary (defined as a 50 meter buffer from the area sources)
- 100-meter spaced receptors out to 500 m from the property boundary/land use application area boundary.
- 500-m spaced receptors from 1 km and beyond.

Emission Sources and Modelled Emission Rates

Criteria pollutants that will be considered in this analysis include Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), and will be measured using Crowcon gas detectors. The modelling will be done based on the baseline study and proposed emission from the designed emission. Baseline Volatile Organic Compounds (VOCs) will be monitored using MiniRAE Lite VOC monitor and prediction made on the future emission based on initial and propose designed emission. Finally, Particulate

Matter (mainly $PM_{10/2.5}$ and TSP) will be determined on site and the design air pollutant modelled to see the impact on the surrounding communities.

Green House Gas Emissions / Climate Change

The AMERI Power Plant to be relocated to Kumasi area is not new in Ghana and has been deployed and used in the country before. A review of any available document or literature on its GHG emission data will be carried out.

Baseline Noise Level Monitoring & Noise Modeling

A CASTLE- SONUS Sound level meter will be used for the noise monitoring. Baseline /background noise levels at the proposed site and its environs will be measured for at least 15 to 20 days. Selection of sampling points and field monitoring will factor the meteorological data as well as terrain data (nature of the topography of the project site (e.g., slope, hilly, mountainous; average height of any impeding structures (e.g., buildings) and respective distances from the noise/sound generating sources.

Noise Level Parameters

The noise level parameters to be measured are as follows:

- LAeq (equivalent sound level, with A-weighted frequency response and Fast time constant)
- LA90 (noise level exceeded for 90% of the measurement period, with A-weighted frequency response and Fast time constant)
- LAmin (minimum sound level with A-weighted frequency response and Fast time constant)
- LAmax (maximum sound level with A-weighted frequency response and Fast time constant)

Noise Assessment and Modelling

The noise impact assessment will be carried out to establish the relationship between the project development noise and the natural masking noise and assess levels against established standards (over Ghana/IFC threshold levels).

The CUSTIC Noise Modelling Software v3.2 will be used for the dispersion model. The numeric algorithms in the software use an equation that estimates the dispersion of the noise in air. The software:

- Uses meteorological data to establish the form of the noise pollution
- Calculates the sound emission/level that is produced by each generating point source per the input data into the software.
- Takes into consideration the type of source and the state of the atmosphere
- Generates out temporary averages (daily, monthly or annual) so that noise pollution averages in each point of the affected area can be calculated.

This model performs satisfactorily for simple sound propagations with no ground interaction, which means that the model can be run above the ground level at any height. The noise propagation shall be modelled in accordance with International Standard ISO 9613-2: 1996 Acoustics – Attenuation of Sound Propagation Outdoors – Part 2: General Method of Calculation. The dispersion model is intended to ascertain and demarcate areas considered to be hotspots so that those areas would be selected for the Noise Monitoring Programme, using the existing Ghana EPA ambient noise level standards.

Surface Water Quality Monitoring

The Adote Stream was identified in the project area during the scoping visit.

Sampling methodology

The Adote stream will be sampled for both field and laboratory analyses. Upstream and Downstream of the Adote stream will be sampled. Samples will be collected at the appropriate point using standard operating procedures to avoid contamination, and into 1 litre plastic bottles. These will be stored in coolers with temperatures below 4^{o}C and transported to the laboratory in Kumasi or Accra (e.g. Ghana Standards Authority or CSIR Water Research Institute laboratories). All sampling sites selected will be geo referenced with an appropriate GPS equipment.

Field and laboratory measurements

Parameters such as pH, temperature, conductivity and dissolved solids will be measured insitu, using a water quality field kit. The laboratory will follow Ghana Standard methods recommended by the Ghana Standards Authority (GSA). The parameters to be analysed will be in line with parameters required to be measured for effluent/ wastewater discharges into Natural Water Bodies by thermal power plants and these have already been provided and discussed under Chapter 2 of this report.

Water Quality Assessment

All potential water effluents and their impacts will be assessed as part of the EIA with comparisons against the national and internationally recognized discharge standards, in this case.

Ecological Study

<u>Rapid Floral Assessment</u>

A rapid flora assessment will be done in order to list plant species that are known or highly probably to occur within the project area with special emphasis on priority (i.e. endemic or threatened) taxa. The Ecologist shall undertake a vegetation assessment which shall involve a rapid assessment of species composition of the area for purposes

of inventorying plants/wildlife species; assessing abundance of species and their relevance or conservation importance.

Faunal Assessment

Again, a rapid faunal assessment will also be undertaken to list the animal species (of particular groups) that are known or highly probable to occur within the project area with emphasis placed on priority (i.e. endemic or threatened) taxa. Four main methods would be used in the faunal survey: direct/opportunistic observation, identification of animal spoors, interviews, and desk surveys of available literature (Hughes & Barry, 1969; Serle et al., 1992; Delany & Happold, 1979; Kingdon, 1987; Hughes, 1988; Haltenorth & Diller, 1988; Larsen, 1994).

For all listed taxa, information on ecological requirements, and known or suspected threats as well as local practices to conserve them will be ascertained.

Socio-Economic Baseline Data Collection

The socioeconomic baseline data on (i) farmers on the project site; (ii) Anwomase community, which is the nearest community to the project site; (iii) Oforikrom Municipality, which is the municipality/district in which the project is located. The socioeconomic baseline data relating to: demographics, community facilities and services, economic environment; employment, labour and livelihood issues; land use and natural resources; governance structures, health, education, culture, lifestyle and recreation will be collected.

The primary data on the social economic conditions of Anowmaso community shall be collected during the various visits to the community and engagement with local stakeholders. Interviews to be conducted will involve state and decentralized agencies, local government officials popularly known as "Assemblymen", government departments, community leaders and individuals with appropriate knowledge in the project area.

Secondary data to compliment the primary data will be collected through a wide literature review of district-based reports obtained from the Oforikrom Municipal Assembly and the various decentralized agencies. Information on the Socio-Cultural / Economic Environment to be obtained shall cover the following:

- Population and Demographics
- Ethnic, Religious and Cultural Heritage
- Historical resources
- Aesthetics and Tourism
- Infrastructure

- Education
- Land tenure and Land Ownership
- Land Use
- Employment/Manufacturing
- Agriculture
- Public Health (including HIV/AIDS)
- Public/Community Safety and Security and Traffic Safety Issues

8.4.5 Identification & Analysis of Potential Environmental & Social Impacts

The potential environmental and social impacts and risks will be assessed using Environmental Matrices, Checklists, Modelling and responses from stakeholders arising from the consultations.

As far as predictable, all the identified impacts and risks will be assessed for significance based on magnitude, extent, duration, sensitivity of the receptor, reversibility, compliance with relevant laws, regulations and standards, concerns and views of stakeholders, overall worker comfort, and likelihood of an occurrence. Section 7.5 provides the impact evaluation approach for the EIA.

The assessment will distinguish between significant positive and negative impacts, direct and indirect impacts, immediate and long-term impacts, and cumulative impacts in relation to other activities. The impact analysis will distinguish between routine construction and operational impacts and include an analysis of accidental events. Of particular note, the impact analysis will include an analysis of sensitive or protected resources in recognition of environmental concerns and requirements.

The impact ratings will be categorized as follows:

- Minor significance;
- Moderate significance; and
- Major significance.

<u>Minor Significance</u>

An impact of minor significance, or referred to as a 'minor impact' is one where an effect will be experienced, but the impact magnitude is sufficiently small and well within accepted standards, and/or the receptor is of low sensitivity/ value.

<u>Moderate Significance</u>

An impact of moderate significance or referred to as a 'moderate impact', will be within accepted limits and standards. Moderate impacts may cover a broad range, from a

threshold below which the impact is minor, up to a level that might be just short of breaching an established legal limit.

Major Significance

An impact of major significance, or referred to as a 'major impact' is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/ receptors.

8.4.6 Development of Mitigation Measures

Appropriate mitigation measures against the significant adverse impacts will be developed with appropriate cost estimates for Environmental and Social Protection for the pre-construction, construction, operation/maintenance and decommissioning phases of the project.

The general rules to be followed in designing the mitigation measures include:

- Avoidance of major impacts: major impacts are impacts where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/ sensitive resources/ receptors.
- Reduction of major and moderate impacts: moderate impacts are impacts within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor, up to a level that might be just short of breaching an established (legal) limit.
- Mitigation of minor impacts: minor impacts occur where effects are experienced, but the impact magnitudes are sufficiently small and well within accepted standards, and/ or the receptors are of low sensitivity/ value.

The mitigation measures to be proposed or recommended will be placed under three major forms, which comprise:

- Preventive measures
    - Measures to be incorporated into the design and project implementation in order to avoid an identified impact/risk
- Control measures
    - Measures to abate or remedy the impacts
- Compensatory measures
    - Measures to be proposed for loss or damage to an affected property or resource

8.4.7 Development of a Monitoring Programme

An appropriate monitoring programme to monitor impacts on the physical, biological and human environments will also be developed. The purpose of the monitoring plan will be to:

a) Verify the accuracy or otherwise of impact prediction methods and predicted impacts;
b) Ensure proper implementation of mitigation measures and the prompt identification of any system failures;
c) Ascertain the effectiveness of the mitigation measures; and
d) Make additions or modifications to the measures that are found to be inadequate.

A sample monitoring plan template to be used is provided below.

Table 8-1: Sample Monitoring Plan template for the Environmental/Social Management

Environmental components	*Parameters to be monitored*	*Monitoring site*	*Methodology / standards*	*Frequency*	*Responsibility*	*Estimated cost/year*
Noise levels						
Air quality						
Water quality						
Effluent/ wastewater quality						
Waste generation and disposal						
Accidents, injuries and workers health						
Public/community complaints						

8.4.8 Provisional Environmental Management Plan (EMP)

A Provisional Environmental Management Plan (EMP) outlining the main issues involved in managing the project's environmental components will be developed as part of the EIS. The provisional EMP will incorporate the following but not limited to these:

a) Environmental, Health/Safety Policies of VRA and the Contractor
b) An outline of the duties of an environmental representative as appointed by Project Developers especially VRA and the Contractor.
c) Structure of reporting for environmental officers, to be linked to operational and administrative activities;
d) Environmental monitoring programme;
e) Project monitoring programme;
f) Capacity building and training requirements;
g) Grievance redress mechanism;
h) Documentation and record keeping;
i) Emergency preparedness and response framework;

j) Statutory reporting arrangements;
k) Environmental audit and review arrangements
l) Environmental management cost estimates

8.4.9 Stakeholder Consultations

Consultations form an integral part of the environmental assessment process. Stakeholders will be engaged to elicit their views/ concerns/ suggestions on the project and also solicit information related to baseline data and challenges, training and capacity building needs for the implementation of the EIA report and EPA permit schedules.

Most key stakeholders have already been identified and adequate approach for the stakeholder consultations and engagement have been discussed in Chapter 6 of this report and will be followed. The stakeholder engagement which started at the scoping stage will be continued, and new stakeholders that may come up during the engagement process will be consulted.

All engagement activities will follow the strategy provided in the chapter 6 and will include a semi-structured approach covering specific focused areas relevant either to the stakeholders/communities as a whole and or to the particular group or individual participating in an engagement activity.

The engagement methods provided in chapter 6 will be strictly adhered to and COVID-19 protocols followed. All stakeholder comments and suggestions raised throughout the EIA process will be captured and presented in the EIA report.

The stakeholders to be consulted and outcome of the stakeholder engagement process will be compiled into a Stakeholder Consultation Report (SCR) to guide stakeholder engagement for the lifecycle of the project. The SCR will form an annex to the EIA report.

8.4.10 Content of Environmental Impact Assessment Report

The EIA report will include a Table of Contents, List of Abbreviations and Acronyms, and a Reference List and Annexes. The EIA report will provide maps, figures and process diagrams to facilitate understanding of the descriptive elements of the report. In accordance to the LI 1652, the EIA is intended to meet the formal requirements of Ghana's EPA and is therefore structured as follows:

1. Consultant's core team for the EIA
2. Table of Content
3. List of Figures, Tables and Plates
4. Executive summary
5. Introduction

6. Policy, Legal and Regulatory Framework
7. Description of Proposed Project
8. Alternative Considerations
9. Environmental Baseline Conditions
10. Stakeholder/Public Consultations and Participation
11. Potential Impact identification and Assessment
12. Impact Mitigation Measures
13. Provisional Environmental Management and Monitoring Plan
14. Decommissioning
15. Conclusion
16. Bibliography or References
17. Annexes

Main issues to be addressed in the EIA report will be considered under the various headings as approved by the Ghana EPA, and excerpts are as provided below:

8.4.10.1 *Non-Technical Executive Summary*

The executive summary will contain a non-technical description of the proposed project, key policies and laws, alternatives/ options considered, baseline information of the project catchment area, potential environmental impacts, management and design of mitigation measures including monitoring programmes and a proposed environmental management plan including budget.

8.4.10.2 *Introduction*

The introduction chapter will contain a brief background of the proposed project and justification for the proposed project. Also, to be included will be the purpose, objective, methodology and approach adopted for the EIA study.

8.4.10.3 *Policies, Legislations and Institutional Framework*

This chapter will capture various policies, laws and regulations as well as guidelines relating to the project and the key institutions to be involved with project implementation.

8.4.10.4 *Description of the Proposed Project*

This section will give detailed description of the proposed project including project scope, components, production processes, labour requirements, resource (water, fuel/gas) requirements and consumption, waste management, project management and implementation schedule among others, as carried out under subsection 8.4.1.

8.4.10.5 *Alternative Considerations*

All alternatives to the proposed project will be considered in detail in this section.

8.4.10.6 *Environmental Baseline Conditions*

The baseline chapter will present a comprehensive description of the existing environment with regard to the project catchment area as well as the external physical, biological and socio-economic and cultural environments. All activities carried out under subsection 8.4.4 will be presented in detail in this chapter.

8.4.10.7 *Stakeholder Consultations and Public Participation*

All the stakeholder engagement activities carried out under subsection 8.4.9, the methodology used, and outcomes of the consultations will be summarized and presented under this chapter of the EIA report.

8.4.10.8 *Impact Identification and Evaluation*

The perceived environmental/social impacts and risks identified and assessed under subsection 8.4. 5 will be presented as a chapter in the EIA report.

8.4.10.9 *Mitigation Measures*

This chapter will present the proposed mitigation measures for the significant adverse environmental impacts and risks that would occur from preparatory/preconstruction, construction and operational/maintenance and decommissioning phases of project implementation.

8.4.10.10 *Provisional Environmental Management and Monitoring Plan*

This chapter will contain information to be developed from subsection 8.4.8 of this Scoping report.

8.4.10.11 *Decommissioning*

This chapter will contain information related to the post-construction activities and procedures to be followed (i.e. after construction of power plant); and post operational phase activities and procedures to be followed in order to safeguard the environment.

8.4.10.12 *Conclusion*

This chapter will present the main conclusions and recommendations resulting from the EIA study.

8.4.10.13 *Bibliography or References*

This section will have the list of literature or documents that were referenced during the preparation of the EIA report.

8.4.10.14 *Annexes*

This section will contain the relevant correspondences, maps, consultation report, and project drawings as appropriate.

8.5 Work Plan and Core Specialists for the EIA

8.5.1 Work Plan

The work plan for the EIA execution is provided in **Table 8-2**. The EIA assignment will be executed in 9 weeks. This period excludes review periods by stakeholders including the EPA.

8.5.2 Key Expertise for the EIA

The key experts to be involved with the EIA will include:

- EIA Expert
- Socio-economic impact Expert
- Air Quality and Emission Dispersion Modelling Expert
- Noise Monitoring and Modelling Expert
- Ecologist
- Health/Safety Expert

Table 8-2: Work Plan

No.	Activity (Work)	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9
1.0	**EIA Phase**									
1.1	Stakeholder/Public Consultations									
1.2	***Specialist Studies and Literature Reviews***									
1.2.1	*Air Quality Monitoring/ Air Emissions & Dispersion Modelling*									
1.2.2	*Submission of Air Emissions & Dispersion Modelling Report to VRA*									
1.2.3	*Noise Level Monitoring & Modelling*									
1.2.4	*Submission of Noise Modelling Report to VRA*									
1.2.5	*Health and Safety Impact Study and Assessment*									
1.2.6	*Socio-economic Impact Study and Assessment*									
1.3	***Other Baseline Studies and literature Reviews***									
1.3.1	*Water quality sampling and laboratory analysis*									
1.3.2	*Ecological Study*									
4.3.4	*Climate, Soil, Geology, Topography/Relief, Seismicity, Drainage networks etc*									
1.4	***EIA Data analysis***									
1.4.1	*Impact identification and analysis*									
1.4.2	*Impact predictions and evaluation*									
1.4.3	*Analysis of Impact mitigation and monitoring data*									
1.5	***EIA Report Preparations and Submissions***									
4.5.1	*Draft EIA Report preparations/submissions*									
4.5.2	*Submission of Draft EIA Report to VRA for review*									
4.5.4	*Submission of final Draft EIA Report to EPA*									

Wk = week

9.0 CONCLUSION

This Environmental Scoping Report for the EIA of the proposed Kumasi 1 Thermal Power Project at Anwomase in the Oforikrom Municipality of the Ashanti Region has been carried out in line with the Environmental Assessment Regulations, 1999, Legislative Instrument (LI) 1652.

Preliminary review of relevant literature, regulatory, institutional and project documents, site inspections during a reconnaissance survey of the project area, initial consultations with some key stakeholders and expert knowledge of the EIA Team were the main tools used to premise the identification of impacts and risks the proposed project is likely to generate, and subsequently defined the Terms of Reference (ToR) for the EIA.

The Scoping Report has identified key biophysical, socio-economic and health/safety risks and impacts that may arise from the construction and operation of the proposed Kumasi 1 Thermal Power Plant. These identified risks and impacts will be subjected to in-depth analysis and evaluation during the EIA for the development of comprehensive mitigation, monitoring and management measures to address the likely adverse impacts on local communities and the environment in general.

The Scoping Report has also defined the draft Terms of Reference (ToR) for the EIA studies and has provided the Work Plan, which will guide the successful execution of the EIA, to ensure that the Project takes off in a sound and acceptable manner.

Preliminary positive impact analyses of this project suggest timely economic and social benefits to the Greater Kumasi Metropolitan Area in particular, the Ashanti Region and the northern part of the country as a whole. There were no objections to the implementation of the proposed project from the initial stakeholder consultations carried out. However, concerns were raised on health/safety to other users of nearby facilities and the Anwomaso community.

The VRA and the Ministry of Energy will ensure that the Project is implemented in line with all relevant national policies, laws and standards to enhance the intended benefits of the Project and reduce potential negative impacts to acceptable levels.

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ANNEXES

Annex 1-1 EPA Response to Project Registration
Annex 1-2 Administrative Flow Chart of the EIA Procedures
Annex 3-1 Copy of Site Plan
Annex 6-1 Copy of Background Information Document (BID) for stakeholders
Annex 6-2 Stakeholder Engagement Form
Annex 8-1 Map showing Air Quality/Noise Sampling Sites

Annex 1-1 EPA Response to Project Registration

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Website: http://www.epa.gov.gh

Our Ref: CE:5327/02/03

May 12, 2021

The Chief Executive
Volta River Authority
Electro Volta House
P.O. Box MB 77
Accra

Dear Sir,

RE: NOTIFICATION OF PLANNED RELOCATION OF THE AMERI POWER PLANT

We acknowledge receipt of your letter dated April 28, 2021 on the above subject and noted.your intention to relocate the Ameri Power Plant to Anwomaso in Oforikrom Municipality of the Ashanti region.

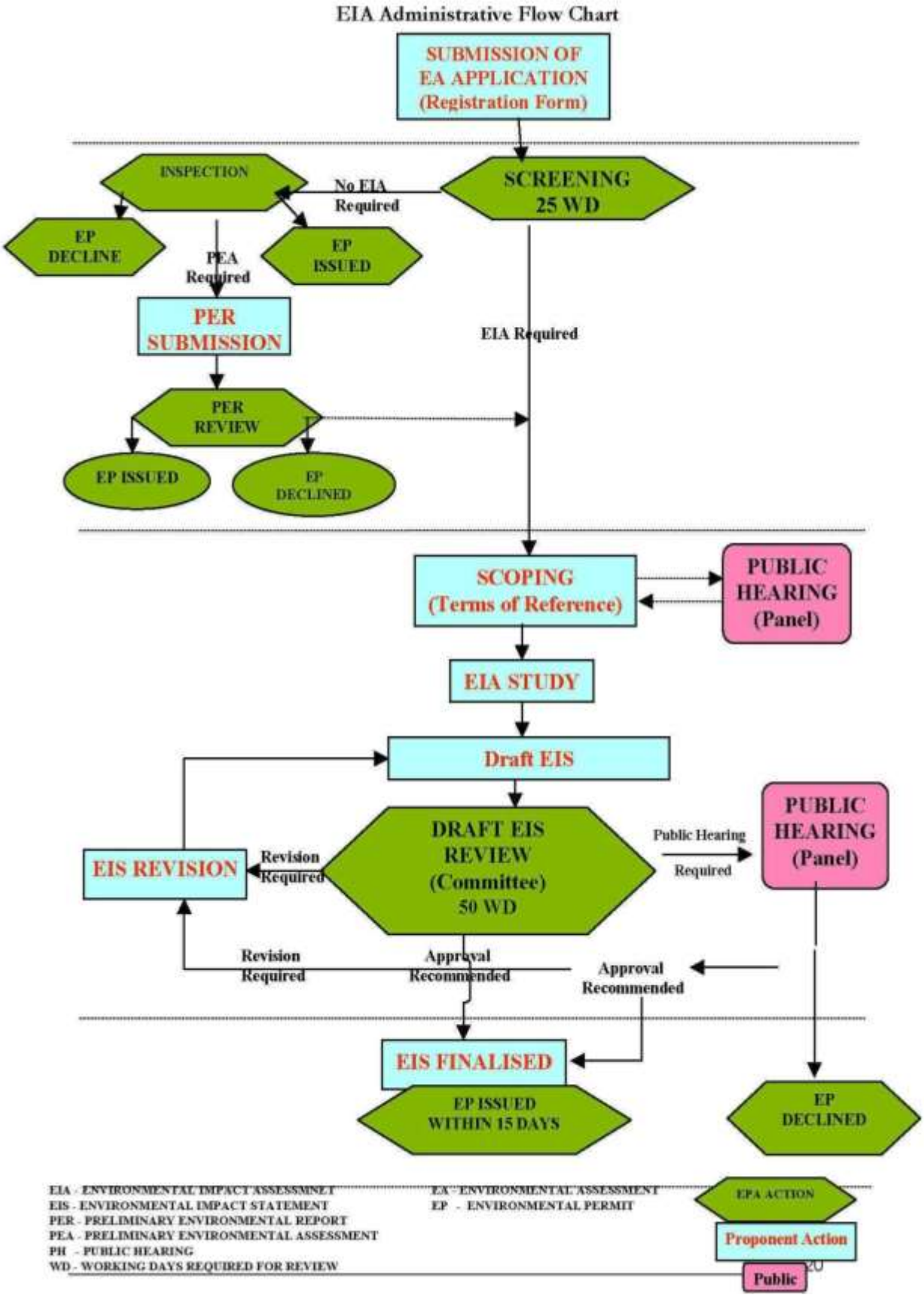
In accordance with the Environmental Assessment Regulations 1999, LI 1652, the Volta River Authority is required to conduct an environmental impact assessment of the relocation of the Ameri Power Plant to Anwomaso in the Oforikrom Municipality of the Ashanti Region and obtain environmental permit for the new site.

Do not hesitate to contact the EPA Head Office **(Room 304/5)** or the undersigned on **(0501301399)** or via **E-mail: eaa@epa.gov.gh** for any assistance or guidance you may require in this regard.

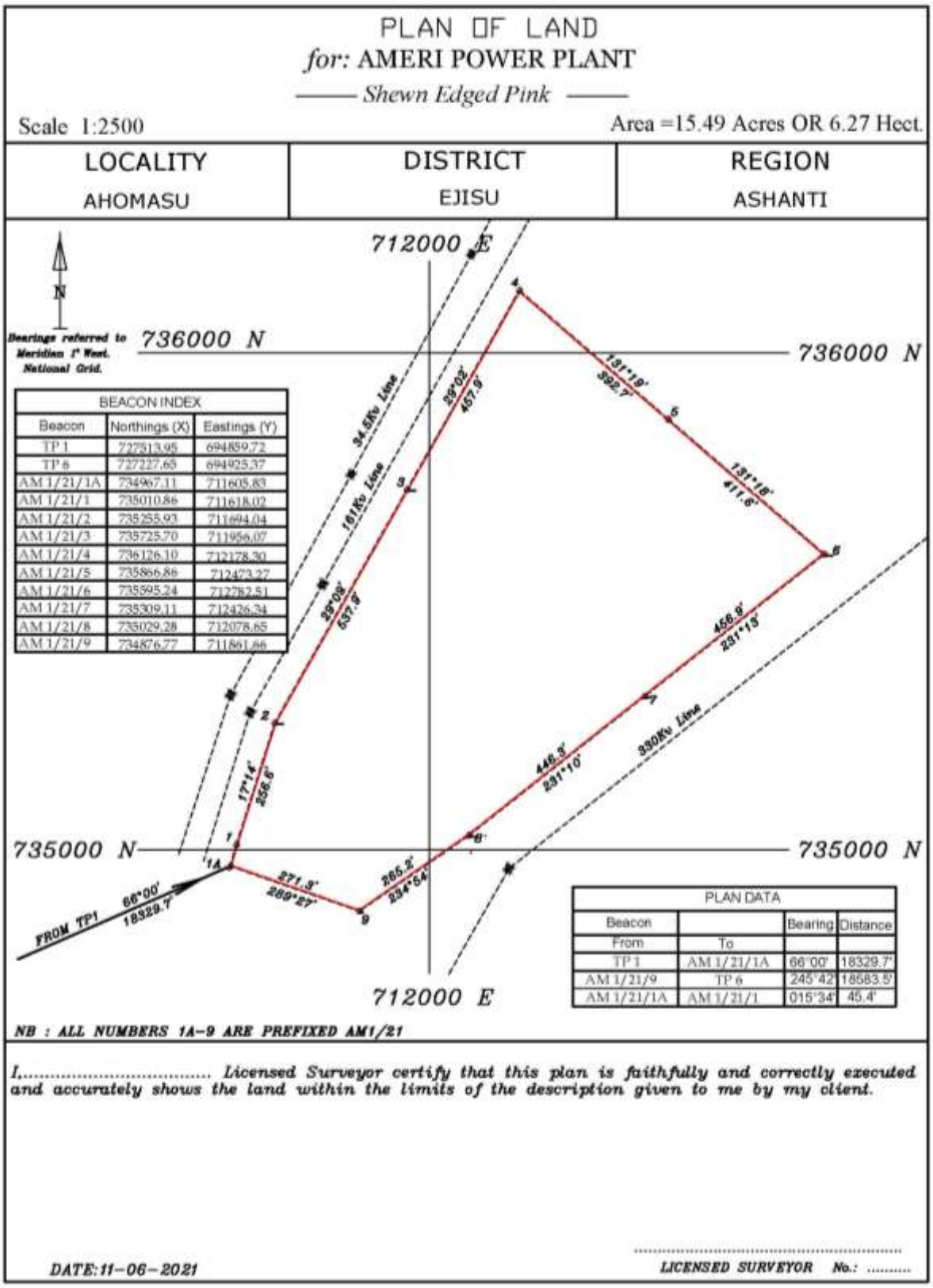
Yours Faithfully,

EBENEZER APPAH-SAMPONG
DEP. EXECUTIVE DIRECTOR /TECHNICAL SERVICES
FOR: EXECUTIVE DIRECTOR

Annex 1-2 Administrative Flow Chart of the EIA Procedures



Annex 1-3 Copy of Site Plan



Annex 6-1 Copy of BID for stakeholder engagement

Scoping and Environmental Impact Assessment

for the proposed development of 250MW Kumasi 1 Thermal Power Plant in Anwomaso, in the Oforikrom Municipal in the Ashanti Region of Ghana

BACKGROUND INFORMATION DOCUMENT

VOLTA RIVER AUTHORITY

AUGUST 2021

BACKGROUND

The Ghana power system is currently having low voltages from Ashanti Region to the northern part of the country. This is mainly because all the power plants are located either in the Southern, Eastern or Western part of the transmission network. The only power plant in the middle portion of the transmission network is the 400 MW Bui Hydropower Plant and about 20 MW of solar power plant in the middle portion which is expected to be increased by about 50 MW when Bui Power Authority completes their solar power project. As a result, in years where the Bui Hydropower Plant has low water elevations, the power system is constrained since dispatch from the hydropower plant becomes limited. Hence having another power plant in the middle sector of Ghana, especially in the Ashanti Region, is a matter of urgency to relieve the Bui Hydropower Plant of the burden of being the only major source of power supply for voltage stability in the Northern sector of the country.

The Government of Ghana (GoG) entered into a Build, Own, Operate and Transfer agreement with AMERI Energy for a fast-track turnkey power generation solution in 2015. The agreement was scheduled to complete its 60-month tenure on January 31, 2021. As such, the Volta River Authority (VRA) as the Assignee has been mandated to perform the GoG's function including taking over the operation and maintenance of the AMERI Power Plant from February 1, 2021.

AMERI Power Plant - Gas Turbine Island and Associated Balance of Plant at Aboadze, near Takoradi

The Ghana Grid Company Limited (GRIDCo) who is the power system operator of Ghana, has indicated at several stakeholder fora that a power plant in the Ashanti Region of Ghana will help improve voltages of the Ghana power system a great deal and especially in the Greater Kumasi area. Currently, Kumasi and the rest of the northern part of the country are experiencing very frequent power interruptions due to low voltages and other power transmission bottle necks in the Kumasi area. This situation is not only affecting power transmission and distribution in Kumasi and Northern Ghana but also impeding the export of power to SONABEL in Burkina Faso. The situation has been aggravated due to the inability of the Bui Power Plant to operate at the desired level during peak and off-peak period due to insufficient inflows.

Therefore, relocating the AMERI Power Plant to Kumasi will be the quickest solution to the challenges faced by the grid. Considering these reasons, the Ministry of Energy together with VRA and other stakeholders including GRIDCo, and Ghana National Gas Company limited have decided to relocate the 250MW AMERI Power Plant to a site in Kumasi, under a project known as the "**Kumasi 1 Thermal Power Plant** (herein after mentioned as the project).

WHAT DOES THE BACKGROUND INFORMATION DOCUMENT TELL YOU?

This Background Information Document (BID) provides you, as an Interested and or Affected Party (I&AP), with the background information on the proposed "**Kumasi 1 Thermal Power Plant Project"** as follows.

- A description of the EIA and Public Participation Processes that will be undertaken for the proposed project; and
- Details on how to register as an Interested and or Affected Party (I&AP) to indicate your interest in the project and receive further information.

What Does the Project Entail?

The Project

The VRA has taken over the AMERI Power Plant and intends to relocate it by developing the **"Kumasi 1 Thermal Power Plant Project"**, which is to comprise of ten (10) 25MW (ISO) GE TM 2500+Aero Derivative Gas Turbines (GTs), totalling 250MW of the existing Ameri Power Plant, along with its related equipment as well as the provision of certain services related to the operation and maintenance of the power plant. Each train of GT and power generator are mounted on mobile platform for easy transportation. The GE TM2500 gas turbines, primarily operate on Natural Gas (NG).

Project Benefits

The following benefits/opportunities are expected to be realized from the possible implementation of the project in the area:

1. Improvement in the voltage stability of the National Interconnection Transmission System
2. Significant reduction in transmission system losses.
3. Improvement in the quality of supply to end users through improved network voltage control via generators.
4. Continuous supply of reliable power to end users

Site Location

The AMERI Power Plant will be relocated to a site adjacent to the GRIDCo K2 BSP 161kV/330kV substation in Kumasi, specifically at Anwomaso, under the Oforikrom Municipal Assembly in the Ashanti Region. The site is situated between GRIDCo's 161kV and 330kV transmission line right of way. The proposed site measures approximately 15 acres and lies between latitudes 6°41'24"N and 6°42'20"N and longitudes 1°31'12"W and 1°30'36"W. It is bounded on the south by 161kV and 330kV substations of GRIDCo, north and west by Farmlands and on to the east by farmland/National Vocational Training Institute Complex of the Ministry of Education. The site of interest belongs to the Kwame Nkrumah University of Science and Technology (KNUST) and the 15-acre piece of land must be acquired.

Aerial View of Proposed Site of the Kumasi 1 thermal Power Project at Anwomaso, near Kumasi

Access to Site

Access to the GRIDCo Substations is by a motorable asphaltic surfaced road (feeder road), about 2.69km, off the main Ejisu-Kumasi Highway. The road, approximately 6m (average) driveway is completed with necessary road furniture. It is noted that the corridor is heavy built-up with housing along on both sides. From the GRIDCo Substation, the site can be accessed via a path along the western boundary of the 330kV substation can be accessed with a small vehicle. However, this cannot be relied upon as access for the transportation of heavy equipment to the site. For a proper access to the site, it is proposed that, the existing access road to the GRIDCo's 161kV substation be extended as this access road goes all the way to the northern boundary of the 161kV substation.

The Main Access Road from the Ejisu - Kumasi Highway

Site Layout

In the preparation of the layout, the topography of the site and the predominant wind direction were considered to minimize the quantum of earth works to be done, piping works and to ensure the optimal operation of the units. The proposed site generally slopes at an average grade of about 5.8% towards the west and about 5% towards the southern part (the GRIDCo's 161kV and 330kV Substations). The proposed layout of the plant shall consist of the underlisted facilities, and to enable their installation, it is required that the site be prepared by engineering it.

1) A – Substation
2) B – Gas Turbine Island
3) C – Warehouse/Workshop
4) D – Office and Control Building
5) E – Car Park
6) F – Water Tank
7) G – On-base Gas Skid

Proposed Layout of Kumasi 1 Thermal Power Plant

It is expected that the site shall be designed to effectively drain off storm water to avoid flooding. Adequate and appropriate type drainage channels shall be provided to ensure that the site is safe from flooding.

Water Availability & Supply

Availability of sufficient amount of water is critical for the operations of a thermal power plant. Water treated as processed water is used for various plant applications ranging from water injection to washing of critical plant components like the gas turbine compressor or used unprocessed for service applications and so on. Water also needs to be stored on site in sufficient quantities for station firefighting. Due to these established requirements, an independent and dedicated water supply, storage, and treatment facility needs to set up for smooth operation of the proposed plant.

The project requires about 7.5 m^3 of demineralized water a day for operations. Currently, there is no access to municipal water supply at the site. The GRIDCo Substation water needs are met by ground water by means of a mechanized borehole. Considering the time frame within which this project should be finished, it is recommended that, the 40m^3/h containerized water treatment plant with a 2 x 100m^3 demineralized water storage tank and a 3 x 300m^3 raw water tanks at the decommissioned Mines Reserve Power Plant site in Tema which are still fit for purpose be serviced and relocated to the Kumasi site to serve the plant. The diesel and electric fire water pumps are also still serviceable and can still be used at the new site. A 1000m^3 water storage tank would be required for storage of water for the station's firefighting system.

Discussions are ongoing for the Ghana Water Company Limited (GWCL) to lay dedicated line from Oduom to Anwomaso to provide potable water as a primary supply of water to the site. For

increased reliability of water supply it is recommended that borehole be sunk on site to serve as backup to the supply from the GWCL.

Fuel Supply Requirements

The GE's TM 2500+ Aero Derivative Gas Turbines primarily runs on natural gas (NG). Each unit requires about 5.5mmscf of NG per day. The ten (10) units will therefore require a total of 55mmscf/day of NG. The proposed site is a green field and does not have any existing infrastructure to support the supply and distribution of gas. A completely new gas infrastructure comprising of pipelines, regasification and gas conditioning units will have to be built to support the operation of the plant at the new site.

Ghana National Gas Company Limited is currently extending a pipeline from Prestea to Dawusaso and a further extension of the gas pipeline would be done to Nyinahin and then to the site in Anwomaso. It is also envisaged that the 330kV transmission line Right of Way would be used for the construction of the gas pipeline to avoid land acquisition and compensation issues. The On-base Gas Skid (labelled as G in the layout) would be fed with gas from this pipeline and distributed to the various gas handling facilities of each gas turbine unit.

Power Evacuation

The existing AMERI plant and substation equipment together with the prefabricated buildings, Mobile station service transformers, Emergency Diesel generators, 11kv medium voltage cables, all interconnecting cables with their cable trays will have to be decommissioned at Aboadze, transported, installed, and commissioned to feed power into the existing 161kV GRIDCo substation at Anwomaso.

Currently, the GRIDCo substation at Anwomaso consist of a 161kV substation and a 330kV substation both with breaker-and-a-half configuration. The 161kV substation has three Step-Down Transformers which serves the ECG substation adjacent to the GRIDCo 161kV substation. The 330kV substation has two auto transformers which steps down voltage from the 330kV transmission lines to feed the 161kV substation. The 161kV substation has six (6) bays and GRIDCo has given an indication of the availability of two free bays for use by the project for power evacuation. However, GRIDCo would have to conduct detailed assessment to determine the complete equipment and protection requirement for the two 161kV line bays at their substation for power evacuation from the plant.

Operation & Maintenance

The VRA already has an O&M team to take over the operations of the plant in Kumasi. The team to operate the Power Plant will consist of thirty-three (33) man operating and maintenance crew. Sixteen (16) out of the 33 will be operators who will run four shift system. All the Operators will be supervised by one operation Engineer and the remaining seventeen (17) will be maintenance crew, comprising of Mechanical, Electrical and Control & Instrumentation with their respective supervisors.

The Environmental Impact Assessment Study

Section 2.2.3 of the Environmental Impact Assessment (EIA) Guidelines for the Energy Sector, Volume 1, dated September 2011, indicates that natural gas fired electric power plant with installed

capacity equal or exceeding 500 kVA requires the undertaken of an environmental assessment and the preparation of an Environmental Impact Assessment (EIA) Report, and this shall apply to the 250MW **"Kumasi 1 Thermal Power Plant Project"**. Volume 2 of the Energy Sector EIA Guidelines outlines the systematic procedures to be followed in the preparation of EIA Reports for the energy sector as well as guidelines on potential impacts and mitigation measures. In line with this legal requirement, a full EIA report for the project is required to enable the Ghana EPA issue an Environmental Permit to allow for physical construction to commence.

SELJEN CONSULT LIMITED, a Ghanaian Environmental Consulting Firm, has been engaged by the VRA to undertake the EIA study and prepare an EIA Report to the Environmental Protection Agency (EPA) for decision-making. As part of the EIA study, SELJEN CONSULT LIMITED, is required to undertake an "Emissions & Air Dispersion Modelling" as well as "Noise Modelling" for the project, and to produce individual reports on these modelling activities. The preparation of the EIA Report is to be guided by the requirements of the various EIA guidelines mentioned above. The process and outputs of this environmental assessment is intended to meet the formal requirements of Ghana's EPA as well as that of international funding agencies. The Terms of Reference sets out that the assignment is in two (2) stages as follows:

1. Stage 1 involves a Scoping Study as part of the preliminary environmental study for the selected site and prepare an **ENVIRONMENTAL SCOPING STUDY REPORT** to provide recommendations for the project development.

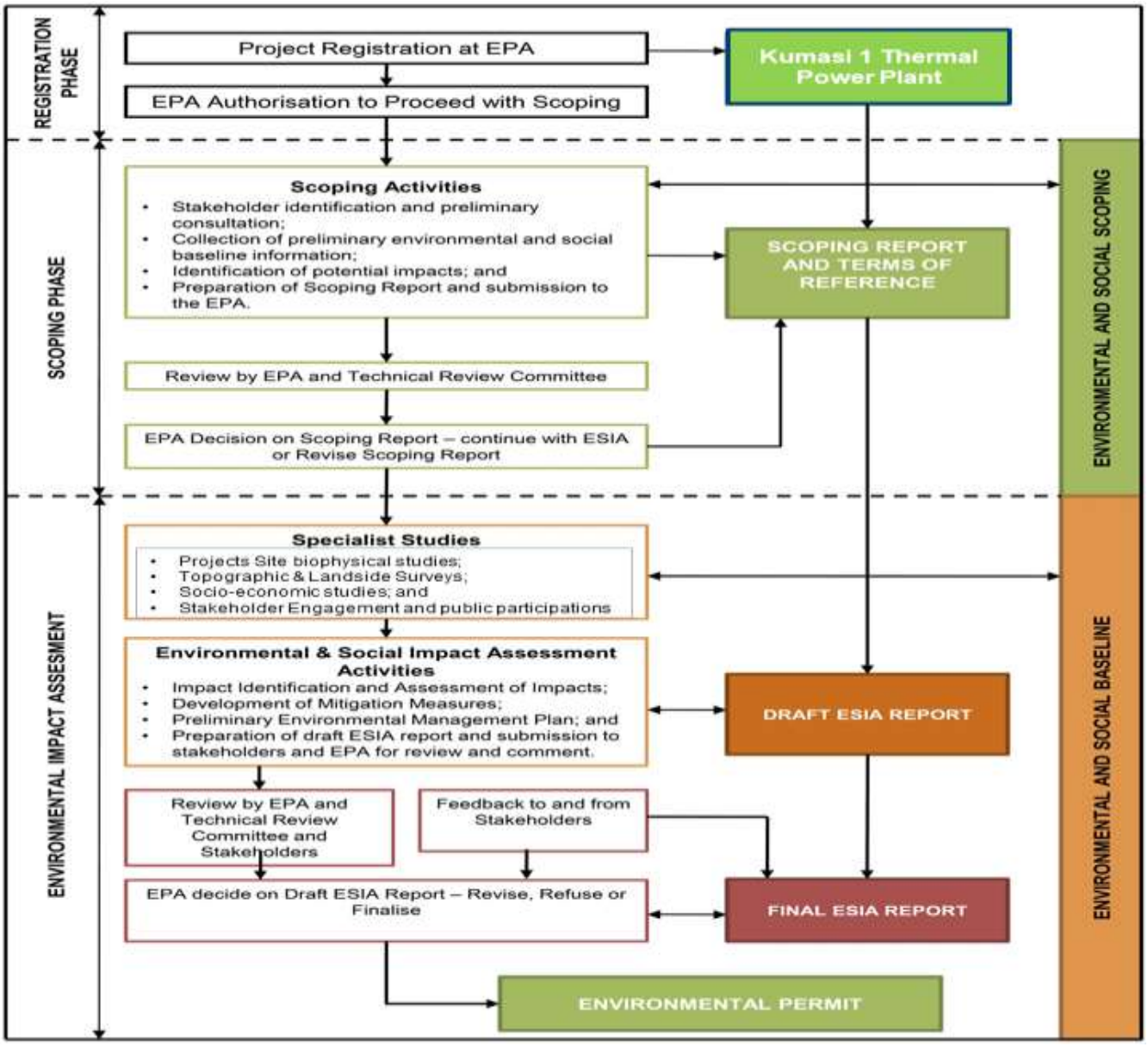
2. Stage 2 will involve full detailed environmental impact assessment study and the preparation of **"Environmental Impact Assessment Report for The Kumasi 1 Thermal Power Plant Project"**.

The main applicable regulations that would be triggered in the context of the proposed project are the Environmental Protection Agency Act, 1994 (Act 490), Environmental Assessment Regulations 1999, LI 1652, the National Climate Change Policy, 2013 as well as Ghana Standards Authority (GSA) Standards Decree, 1973 (NRCD 173) and applicable standards for ambient air quality, ambient noise control and effluent discharges. The list of relevant regulations will be refined during the Scoping and EIA Processes, and other regulations triggered may be removed or added as applicable.

The potential impacts of the project will be considered for the Pre-Construction, Construction and Operational/Maintenance and Decommissioning Phases. Potential impacts on or due to the following will be identified and discussed.

- Global Climate Change & Greenhouse Gas Emissions
- Socio-economic and local communities
- Geology & Soils
- Noise and Vibration
- Air Quality
- Traffic & Transport
- Landscape & Visual intrusion
- Terrestrial Ecology

Public Safety, Occupational health, and safety risks as well as other risks and hazards such as vandalisation and theft are also to be identified. To complete this analysis of environmental consequences associated with impacts on public health and safety, the EIA study shall also consider potential impacts on hazardous materials/hazardous waste, waste management, traffic and transportation safety, worker safety and fire protection, and geologic hazards. The steps in the Scoping and EIA Process are shown as below.



How can you get involved in the EIA Study?

1. By responding to our invitation to register as an interested and or affected party for this project.
2. By email a Comment and Registration Form to Seljen Consult Limited.
3. By telephonically contacting Seljen Consult Limited if you have a query, comment, or require further project information.
4. By reviewing the various reports within the stipulated comment periods provided.
5. By attending any feedback meetings, which may be held during the review period.

If you register as an I&AP, there will be opportunities for you to be involved in the Scoping and EIA Processes through receiving information, registering your interest on the project database, raising issues of concern, and commenting on reports. Inputs from I&APs, together with the information and assessment provided by the Environmental Assessment Practitioner and relevant specialists, will assist the Environmental Protection Agency (EPA) with their decision-making in terms of whether to grant or refuse an environmental permit for the proposed project.

To register as an I&AP, please complete the Comment and Registration Form included with this BID and kindly return:

Name: Kofi Gatu
Address: Seljen Consult Limited,
P. O. Box AT 140,
Achimota-Accra
Email: seljencon@gmail.com:
Mobile/WhatsApp: +233-20-843-4557

REGISTRATION AND COMMENT SHEET:

Should you have any queries, comments or suggestions regarding the proposed **Kumasi 1 Thermal Power Plant Project"** being developed by the Volta River Authority at Anwomaso near Kumasi, under the Ejusu-Juaben Municipal Assembly in the Ashanti Region, please note them below and return this sheet to:

Please formally register me as stakeholder and provide further information and notifications during EIA process	Yes	No
I would like to receive my notifications by:	Post	Email

Comments:

Please fill-in your contact details below for the project database:

Title & Name			
Organisation			
Telephone		**WhatsApp**	
Mobile Phone		**Email**	
Postal Address			
Name	**Signature**		**Date**

Annex 6-2 Stakeholder Engagement Form

SELJEN CONSULT

KUMASI 1 THERMAL POWER PROJECT
STAKEHOLDER ENGAGEMENT FORM

Title of Project: ..... Date:.....
Proponent: ..... Time:.....
Identified Stakeholder: ..... Venue: .....
Interviewer (s):
.....

Stakeholder/Officers Consulted		
Name	Contact Number	Position

Summary of Stakeholder discussions/Comments/Concerns

Issue	Comments/Concerns/Recommendations

SELJEN CONSULT

STAKEHOLDER ENGAGEMENT FORM

Issue	Comments/Concerns/Recommendations

Name:……

Signature:……

Annex 8-1 Map showing Air Quality/Noise Sampling Sites