Client:
West African Power Pool (WAPP)

Ghana

400/330kV WAPP GHANA - CÔTE D'IVOIRE INTERCONNECTION REINFORCEMENT PROJECT

Feasibility Study & Line Route and Environmental and Social Studies

FINAL ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

Ghana

January 2026

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GRIDCo

GRIDCo CORPORATE ENVIRONMENTAL POLICY STATEMENT

1. GRIDCo is committed to ensuring continuous improvement of environmental performance to minimize the impacts of all its operations on the environment, in line with the principles of sustainable energy sector development, in addition to complying with National and International Environmental Protection Standards and Regulations and make Environmental considerations a priority in all Business Planning.

2. In furtherance to its Aims, GRIDCo will pursue the following specific objectives:

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

I. Assess Environmental impacts of processes, operations and products.
II. Focus on Pollution prevention, Protection of Biodiversity and Waste reduction.
III. Ensure compliance with National and International Environmental Protection Regulations.
IV. Set annual Environmental targets to ensure continuous improvements.
V. Monitor and report on Environmental Performance as required by the appropriate agencies and stakeholders.

b. Ensure minimum Environmental impact of GRIDCo's operations and take adequate steps to mitigate any such anticipated adverse impacts.
c. Promote Environmental awareness and individual sense of responsibility among its employees 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 dialogue on Environmental issues.

g. Undertake programmes in collaboration with relevant agencies and communities to mitigate the impact on the livelihood of individuals and communities displaced or affected by GRIDCo's operations.

3. Each employee of GRIDCo is charged with the responsibility of ensuring that the objectives of this Policy Statement are diligently carried out

Signed.....
Chief Executive

Date..... May 17, 2010

EXECUTIVE SUMMARY

INTRODUCTION

In January 2006, the West African Power Pool (WAPP) was established by the Economic Community of West African States (ECOWAS) with the goal of creating a regional electricity market in West Africa. The objective is to develop critical infrastructure to ensure that all ECOWAS member states have access to affordable energy supplies. The current project focuses on the reinforcement of the 330 kV Côte d'Ivoire–Ghana interconnection, a key component of the WAPP Coastal Transmission Backbone (CTB), which aims to connect Akoupé-Zeudji in Côte d'Ivoire to Ikeja West in Nigeria, passing through several countries, including Ghana. The Ghana Grid Company (GRIDCo), responsible for the transmission of electricity in Ghana, is the project developer. This Environmental and Social Impact Assessment covers the Ghana side of the Reinforcement Project 125 kilometres from Bibianiha near Dunkwa-on-Offin in Ghana to Omanpe Ghana-Côte d'Ivoire border with a Substation at Bibianiha

An Environmental and Social Impact Assessment (ESIA) is a legal requirement in Ghana for development projects like this high-tension transmission line. The ESIA aims to identify potential adverse environmental and social impacts of the project and propose measures to mitigate them. GRIDCo previously obtained an Environmental Permit in 2015 for this project, but the permit has since expired, necessitating an update of the Environmental Impact Statement (EIS). The updated ESIA will ensure compliance with Ghana's environmental regulations, as well as meet the requirements of the World Bank's Environmental and Social Standard (ESS1): Environmental and Social Assessment and Management and other relevant Environmental and Social Standards (ESSs) as the Bank intends to finance the project. Also attached to this ESIA is a Bio-Diversity Assessment Report of the Project Corridor (see Appendix X)

The project is vital to meet the increasing electricity demand in West Africa and to enhance the reliability of the regional power grid. By integrating the national electricity networks of ECOWAS member states, the project will facilitate optimal power exchanges and trading across the region, thereby contributing to the economic development and energy security of the West African sub-region. For Ghana, specifically, the project will help to stabilize and increase the grid's capacity, ensuring a more reliable electricity supply to meet both domestic and regional demands.

POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Environmental Protection Agency (EPA) as the primary regulatory body in Ghana, responsible for enforcing environmental protection laws and ensuring compliance with Environmental Assessment (EA) protocols. The EPA Act 1994 (Act 490) and the Environmental Assessment Regulations 1999 (LI 2504) are central to the legal framework, mandating the need for Environmental and Social Impact Assessments (ESIAs) for projects like the high-tension transmission line.

The project will be implemented in line with national legislations, including the Constitution of the Republic of Ghana (1992), which protects private property rights and ensures fair compensation in cases of compulsory land acquisition for public welfare. It also meets the requirements of specific laws related to energy, land use and acquisition, labor, social and environmental protection, such as the Energy Commission Act 1997 (Act 541), the Lands Act 2020 (Act 1036), and the Labor Act 2003 (Act 651). It will also meet the requirements of the Environmental and Social Framework- Environmental and Social Standard 1 (ESS1) and other relevant Environmental and Social Standards.

CONSIDERATION OF ALTERNATIVES

The Environmental and Social Impact Assessment (ESIA) report evaluates the various alternatives considered during the planning phase of the high-tension transmission line project. The process by which the project team examined multiple options regarding equipment, route alignment, and overall project viability to ensure the most efficient and environmentally sustainable outcome.

Several alternatives were assessed, including the "No Development Scenario," alternative methods for transmitting power, different transmission line routes, alternative phase conductors, and various tower designs. The "No Development Scenario" was considered but ultimately dismissed due to the significant socio-economic benefits that the project will provide, such as improved energy supply, economic growth, and enhanced quality of life in Ghana and West Africa. Additionally, not proceeding with the project would likely lead to less efficient and more environmentally damaging alternatives, such as increased reliance on diesel generators.

For the mode of transmitting power, the project team evaluated both overhead and underground cabling. While underground cabling offers advantages in terms of reduced environmental impact and security, it was determined that overhead cabling is more cost-effective and easier to maintain, making it the preferred option for this project.

For the route selection, GRIDCo decided to align the new transmission line route with the right-of-way of an earlier project designed in 2014 rather than reroute the project elsewhere to minimize costs, delays, and environmental and social disruptions. Although this choice involves managing legacy issues, notably the non-payment of compensation for impacted farms and other assets during the preparatory phase of the parent project that was not implemented.

Aluminum Conductor Steel Reinforced (ACSR) cables were selected for the transmission line in favour of copper cables, due to their cost efficiency, durability, and suitability for long-distance power transmission. Finally, among various tower designs considered, the horizontal configuration was chosen for its cost-effectiveness, ease of maintenance, and better load distribution, despite requiring more land. This design also minimizes visual impact while ensuring safety and reliability for the transmission line. The other configuration assessed were Triangular and Cat's Head Tower Configurations.

DESCRIPTION OF THE PROJECT

The proposed transmission line project, spanning across Ghana and Côte d'Ivoire, focuses on constructing and operating a high-tension transmission line within Ghana. The transmission line will stretch approximately 125 km, (from Bibianiha near Dunkwa-on-Offin to Omanpe -Ghana Côte d'Ivoire border) crossing five districts within three regions of Ghana. These districts include Upper Denkyira East in the Central Region, Wassa Amenfi Central, Wassa Amenfi West, and Wassa Amenfi East in the Western Region, and Aowin Municipal in the Western North Region. The project also involves the development of the Dunkwa II Substation, strategically located near Dunkwa-on-Offin.

A 40-meter Right-of-Way (RoW) will be acquired for the project, requiring approximately 500 hectares of land. The acquisition will be managed by GRIDCo in collaboration with the Lands Commission, ensuring that affected properties are compensated. The construction phase will involve activities such as geotechnical investigations, tower spotting, assembling and the erection of 320 pylons across the designated regions. The project is expected to employ about 150 people, working in various segments of the transmission line at the same time.

BASELINE ENVIRONMENTAL CONDITIONS

The Upper Denkyira East Municipality, situated in Ghana's Central Region, spans 501.94 square kilometers, accounting for 5.19% of the region's land area. It is bordered by Adansi South, Assin North, Twifo Atti-Morkwa, Wassa Amenfi East, and Upper Denkyira West. The municipality features a varied landscape with a forest-dissected plateau, elevated around 250 meters above sea level, and a network of rivers and tributaries, including the major River Offin.

The climate is semi-equatorial with temperatures ranging from 20ºC to 35ºC and two rainy seasons. Vegetation consists mainly of semi-deciduous forests, though these have been impacted by cocoa farming and illegal mining. Forest ochrosols in the region are fertile, supporting crops like cocoa and oil palm. Environmental issues include deforestation from illegal activities and waste management challenges, with the landfill nearing capacity.

Water resources are a major concern, with households relying on river water, pipe-borne supplies, boreholes, and wells. Pipe-borne water is the primary source for 40.5% of households, but many also use unprotected wells, posing health risks. Climate change has exacerbated problems such as altered rainfall patterns, drought, and flooding.

Demographically, the municipality has a population of 101,273, with a growth rate of 3.3% annually. It is predominantly rural (55.6%) with a high age dependency ratio of 74.2%. Traditional land tenure is communal, managed by local chiefs. Addressing climate change, environmental degradation, and water management are key to the municipality's sustainable development.

The Wassa Amenfi Central District, established in 2012 with Manso Amenfi as its administrative capital, spans 1,845.9 square kilometers in Ghana's Western Region. Positioned between latitudes 5° 20' N and 6° 70' N and longitudes 2° 09' W and 2° 27' W, the district borders Bibiani Anhwiaso Bekwai Municipality, Upper Denkyira West District, Sefwi Wiawso Municipality, Aowin Municipality, Prestea Huni-Valley Municipality, Wassa Amenfi East Municipality, and Amenfi West Municipality. It has a population of 119,117, comprising 63,212 males and 55,905 females.

The district features undulating terrain with an average elevation of 153 meters and is intersected by significant rivers such as Tano and Ankobra, which support domestic and agricultural needs. The climate is characterized by high annual rainfall between 1,500 mm and 2,200 mm, supporting the district's extensive cocoa, palm, and rubber plantations. The area's rich vegetation includes moist semi-deciduous forests and four forest reserves, which are crucial for biodiversity and economic resources but face threats from illegal mining activities.

Geologically, the district is part of the Asankrangwa-Manso-Nkwanta Gold Belt, containing valuable mineral deposits. Soil types support diverse agriculture, including tree crops and food crops, though illegal mining has led to significant environmental damage. Water resources are variable, with many households relying on rivers and streams, impacting water quality and health.

The population is predominantly young, with 43% under 15 years old and a high dependency ratio of 85. The district's cultural fabric includes the Wassa ethnic group, with traditional practices influenced by Akan heritage. Major festivities include the Yam Festival, celebrating the harvest of water yam. Christianity is the dominant religion, with a minority following Islam and traditional beliefs. The land tenure system is communal, governed by traditional authorities.

The Aowin Municipal Assembly is situated in the mid-western part of Ghana's Western Region, encompassing a total land area of 2,607 square kilometers. Positioned between latitudes 5° 25' N and 6° 14' N and longitudes 2° 30' W and 3° 05' W, the municipality shares borders with Amenfi West Municipal, Juaboso and Sefwi Akontombra Districts, Jomoro Municipal, and the Republic of La Côte d'Ivoire. It has a population of 129,721, with a gender distribution of 68,236 males and 61,485 females.

The region features an undulating landscape, with elevations exceeding 305 meters and major rivers including the Tano and Bia, which are crucial for water supply. The climate is Wet-Semi Equatorial, with an annual average temperature of 26°C and bimodal rainfall ranging between 1,700 mm and 2,100 mm. Vegetation predominantly consists of tropical rainforest, with some semi-deciduous forest in the northeastern part. Soil types such as Acrisols and Ferralsols support agriculture, though illegal mining has led to environmental degradation.

The population is youthful, with significant proportions under 15 years, necessitating increased infrastructure development. The cultural landscape includes traditional practices and festivals, such as the Ellue Yam Festival, reflecting the area's rich heritage.

Land tenure is primarily governed by customary practices, with ongoing efforts to integrate formal land registration systems. The municipality's development plans emphasize addressing climate change impacts, managing natural resources sustainably, and improving living conditions for its residents.

The vegetation/land-use types along the proposed Transmission line route in all the districts is mainly, fallow-lands, cash crops, food crop farms such as Cocoa, Rubber, Cassava, plantain etc. and lands degraded by illegal mining (*Galamsey*) activities. Furthermore, the proposed transmission line traverses four major rivers namely Ankobra, Tano, Disue and Boin rivers and one stream in all the districts.

PUBLIC PARTICIPATION/STAKEHOLDER ENGAGEMENTS

Stakeholder engagement for the ESIA report involved consultations with key entities including traditional councils, municipal assemblies, and affected communities in the project area. The consultations, which started in December 2023, aimed to identify an optimal project route, minimize impacts on sensitive sites, and increase community awareness and acceptance of the project. Methodologies included bilingual communication and community meetings, where stakeholders raised concerns related to land acquisition, compensation, and environmental impacts. A grievance redress mechanism was established to address complaints transparently and ensure community feedback is integrated into project planning and execution. The process also includes measures for handling gender-based violence (GBV) and other sensitive issues.

The project activities will include constructing a substation, clearing vegetation to demarcate the project Right-of-Way and Centerline, tower spotting, excavations and establishing of tower foundations, assembling and installation of towers as well as stringing of the transmission lines and insulators in modified and natural landscapes and habitats with adverse impacts on vegetation, wildlife, and rivers that traverse the project Right-of- Way. Civil works will be associated with soil erosion, and waste generation as well as risks to the health and safety of workers and local communities through falls, cuts electrocution and other accidents.

In terms of social risks, land-take (500 hectares) leading to the physical and economic displacement of people will occur. The affected lands include small-scale mining areas, cumulatively covering about 29.9 acres of the demarcated project right-of-way. Other social risks are labor influx into the project areas, including overseas workers, posing community and health risks like the outbreak and/or spread of infectious/communicable diseases, malaria, cholera, HIV/AIDs, unwanted pregnancies, Sexual Exploitation and Abuse (SEA)/Sexual harassment (SH) in project communities. The increased presence of workers and clashes with illegal miners may trigger and/or exacerbate social conflicts that may require the intervention of armed security personnel. Site workers may be survivors or perpetrators of Gender based Violence (GBV) including Sexual Exploitation Abuse (SEA) and Sexual Harassment (SH). Other social risks associated with the construction phase of the project are use minors for activities on site, prevalence of

illegal and discriminatory labor practices, accidents involving site workers, equipment, and residents of the project catchment communities.

During the operational phase of the project potential vandalization of the towers and transmission lines by thieves and illegal miners as well as health and safety, risks notably, electrocution and falls may lead to long term injuries and death. Regular maintenance of the Right-of-Way, essential for the integrity of the transmission line, may adversely affect flora and fauna due to the implementation of necessary vegetation control measures such vegetation clearing and pruning. It may also involve the use of armed security personnel who may use disproportionate force to evict encroachers within the demarcated Right-of-Way and/or commit other human right abuses Waste generation from routine maintenance, including vegetative matter and electronic waste, is expected to be limited but requires proper management to avoid environmental harm.

Public safety concerns include potential exposure to electromagnetic fields (EMF) and risks from tower collapse and cable disengagement due to vandalism, theft and/or extreme weather events, though research indicates minimal adverse health effects from EMF exposure. Fire hazards from electrical faults and bush fires are also potential risks during the operational phase of the project.

The environmental and social impacts/risks that were identified were duly evaluated to establish their level of significance in relation to the project based on the magnitude (scale, extent, and duration) of the potential impact and sensitivity of the receiving media.

IMPACTS/RISK MITIGATION & ENHANCEMENT MEASURES

Mitigation measures proffered for the construction phase include enforcement of Environmental and Social Clauses inserted into the Works Contract that will be binding on the Contractor and any Sub-Contractor that will be employed on the sub-project. It will institutionalise the use of Personnel Protective Equipment and signing of Code of Conduct by site workers as well as organizing occupational health and safety training and GBV sensitization sessions for site works and the project affected communities. GRIDCo and security personnel who will be used for Right of Way Protection Operations will sign Memorandum of Understanding to establish all the necessary ground rules guiding their assignment as well as Code of Conduct in addition to running background checks on selected security personnel prior to their deployment for field work.

To address land acquisition concerns, GRIDCo will prepare and implement Resettlement Action Plan (RAP) and ensure compensation for affected individuals, adhering to national legal and policy standards as well as the requirement of World Bank ESS5 and 10. There will be Livelihood Restoration Program for affected communities, where illegal mining activities (*galamsey*) have been identified during the preparation of the RAP. Construction phase mitigation measures will also include safeguarding cultural heritage, managing traffic impacts, and controlling waste and noise pollution, with specific protocols for handling materials and minimizing disruptions. Measures to manage air quality will involve limiting land clearance, regular

site watering, and maintaining equipment to reduce dust emissions. These measures aim to minimize negative effects and enhance project benefits across all phases of implementation.

To mitigate soil impact during the high-tension transmission project, GRIDCo will implement erosion control measures such as silt fences, terracing, and vegetation buffers to prevent soil degradation around tower foundations. Site management practices will include limiting land disturbance and using matting to reduce soil compaction, while disturbed areas will be restored with native vegetation for stabilization. Erosion will be minimized by restricting land clearance and avoiding construction on steep slopes, with temporary impacts expected to be managed through prompt re-vegetation. To prevent water pollution, construction will avoid blocking water bodies and herbicides will not be used, while measures for managing wastewater and spillage will be enforced. Occupational safety will be addressed through adherence to international standards, with specific measures to prevent hazards from tower collapses, falling objects, and snakebites, alongside efforts to minimize impacts on flora and fauna.

To manage vegetation within the right-of-way (RoW) of the high-tension transmission project, GRIDCo will use physical or mechanical clearing methods, avoiding chemicals like weedicides to prevent environmental harm. This approach minimizes the impact on surrounding vegetation and avoids potential water pollution and worker safety issues associated with chemical use. During construction, potential risks from illegal mining will be managed by situating towers away from mining sites, and public education on mining dangers will be promoted. Waste management practices will ensure proper disposal and recycling of construction debris, while occupational safety measures will include protective equipment and adherence to safety regulations. Public safety and socio-economic impacts will be addressed through careful project execution and local employment, boosting temporary job opportunities and local economic benefits.

The project's impact on local populations is expected to be minimal, with only about 25% of the construction workforce potentially coming from outside the community if necessary, and these workers will be accommodated in a dedicated work camp. Archaeological and cultural chance finds will be managed through a Chance Find Procedure in compliance with national regulations Work camps will be strategically located away from water bodies and settlements to mitigate environmental and noise pollution, with strict waste management and sanitation measures. Public safety will be a priority, with anti-theft measures, secure installations, and regular maintenance to prevent accidents and ensure community well-being.

Measures to prevent in the incidence of GBV/SEA/SH and ensure accountability include pasting posting in the project communities and organizing GBV/SEA/SH sensitization and training sessions for staff of site workers, security personnel, field workers of GRIDCo and residents of projected affected communities in areas such as GBV/SEA/SH. The use of trained focal persons at the community and health facility level to receive GBV/SEA/SH complaints and other grievances and referring GBV/SEA/SH cases to the Police Station/Domestic Violence Victims Support Unit (DOVVSU) Office/helpline as well as the Social Safeguard

Specialist on the project for the necessary investigations to commence. Case management shall be based on the survivor centred approach.

GRIDCo and security personnel who will be used for Right of Way Protection Operations will sign Memorandum of Understanding to establish all the necessary ground rules guiding their assignment as well as Code of Conduct in addition to running background checks on selected security personnel prior to their deployment for any Right-of-Way protection operations. A security risk assessment and management plan will be prepared prior to the commencement of works and updated throughout the project implementation.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (ESMP) outlines a comprehensive approach to managing and monitoring environmental, social, and occupational risk and impacts throughout the project lifecycle. GRIDCo's Corporate Environmental Policy ensures adherence to national and international standards, while a dedicated Environmental and Social Risk Management and Training Programme establishes roles and responsibilities for the Project Environmental and Social Management Team. This team, including specialists in environmental and social aspects, will oversee compliance, liaise with regulatory bodies, and implement monitoring activities.

GRIDCo's Project Implementation Unit (PIU) consisting of skilled professionals, including an Environmental Management Specialist and Social Development Specialist, will ensure effective management and adherence to environmental guidelines. Continuous training and audits will support project staff in maintaining high standards of environmental and social performance. The contract stipulates the contractor's obligations, including labor, equipment, materials, compliance with environmental and social management plans, and overall execution of the project.

The General Health and Safety Procedures for the project will be governed by GRIDCo's "Corporate Safety Rules," Safety Manual, and the Factories, Offices and Shops Act (1970), ensuring compliance with occupational safety and health standards. Key safety measures include proper manual lifting techniques, hearing protection, use of personal protective equipment, and fire prevention systems, with specific guidelines for dealing with hazardous materials and emergencies. Pollution prevention will be managed through strict protocols for waste and spill management, supported by ongoing environmental and social team training. Monitoring of health and safety parameters, including noise, air quality, and waste management, will be conducted according to established guidelines, with corrective actions implemented as necessary. Comprehensive training programs will be provided to staff on environmental and safety issues, complemented by regular community education to enhance safety awareness.

GRIDCo's monitoring and reporting program includes a comprehensive plan for data management, covering storage, handling, and analysis responsibilities, with clear reporting lines to ensure effective oversight of site operations and compensation activities. Monthly reports will be provided to GRIDCo

Management, WAPP, and other stakeholders, while incident/accident reports will be submitted promptly (within 48 hours) to the World Bank or other relevant stakeholders in the event of incidents/accidents. Bi-annual and annual reports will be prepared for the World Bank and EPA, respectively, detailing environmental management and compliance. An emergency response plan will be implemented to address potential incidents, including fire, floods, and chemical spills, with regular drills and training for personnel. The Project Implementation Unit will oversee the reporting process and ensure that all documentation and emergency preparedness measures are maintained effectively.

Additionally, a detailed budget of US$ 425,000.00 has been estimated for environmental management planning and which includes monitoring, training, and unforeseen expenses, to ensure comprehensive management and response capabilities.

EMERGENCY RESPONSE PROCEDURES

The emergency response procedures for the project address potential incidents including fires, medical emergencies, and oil spills. For small fires, immediate alarm activation, evacuation, and safe extinguishing measures are outlined, while large fires require professional intervention and organized evacuation. Medical or accident-related emergencies involve prompt first aid, transport to medical facilities, and thorough investigation and documentation. Oil and solvent spills necessitate quick containment and clean-up using appropriate materials, with immediate reporting to the Environment, Social, Health, and Safety Officer.

DECOMMISSIONING PLAN

The Decommissioning Plan (DP) outlines GRIDCo's strategy for managing the end-of-life phase of the proposed transmission line, anticipated to operate for over fifty years. The plan ensures decommissioning is conducted systematically, aiming for minimal environmental impact and adherence to best practices. Key objectives include executing rehabilitation in an orderly fashion, achieving agreed post-project land-use outcomes, and avoiding ongoing liabilities. The process involves the removal of all project-related materials within a year of decommissioning, followed by land and water restoration to near-original conditions, and compliance with national regulations and local standards. GRIDCo will engage contractors to manage waste using the principles of reuse, reduction, and recycling, and will notify the EPA and other stakeholders, providing detailed reports and financial assurances as required.

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Appendix XVII: Environmental and Social Management Plan (ESMP)

LIST OF ABBREVIATIONS

ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GRIDCo	Ghana Grid Company
GRA	Grievance Redress mechanism
RoW	Right-of-way
WB	World Bank
ESF	Environmental and Social Framework
ESS	Environmental and Social Standard
EPA	Environmental protection autority
SEP	Stakeholder Engagement Plan
WAAP	West African Power pool
PIU	Project implementation unit
RAP	Resettlement Action Plan
SEA	Sexual Exploitation and Abuse
SH	Sexual Harassment
GBV	Gender Based Violence
DOVVSU	Domestic Violence and Victims Support Unit (of the Ghana Police Service)
LI	Legislative Instrument

1 INTRODUCTION

1.1 Project Background

In January 2006, a new entity called the West African Power Pool (WAPP) was founded by articles of agreement among members of the Economic Community of West African States (ECOWAS). The WAPP aims to create a regional electricity market in West Africa by prudently developing and implementing critical infrastructure projects that would enable all ECOWAS members to have access to affordable energy supplies.

The Revised ECOWAS Master-plan developed in 2004, identifies the key priority projects that need to be implemented to ensure stable integration of the national electricity networks in the ECOWAS Region and facilitate optimal power exchanges and trading between the Member States. Prominent among the infrastructure sub- programmes to be developed is the WAPP Coastal Transmission Backbone (CTB), which seeks to establish a robust 330 kV transmission link from Akoupé-Zeudji in Côte d'Ivoire to Ikeja West in Nigeria passing through Dunkwa-On-Offin, Aboadze, and Volta in Ghana, Mome Hagou in Togo, and Sakete in Benin. The Benin – Nigeria interconnection project was commissioned in February 2007 and the Ghana – Togo – Benin interconnection project has been implemented. The Ghana Côte D' Ivoire link remains outstanding.

The WAPP Secretariat on behalf of CI-ENERGIES, formerly known as Société de Gestion du Patrimoine du Secteur de l'Electricité (SOGEPE) and Société d'Opération Ivoirienne d'Electricité (SOPIE) of Côte d'Ivoire, and the Ghana Grid Company (GRIDCo) has procured the services of STUDIO PIETRANGELI (SP**)** an International Consulting firm to update a number of studies and reports on the double circuit 330 kV Côte d'Ivoire–Ghana interconnection reinforcement project, which was originally done by ANTEA GROUP in 2014. For the Ghana section, an Environmental Permit (Permit number CE0019720102) was issued by the EPA in March 2015 under Ghana law. Additionally, an Environmental Management Plan (EMP) was prepared in March 2017. However, with the abandonment of the planned project works, and recent efforts to revive the project under World Bank funding, an update has become necessary. The update involves:

- Update of line route study and production of maps, plan and profile drawings
- Update of Environmental and Social Impact Assessment (ESIA), Environmental and Social Management Plan; and
- Update of the Resettlement Action Plan for the project.

This Environmental and Social Impact Assessment covers the Ghana section of the Ghana -Côte d' Ivoire Reinforcement Project. The Ghana section involves the development of a 125-kilometrehigh tension transmission line from Bibianiha near Dunkwa-On-Offin in Ghana to Omanpe on the Ghana-Côte d'Ivoire

border, with a substation at Bibianiha (see Figure 1 for the route map of the Ghana Section). The Côte d'ivoire section is being implemented by CI-ENERGIES.

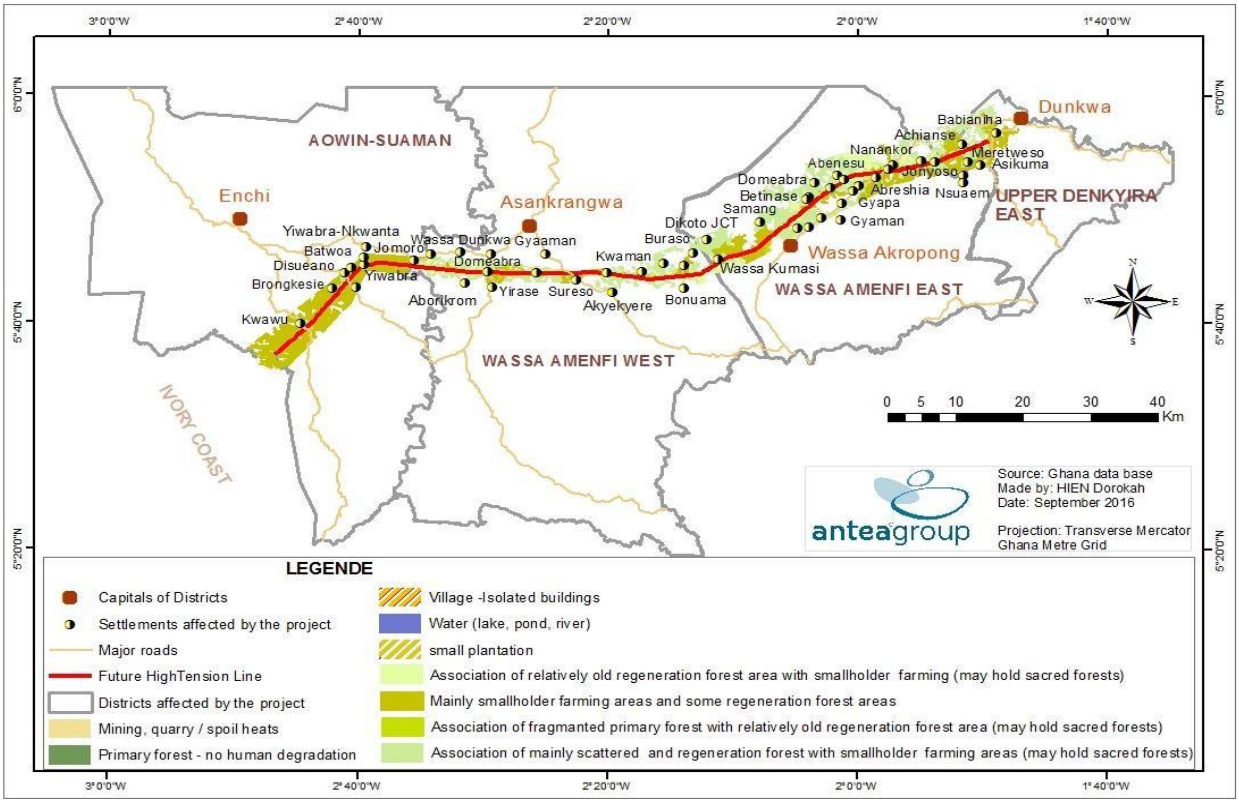


Figure 1; Project map showing Ghana side of the transmission line

The transmission line will operate at 330kV and 400kV voltages, providing high-capacity transmission capabilities and reducing power losses during transmission over long distances. The project spans critical locations on both the Ivorian and Ghanaian sides, providing clear linkage between existing power networks in both countries.

By creating a reliable connection between Côte d'Ivoire's energy reserves and Ghana's, the project will provide both nations with more stable access to electricity, especially in times of peak demand. The interconnection project enables efficient trading of power between Côte d'Ivoire, Ghana, and eventually other neighboring countries, furthering regional integration. The project will extend power to rural areas in both countries, fostering economic development and improving the quality of life for remote communities. Côte d'Ivoire is a net exporter of power in the region, and Ghana can leverage this connection to meet local demand during periods of electricity shortage.

The 330/400kV Ghana-Côte d'Ivoire Interconnection Transmission Line Project is crucial for enhancing the energy supply and stability of both nations, fostering cross-border collaboration, and contributing to the larger vision of an interconnected West African energy market.

1.2 Project Developer

The proponent, Ghana Grid Company GRIDCo was incorporated by the Energy Commission Act, 1997 (Act 541) and the Volta River Development (Amendment) Act, 2005 (Act 692), for the exclusive operation of the National Interconnected Transmission System as an independent Utility to take over the transmission functions of the Volta River Authority (VRA) within the framework of the Ghana Power Sector reforms.

GRIDCo was incorporated on December 15, 2006, as a private limited liability company wholly owned by the Government of Ghana under the Companies Code, 1963 (Act 179) and granted a certificate to commence business on December 18, 2006. The company became operational on August 1, 2008. GRIDCo is mandated to:

- Carry out the business of economic dispatching and transmission of electricity from facilities of wholesale suppliers to bulk customers or distribution companies and utilities in Ghana and West Africa without discrimination.
- Acquire by purchase or otherwise construct, establish, manage, maintain, and otherwise deal with all transmission facilities, works, buildings, and other systems necessary to transmit electric energy.
- Undertake metering and billing of all power transfers in the National Interconnected System.
- Carry out any general commercial activities related to the safe and reliable operation of the transmission system and economic dispatch of electric energy.

The total kilometers of the transmission line as of the end of 2020 was 6600km. The breakdown for the various voltage levels within the network is tabulated in Table 1.

Table 1: The breakdown for the various voltage levels

Voltage Level (kV)	Length of line in kilometers (2018)	Length of line in kilometers (2019)	Change in length (%)
330	565.00	1096.77	94.12
225	92.20	92.20	0.00
161	4,990.67	5,106.71	2.33
69	212.00	212.00	0.00
34.5	92.30	92.30	0.00

The Government of Ghana is the sole shareholder of GRIDCo under the Ministry of Energy. Details on GRIDCo can be accessed on its website www.gridcogh.com.

1.3 Justification of Project

The project's goal is to increase the country's current grid supply to meet West African consumers' urgent demand for power. The project also aims to create a regional electricity market in West Africa by prudently

developing and implementing important infrastructure that will enable all ECOWAS members to have access to affordable energy supplies.

1.4 Purpose of Environmental and Social Impact Assessment

It is a legal requirement in Ghana under the Environmental Protection Agency Act, 1994 (Act 490), and the Environmental Assessment Regulations 1999 (LI 2504) that development projects of this nature should be subjected to Environmental Impact Assessment (EIA). An environmental permit in 2015 was obtained for the construction of this project upon approval of the Environmental Impact Statement (EIS). (Copy of the expired Permit attached as Appendix I. The EPA upon submission of application for renewal of the permit requested GRIDCo to update the EIS for their approval for the construction of the project. (Copy of EPA response to renewal of permit application attached as Appendix II.

In addition, it is the policy of GRIDCo to ensure the welfare of the people likely to be adversely affected by its operations as well as to assist in the sustainable development of the environment within which it operates. The ESIA will enable GRIDCo to:

a. Obtain the necessary environmental permit for commencement and implementation of the project
b. Comply with the requirements of WB ESS1 and other relevant ESSs)
c. Implement the project with minimum adverse effects on the physical, biological, socio-cultural and socio-economic environments.

The study is concerned with the ecological and social aspects of the project within the project area, particularly the possible adverse consequences such as pollution, disturbance of habitat, truncation of land uses, dislocation of people and other forms of social distress, loss of buildings and fields, and dangers to people and animals. The study has addressed indirect as well as direct impacts but emphasizes on mitigation measures.

2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The relevant policies, legal and institutional frameworks that must be considered for the successful implementation of the project have been gathered and reviewed as part of this draft Environmental Impact Statement. All relevant national and international policies, laws, regulations, guidelines, and standards that may apply to this proposed high voltage transmission line and its auxiliary structures have been applied as required. Consultations have also been carried out with some of the relevant agencies to ensure compliance.

The broad mandate for environmental protection falls under the EPA, as the lead regulator in Ghana. The adoption of the National Environmental Action Plan led to the enactment of the EPA Act, 490 (1994) which for the first time gave legal support to Environmental Assessment implementation in Ghana, after almost fifteen years of experimentation. The passing of the Ghana ESIA Procedures into the EA Regulations (LI 2504, 1999) further consolidated EA application in Ghana.

All relevant legal, institutional framework and their implications for the successful take-off and implementation of the proposed project were analyzed during the ESIA exercise.

2.1 National Legislations

2.1.1 The Constitution of the Republic of Ghana, 1992

The 1992 Constitution provides the highest level of protection for private property rights. Private property may only be seized in situations where the state has a legitimate need to impede on those rights. No property "shall be compulsorily taken possession of or purchased by the State" unless it is, among other things, "to promote the public welfare," according to Article 20.

The Constitution further stipulates that the affected owners cannot suffer financial hardship when private lands are given up for the benefit of the public. According to this, "The State may only acquire property through compulsory acquisition if a statute is in place that guarantees (a) the rapid payment of just compensation; and (b) the right of any person with an interest in or right over the property to contact the High Court. Additionally, "the State shall resettle the displaced inhabitants on suitable alternative land with due regard for their economic well-being and social and cultural values where a compulsory acquisition or possession of land affected by clause (1) of this article involves the displacement of any inhabitants."

2.1.2 The Environmental Protection Agency Act, 1994 (Act 490)

in place of the previous Environmental Protection Council Decree (NRCD 239), the Government of Ghana enacted the Environmental Protection Agency (EPA) Act 1994 (Act 490). The environmental policy objectives could not be achieved without the Agency's ability to enforce compliance with the Act. Act 490 created the EPA's powers, duties, organizational structure, and financial support. It also authorized the

Agency to guarantee that all investments and endeavors comply with all established Environmental Assessment (EA) protocols in the planning and implementation of development projects, including compliance with regard to those that are already underway. The Ghana EPA Act 490 is essential for ensuring that high-tension transmission projects are planned and executed in an environmentally responsible manner, with due consideration for the potential impacts on both the environment and local communities.

2.1.3 Environmental Protection Act, 2025 (LI 2504)

Enacted in January 2025 in accordance with Section 29 of Act 1124, the Environmental Protection Act, 2025 (LI 2504) lays down the specifications for environmental permits, environmental impact assessments (ESIAs), environmental management plans (EMPs), environmental certificates, and the preparation of preliminary environmental reports (PERs). To control nature, quantities, circumstances, or concentrations of substances that may be released into the environment, the Act granted the EPA the authority to request an environmental impact assessment and/or an environmental management plan from various categories of undertakings, enterprises, construction, or development.

In order to ensure effective prevention, minimization, and mitigation of the potential impact of industrial developments existing before and after coming into force of LI 2504, the Environmental and Social Impact Assessment (ESIA) procedure serves as both a compliance promotion tool and a regulatory tool to be enforced under Section 29 of LI 2504. One of the projects for which an ESIA is required is the construction and operation of a power transmission line.

2.1.4 Fees and Charges (Miscellaneous Provisions) Act, 2022 (Act 1080)

Following evaluation and approval of the relevant environmental assessment report, this Act lays out the parameters for fees that the EPA may levy before issuing environmental licenses and certificates.

2.1.5 Volta River Development (Amendment) Act 2005, (Act 692)

The Amendment to Volta River Development Act, 1961 (Act 46) was passed in 2005 as the result of Ghana's Power Sector Reforms. The power transmission function of VRA was given to Ghana Grid Company Limited GRIDCo), a transmission utility company, by the Volta River Development Act, 2005 (Act 692). All of the Ghana's electricity transmission and evacuation infrastructure, which VRA had previously overseen together with power generating, is now under the control of GRIDCo.

2.1.6 Energy Commission Act, 1997 (Act 541)

Act 541 created the Energy Commission and outlined its responsibilities for the development, management, regulation, and use of Ghana's energy resources; licenses for the transmission, wholesale supply, distribution, and sale of electricity and natural gas; and the marketing, sale, refining, storage, and bulk distribution of petroleum products, among other related matters.

According to the terms of the Energy Commission's "PUBLIC NOTICE - EC N. 003," GRIDCo must register the project with the Commission and secure a permit prior to starting construction on the project. The EPA must authorize an environmental permit before this permit may be issued. In order to formally establish the framework for licensing electricity production, supply, and distribution as well as sale services in Ghana's power sector as specified by the Energy Commission Act, 1997 (Act 541), the Energy Commission of Ghana developed and issued a "Licensing Manual for Service Providers in the Electricity Supply Industry" in 1996.

2.1.7 Factories, Offices and Shops Act, 1970 (Act 328)

Act 328 upholds the obligations of the employer and advances the health, welfare, and safety of those who work in the nation. Employers must abide by the Act and make sure that all workers (including those of the contractor, the supervising consultant and the utility i.e. GRIDCo have a safe and healthy work environment to protect their own health and well-being.

2.1.8 Hazardous and Electronic Waste Control and Management Act, 2016 (Act 917)

Act 917 conforms with the World Bank Environmental and Social Standard 3 which recognizes that economic activity and urbanization often generate pollution to air, water, land, and consume finite resources that may threaten people, ecosystem services, and the environment at the local, regional, and global levels. The current and projected atmospheric concentration of greenhouse gases (GHG) threatens the welfare of current and future generations. At the same time, more efficient and effective resources use, pollution prevention, and GHG emission avoidance and mitigation technologies and practices have become more accessible and achievable. This Act sets out the requirements to address resource efficiency and pollution prevention and management throughout the project life cycle consistent with Good International Industry Practice (GIIP). The proposed project would therefore be executed in compliance with this law.

2.1.9 Public Health Act, 2012 (Act 851)

Act 851, passed in 2012, is aligned with the Environmental and Social Standard on Community Health and Safety (ESS4) of the World Bank, which requires that project developers:

- Anticipate or avoid adverse impacts on the health and safety of project-affected communities during project life-cycle from routine and non-routine circumstances;
- Promote quality, safety, and climate change considerations in infrastructure design and construction, including dams;
- Avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials, and have in place effective measures to address emergency events; and
- Ensure that safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.

The Act, thus, deals with the risks to and effects on the health, safety, and security of the communities affected by the power transmission project, as well as the GRIDCO's obligation to prevent or minimize such risks and impacts, paying special attention to those who are vulnerable such as physically challenged, old women and children.

2.1.10 Labour Act, 2003 (Act 651)

Employers are required by Part XV, Sections 118(1) and (2a-h) of the Act to guarantee that each employee works in a satisfactory, safe, and healthy environment. They are also required to provide the information, instructions, training, and supervision that other employees need in order to ensure the health and safety of those employees who are performing a specific job at work such as those stringing of the power lines.

2.1.11 Workmen's Compensation Law, 1987 (PNDCL 187)

The 1986 Act establishes guidelines for the payment of compensation to employees for personal injuries sustained while on the job. This includes regulating the employer's liability in these situations, the payment of medical expenses and provision of medical aid, certain occupational diseases, degrees of partial incapacity specified in a schedule, the determination of claims, remedies against the employer and third parties, protection of compensation against attachment or assignment, and the distribution of compensation in the event of the worker's death. When carrying out the project, GRIDCo will adhere completely to this Act. To ensure adherence to the relevant Act, GRIDCo will leverage its established internal policies and procedures specifically designed to comply with regulatory requirements. We will engage with GRIDCo's E&S team to reference their exact internal policies, such as their Environmental and Social Management System (ESMS), which aligns with national environmental regulations, including Act 490 (1994) and LI 2504 (1999). Additionally, GRIDCo's compliance framework includes regular internal audits, staff training programs, and continuous monitoring protocols, all of which are aimed at ensuring full compliance with the Act during the high-tension transmission project. These references will be documented to provide clear evidence of GRIDCo's commitment to adhering to legal and environmental standards.

2.1.12 Persons with Disability Act, 2006 (Act 715)

The Disability Act 715 was passed in 2006. The Act covers thematic areas such as rights, accessibility, employment, education, transportation, and health care for Persons with Disabilities (PWDs); the establishment and functions of a National Council on Persons with Disability, and some miscellaneous provisions. The passage of the Act was considered a noteworthy milestone in Ghana's human rights discourse as it gave the hope that it will improve the life of PWDs to enable them to be part of mainstream society. The proposed project will be executed in full compliance with the Act. Based on this we have taken the following steps in the stakeholder engagement.

Stakeholder Engagements, Identification and compensation: We have designed our stakeholder engagement process to be fully inclusive, ensuring that PWDs are effectively involved. This includes:

- **Accessible Meeting Venues:** All stakeholder meetings will be held in locations that are accessible to PWDs, with necessary accommodations such as ramps, sign language interpreters, and other assistive devices.
- **Tailored Communication:** Information will be provided in accessible formats, including braille, large print, and audio versions, to ensure that all PWDs can participate fully in the engagement process

- **Identifying Affected PWDs:** We will conduct thorough surveys and consultations to identify PWDs whose livelihoods may be impacted by the project. Special attention will be given to ensure that no one is overlooked, particularly those in remote or hard-to-reach areas.

Compensation and Support: Affected PWDs will be provided with fair compensation for any loss of livelihood, along with additional support tailored to their specific needs. This may include vocational training, financial assistance, and other forms of livelihood restoration to ensure they are not disadvantaged by the project.

2.1.13 Children's Act, 1998 (Act 560)

The Act aims to reform and consolidate the law relating to children. The act provides for the rights of the child, maintenance and adoption, regulates child labor and apprenticeship, and provides for ancillary matters concerning children generally and related matters. The act is divided into four parts as follows: Part I covers the rights of the child and parental duty, including the right to name and nationality, the right to grow up with parents, and the right to education and well-being. Part II covers quasi-judicial and judicial child adjudication, including child panels and family tribunals. Part III covers parentage, custody, access, and maintenance, including the duty to maintain a child, custody, and access. Part IV covers fosterage and adoption, including foster-care placement and adoption application. Consequently, the proposed project will be carried out in accordance with the Act. This Act is relevant to high-tension transmission line projects as it provides a legal framework to protect children's health, safety, and welfare, ensuring that their rights are not compromised by the project.

2.1.14 Local Governance Act, 2016 (Act 936)

The Act establishes a National Development Planning System, defines and regulates District Assembly planning procedures, establishes a Local Government Service, creates and oversees the District Assemblies Common Fund, monitors and oversees internal audit activities within District Assemblies, and addresses related matters. It also provides for local governance by the Constitution. The Local Government Act 2016 (Act 936) is crucial for ensuring that the high-tension transmission project aligns with local governance structures and development plans. The project affects a total of four Metropolitan, Municipal, and District Assemblies (MMDAs), each of which has been actively involved in the initial stages of planning and consultation. Initial engagements with these MMDAs have led to the identification of key local concerns, such as land use conflicts and the need for community-level impact assessments. The assemblies have provided valuable input on routing alternatives to minimize disruption and have expressed support for the project, contingent on continued collaboration. These engagements have laid the groundwork for effective

coordination with local authorities, ensuring that the project proceeds smoothly and benefits from local insights. The proposed project shall be carried out in accordance with all applicable provisions.

2.1.15 National Museums Decree, 1969 (NLCD 387)

The preservation of any archaeological finds is covered by NLCD 387. This statute sets forth the guidelines for the National Museums and Monuments Board's functions. The steps that must be taken in order to find any such artifacts are described in NLCD 387. The National Museum Decree, 1969 (NLCD 387), is relevant to the high-tension transmission project as it mandates the preservation of any cultural and historical artifacts that may be uncovered. Given the linear nature of this project, chance finds—such as ancient artifacts or archaeological remains—are possible during construction, making the provisions of this Decree vital for ensuring these finds are reported, preserved, and protected according to national heritage law.

2.1.16 Volta River Authority (Transmission Line Protection) Regulations, 1967 (LI 542)

The GRIDCO Transmission Lines are secured and public safety is guaranteed by the VRA (Transmission Line Protection) Regulations, (1967) LI 542.The Regulations define the term "transmission line right of way" and restrict or forbid a number of activities within the RoW, such as building construction, farming, mining, and agriculture, which are only permitted with prior approval from GRIDCo.

2.1.17 Volta River Authority (Transmission Line Protection) (Amendment) Regulation, 2004 (LI 1737)

VRA (Transmission Line Protection) (Amendment) Regulation, 2004 (LI 1737) which provides for the right of way distances for 69 kV, 161 kV, 225kV, 330 kV transmission lines. The RoW for 225 kV and 330 kV transmission towers is 40m, whilst that of 69kV and 161 kV is 30 m. This regulation prohibits some activities in the RoW including mining, construction of buildings, and cultivation of some types of crops.

2.1.18 Electricity Transmission (Technical, Operational and Standards of Performance) Rules, 2008 (L.I. 1934)

LI 1934 outlines the standards, guidelines, processes, and regulations that control the creation, management, upkeep, and usage of the high voltage national interconnected transmission system. The design update studies undertaken by SP have fully incorporated the requirements of LI 1934 to ensure compliance with national standards for the high-voltage transmission system. This includes adhering to the specified guidelines and processes for the safe creation, management, and upkeep of the transmission infrastructure. Additionally, the studies are aligned with LI 1934 regulations to optimize system reliability, efficiency, and safety within the national interconnected transmission network. It also defines the national interconnected transmission system. The guidelines are designed to guarantee that the transmission system offers an equitable, transparent, non-discriminatory, open access, safe, dependable, secure, and economically viable means of delivering and transmitting power.

2.1.19 Fire Precaution (Premises) Regulations, 2003 (LI 1724)

In accordance with LI 1724, among other regulations, sufficient steps must be made to eliminate potential fire outbreak causes, and every project or facility must get a fire certificate. GRIDC has confirmed that securing fire certificates for their transmission lines is not required, which has been noted to clarify the project's fire safety compliance considerations.

2.1.20 The Lands Act, 2020 (Act 1036)

Ghana has a diverse land tenure system, which includes customary, leasehold, and freehold systems. The Lands Act addresses issues related to these tenure systems. The Act typically outlines the administrative structures and procedures for land management, including the roles and responsibilities of various agencies involved in land administration.

Registration of land is a crucial aspect covered in this legislation. The Act details the process of land registration, the rights and obligations of landowners, and the importance of having a registered title. Addressing land disputes is a significant part of the Act and it establishes mechanisms for resolving conflicts related to land ownership, boundaries, and other land-related issues. The Act includes provisions related to land use planning and zoning regulations to ensure orderly development and proper utilization of land resources. The Act further incorporates provisions to address environmental concerns and sustainable land use practices, promoting responsible land management. It also specifies the conditions under which the government can acquire or control land for public purposes and the compensation mechanisms for affected landowners. Given the importance of customary land tenure in Ghana, the Lands Act has provisions to protect the rights of customary landowners.

2.1.21 Lands Commission Act, 2008 (Act 767)

Act 767 unifies public service land institutions' activities under the Commission to ensure efficient and successful land management and to address associated issues. As a matter of fact, the 1992 Constitution mandates that no stool land may be developed or disposed of unless the Lands Commission of the region in which the land is located certifies that the development or disposition is compliant with the development plan created or authorized by the local planning authority. The Lands Commission Act, 2008 (Act 767) is relevant to the project as it governs the management, allocation, and registration of land titles. For this high-tension transmission line project, compliance with Act 767 ensures that all land acquisitions and usage are legally approved and documented, preventing potential disputes and facilitating smooth project implementation. The divisions of the Lands Commission are as follows:

- Survey & Mapping Division
- Land Registration Division
- Land Valuation Division
- Land Administration

2.1.22 Land Use and Spatial Planning Act, 2016 (Act 925)

This Act, which was passed in 2016, aims to regulate national, regional, district, and local spatial planning as well as the general aspects of socio-economic development and related matters. It also provides for the sustainable development of land and human settlements through a decentralized planning system and ensures that land is used wisely to improve quality of life, promote health, and ensure safety in human settlements. The proposed project shall rigorously adhere to all applicable provisions of this Act.

2.1.23 Wild Animals Preservation Act, 1961 (Act 43)

Act 43 prohibits the hunting and export of listed species, thereby protecting a number of animal species, with the support of its subsidiary legislations LI 710 and LI 685. The LI 710 allows for the establishment of Wildlife Reserves and the preservation of the local flora and fauna. Schedules of animal species with differing levels of legal protection are also provided under LI 685. Furthermore, they impose limitations on the issuance of Game Licenses and Export Permits for Games and Trophies. The Ghana Wildlife Preservation Act 43 is relevant to a high-tension transmission line project as it provides legal protection for wildlife and their habitats. The Act requires that any development project, including high-tension transmission lines, avoid disrupting or endangering wildlife, particularly in protected areas such as national parks, wildlife reserves, or other ecologically sensitive regions. The project must take measures to minimize habitat destruction, avoid disturbing migration patterns, and protect endangered species, ensuring that the construction and operation of the transmission lines do not negatively impact Ghana's biodiversity and natural ecosystems.

2.1.24 Forestry Commission Act, 1999 (Act 571)

Act 571 reinforces the Forestry Commission's constitutional status and designates it as the only entity responsible for carrying out government policies in the forestry sector. Act 571 of 1999 created the new Forestry Commission, and since then, the Commission has concentrated on enhancing employee accountability, monitoring, and performance. The main relevance of the Ghana Forestry Commission Act 571 to a high-tension transmission line project is its role in ensuring the sustainable management and protection of forest resources. If the transmission line route passes through or near forest reserves, the Act requires that the project obtain necessary approvals from the Forestry Commission and implement measures to minimize deforestation and environmental degradation. This includes reforestation efforts, maintaining ecological balance, and protecting the integrity of forest ecosystems affected by the project.

2.2 Relevant Policies

2.2.1 Gender Policy 2015

The National Gender Policy of Ghana was developed to promote gender equality and women's empowerment in the country. The policy aims to improve the social, legal, civic, political, economic, and socio-cultural conditions of the people of Ghana, particularly women, girls, children, the vulnerable, and

people with disabilities. The policy seeks to re-emphasize the government's commitment to promoting women's human rights and empowerment, as well as to continue working towards the greater development of both men and women. The policy is guided by key principles such as gender mainstreaming, gender equality, equity, and women's empowerment. The policy recognizes the need for effective policies that promote gender equality and equity at all levels and sectors of society. It further provides a comprehensive framework that addresses issues such as women's access to justice, leadership, and accountable governance, gender roles and relations, and economic opportunities for women. This policy ensures that gender considerations are integrated into all phases of a high-tension transmission line project, promoting equality, inclusiveness, and the protection of women's rights and interests.

2.2.2 National Environmental Policy, 1995

In 1995, the National Environmental Policy was put into effect. This policy was developed with a broad vision that was guided by respect for all pertinent environmental and sustainable development principles and issues. With an overarching goal of managing the environment to maintain society as a whole, the Policy strives for sustainable development both now and in the future. The goal of the strategy is to bring Ghanaians together in the pursuit of a common goal: a society in which every citizen has access to enough nutritious food, clean water and air, appropriate housing, and other needs. This will additionally facilitate their ability to lead a satisfying life in spiritual, cultural, and physical balance with their environment through integrated and coordinated environmental management, guaranteeing:

- citizens' quality of life and their living and working environments equal
- access to land and other natural resources
- more efficient use of social, cultural, and natural resources
- public participation and environmental governance

The EPA is the official government organization in charge of integrating, coordinating, and carrying out the policy by making sure that environmental rights of individuals are upheld, environmental sustainability issues are suitably addressed, and government policy priorities and objectives are carried out. As a result, the proposed project will be carried out in accordance with the National Environmental Policy.

2.2.3 National Climate Change Policy 2013

The vision and goals for efficient adaptation, social development, and mitigation are outlined in the National Climate Change Policy (NCCP). The stated objective is to "achieve equitable low-carbon economic growth and sustainable development for Ghana while ensuring a climate-resilient and climate-compatible economy." Although it concedes that economic modernization would result in higher emissions, it contends that the new development route will lower emissions relative to the business as usual (BAU) baseline by reducing energy waste and enhancing public transportation and infrastructure. Low carbon growth and development routes that are resilient to climate change are priorities for the NCCP. It suggests tackling climate change by fusing ancient knowledge with new and developing information. The Climate Change

Policy outlines key strategies to address the impacts of climate change across various sectors, including infrastructure development. Several sections of the policy are directly linked to infrastructure projects, such as the construction of high-tension transmission lines as follows:

1. Building Climate-Resilient Infrastructure: The policy emphasizes the need for infrastructure that can withstand the adverse effects of climate change, such as extreme weather events, rising temperatures, and sea-level rise. For high-tension transmission lines, this means designing and constructing the infrastructure to be resilient to such impacts, ensuring long-term functionality and safety. This might involve using materials and technologies that are more durable under changing climate conditions and considering climate risks in the siting and routing of the transmission lines.

2. Increasing Resilience of Vulnerable Communities to Climate-Related Risks: The policy focuses on protecting communities that are particularly vulnerable to climate change. High-tension transmission line projects must consider the potential impacts on these communities, including how the infrastructure might exacerbate vulnerabilities or disrupt local adaptation strategies. Measures should be taken to ensure that the project does not increase the risk of flooding, heatwaves, or other climate-related hazards for nearby communities, and instead, enhances their resilience.

3. Increasing Carbon Sinks: The policy supports actions that enhance carbon sequestration through the preservation and expansion of forests, wetlands, and other natural carbon sinks. When constructing high-tension transmission lines, the project should minimize deforestation and land degradation, and where possible, include reforestation or afforestation efforts to compensate for any loss of vegetation. This aligns with the goal of maintaining or increasing carbon sinks as part of Ghana's climate change mitigation strategy.

4. Improving Management and Resilience of Terrestrial, Aquatic, and Marine Ecosystems: The policy emphasizes the protection and sustainable management of ecosystems, which are vital for biodiversity and climate resilience. This High-tension transmission line project should be planned and executed in a way that avoids or minimizes damage to terrestrial, aquatic, and marine ecosystems. This includes careful consideration of the route to avoid sensitive habitats, implementing measures to restore any affected ecosystems, and ensuring that the project does not contribute to ecosystem degradation.

The Climate Change Policy guides the integration of climate resilience into infrastructure projects like high-tension transmission lines, ensuring that they are designed to be sustainable, protect vulnerable communities, enhance carbon sinks, and preserve ecosystems.

2.2.4 GRIDCo Corporate Environmental Policy

The GRIDCo Corporate Environmental Policy Statement commits the organization to upholding national and international environmental protection regulations while also ensuring continuous improvement of environmental performance to minimize the environmental impacts of all its operations.

2.3 World Bank's Environmental and Social Standards (ESS1-10)

The relevant Environmental and Social Standards of the World Bank will be strictly by the principles of sustainable development and environmental integrity in the implementation of the proposed project. In 2018, the World Bank adopted a new set of environmental and social policies called the Environmental and Social Framework (ESF). As of October 1, 2018, the ESF applies to all new World Bank investment project financing. With existing projects continuing to apply the Safeguard Policies, the two systems will run in parallel for an estimated seven years.

The Project follows the ten Environmental and Social Standards (ESSs) under the Environmental and Social Framework that establish the standards that the project should meet throughout the project life cycle:

- ESS 1: Assessment and Management of Environmental and Social Risks and Impacts;
- ESS 2: Labor and Working Conditions;
- ESS 3: Resource Efficiency and Pollution Prevention and Management;
- ESS 4: Community Health and Safety;
- ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
- ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- ESS 7: Indigenous Peoples / Traditional Local Communities;
- ESS 8: Cultural Heritage;
- ESS 9: Financial Intermediaries; and
- ESS 10: Stakeholder Engagement and Information Disclosure.

ESS 1: Assessment and Management of Environmental and Social Risks and Impacts

This standard sets out the Borrower's responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing (IPF), in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESSs). The essence of ESS 1 is to ensure that projects supported by financial institutions adhere to robust environmental and social standards, thereby promoting sustainable development, safeguarding natural resources, and enhancing the well-being of communities and ecosystems. This standard is relevant for the project.

ESS 2: Labor and Working Conditions

This standard recognizes the importance of employment creation and income generation in the pursuit of poverty reduction and inclusive economic growth. Borrowers can promote sound worker-management relationships and enhance the development benefits of a project by treating workers in the project fairly and providing safe and healthy working conditions. The ESS 2 aims to create an enabling environment where labor rights are respected, workers are treated with dignity and respect, and workplaces are safe,

inclusive, and supportive. By adhering to these standards, projects can contribute to sustainable development and the well-being of workers and communities. This standard is relevant for the project.

ESS 3: Resource Efficiency and Pollution Prevention and Management

This standard recognizes that economic activity and urbanization often generate pollution to air, water, and land, and consume finite resources that may threaten people, ecosystem services and the environment at the local, regional, and global levels. This ESS sets out the requirements to address resource efficiency and pollution prevention and management throughout the project life cycle. The ESS 3 aims to promote sustainable resource use, minimize pollution, and enhance environmental performance within projects, thereby contributing to sustainable development and the protection of natural ecosystems and human health. By integrating resource efficiency and pollution prevention measures, projects can mitigate environmental risks and optimize their long-term sustainability. This Standard is relevant for the project.

ESS 4: Community Health and Safety

This standard addresses the health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Borrowers to avoid or minimize such risks and impacts, with particular attention to people who, because of their circumstances, may be vulnerable. The essence of ESS 4 is to prioritize the health and safety of communities and workers impacted by projects, ensuring that their rights are protected, risks are minimized, and benefits are maximized. By integrating health and safety considerations into project design, implementation, and monitoring, projects can contribute to sustainable development and the well-being of all stakeholders involved. ESS4 is relevant for the project.

ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

Involuntary resettlement should be avoided. Where involuntary resettlement is unavoidable, it will be minimized and appropriate measures to mitigate adverse impacts on displaced persons (and on host communities receiving displaced persons) will be carefully planned and implemented. The aims of ESS 5 are to ensure that land acquisition and involuntary resettlement processes are conducted in a manner that respects the rights, dignity, and well-being of affected communities and individuals. By prioritizing the needs and concerns of affected persons and providing adequate compensation, assistance, and support, projects can minimize adverse impacts and contribute to sustainable development and social equity. This standard is relevant for the project

ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

This standard recognizes that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development and it recognizes the importance of maintaining core ecological functions of habitats, including forests, and the biodiversity they support. ESS6 also addresses sustainable management of primary production and harvesting of living natural resources

and recognizes the need to consider the livelihood of project-affected parties, including Indigenous Peoples, whose access to, or use of, biodiversity or living natural resources may be affected by a project. The goal of ESS 6 is to support human well-being and ecosystem resilience by encouraging the sustainable stewardship of biodiversity and living natural resources, guaranteeing their preservation for future generations. Projects can help conserve biodiversity, promote sustainable development, and increase climate resilience by incorporating biodiversity considerations into their planning, execution, and monitoring phases. This standard is relevant for the project.

ESS 7: Indigenous Peoples / Traditional Local Communities

This standard ensures that the development process fosters full respect for the human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods of Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities. ESS7 is also meant to avoid adverse impacts of projects on Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities, or when avoidance is not possible, to minimize, mitigate and/or compensate for such impacts. ESS 7 aims to ensure that projects respect and promote the rights, cultures, and well-being of indigenous peoples and traditional local communities, fostering inclusive and equitable development that recognizes and values their unique contributions to society and the environment. By engaging with communities as partners and respecting their knowledge, values, and aspirations, projects can contribute to sustainable development and social justice. This standard is not relevant for the project.

ESS 8: Cultural Heritage

This standard recognizes that cultural heritage provides continuity in tangible and intangible forms between the past, present and future. ESS8 sets out measures designed to protect cultural heritage throughout the project life-cycle. In the framework of development initiatives, ESS 8 seeks to preserve and advance the protection of cultural heritage. Projects can support sustainable development while assisting in the preservation of cultural diversity, heritage, and identity by acknowledging the value of cultural assets, interacting with impacted communities, and putting into practice efficient conservation techniques. This standard is relevant to the project.

ESS 9: Financial Intermediaries

ESS9 recognizes that strong domestic capital and financial markets and access to finance are important for economic development, growth and poverty reduction. FIs are required to monitor and manage the environmental and social risks and impacts of their portfolio and FI subprojects, and monitor portfolio risk, as appropriate to the nature of intermediated financing. The way in which the FI will manage its portfolio will take various forms, depending on a number of considerations, including the capacity of the FI and the nature and scope of the funding to be provided by the FI. ESS 9 focuses on promoting responsible investing by integrating environmental and social considerations into the operations of financial intermediaries. By

adopting robust environmental and social risk management systems, engaging with stakeholders, and adhering to international standards, FIs can contribute to sustainable development and positive social and environmental outcomes. ESS 9 is not relevant for this project.

ESS 10: Stakeholder Engagement and Information Disclosure

This standard recognizes the importance of open and transparent engagement between the Borrower and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation. ESS 10 aims to promote transparent, inclusive, and participatory processes that engage stakeholders in decision-making, foster trust and accountability, and contribute to sustainable development outcomes. By respecting stakeholder rights, facilitating access to information, and building meaningful partnerships, projects can enhance their social legitimacy, reduce conflicts, and achieve more effective and equitable results. ESS 10 is relevant for the project.

2.4 Relevant World Bank Group Guidelines, 2007

2.4.1 World Bank Group EHS Guidelines, 2007

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP), as defined in ESS3. The EHS Guidelines contain the performance levels and measures that are normally acceptable to IFC and that are generally considered achievable in new facilities at reasonable costs by existing technology. For World Bank-funded projects, application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets with an appropriate timetable for achieving them. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to IFC/World Bank, become project or site-specific requirements. The World Bank Group EHS Guidelines for Power Transmission and Distribution and General Guidelines are relevant for this sub-project.

2.4.2 World Bank Good Practice Note: Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil Works

The Good Practice Note operationalize and discusses the scope, prevention, minimization, and mitigation measures for Gender-based Violence risks that are associated with Bank Investment Project Financing. It covers Sexual Exploitation and Abuse (SEA)-exploitation of a vulnerable position differential power or trust for sexual favours and actual or threatened sexual intrusion, Workplace Sexual Harassment (SH) in the form of unwanted sexual advances, requests for sexual favors, and sexual physical contact as well as human trafficking (Sexual slavery, coerced transactional sex, illegal transaction people movement. Also presented in the guidance note are non-SEA issues of physical assault, psychological and physical abuse,

denial of physical services and resources together with intimate partner violence. In responding to project-related GBV/SEA/SH risks, the document proposes adaptable survivor-centered as well as risk and evidence-based approaches that emphasize prevention and risk minimization-especially risks that harm girls and women. It also alludes to the importance of building on local knowledge through stakeholder engagement and continuous monitoring and learning.

Strategies to be implemented by various actors throughout the project cycle to identify GBV/SEA/SH risks on bank-financed projects include risk mapping, assessment, and stakeholder consultation. Mitigation and minimizing measures such as the use of Codes of Conduct, GBV Service Providers, and Environmental and Social Management Plans in addition to capacity assessment are discussed in the document. The guidance note also layouts lays out monitoring and evaluation requirements and stresses the need for sensitization and capacity building for stakeholders.

2.4.3 ESF/Safeguards Interim Note: Covid-19 Considerations in Construction/Civil Works Projects

This interim note emphasizes the importance of careful scenario planning, clear procedures and protocols, management systems, effective communication and coordination, and the need for high levels of responsiveness in a changing environment due to the COVID-19 pandemic. It recommends assessing the current situation of projects, putting in place mitigation measures to avoid or minimize the chances of infection (coronavirus), and planning what to do, if either project workers become infected or the workforce including workers from proximate communities are affected by COVID-19. The recommendation in this interim note covers cleaning and waste disposal, medical services, and general hygiene for the workforce together with the management of site entry and exit points, work practices, and medical supplies for site workers. There are also recommendations to ensure continuity in the supply of materials and project activities amidst disruption in supply chains because of COVID-19. The interim note is useful for both project Consultants and Contractors in spite of the fact that the pandemic has been curbed in Ghana.

2.4.4 International Labour Norms

Ghana's labour laws generally align with international labor norms and standards established by the ILO, there may be variations in specific provisions, implementation mechanisms, and enforcement practices. Continuous efforts to strengthen legal frameworks, enhance enforcement mechanisms, and promote social dialogue are essential to ensure compliance with international labour standards and protect workers' rights.

In case the fundamental labour laws as defined by the International Labour Office (ILO) are not fully covered by national legislation, the proponent of a project financed by an international institution such as the WB needs to conceive and implement ad hoc verifiable procedures in order to guarantee the implementation of international labour norms at least during the Construction and management phases of

the project. The objective is to avoid unacceptable labour conditions and practices and to promote a rational management of social relations.

2.4.5 World Bank Environmental and Social Risk Classification

Under the World Bank ESF, the World Bank classifies projects into four (4) categories, High, Substantial, Moderate, and Low largely based on the scale of the project-level impacts and risks, the country's socio-political conditions as well as the capacity of the borrower to manage the associated environmental and social impacts/risks. Projects classified as category 'High Risk' carry very significant and mostly irreversible environmental and social impacts/risks requiring Environmental and Social Impact Assessment. Projects are also categorized as high risk if, they are to be implemented in countries or regions with a history of social conflict, uncertain or weak regulatory environments and/or in situations where the borrower has a weak capacity to manage the potential environmental and social risks/impacts. High-risk projects also have long-term, irreversible significant, cumulative and/or transboundary impacts/risks that are difficult or sometimes impossible to mitigate.

Substantial Projects are less complex medium-scale projects. Such projects have, few adverse impacts/risks compared to high-risk projects, which are mostly temporary and reversible. Projects rated as substantial may have a transboundary impacts/risk but the impacts/risks can be readily mitigated. Projects in this category are implemented in countries and regions, in which there are concerns about social conflicts but the capacity concerns about borrower's ability to management the potential environmental and social risks can be addressed.

Projects rated as 'low' have environmental and social impacts/risks of low magnitude, which are predictable, temporary, reversible site-specific and easily mitigated, while those rated 'low' have minimal to negligible impacts/risks and may not require any environmental and social assessment.

The Environmental and Social Risk Rating for the project is "High". The project will support construction of high-voltage transmission lines creating new environmental footprint in the modified and natural landscapes and habitats with adverse impacts on vegetation wildlife and rivers due to vegetation clearance for creating ROW, earth works, erection of towers and stringing of transmission lines. Civil works will be associated with impacts and risks such as soil erosion, and waste degeneration as well as risks to the health and safety of workers and local communities such as accidents.

In terms of social risks, land-take (500 hectares) leading to the physical and economic displacement of people will occur. Other social risks are labor influx into the project areas, including oversea workers, posing community and health risks like communicable diseases, STDs, HIV/AIDs, unwanted pregnancies, sexual exploitation, and abuse/sexual harassment in project communities. The increased presence of workers and clashes with illegal miners may trigger and/or exacerbate social conflicts that may require the

intervention of armed security personnel. Lastly, the transboundary nature of the interconnection lines (tying with Côte d'Ivoire) could make issues more challenging.

There is also limited institutional capacity at GRIDCO to undertake environmental, social and health and safety management in accordance with the newly introduced World Bank ESSs even though they have implemented Bank projects under OPs with relative satisfaction.

3 CONSIDERATION OF ALTERNATIVES

This Chapter contains a description of the proposed development. However, during the project planning stage, a number of options had to be taken into account in terms of equipment and the project's viability before the various components of the projected development were chosen.

Numerous feasibility studies have been conducted, which have aided this ESIA study in presenting possibilities in a comparative manner, outlining the distinctions between each possibility, and giving the public and decision-makers a sound foundation on which to choose. A portion of the data used to compare the options will be derived from the alternative's design, and a portion will be based on the consequences that each alternative will have on the environment, society, and economy if it is implemented.

The following alternatives were discussed at the draft ESIA stages:

- No Development Scenario; and
- Project Implementation Option

3.1 The "No development scenario"

Under this scenario, the existing 225 KV transmission line from Prestea to Côte d'Ivoire will continue to be the only transmission line that supplies power from Ghana to Côte d Ivoire and vice versa. It will undergo route maintenance in the foreseeable future. The line is overloaded and susceptible to faults.

Opting for the No Development Scenario means that there will be no need to acquire additional land as wayleaves for the any new transmission line and the siting of a new substation saving at least 500 hectares of land including farming lands and secondary forests. Closely related to the issue of avoiding land take, the no action scenario minimise physical and economic displacement as there is no anticipated loss of livelihood and damage to assets.

Environmental impacts such as material use, habitat destruction and loss of vegetation is also limited as routine maintenance activities will be largely confined to Right of Way of the existing transmission line and its immediate environs with very minimal civil works such as establishing tower foundations.

Nonetheless, pursuing the no development option implies that there will be no feasible means of evacuating power between these two countries, if the existing 225KV transmission line develops a fault. More importantly, an overloaded circuit presents a significant risk to the entire power transmission system of both Ghana and Côte d' Ivoire with a potential to cause blackouts and load shedding in both countries with its attendant loss of foreign exchange, loss of investment and insecurity as well as the shift to smaller diesel stand-alone power systems in the respective countries.

Even though the "No development scenario" seems to have minimal environmental and social risks/impacts, pursuing this option undermines the objective of the West African Power Pool, that is, 'to develop a power transmission network that interconnects the entire West African Region.'

The "No development" alternative does not, therefore, represent an option that meets the best interests of people in the project corridor, Ghana and West Africa as a whole.

3.2 Project Implementation Option

The project implementation Option seeks to develop an additional interconnection transmission line between Ghana and Côte d' Ivoire. This alternative loop is a 333 KV transmission line from Dunkwa- on -Offin to Omanpe (Ghana-Côte d' Ivoire border) where it will tie into a new 400 KV transmission line on the Côte d' Ivoire side also to be developed under this project by CI Energies. This option resolves the potential operational challenges associated with the current system of transmission as it is an upgrade on the current 225 KV transmission line serving the two countries. In addition, it will ensure more reliable transmission of power between the two countries in furtherance of the WAPP objective.

These notwithstanding, the implementation of this option is associated land take, loss of livelihood for farmers and other land owners within the proposed Right-of-Way and the site for the construction of a new substation, loss of habitats and other environmental and social impacts. These will require the preparation of Environmental and Social Impact Assessment and an accompanying Environmental and Social Management Plan that will be implemented throughout the project cycle to mitigate the potential environmental and social impacts/risks of the project.

The development benefits of the project implementation option including reliable power supply outweighs that of the 'No Action Scenario'. The beneficial projects impact of the project such as employment generation and increase investments with stable power supply also outweighs the negative environmental and social risks/impacts associated with project implementation, especially, if these impacts/risks are situated in the context of they being largely resolved using the mitigation hierarchy. From the foregone, the Project Implementation Scenario is selected for further analyses.

3.2.1 Mode of Transmitting Power

Under Project Implementation option the underlisted variants were assessed:

- Alternative Means of Evacuating Power
- Alternative Transmission Line Routes;
- Alternative Phase Conductor Material; and
- Alternative Tower Designs
- Options for Power Transmission

Two transmission modes of passing the transmission lines in between towers were considered and assessed. These are the subterranean approach and the overhead cabling approach. In the former, the cables are buried underground. They only appear on the surface at termini. The overhead cabling involves the mounting of towers at specified intervals and stringing the interconnection cables along the towers.

Burying transmission lines in the ground makes it less susceptible to vagaries of the weather, while minimizing energy losses. These notwithstanding, this transmission option is associated with trenching, landscape alteration and adverse impacts on properties and livelihoods under this project. Construction and maintenance costs are also higher compared to the use of overhead cabling (see Table 2).

Table 2: Estimated cost of overhead towers against underground cables

Type	Underground cable	Overhead Towers Compact design	Overhead Towers Lattice steel towers
Cost per km (US$)	400,000	84,500	85,000 –100,000

Laying the lines through the ground also adversely affects landscapes such as mountains. Barriers such as mountains, rivers and road crossing makes construction more difficult compared to overhead transmission. Accessing the lines for repair works is also difficult and take a longer time for underground cabling. More insulation is also required under this approach.

Transmitting power via overhead cables visually pollutes areas where they run. It may obstruct the movement of birds and other flying objects and it is easily struck by lightning. As the lines and towers are visible, they are also easier targets for terror attacks, theft and vandalism compared to underground cables. Nonetheless, power transmission by overhead cables is preferred to underground cabling under the project on the account of lower construction and maintenance cost, better accessible during routine maintenance and repairs as well as ease of construction and maintenance.

3.2.2 Transmission Line Route

The choice was between selecting a new route and aligning the project with the proposed route under the earlier project in 2014. The decision was taken by GRIDCo to align the route with the RoW of the earlier project as much as practicable rather than a total change in route alignment because of the underlisted reasons:

i. Survey data was largely available for selected route minimising delays and cost;
ii. The vegetation cleared formerly has not fully established making accessibility easier

iii. The existing route avoids most of the degraded mining areas and sites as much as possible;
iv. The existing (selected) route avoids settlements and built-up areas traversing farmlands and green fields; and
v. The communities within the corridor are aware of the project (existing RoW) making community acceptability easier, limiting encroachment and resettlement impacts.

This option is, however, associated with legacy issues from the previous project, notably, non-payment of compensation to persons affected during the demarcation of the Centre line and Right of Way previously under the old project. Figure 2 presents the selected route alignment).

Another consideration was that the selected route in 2014 avoided sensitive environmental areas inside the project zone as much as feasible by GRIDCo, in addition to the limitations and requirements associated with the selection of corridors (see Table 3 for the list of environmentally sensitive areas avoided during route selection).

Table 3: Environmental and Social Sensitive Areas Avoided by the 2014 Right-of- Way

Areas Protected by Law	National parks (current or anticipated), Reserves (flora, fauna), Protected forests
Forest Areas and Vegetation:	Forests and forest groves, Plantations (pines, cashew trees, fruit trees), Gallery-forests and coastal vegetation hedges, mangroves, other humid or tropical ecosystems, areas containing threatened species and species of social, economic, cultural, and scientific interest
Faunal Areas:	Bird migration corridors and flock areas, recognized faunal habitats, threatened species
Human habitat:	Populated areas (cities, villages, hamlets, etc.), Land use, anticipated development zones
Cultural Areas:	Sacred forests and woods, Archaeological or historical sites, Panoramic and tourist sites, Shrines/religious sites/cemeteries

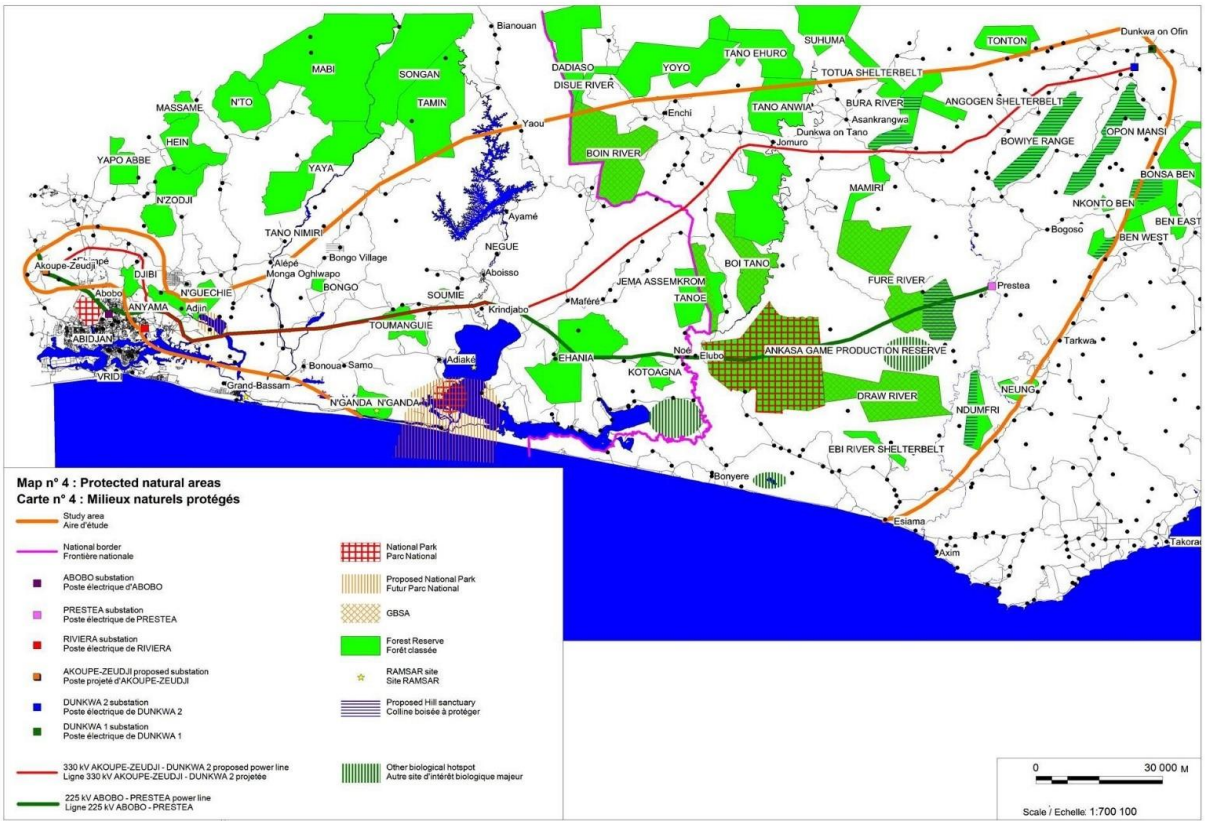


Figure 2: Transmission line route showing Forest reserves, townships, waterbodies and others

3.2.3 Alternative Phase Conductors

Aluminium and Copper insulators were evaluated for this project. For Aluminium Conductors, Aluminium Conductor Steel Reinforced (ACSR) conductors, that is, aluminium conductors with a steel wire core, All Aluminium Alloy Conductors (AAAC) and Aluminium Conductor Alloy Reinforced (ACAR) conductors are the most common types used for high tension and very high-tension overhead lines.

Aluminum conductors are light, more cost-effective, and have a higher strength-to-weight ratio making them ideal for long transmission lines, where weight and cost are significant factors in the selection matrix. However, they have lower electrical conductivity compared to copper and are more prone to corrosion. Copper Conductors, on the other hand, offer superior electrical conductivity, better thermal resistance, and greater durability, but they are heavier, more expensive, and harder to work with in large quantities.

The project chose to use aluminum due to its cost-efficiency and suitability for long-distance transmission, while also considering the specific needs for durability and conductivity in certain sections of the transmission network. The choice of aluminum was also influenced by compatibility with the existing insulators within the Ghana network.

Therefore, in terms of strength, system safety, and security requirements, the proposed network's design criteria would be comparable to, or at least compatible with, those of the current grid. ACSR is the selected option for this project.

3.2.4 Tower Design Alternatives

Several criteria were considered while determining which type of tower design to utilize for the project. These included wind loads, loading stresses, and safety considerations. Others were phase-to-earth wire clearances and clearances to the tower structure (the ground level of the attachment point of the suspension and anchor strings). Three configurations were studied for the suspension towers. These were: Triangular configuration tower with two earth wires, Cat's head configuration tower and Horizontal configuration tower (see Appendix XII for illustrations of the Alternative Tower Designs).

a. Triangular Configuration tower with Two Earth Wires

Triangular Configuration Towers with two earth wires offer good structural stability and are resistant to wind loads. This configuration also provides enhanced protection against lightning strikes, hence, improving system reliability. It requires less space, making it suitable for areas with limited Right-of-Way.

Nonetheless, the compact design can make maintenance more challenging, especially when accessing conductors. It requires more steel for construction, leading to potentially higher costs. The triangular shape causes greater visual intrusion compared to the other two configurations (Appendix XII).

b. Cat's Head Configuration Tower

The Cat's Head Configuration is more suited for difficult terrains such as mountains. The unique shape of these types of towers can make them blend more easily into certain landscapes, reducing visual intrusion. It allows for optimal spacing between conductors, reducing the risk of short circuit. Nonetheless, this tower configuration does not support heavy load compared to the triangular and horizontal configurations limiting its use for high-capacity transmission lines such as 330KV transmission lines. The unconventional shape can complicate construction and increase costs. Finally, accessing conductors during maintenance is more difficult due the tower shape (Appendix XII).

c. Horizontal Configuration Tower

The horizontal arrangement of conductors is straightforward; hence it reduces construction complexities and cost. It also makes conductors easier to access during repair and routine maintenance. The design allows for even distribution of mechanical loads, enhancing structural integrity. This style of towers have the extra benefit of requiring less land for the tower support system and having exceptionally sturdy construction (Appendix XII).

Horizontal Configuration Towers, however, require more land area for installation due to the horizontal spread of conductors, potentially increasing Right-of-Way extent and cost. Conductors may sag more between towers under this configuration, necessitating more frequent maintenance or closer tower

spacing. The horizontal configuration may have height limitations, which could affect performance in areas with tall vegetation or buildings.

GRIDCo opted for the horizontal configuration due to its ease of maintenance and straightforward design, which simplifies construction and reduces costs compared to Triangular and Cat's Head Tower Configuration. The even load distribution and simple structure make it ideal for long transmission lines, where reliability and ease of access are crucial. Despite requiring more land, the benefits of reduced construction complexity and easier maintenance outweighed the limitations of this configuration.

4 DESCRIPTION OF THE PROJECT

4.1 Project Location & Site Setting

The proposed transmission line is intended to span both Ghana and Côte d'Ivoire. This report's analysis is limited to the Ghanaian section of the line. Five districts in three regions will be involved in the construction and operation of the proposed transmission line and the sub-station (Figure 1). These districts are:

- Upper Denkyira East Municipal Assembly (Central Region);
- Wassa Amenfi Central District Assembly (Western Region);
- Wassa Amenfi West Municipal Assembly (Western Region);
- Wassa Amenfi East Municipal Assembly (Western Region) and
- Aowin Municipal Assembly (Western North Region).

The transmission lines will be built inside a 40-meter-Right of Way over a distance of approximately 125 km on the Ghanaian side from the Côte d'Ivoire border (Omanpe) to the upcoming substation at Bibianiha near Dunkwa-on-Offin (see Appendix XI). Figure 3 shows map of the administrative area of the proposed transmission line. The following restrictions on the Ghanaian side limit the geographic area used to choose the least effect corridor.

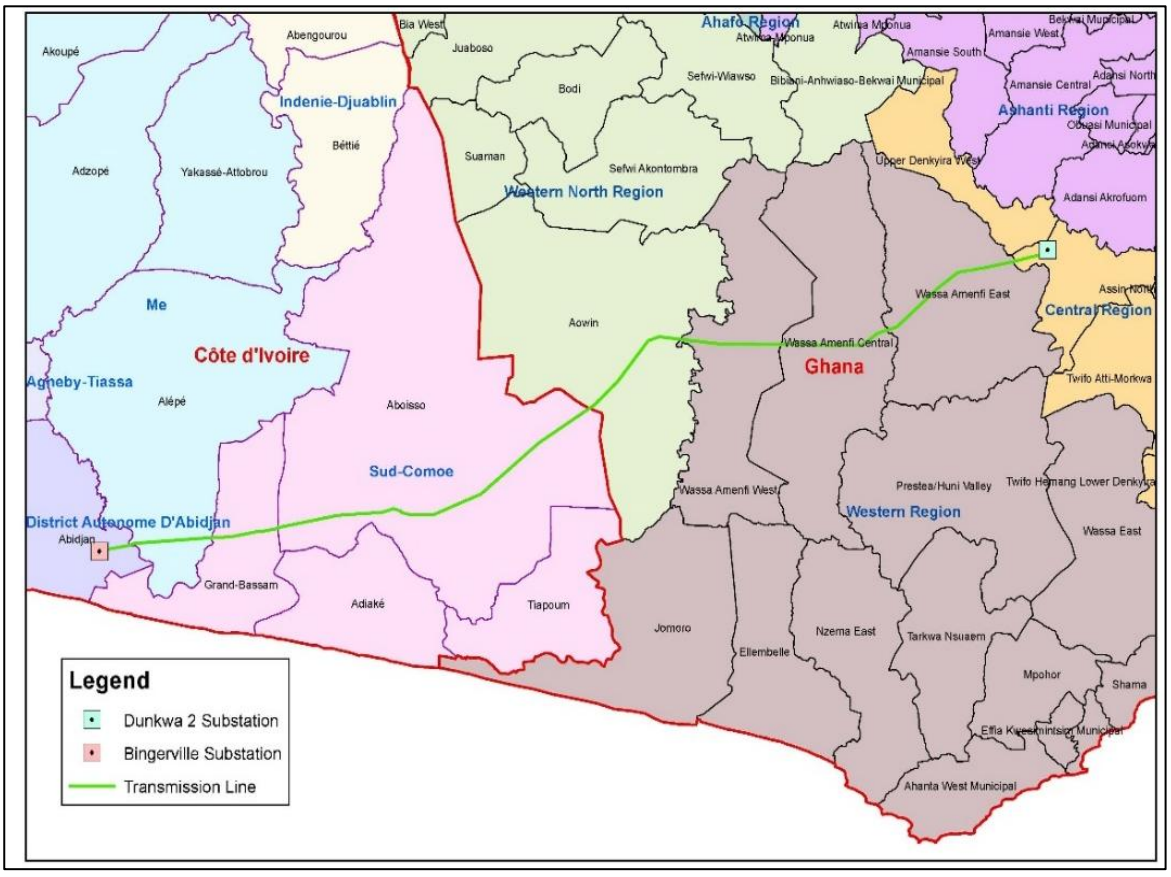


Figure 3: Administrative map of the Côte d'Ivoire-Ghana sections of the Transmission Line

4.2 Accessibility to Substation Site

Dunkwa II Substation, to be located South-West of Dunkwa-on-Offin is the starting point of the project in Ghana. The substation for "400kV/330kV Côte d'Ivoire - Ghana Interconnection Reinforcement Project", is located 1.6 km southwest of Bibianiha, a village located 3km south-east of the town of Dunkwa-on-Offin. The village has a motorable untarred road which doubles as access to the proposed substation site. Figure 3 shows the proposed road to the substation at bibianiha. Figure 4 shows the existing lines near proposed Dunkwa II substation site, as it will be located in proximity of the two 161kV power lines (Prestea-Obuasi and Bogosa-Dunkwa I) and of the line route of the 330kV power line between Aboadze and Kumasi. Figure 6 shows the location of the project within the high-tension electricity network of SE Côte d'Ivoire and SW Ghana. Figure 7 shows some aerial photographs of the project corridor showing landscapes interspersed with significant galamsey activities.

Figure 4: Area photograph of the proposed sub station at Bibianiha

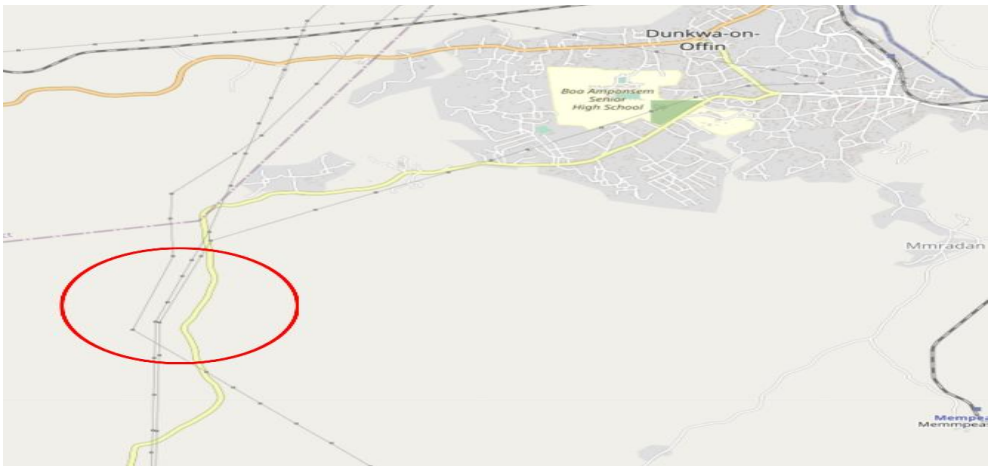


Figure 5 Access to the proposed Dunkwa II Substation

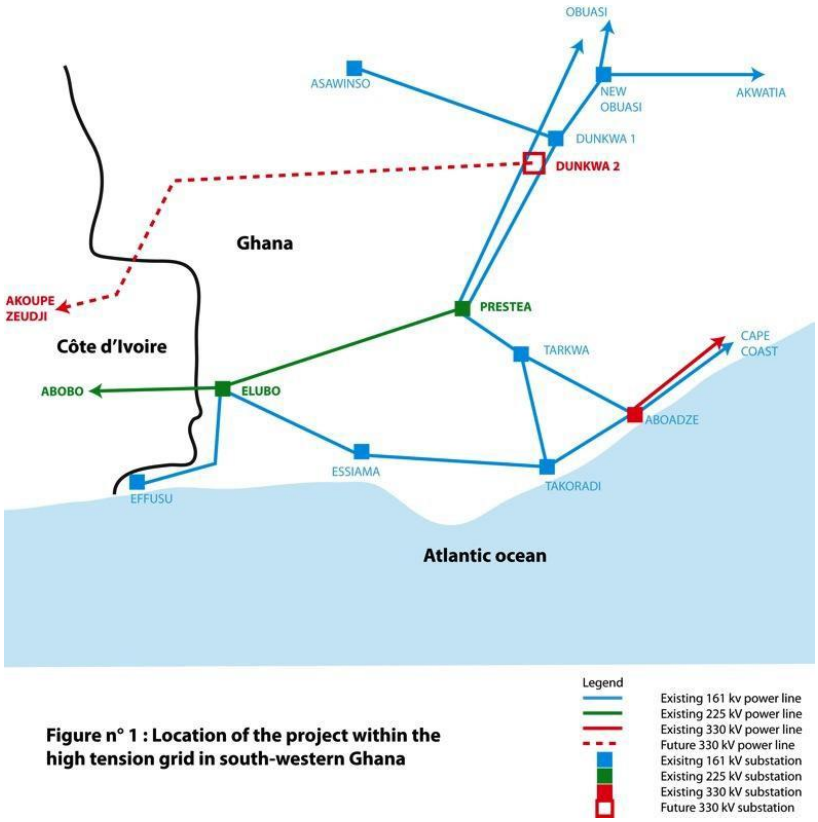


Figure n° 1 : Location of the project within the high tension grid in south-western Ghana

Figure 6: Project location within the high tension electricity network in SW Ghana

Figure 7: Some aerial photographs of the project corridor showing landscapes interspersed with significant galamsey activities

4.3 Overview of Project Development

The activities to be undertaken during this phase of the proposed project field surveys, consultations with the authorities and communities affected, feasibility survey, editing of the Scoping Report, Line Route Study, Feasibility Report, ESIA and two associated documents: ESMP and RAP. Other activities are as follows:

4.3.1 Right of Way Acquisition

A 40m corridor is to be acquired for the construction of the project. The entire stretch of the RoW falls within Upper Denkyira East Municipal (Central Region); Wassa Amenfi Central District (Western Region); Wassa Amenfi West Municipal (Western Region); Wassa Amenfi East Municipal (Western Region) and Aowin Municipal (Western North Region).

Thus, the total land take for the project is expected to be approximately 500 hectares and the acquisition would be done through the state power of eminent domain. GRIDCo, in collaboration with, Lands Commission will ensure that all properties (land, structures, and crops) within the 40m corridor are valued for fair and adequate compensations at replacement to be paid to as Project Affected Persons (PAPs)- those whose livelihoods and assets such as land, farms and structures are impacted by the project activities.

4.3.2 Access Tracks

Access tracks of approximately 3.5 m to 5 m wide, i.e., sufficient width for construction and subsequent maintenance traffic will be created and maintained within the RoW under the towers and from nearby road networks.

4.3.3 Dunkwa II Substation

Dunkwa II Substation, to be located at Bibianiha, South-West of Dunkwa-on-Ofin is the departing point of the project line in Ghana. The substation located 1.6 km southwest of the Centre of Bibianiha, a village located 3 km from the town of Dunkwa. There are existing lines near the proposed location of the Dunkwa II substation, as it will be located in proximity of the two 161kV power lines (Prestea-Obuasi and Bogoso-Dunkwa I) and of the line route of the 330kV power line between Aboadze and Kumasi.

4.4 Pre-Constructional Phase

The project's field surveys, discussions with relevant authorities and communities, update of feasibility study, Line Route Study, ESIA, and two related documents, ESMP and RAP, are among the tasks to be completed during this stage of the proposed project.

4.4.1 Line Route Survey

Desktop studies were first carried out using Google Earth maps and Ghana topographical maps to update and identify the possible transmission line corridors from the proposed Dunkwa II Substation to the Ivorian-Ghanaian border, Omanpe near Kwawu in the Aowin Municipality of the Western North Region. This was followed by a reconnaissance survey along the proposed routes to assess the suitability for selection of an optimal one. The site visits also assisted in identifying features on the ground within a 100m-500m radius of the optimal route which could not otherwise be identified by the Google maps or topographical maps using drones. The avoidance of the Ankasa National Park, about 50km away from the selected route), three forest reserves (Jema-Asemkrom, Boin-Tano and Draw River (forest reserve) one globally significant biodiversity areas (how many were avoided), villages (32), property destruction, and areas of socio-cultural relevance are a few of the reasons that went into choosing the optimal route for the transmission line.

4.4.2 Consultations

A number of traditional authorities in the affected communities, opinion leaders, Municipal and District Assemblies, District Forest Reserve offices, Mineral Commission offices, and regulatory agencies were consulted during the ESIA study. Some of these consultations are detailed in Chapters 4,5 and Appendixes VI, VII

4.4.3 Preparation of Environmental Impact Assessment for World Bank Approval and Environmental Permit

ESIA preparation is mandatory to allow for the commencement of the physical construction for such a project. Various activities have been undertaken regarding the acquisition of the Environmental Permit for the project including the registration of the project, approval of Scoping Report and preparation of this draft ESIA for review and approval. An Environmental Permit will subsequently be issued upon payment of processing and permit fees in line with Fees and Charges (Miscellaneous Provisions) Act, 2022 (Act 108). The Permit would outline various conditions that must be adhered to in project implementation. It must be noted that it is an offense under Regulation 29 of the Environmental Assessment Regulations LI 2504 of 1999 to start a project without an Environmental Permit. The World Bank will also review and approve the ESIA prior to the commencement of works.

4.4.4 Updating the Resettlement Action Plan (RAP)

The Ghana–Côte d'Ivoire Interconnection Reinforcement Project is expected to result in land acquisition and economic displacement, primarily due to the establishment of the 40 m Right-of-Way and construction of transmission towers and associated infrastructure. These impacts include loss of land, crops, trees, and temporary disturbance to livelihoods.

This section of the ESIA provides only a high-level summary of resettlement-related impacts, in accordance with World Bank Environmental and Social Standard 1 (ESS1). All detailed resettlement aspects, including identification of Project Affected Persons (PAPs), asset inventories, valuation, compensation entitlements, livelihood restoration measures, and implementation arrangements, are fully addressed in the standalone Resettlement Action Plan (RAP) prepared in accordance with World Bank ESS5.

4.4.5 Valuation, Compensation & Land Acquisition

The land acquisition for the right of way (RoW) of the project involves enumeration, referencing of properties within the 40m corridor, valuation of those properties, and compensation payment to the affected owners. These activities wil be carried out by Certified Valuers in the Lands Management Section of GRIDCo Engineering Department with the support of the traditional and the local administrative authorities. The valuations of the affected properties (buildings, lands, and crops) contained in the RAP are deemed fair, adequate and as replacement costs for the affected properties. Again, the preparation of the RAP would be guided by the GRIDCo Land Acquisition and Resettlement Framework Policy and the Lands Act of 2020 (Act 1063).

4.4.6 Acquisition of The Right-Of-Way (ROW)

The proponent will then proceed to acquire the Right-of-Way in accordance with all laws, rules, operational directives, and guidelines upon the EPA issuing an environmental permit.

Article 20 of Ghana's 1992 Constitution stipulates that all parties impacted by state acquisitions must get just and sufficient compensation. RAP will therefore be prepared in line with principles of World bank ESS5 to acquire the RoW for the construction of the project.

This will be done through referencing of all properties, land, crops and buildings, by an independent consultant, Studio Pietrangeli (SP), in collaboration with the Lands Commission to be monitored by the Land Management Department of GRIDCo.

4.4.7 Sourcing of Funds and Procurement

Another activity that will depend to a large extent on the issuance of an environmental permit will be the securing the funding for such a major development. World Bank is the funding agency for this project.

All procurement of goods and services will be done in compliance with national laws and World Bank procurement requirements. Most of the materials and other components of the transmission line will be manufactured and procured internationally, as they are not available for purchase in Ghana. It is expected that project contractors would source these from worldwide level suppliers. Catalogs, certificates, references list, etc. are to be provided to GRIDCo for concurrence. The equipment should have the minimum but necessary configuration to achieve the project's objectives. The procurement of the equipment will take into consideration past importation records of such equipment, the operation, and

maintenance capability of GRIDCo, and other relevant matters. The manufacturer's authorizations are to be provided showing that the Contractor has been duly authorized by the main manufacturers for this project to supply and install that item in Ghana.

4.4.8 Impacts on Biodiversity

The Ghana–Côte d'Ivoire Interconnection Reinforcement Project is expected to generate direct, indirect, and cumulative impacts on biodiversity during both the construction and operational phases. Vegetation clearing within the Right-of-Way (RoW), construction of tower foundations, development of access tracks, and long-term maintenance activities will result in habitat loss, habitat degradation, and habitat fragmentation along the transmission corridor.

Construction activities will cause disturbance and temporary displacement of terrestrial fauna due to increased noise, human presence, and machinery movement. In addition, the transmission line poses risks to avifauna through collision and electrocution, particularly during the operational phase. The alteration of habitat structure and disruption of ecological corridors may also affect wildlife movement and ecosystem connectivity.

Over the long term, cumulative impacts may arise from repeated vegetation management and increased access to previously undisturbed areas, potentially leading to localized reductions in species abundance and changes in ecosystem functions.

4.5 Construction Phase

i. The following construction activities will be undertaken:
ii. Geotechnical Investigations
iii. Tower spotting
iv. Construction of access and tower corridor tracts
v. Clearing of right-of-way
vi. Clearing and excavation of tower base and foundation
vii. Clearing of tower track
viii. Storage and transportation of equipment and materials
ix. Erection of towers and stringing of transmission lines

4.5.1 Geotechnical Investigations

A detailed geotechnical investigation will be carried out for the towers for the proposed transmission line. The work will comprise drilling boreholes and performing a Standard Penetration Test to satisfactory depths. The field and laboratory tests will then be carried out to provide the subsoil profile and the soil physical and chemical properties required for calculations of the foundation soil bearing capacity and help in foundation design.

4.5.2 Tower Spotting

This involves choosing each location where the towers (or pylons) will be installed. It is important to note that tower spotting occurs along the whole transmission line.

Land surveying and soil study are related activities to tower spotting. These operations require clearing some vegetation and access to the line path, which could result in impacts on farms. The best foundation and design for any tower will be determined via topographical studies and tower spotting. At this point, the final tower site may be somewhat modified to accommodate the transmission line corridor's vertical profile and avoid any buildings that might have been built after baseline data was gathered for the proposed RoW. These changes will only be made in directions of a few meters.

4.5.3 Construction of Access and Tower Corridor Tracts

A maintenance track of 4 m width shall be constructed along the entire length of the wayleave. Wherever possible, existing access tracks shall be used to gain access to the proposed line route. Where there are no such tracks available, new access tracks will be constructed from the closest public road to the RoW. The access track as well as the maintenance track in the RoW, which will be constructed during the construction phase, will be retained for the operational phase. The tracks will be used for the transportation of labour and material to the line route as well as for the installation of towers and conductors.

The tracks will be cleared of tree stumps, shrubs and other vegetation likely to obstruct the transport of construction machinery, equipment and maintenance staff to the tower corridor. Cut trees will be neatly stacked to one side of the proposed tracks for the use of, or sale by, the communities close to the site of clearance.

4.5.4 Clearing of Right-Of-Way

The construction and operation of the proposed line will require a Right-of-Way of 20 m width on each side of the centre line of the transmission line. This 40 m wide wayleave, which will run the total length of the transmission line, shall be cleared of vegetation to a height of about 1.25 m above ground level, except in areas crossing forest galleries along rivers of great ecological interest in particularly for rare species which could be adversely affected by habitat fragmentation of the forest cover. In this case the vegetation will be kept and maintained up to a height of 8m by use of raised pylons overhanging the forest gallery**.**

Trees considered being potentially capable of threatening the proposed transmission line beyond the 40 m width will be cut down or pruned as appropriate. These are trees whose branches might grow large enough to obstruct the transmission lines or which could topple over and cause harm to the line. Mechanical methods will be employed for all vegetation clearance (chain saw, forestry wood chipper). There will be no usage of herbicides to manage the vegetation.

4.5.5 Clearing and Excavation of Tower Base and Foundation

The proposed tower base areas will also be totally cleared and all roots removed. With a total of about 320 pylons to be constructed in Ghana, a total tower base area of about 15 000 m^2 will be cleared and all roots removed for the purpose of the construction of the transmission line (Figure 8). The area to be cleared for a single tower will be made up of the dimensions of the tower base (for ex. 7m x 7m depending on tower design) with an additional buffer of 2m on the periphery of the base (in total 9m x 9m).

Figure 8 Tower-base and foundation

Tower foundations will vary according to the prevailing geology. A majority of them will however have footings of the pad and chimney type, which will be excavated mechanically. By this method, a concrete pad will be constructed at the bottom of the excavation, and each foot of the tower erected within its own 'chimney' of steel reinforced concrete. After about two days, the formwork will be removed and the excavation will then be backfilled to original ground level and consolidated.

The ground surfaces of the tower sites will be so graded as to gently provide drainage away from the tower legs and to avoid the collection of water (leading to the creation of stagnant pools) at the tower bases. Where necessary, (particularly on hillsides), terracing, cribbing or riprap may be used to provide protection for tower foundations.

In areas prone to flooding (swampy areas) a raft foundation for the transmission line towers may be used. The raft foundation is similar in concept to the pad and chimney foundation except all four feet of each tower will be set on a single raft of concrete.

4.5.6 Tower Assembly & Installation

Once foundations have achieved their designed strength, the towers will be assembled and erected. These works will be undertaken within the RoW to avoid any additional vegetation clearance. For such self-supporting towers, the construction materials will be delivered to the site, and the full assembly conducted at the tower locations. Construction time at each site will be short at approximately 3 days for the self-

supporting towers. Once a full section of towers has been assembled, the lines will be strung. This involves attaching pulleys to each isolator, threading a rope through these, and then pulling the conductor through, under tension, to ensure that no contact is made with the ground. Any damage to the conductor during this process (particularly any contact with the ground) will impair the line function. (Figure 9)

Figure 9 Tower Assembly and Installation

4.5.7 Storage and Transportation of Equipment and Materials

Almost all the materials to be used in the construction of the transmission line will be imported. Such components include tower steel and its components in broken down form, conductors, insulators, transformers, switchgear, etc. Materials that will be procured locally will include aggregates i.e. sand and stone, cement and other miscellaneous supplies and services. The imported components will be delivered by ship to either the Tema or Takoradi ports. After clearance from the ports, the materials shall be stored at the Contractor's storage site. It must be noted that the materials for the towers will not be bulky and unwieldy. They will therefore not require any specialized vehicles.

During construction, the materials will be trucked to the site via public roads and access tracks. Vehicle movements will be minimal since the site offices will be put close to the proposed line route.

The locations of the site offices cannot be specified now but their construction will not involve extensive vegetation clearance. In addition, the site/workers' camp will be constructed:

- at least 0.5 km from natural water courses and marshlands
- at least 1 km from settlements and on relatively level ground.

The location of the work camps will not impact negatively on cultural properties, and on forest reserves. It will also be located as to avoid the destruction of crops and buildings.

4.5.8 Commissioning

Final commissioning involves the testing of the towers to ensure that all steelwork joints are correctly made and are tight. The connection of the electrical plant will be checked, and once approved power connections are established. Commissioning of the line will take approximately one week.

4.5.9 Post Construction Demobilization

Upon completion of the construction phase and commissioning, the Project Contractor shall be responsible for all demobilization activities (involving systematic tasks such as equipment removal, material disposal, and document organization) per the requirements of the contract agreement documents.

4.5.10 Erection of Towers and Stringing of Transmission Lines

After transporting the steelwork and its components to the construction yards the transmission towers will be erected. Typically for a 330 kV and other high voltage transmission line, the average span between towers will be about 400m giving a total number of towers for this project in Ghana of about 320 pylons. The towers will have concrete footings with foundation depths of 3m or more depending on the nature of soils at the selected tower spots. Once the towers are erected, the conductors and shield wires will be strung and appropriately 'tensioned' to provide the minimum clearance (8 m) between ground level and the lowest conductor.

River Crossings and Key Details

The proposed transmission line is expected to cross several overhead electricity distribution lines, rivers, and streams. On the Ghana side, the major rivers that the transmission line will cross are:

- Boin River (Border): Serving as part of the frontier, this river spans a key crossing point between Ghana and neighboring regions.
- Disue River: Known for its moderate flow during most of the year, but with a history of swelling significantly during rainy seasons.
- Tano River: One of Ghana's longest rivers, flowing from the Bono region to the south-western coast, with a high-water level during peak rainy seasons.
- Ahuro River: A tributary known to flood occasionally in low-lying areas during heavy rains.
- Mamire River: A smaller watercourse, but prone to seasonal flooding and erosion along its banks.
- Yaya River: This river experiences mild seasonal variations but can reach higher flood levels during particularly heavy downpours.
- Merechu River: Known for its varying flow rate, which intensifies during heavy rains and poses a risk of flooding in nearby communities.

In crossing these water bodies, the transmission line design incorporates safety features to mitigate potential impacts from these rivers' fluctuations, particularly during the rainy season.

River's Highest Water Level and Statistics

The river height clearances were determined based on hydrological data from local meteorological and environmental agencies. Historical water level data during peak rainy seasons over the past decade were analyzed to define the highest water levels for each river. For example, the Tano River's highest water level during the rainy season has been recorded at approximately 400m meters. The project team has used this information to ensure adequate safety margins and has applied a minimum clearance of 8 meters between the lowest conductor and the highest possible water level.

Guard structures will be employed where the line crosses overhead electrical distribution lines, communication lines, and roads. These structures are essential for ensuring that the power line does not create hazards or disturbances to existing infrastructure.

Transmission Tower Heights and Clearances

Based on the line survey and river crossing data, the average river crossing span is approximately 300 meters, ranging between 200 and 400 meters. Given the need for an 8-meter clearance, along with the rivers' highest water levels and a safety margin of 10 meters (ranging between 5 and 15 meters), the conductor attachment height at the towers will be approximately 33 meters, with total tower heights reaching around 50 meters.

Once the towers have been erected and the lines strung, comprehensive testing and measurements will be conducted to verify that the transmission line performs as expected. Special attention will be paid to the clearances between the lines and the ground to ensure compliance with safety standards. The lines will also be tensioned according to the project specifications.

Soil and Environmental Considerations

After the construction of the transmission line, the soil conditions along the right-of-way will be assessed for potential issues, such as soil compaction or erosion. Bare soil areas will be left to naturally re-colonize with native vegetation, helping to stabilize the soil and mitigate erosion risks.

Consideration of Extreme Weather Events, Including Flooding

One critical addition to the project planning is the need to consider extreme weather events, including flooding. As climate change accelerates, the frequency and intensity of such events are likely to increase. To address these risks, the project team will incorporate designs that account for extreme flooding events in vulnerable areas, particularly around river crossings. Flood-resistant infrastructure, additional drainage

measures, and adaptable designs will be put in place to ensure the safety and longevity of the transmission line.

The line will be fitted with an optic fibre cable/ Optic Ground Wire (OPGW), which will be used for system protection, control and communication purposes. (Figure 10)

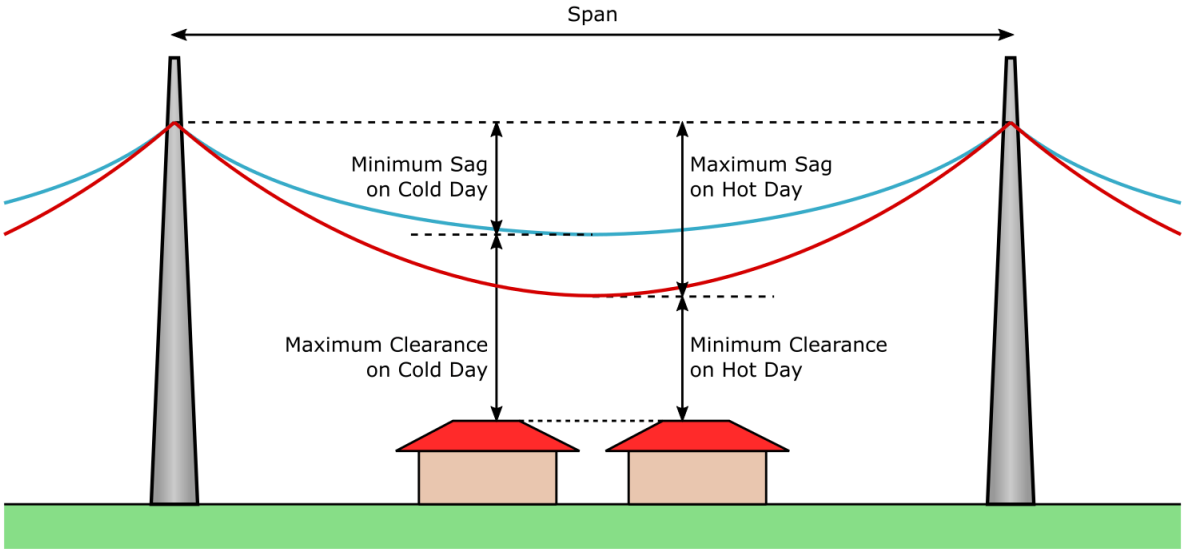


Figure 10; Erection of Towers and Stringing of Transmission Lines

4.5.11 Substations Construction

A location layout plan has been developed for the Substation construction. The substation shall be constructed at the terminal point of the line at Bibianiha near Dunkwa-on-Offin and shall be dubbed Dunkwa II Substation. Construction shall involve the casting of all the necessary concrete foundations required to support the new equipment. Once these have achieved a suitable strength, the electrical equipment will be delivered and mounted. This involves the use of heavy lifting equipment to position the plant followed by wiring and connection. All oil-filled plants will be charged with suitable oils once this equipment is in place.

Construction Process and Design Scheme

The substation construction will begin with the preparation of the site, followed by the casting of reinforced concrete foundations. These foundations will support the substation's major equipment, including transformers, circuit breakers, switchgear, and control panels. The concrete must be designed to meet load-bearing requirements and withstand both operational stresses and environmental factors, such as soil conditions and potential seismic activity.

Once the concrete foundations have cured and reached the required strength, the electrical equipment will be delivered and installed. This phase involves the use of heavy lifting machinery to position the components, such as transformers, which will then be wired and connected according to the substation design.

Oil-filled equipment, such as transformers, will be charged with suitable insulating oils. Based on industry standards and environmental safety considerations, the use of non-PCB (polychlorinated biphenyl) oils, such as biodegradable ester-based oils or mineral oils with low toxicity, will be prioritized. PCB oils are highly discouraged due to their environmental and health hazards. All oil-handling operations will be conducted with care to prevent leaks and spills, and **oil containment systems** will be installed around transformers to mitigate any accidental discharges.

Safety and Infrastructure Considerations

To ensure the safety of both the substation and the surrounding area, the following features will be included in the design:

1. **Fencing**: The substation will be **fully fenced** to secure the site and prevent unauthorized access. The fencing will be designed to meet security standards, with gates and access control systems for staff and maintenance teams. Signage warning of high-voltage hazards will be prominently displayed.
2. **Workstation and Staffing**: The substation will include a **control room** or **workstation** for monitoring and operating the equipment. This workstation will be equipped with control panels, monitoring devices, and communication systems. The substation will also accommodate staff, including technicians and operators, who will manage the daily operations and maintenance tasks.
3. **Drainage System**: To prevent waterlogging and damage to equipment, a **comprehensive drainage system** will be constructed. This system will be designed to manage rainwater runoff and any other water ingress, particularly during extreme weather events such as heavy rains. Proper grading of the site and the use of storm drains will ensure that water is efficiently directed away from critical equipment.
4. **Lightning Protection**: The substation will be equipped with a **lightning protection system** to safeguard against lightning strikes, which could cause significant damage to the equipment. **Lightning arresters** and **grounding systems** will be installed to channel lightning energy safely into the ground, minimizing the risk of electrical faults or equipment damage.
5. **Fire Prevention and Safety Systems**: Given the presence of oil-filled transformers, fire prevention measures will be integral to the design. The substation will be equipped with **fire suppression systems**, including fire extinguishers, and containment pits to capture and contain any oil spills that could lead to a fire hazard.
6. **Environmental Safeguards**: Measures will be taken to ensure that the construction and

operation of the substation comply with environmental regulations. This includes managing noise levels during construction, controlling dust emissions, and ensuring that all waste, including oil and electrical components, is properly disposed of.

Recommendations for Further Consideration

In addition to the design elements outlined above, it is recommended that the following features be further considered or enhanced:

- **Backup Power Supply**: Installing a backup power generator to ensure continuous operation of critical equipment in case of grid failure.
- **Surge Protection**: Including additional **surge protection devices** for equipment sensitive to voltage spikes and surges, particularly during grid disturbances or switching events.
- **Sustainability**: The possibility of incorporating renewable energy sources such as solar panels to power auxiliary equipment and lighting within the substation.

Testing and Commissioning

Once all equipment is in place, **extensive testing and commissioning** activities will be carried out to ensure the substation operates safely and efficiently. This will involve tests on insulation resistance, transformer integrity, switchgear operation, and system synchronization. The substation will not be brought online until all systems have passed the necessary tests and comply with operational standards.

The Dunkwa II Substation will be constructed with safety, security, and operational efficiency as priorities, integrating modern standards in equipment handling, environmental safeguards, and lightning protection. These design features will ensure the substation's long-term functionality and safety while minimizing environmental impact.

4.6 Operational Phase

The project's operational phase will include maintaining the RoW and all high-tension equipment in addition to commissioning the power line (pylons, conductors, substation and cables).

The operation and maintenance of the transmission line will be based on accepted international standards, such as those of the International Electrotechnical Commission (IEC). GRIDCo has its own specific procedures for the operation and maintenance of its lines as set out in the 'GRIDCo Corporate Safety Rules' and RoW management Policy. This document concerns itself with issues which are considered of paramount importance such as public security and the safety, health and welfare of maintenance crew.

The primary tasks to be completed during the transmission line's operational life cycle are vegetation control in the RoW, routine and emergency maintenance and repairs, and surveillance of the state of the conductors, towers, and RoW. GRIDCo in line with Legislative Instrument (L.I) 542 is mandated to maintain and protect its transmission line RoWs from hazards and encroachments. However, Regulation 1(g) (ii) of

the L.I authorizes GRIDCo to approve and regulate sustainable undertakings within the transmission line RoWs.

It is based on this legal framework that GRIDCo has recently developed a RoW Management Policy, which among other things set out guidelines for some sustainable undertakings to be permitted under the RoW including annual crop farming subject to approval by GRIDCo.

GRIDCo maintains a Transmission Department with headquarters in Tema that is responsible for the operation and maintenance of its transmission network in Ghana. The Company carries out its duties under three broad categories. These are discussed below.

4.6.1 Routine Running Maintenance

This comprises of the Department doing regular maintenance to guarantee the integrity and security of the lines. The following are some of the maintenance tasks completed here:

- Aerial surveillance by helicopter. This is done to ensure that potentially hazardous defects are pre-empted and the integrity of the line is maintained and sustained. This is done on an annual basis.
- Foot patrol. The Line Maintenance Team carries out routine physical examination of the transmission line and its component parts to ensure the safety, security and integrity of the line. Such activities are carried out yearly.
- Security patrol. This is done to check on segments of the line close to populated areas for signs of vandalism, theft of bolts and nuts, tampering, and general security of the lines. It is to ensure an early detection and rapid response to acts of vandalism and to rectify such situations as promptly as possible.
- Tower auditing and repairs. This provides a means of assessing the ageing process of towers. It starts one year after the commissioning of a line section and it follows a one-year cycle. In a cycle of tower auditing, 10% of all suspension towers and all dead-end towers are thoroughly examined. As the line ages, it is subjected to wear and fatigue which may not be noticeable by a distant visual inspection. Detection and tightening of loose bolts on support and hardware can reduce premature wear and indicate the need for replacement of worn components before failure.
- In the course of operation, all identified defects are repaired. Such defects may include the replacement of defective conductors, flashed over insulators, broken dampers, vandalized components, and maintenance of access tracks and RoW.

4.6.2 Major Maintenance

These are scheduled maintenance programmes that are carried out on the transmission line as a result of the ageing of towers, the conductors and various equipment in the substation. The repairs may also arise out of the running maintenance activities. These maintenance schedules are typically required since the lines pass through hazardous places (mining sites, industrial areas and coastal zones prone to salt spray). The following are a few of the tasks completed as part of the significant maintenance program:

- Re-insulation of sections of the transmission line
- Treatment of rust and re-painting of tower components
- Replacement of corroded towers and transmission line components
- Replacement of conventional bolts and nuts with anti-theft fasteners,
- Rehabilitation of access roads and tracks.

4.6.3 Emergency Maintenance

These are activities relating to correction of sustained line faults. These may span a whole spectrum of minor faults (e.g. insulator failure) to such major defects as tower failures. Some of the activities carried out under this programme include the construction of a temporary by-pass line to replace collapsed sections, reconstruction of the collapsed section as well as aerial and ground patrols to locate sustained line faults.

5 BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

5.1 Data Collection Methodology

A reconnaissance survey was undertaken in December 2023 to gather the biophysical and socio-cultural data from the project zone of influence. Published district profiles of the Upper Denkyira East Municipal (Central Region), Wassa Amenfi Central District (Western Region), Wassa Amenfi West Municipal (Western Region), Wassa Amenfi East Municipal (Western Region) and Aowin Municipal (Western North Region) Assemblies were the main source of the secondary data for the baseline. The baseline which comprises primary and secondary data collected within the project area covered the following: Location and Size, Topography and Drainage, Climate, Vegetation and Soils, the Natural Environment, Water Resources, Climate Change, and Demographic Characteristics.

5.2 Upper Denkyira East Municipality

5.2.1 Location and Size

The municipality is situated between latitudes 5° 30' and 6° 02' North of the Equator and longitudes 1° W and 2° West of the Greenwich Meridian. It is bodered by Adansi South to the north, Assin North Municipality to the east, Twiffo Atti-Morkwa District to the south, Wassa Amenfi East to the west, and Upper Denkyira West District to the north-west. With 501.94 square kilometers of land, or 5.19 % of the Central Region's total land area, the Upper Denkyira East Municipality is quite small.

5.2.2 Topography and Drainage

The area falls under a forest-dissected plateau, rising to about 250m above sea level. There are pockets of steep sided hills alternating with flat-bottomed valleys. Dunkwa-on-Offin, the Municipal Capital, has a series of high lands circling it. The major river in the area is the River Offin. There are a number of streams which are tributaries to the river. Prominent among them are the Subin Ninta, Aponapon and Tuatian in the South, Afiefi and Subin in the North with the proposed transmission line route crossing Aponapon stream crossing in this district (Appendix IX).

5.2.3 Climate, Vegetation and Soils

Climate

The Municipality falls within the semi-equatorial zone, with its attributes. At 35ºC in the hottest months and roughly 20ºC in the coolest, the average annual temperature is maintained. A total of 120mm to 200 mm of precipitation occur throughout each of the two rainy regimes. September to mid-November is the second rainy season, while May to June is the first, with June being the heaviest. November through February is the primary dry season.

Vegetation

The Upper Denkyira East Municipality falls within the semi-deciduous forest zone. It consists of three layers which do not differ much from the rain forest. Evergreen trees are those found in the bottom levels and parts of the uppermost layers. This is a result of the area's typical moisture. Most of the secondary woods that remain are as a result of the growing cocoa industry and mining activity in the area, particularly in the northern portion of the Municipality. The forest is home to several valuable timber species, including *Triplochiton scleroxylon* (wawa) and *Khaya ivorensis* (African mahogany). The Benso-Benn Forest Reserve is the district's only significant forest reserve. Just 20% of the 86.03 square kilometers of total forest area is located inside the Upper Denkyira East Municipality. The settlements of Asikuma, Tegyemouso, Denyasi, Atobiase, Esaase, and Fawomanyo exist around the forest. The forest is home to a variety of highly valuable tropical hardwood species, including Edinam (*Entandrophragma angolense*), Mahogany (*Khaya ivorensis*), Odum (*Milicia excelsa*), and Wawa (*Triplochiton scleroxylon*). As a result, lumbering has contributed significantly to the district's economy. But because the forests outside of the reserves are not properly managed, this has caused several environmental issues including activities of Illegal chainsaw operators. In the Municipality, frequent bushfires have also contributed to various types of environmental degradation and the loss of forests. The majority of known species, including monkeys and antelopes, which were primarily located in woods, is currently in danger of being extinct.

The vegetation along the line route is mainly degraded fallow lands, cashcrop farms (palm, cocoa), cashfood crop farms (cassava, plantain), illegal mining (Galamsey). In this area, plant communities are often characterized by degraded forests, open scrublands, and grasslands, with pioneer species like *Chromolaena odorata* and *Andropogon gayanus* becoming dominant.

Soils

Forest ochrosols are the main type of soil present in the region. These soils have colors ranging from orange to brown. Compared to oxysol, the soil is not substantially leached. The soils are often alkaline and have higher levels of soil nutrients as a result of the less rainfall. They are the best soils in the nation in terms of crop productivity. The region is ideal for growing tree crops like oil palm and cocoa. Approximately half of the arable area in the Municipality is covered in cocoa. Other crops that perform well include plantains, cassava, and maize.

5.2.4 The Natural Environment

The Municipality is fighting small-scale miners, commonly referred to as "galamsey," in the fight against environmental deterioration. A significant amount of the Municipality's huge land area, as well as certain forest regions, have been degraded by their operations. A further obstacle to the green economy is the problem of illegal logging by chainsaw operators, both on and off reservations. Animals and other microbes are also becoming extinct as a result of it. The Municipality's Forest Services Division works to preserve and safeguard the forest by maintaining a patrol of forest guards to prevent illicit activities. In the Municipality, steps are also taken to guarantee the reforestation of endangered tree species. One cannot

undervalue the importance of waste management as a component of the green economy. In order to guarantee that waste is evacuated to the landfill, Zoomlion and the Municipality work together. However, because the dump site is full, the neighborhood is at risk of environmental contamination. Figure 11 shows degraded project area by the activities of illegal miners.

Figure 11: Degraded project area by the activities of illegal miners

5.2.5 Water Resources

Water situation has also been a burden on the Municipality since ensuring potable water embraces good health and development. The main sources of water in the Municipality are River (River Offin), Pipe borne water, boreholes, Small Town Water System and Wells. The water is used for household activities, drinking, fishing, "galamsey" activities to mention but a few. The following are the proportion of sources of water usage by household: 40.5% of households use pipe borne water, 34.6% use bore holes, 2,5% use unprotected wells, 0.1% use rainwater, 4.8% use bottled/sachet water,14.0% use river/stream and 3.5% use others.

It could be deduced that majority of the household depends on pipe borne for drinking and for other domestic purposes due to the presence of Ghana Water Company and Small-Town Water Systems, followed by boreholes in the Municipality. However, some of the households have two or more sources of water for their household and other activities. Information gathered from the community assessment found out that (60) communities need boreholes. Also, about 2.5 representing about 355 of the household use unprotected well and this call for an intervention since the effect of water borne diseases cannot be underestimated.

5.2.6 Climate Change

The long-term modification of global weather patterns particularly, increases in temperature and storm activity, that is thought to be a possible outcome of the greenhouse effect is known as climate change, sometimes called global warming. It is the detectable rises in the mean temperature of the landmasses, seas, and atmosphere of Earth.

The two main aspects of the municipality's changes that have been seen are variations in temperature and rainfall patterns. The emission of greenhouse gases (such as chlorofluorocarbon (CFC) from excessively used cars), deforestation (the loss of woodlots for light industrial and residential uses), illegal mining operations, and construction near waterways or flood-prone areas are some of the causes mentioned as being specific to the Municipality. These are some effects of climate change:

- Dwindling water and forest resources
    - Perennial drying up of water sources due to drought
    - Drying up of wetlands
    - De-vegetation of the land
    - Hardening of soil
    - Destruction of habitat of fauna
- Soil erosion (leading to siltation of drains and water bodies).
- Changing rainfall pattern - adversely affecting agricultural development.
- Extreme Drought (Drying out of rivers and streams as a result of farming along river banks; and dumping of waste into the river beds).
- Flooding as a result of heavy rains leading to the destruction of lives and property in communities such as are Sofokrom, Atachem, Accra Town, Railway/Kyekyewere Station, Presentease, Mbraiam, and Gambia, among others.
- Threat to (extinction of) plants and animal species

The Municipal Assembly has implemented the following mitigation and adaptation strategies for climate change:

- Tree Planting
- Conservation of forests
- Sustainable (Physical) development
- Good landscaping with plants
- Construction of drainage system
- Water Harvesting
- Dredging of silted rivers and streams to allow for free flow of run-off water when it rains
- Strict enforcement of good building standards.

5.2.7 Demographic Characteristics

Population

The Municipality has 101, 273 residents in total. Males make up 49.16 percent and females 50.84 % of the overall population. There is an annual population growth rate of 3.3%. In the Municipality, there are roughly 97 males for every 100 females, or a sex ratio of 96.67. Compared to the national growth rate of 2.7 % annually, the present growth rate of 3.3 % is greater. A population's age and gender are its most fundamental traits, and they have an impact on a variety of demographic and policy issues. Every population has a unique age and sex composition, which represents the quantity and distribution of men and women in each age group. The social and economic circumstances of the population, both now and in the future, may be significantly impacted by this structure. There are differences in the Municipality's age cohorts, nevertheless. For instance, between the ages of 15 and 19, the population begins to decline significantly more in men than in women. A population pyramid can be used to better illustrate the structure of age and sex. The fertility, death, and migration rates all have a significant impact on the pyramid's structure. The fact that a higher percentage of people reside in rural areas must be noted. This is explained by the farming and mining that takes place in the rural areas. Living in rural areas makes up more than half (55.6%) of the population.

Age dependency is used to research the kind of support that is provided to the elderly and/or young. People 65 years of age and under make up a sizable share of the Municipality's population. The percentage of reliance in the Municipality is 74.2%. When compared to the Municipality's dependency ratio, the urban setting registers the greatest percentage, or 77.1%.

Land Tenure System: Land tenure in Denkyira traditional area is typically communal, with land owned by the community and allocated to individuals or families by the chief or traditional authority. Chiefs play a significant role in land distribution and management.

5.3 Wassa Amenfi West Municipal Assembly

5.3.1 Location and Size

The Wassa Amenfi West Municipal Assembly is situated between latitudes 5° 22'N and 5° 60'N and longitudes 2° 18'W and 2° 37'W. It contains more than 198 settlements spread across a total land area of 1448.6 square kilometers. The Prestea Huni Valley Municipality and Wassa Amenfi Central District border the municipality to the east, Sefwi Akontombra District and Sefwi Wiawso Municipality to the north, Jomoro Municipality and Ellembelle District to the south, and Aowin Municipality to the west.

5.3.2 Topography and Drainage

Generally, the landscape is undulating, with an average summit elevation of 153 meters (500ft). Rivers and streams are well-connected. Among them are the rivers Tano, Yire, Kwama, and Samre. During the

dry season, vegetable farmers in particular rely on these rivers for irrigation and domestic water needs. As a result, the district's several enclaves have severe water shortages. Despite this, the municipal area's socioeconomic development greatly benefits from the rivers and other streams. However, the majority of these rivers and streams are contaminated due to illicit mining (Galamsey) activities in the municipal area. Climate, Vegetation and Soils. The line route crosses river Tano in the wassa Amenfi West (Appendix IX).

Climate

The municipality is located in the wettest part of the nation. The north experiences 1500 mm of yearly rainfall, whereas the south receives 1750 mm on average. The two primary rainy seasons are from September to early December and from March to July. In terms of range and severity, there are two dry seasons that distinguish them: December through February and August. Temperatures are generally high ranging from 24^{o}C -29^{o}C (75^{o}F -83^{o}F). Maximum temperatures are in March and coolest month is August. The area is a good location for the development of both cash and food crops due to its climate. But the continuous, intense rains have a detrimental impact on the municipal roads, particularly the unpaved ones, which are mostly impassable during the rainy season.

Vegetation

The vegetation of the municipality is the moist semi–deciduous forest. The vegetation supports agricultural activities. The municipality has three (3) forest reserves covering a total area of 17,536 hectares as follows: Mamire Forest Reserve (4,814 ha), Fure Head Water Forest Reserve (7,192 ha) and Fure River Forest Reserve (5,503 ha) (Figure 12).

The forests contain many timber species like *Entandrophragma cylindricum* (Sapele), *Milicia excelsa* (Odum), *Khaya ivorensis* (African Mahogany), *Triplochiton scleroxylon*(Wawa), *Tieghemella heckelii* (Makore) among etc. Most are exploited to feed the two large expatriate wood processing firms' Samartex and SMS in Samreaboi and Manso Amenfi respectively. Some are exported mostly to European countries. A very small proportion feed the new indigenous wood processing concerns springing up lately. In addition, a few of the forest's plants and trees have significant therapeutic significance. Water bodies like the Tano and Tutua rivers are also protected by the forest. In addition, the district's numerous forests offer a natural habitat and friendly environment for a variety of animal species, including antelopes, monkeys, elephants, birds, squirrels, snails, and a host of other forest animal species that serve as a source of meat for both the local population and those living outside the district. The various animal species serve as tourist attractions and enhance the natural beauty of the area. The Forest Services Division's efforts to stop mining in the reserves have minimised the impact of small-scale and illicit mining (galamsey) activities. Nonetheless, there are a few cases where unauthorized miners work at strange hours while evading detection. In the forest reserves, there are also illicit chainsaw operations that have a detrimental impact

on the ecology. These actions deprive the Traditional Authority, the Assembly, and the Government of much-needed revenue.

The transmission line route does not intersect any designated forest reserves, with the closest reserve located approximately 2 kilometers away. The predominant land use along the route includes extensive cocoa farms, palm plantations, and rubber plantations, reflecting the area's agricultural focus. However, the area is significantly affected by illegal mining activities, commonly referred to as Galamsey, which has led to considerable environmental degradation. The presence of these mining operations has further altered the natural landscape, impacting soil quality and vegetation.

Figure 12: Aerial vegetational view of the project area

Soils

The granites and Birimian rocks (basalt-andesite-rhyodacite lavas, with elevated Mg-Ca-Na contents, and volcaniclastics (Zitzmann et al., 1997) are connected to the geological soil formations found in the municipal area. Additionally, two primary agricultural soil groupings have been recognized. These are the forest ochrosol-oxysols and oxysols. Tree crops like coffee, oil palm, rubber, cola, and cocoa can be grown on the soil. Food crops like plantains, cassava, maize, rice, tomatoes, peppers, and garden eggs are also supported by it.

5.3.3 The Natural Environment

In years back, there existed diversity of life with much better opportunities for economic development and responsiveness to climate adaptation and change. Increase in population and the desire to use all means to exploit resources hidden in the earth without putting in measures to reclaim degraded lands has the

potential to deprive the future generation of safe environment. Activities of lumbering in the forest and reserve areas are gradually destroying the natural habitats of animals and birds. Rivers like Tano, Ankobra have been polluted to the extent that it becomes difficult to even treat for domestic purposes. Water Resources

For human health as well as for usage in home, industrial, agricultural, and mining operations, clean, readily available drinking water is essential. The municipal system offers several options for the supply of potable water. These come from pump-equipped hand-dug wells, automated boreholes, and pipe-borne Small Town Piped Water Systems. There are also rivers, streams, and wells that have been dug. The primary source of drinking water for residential units in the municipal system is a river or stream (27.9%), followed by a bore hole, pump, or tube well (23.4%). A total of 25.5% of the municipal drinking water sources are pipe-borne inside dwelling units (4.1%), pipe-borne outside dwelling units (9.9%), and public tap/standpipe (11.5%). In rural areas, rivers/streams account for 47.3% of households' drinking water supply, while bore-hole, pump, and tube wells account for 24.3%. In urban areas, protected wells account for 26.0% of the total, with bore-hole, pump, and tube wells coming in second and third, respectively (22.3%). Pipe-borne water is utilized more frequently in urban areas than in rural ones (13.9 % of households use all three sources combined). Pipe-borne water is used inside dwelling units (7.6%), outside dwelling units (15.7%), and public taps/standpipes (15.9%). Additionally, households in urban areas utilize sachet water at a rate of 4.1% compared to 0.5% in rural areas.

5.3.4 Climate Change

The municipality's development is aided by concerns about climate change and natural disasters. Planning appropriately to reduce such hazards would be made possible by an examination of the local climate's changing characteristics.

Thousands of people are displaced by flooding. In 2018, 1,678 persons were impacted. Flooding ruined lives, wrecked property, killed animals, damaged roads, bridges, and damaged supplies of gas, power, water, and communication, among other things.

Humans, animals, and fowl are all injured or killed by fires. In addition to causing property damage, fires can destroy priceless items, records, workplaces, homes, schools, and clinics, leaving people without a place to live.

Because of leaching, erosion results in infertile soil. Roads, homes, and other structures are also harmed or destroyed by erosion. Water-borne illnesses like cholera and others are brought on by pollution of water bodies. Because illegal miners have contaminated the majority of the municipality's water sources, it is dangerous to drink the water or use it for agricultural.

Mud-built, weak buildings have degraded in flood-prone areas, making occupancy challenging. Forests and farmlands have been destroyed and degraded as a result of illegal mining. Severe ditches with

subterranean water are another effect of it. It ruins lives once more. Disease outbreaks and air pollution are also caused by the dumping and piling of waste in unapproved locations.

5.3.5 Demographic Characteristics

Population

The population of the municipality is 105,000 comprising of 47,361 (51.4%) males and 44,791 (48.6%) females. Rural dwellers accounts for 58.6% of the population with the remaining 41.4% in urban centres.

The population size and age-sex composition have broad ranging consequences for a number of socio-economic indicators such as the welfare of the people. It must be noted that 41.4% of the total population were in the 0-14 age group. Sex ratio is the number of males per 100 females in a population. The sex ratio of 105.7 is indicative that, relatively, males outnumber females in the municipality.

Age-dependency ratio is a measure of the dependent population made up of those below 15 years and 65 years and older, to the independent population, that is, those in the 15-64 age group. The ratio is used to measure the burden borne by those in the working age group. The 48-age dependency ratio for the municipality is 80.3 implying that the proportion of those who depend on the independent group for their sustenance is high. This may have adverse effect on savings for the age cohort 15-64years thereby putting pressure on the Municipal Assembly and Government to increase social interventions like Livelihood Empowerment Programme (LEAP), School Feeding Programme and the Assistantship to needy but brilliant students among others.

The population density of the municipality has risen from 64 persons per square kilometer to 78 persons per square kilometer, indicating that currently, more pressure is being exerted on available land for farming as well as domestic and industrial purposes. This therefore enjoins the Assembly to ensure effective utilization of land especially in the capital as well as other zonal council centres; acquisition of land banks by the Assembly should also be a priority.

5.3.6 Culture and Tradition

The Wassa Amenfi West Municipal has three divisional areas and chiefs who pay homage to the Paramount Chief (Omanhene) of the Wassa Amenfi Traditional Area at Wassa Akropong. These three divisional areas within the municipality are Asankrangwa, Breman and Moseaso. Below the divisional chiefs are the sub-chiefs (Odikro) for minor settlements. Tradition has it that, the people of the municipality are a mixture of migrants from Akwamu, Ashanti, Assin and Ivory Coast. The cultural practices and characteristics of the people are not different from other Akan settlements. Inheritance is through matrilineal lineage whilst funerals, chieftaincy and marriage rites are purely of Akan origins. Like other Akan groups, there are five (5) notable clans namely: Agona, Abrade, Asona, Bretuo and Ahene. Every third Friday of the month is observed as taboo day and no one is supposed to go to farm at Asankrangwa. This is referred to as Adum.

In certain communities of the municipal area, it is also a taboo to rear or keep goats especially in communities where the Tano River drains. The major festival of the people is the Yam Festival, which is celebrated annually between March and April to herald the harvest of the water yam. The Adipa festival is celebrated to offer thanks and food to the gods for bumper harvest and for protection throughout the year. The Chiefs are the custodians of the land and have leased some to family members, migrant farmers, private organizations/individuals etc.

On ethnicity, the Akans constitute the largest ethnic group (77.5%) of the total population. Other minority ethnic groups are Mole Dagbon (7.0%), Ewe (6.0%), Ga Dangme (4.8%), Guans (1.8%), Grusi (1.1%), Gurma (0.8%), Mande (0.7) and all other ethnic group forms 0.4%.

Religious Affiliation Every citizen in Ghana is enjoined by the 1992 constitution to have freedom of worship and may choose to join any religious group provided the practices of the said group are consistent with the same constitution. The majority (80%) of the people are Christians (Catholic, Protestants, Pentecostal/ Charismatic and other Christians) followed by Islam (12%). Only a small proportion of the population are adherents of the traditional religion (1%) or other religions not specified whilst those not affiliated to any religion account for 6%. Although there is religious pluralism, practitioners co-exist peacefully.

Land Tenure System: In Wassa Amenfi traditional area, land tenure is generally based on communal ownership with rights granted by traditional leaders. Land use and inheritance are governed by customary laws, with the chief having substantial authority over land allocation.

5.4 Wassa Amenfi East Municipal Assembly

5.4.1 Location and Size

In August 2004, the Wassa Amenfi District Assembly was dissolved and replaced with the Wassa Amenfi East Municipal Assembly, which was established as a district under Legislative Instrument (L.I) 1788. On March 15, 2018, it was proclaimed and given the official status of a municipality by Legislative Instrument (L.I) 2289.

The Municipality is situated in the region's center. It is 1,558 square kilometers in size and is located between latitudes 5º 30' N and 6º 15' N and longitudes 1º 45 W and 2º 11 W.

Its borders are as follows: Upper Denkyira West District and Upper Dekyira East Municipality to the north, Prestea Huni Valley Municipality to the south, Mpohor District to the east, and Amenfi West Municipality to the west.

As per the 2021 population and housing census, the Municipality has a total population of 175,696 people, comprising 95,283 males and 84,413 females.

5.4.2 Topography and Drainage

With an average summit elevation of 155m, the terrain is primarily undulating (500ft). A good network of streams and rivers exists. Among these, the rivers Manse and Ashire are notable and the proposed transmission line crosses them (Appendix IX). During dry seasons, the quantities of these rivers and streams significantly decrease. During dry seasons, most streams entirely dry up, even though they are mostly needed for residential and consumer needs.

5.4.3 Climate, Vegetation and Soils

Climate

The project area is located in the nation's belt of rainfall, which experiences high annual precipitation, contributing to lush vegetation and a diverse ecosystem. The range of the yearly average rainfall is 1400 mm to 1730 mm. Extremes can occasionally reach 2100 mm. There are two primary patterns of rainfall. The first one begins in March and runs through July, while the second one begins in September and runs through the first half of December. Most of the year, there are typically high temperatures between 24°C and 29°C (75° and 83° F). March has the highest temperatures, while August is the coolest month.

Vegetation

Thick vegetation cover is the result of significant rainfall and several types of soil interacting. The Municipality is covered with semi-deciduous forest types. There are four forest reserves in the district, totaling 212.62 square kilometers. These are the forest reserves in Opon-Manse, Bowie, Tonton, and Angoben. Antelopes, monkeys, and elephants can all find a natural home in the forest reserves. Birds and snails use it as a habitat as well. The residents can also obtain high-value medicinal herbs and trees from the reserves. These forests contain species of trees like *Entandrophragma cylindricum* (Sapele), *Milicia excelsa* (Odum), *Khaya ivorensis* (Mahogany), *Triplochiton scleroxylon* (Wawa), and others. There are vast tracts of bamboo in other regions of the forest zone that could be used for socioeconomic development. **The transmission line route** does not intersect any designated forest reserves, with the closest reserve located approximately 2 kilometers away. The predominant land use along the route includes extensive cocoa farms, cassava, pepper and garden eggs, reflecting the area's agricultural focus. However, the area is significantly affected by illegal mining activities, commonly referred to as Galamsey, which has led to considerable environmental degradation. The presence of these mining operations has further altered the natural landscape, impacting soil quality and vegetation.

Soils

Three main geological soil formations identified in the district are: Upper Birimian, Lower Birimian and Granites. The granite deposits in the district make most parts of it rich in minerals like gold. Two main

agricultural soil groups identified are forest ochrosol-oxysols found in the northern parts and oxysols in the southern parts. Large enclaves of clay deposits are also available.

5.4.4 The Natural Environment

The project area offers a diverse range of living conditions along with improved prospects for economic growth and adaptability to changing climate conditions. Future generations may be deprived of a safe environment due to population growth and the desire to employ all available means to extract riches hidden beneath the surface of the planet without taking action to recover degraded regions. The natural habitats of animals and birds are being steadily destroyed by activities related to lumbering in the forest and reserve regions. It is now difficult to use rivers for residential purposes due to their extreme pollution.

5.4.5 Water Resources

In the project area, 35.2% of households use river/ stream as main source for drinking water, followed by bore-hole/pump/tube well (23.4%). The main source of drinking water for urban households is pipe-borne outside dwelling (44.8%) while it constitutes a mere 15.4% for households in rural areas. Rivers/ streams constitute 37.9% of main source of drinking water for rural households but it constitutes only 1.6% of source of drinking water for urban households. This means a large proportion of households in the municipality still do not have access to improved source of drinking water.

The source of water, especially that used for drinking, has a significant impact on the prevalence of diseases. For example, a decrease in diarrhea is one of the primary health advantages of a clean drinking water supply. With the exception of 11.5 percent of urban homes who utilize protected wells for other domestic purposes, the source of water for domestic use was comparable to that of drinking water. It is clear that the district's rural areas are more likely to rely on boreholes, pumps, or tube wells.

5.4.6 Climate Change

Natural disasters and climate change issues contribute to the municipality's development. Analyzing the changing features of the local climate would enable suitable planning to minimize such threats.

5.4.7 Demographic Characteristics

Population

Wassa Amenfi East Municipal recorded a population of 83,478 (year?). Persons between the ages 0-4 years (15.2%) have the highest proportion among the age groups. This is closely followed by age groups 5-9 years, 10-14 years with 13.8% and 12.9% respectively. The age group 80-84 years constitutes 0.5% with 85years and older having the least proportion of 0.4%. Of the Municipality’s total population (83,478), there are more males (51.4%) than females (48.6%). Within the age group 0-4, there are slightly more females (15.5%) than males (15.1%). The proportion of females in age groups 80-85 and 85 years and

older is 0.6 percent and 0.5 % respectively. These proportions are higher compared to their male counterparts, which is 0.4% in both age groups.

Sex ratio is the ratio of males to females in a given population, usually expressed as an index of the number of males for every 100 females. Out of the total population of 83,478 in the municipality, there are more males (51.4%) than females (48.6%) and this translates into a sex ratio of 105.7 males to 100 females. The percentage of the district's share of the regional population is 3.5%. In urban areas, sex ratio is 94.4 males to 100 females, whereas in rural areas in the district, sex ratio is 106.6 males to 100 females, showing more males than females in the rural areas as against the urban areas

In addition, out of the total population of 83,478, persons under 15 years have the highest proportion of 42%. This is followed by persons within the age group 30-59 who constitutes 25.6%. Persons 60 years and older constitute the least in the district with 5.5 percent. For the sexes, there are more males under 15 years (42.2%) than females under 15 years (41.7%).

Age Dependency is the ratio of persons in the dependency ages (generally under age 15 and 65 years and older) to those in the working age group (15-64 years) in a population. The age dependency ratio indicates that the district has a high working population of 54.3% of which males and females are about equal proportions of 54.1 percent and 54.0 percent respectively. Child dependency ratio is 77.4 while old age dependency ratio is 6.9. The total dependency ratio of the district is 84.3.

5.4.8 Culture and Tradition

The project area's predominant ethnic group is Wassa. Other minor ethnic groups include the Nzemas, Sefwis, Asantes, and Akyems, though. The existence of migrants seeking work in the district's mining, agricultural, and other economic sectors explain the presence of various ethnic groups. The Wassas share a common cultural background with regard to inheritance, succession, and ancestry. The matrilineal structure of kinship and descent upholds the custom of inheritance.

Like in the rest of the nation, the chieftaincy institution plays a significant role in the municipality's social structure. One of the three historic Wassa districts, the capital city of the Amenfis is Wassa Akropong, which also serves as the home of the paramount chief for the region. The Omanhene serves as the chairman of the Traditional Council in accordance with custom. Under the Omanhene, there are roughly forty-five divisional heads in all.

The Kokrobo Oman Kwantukesie festival, which takes place every year in March and April, is the district's main celebration. One of the smaller holidays observed in the district is the Bermutuo festival, which is marked by a time of stillness and quietness as well as some stool-cleaning rites performed by the traditional authority.

The district's primary and predominate religion is Christianity. The district is home to a variety of Christian denominations, including Methodist, Pentecostal, Charismatic, and Catholic. Islam and traditional religions are the other religious persuasions.

The project area is home to a number of heritage sites. Lake Broso is a naturally occurring lake in the district. The district and the nation stand to gain from the development of this into a complete website. Other tourist attractions in the district include a sacred stone in Asrewadi Forest, sacred tree species at Moseaso and Manseso, an underdeveloped waterfall at Akwadaakro, and a cave at Tawiahkrom. However, these are underdeveloped areas.

Land Tenure System: In Wassa Amenfi traditional area, land tenure is generally based on communal ownership with rights granted by traditional leaders. Land use and inheritance are governed by customary laws, with the chief having substantial authority over land allocation.

5.5 Wassa Amenfi Central District Assembly

5.5.1 Location and Size

The Wassa Amenfi Central District, with its administrative capital Manso Amenfi, was carved from Wassa Amenfi East and forms part of the new districts and municipalities created in the year 2012.

The Wassa Amenfi Central District is located in the middle part of the Western Region and lies between latitudes 5^{o} 20'N and 6^{o} 70'N and longitudes 2^{o} 09'W and 2^{o} 27'W. It has an estimated land size of 1,845.9 square kilometres with 131 communities.

It is bounded to the north by Bibiani Anhwiaso Bekwai Municipality and Upper Denkyira West District and Sefwi Wiawso Municipality; to the north-west by Aowin Municipality; to the south by Prestea Huni-Valley Municipality; to the east by Wassa Amenfi East Municipality and to the west by Amenfi West Municipality. The population of the District according to the 2021 population and housing census (PHC) stands at 119,117 with 63,212 males and 55,905 females.

5.5.2 Topography and Drainage

The topography of the project area is generally undulating with summits averaging 153m.The district is blessed with a good number of rivers and streams, including the Tano and Ankobra rivers. These rivers serve as sources of water for domestic and farming (irrigation) purposes, especially for vegetable farmers during the dry season.

5.5.3 Climate, Vegetation and Soils

Climate

The project area falls within the wettest parts of the country, with average annual rainfall ranging from 1500mm to 2200mm. The district experiences a bimodal rainy season; March to July and September to

early December. Temperatures are generally high ranging from 26°C – 27°C (75°F - 83°F) during the year. August is the coolest month of the year and the maximum temperatures occur in March. The district being one of the richest cocoa growing areas. The climate of the district is suitable for the growing of various crops, particularly both cash and food crops as stated earlier on. Nevertheless, the climate has put the district in an enviable position of being one of the leading producers of cocoa in the country. The good climatic condition provides high water table which is good for the drilling of boreholes and construction of hand-dug wells.

Vegetation

The project area falls within the high rain forest zone and is covered by the moist semi-deciduous forest type. The district has four forest reserves covering a total area of 425.14kilometre square. Some trees and plants in the forest have high medicinal value. The forest also protects water bodies such as rivers Fure and Samire which also drain the district. The forest cover of the district is made up of closed forest (highly dense vegetation), moderately closed trees with herbs and bush cover, moderately dense herb/ bush with scattered trees and the open forest with sparsely inhabited trees. The various forests in the district also provide the necessary natural habitat and congenial atmosphere for different species of animals such as antelopes, monkeys, birds, squirrels, snails and a host of other forest animal species which provide the source of meat to not only the inhabitants of the district but those outside. The forests contain many economic tree species like *Entandrophragma cylindricum* (Sapele), *Milicia excelsa* (Odum), *Khaya ivorensis* (Mahogany), *Triplochiton scleroxylon* (Wawa), etc. Most are exploited to feed the wood processing firms. Some are exported mostly to European countries. The forest cover in the district also makes it very difficult for agriculture mechanisation. The land along the route is primarily used for agriculture, featuring extensive cocoa farms, palm plantations, and rubber plantations. However, illegal mining activities, known as Galamsey, have heavily impacted the area, resulting in significant environmental degradation.

Soil

The Wassa Amenfi Central District lies geologically within the Ghanaian Shield area which consists of the lower Proterozoic Volcanic and the Flyschoid Meta sediments of the Birimian System. The district falls within the Asankrangwa-Manso-Nkwanta Gold Belt which is associated with Birimian rocks. The rock type contains deposits of bauxite, manganese and iron-ore.

Two major soil groups are identified in the district. These are the Forest Ochrosol-Oxysols and Oxysols. These soils support the cultivation of tree crops such as coffee, oil palm, rubber, cola and cocoa. The soil type also supports the cultivation of food crops such as plantain, cassava, maize, rice, tomatoes, pepper and garden eggs. There is also a large deposit of clay which also supports building construction.

5.5.4 The Natural Environment

The project area offers a diverse range of living conditions along with improved prospects for economic growth and adaptability to changing climate conditions. Future generations may be deprived of a safe environment due to population growth and the desire to employ all available means to extract riches hidden beneath the surface of the planet without taking action to recover degraded regions. The natural habitats of animals and birds are being steadily destroyed by galamsey activities. It is now difficult to use rivers for residential purposes due to their extreme pollution.

5.5.5 Water Resources

In the project area, 35.2% of households use river/ stream as main source for drinking water, followed by bore-hole/pump/tube well (23.4%). The main source of drinking water for urban households is pipe-born outside dwelling (44.8%) whilst it constitutes a mere 15.4% for households in rural areas. Rivers/ streams constitute 37.9% of main source of drinking water for rural households but it constitutes only 1.6% of source of drinking water for urban households. This means a large proportion of households in the municipality still do not have access to improved source of drinking water.

The source of water, especially that used for drinking, has a significant impact on the prevalence of diseases. For example, a decrease in diarrhea is one of the primary health advantages of a clean drinking water supply. With the exception of 11.5 percent of urban homes who utilize protected wells for other domestic purposes, the source of water for domestic use was comparable to that of drinking water. It is clear that the district's rural areas are more likely to rely on boreholes, pumps, or tube wells.

5.5.6 Climate Change

Natural disasters and climate change issues contribute to the municipality's development. Analyzing the changing features of the local climate would enable suitable planning to minimize such threats.

In the municipality, there are extreme weather events. Flooding has caused thousands of people to be evacuated. Flooding, among other things, destroyed lives, destroyed property, killed animals, damaged roads, bridges, and supplies of gas, electricity, water, and communication.

Fires hurt and kill people, animals, and poultry. Fires can destroy irreplaceable objects, documents, offices, houses, schools, and clinics in addition to causing property damage, leaving individuals without a place to live.

5.5.7 Demographic Characteristics

Population

The population of Wassa Amenfi Central is 69,014, representing 2.9 % of the total population of the Western Region (2,376,021). Out of the total population of the district, males constitute 35,866 (52.0%)

and females 33,148 (48.0). The distribution of the population by age also shows the age group 0-4 as recording the highest proportion (15.2%) of the district's population which is followed by the age group 5-9 (14.2%). The district's population is youthful with about 43.0% below 15 years and just 3.3 % are reported to be 65 years and over. This leaves 54.0 % of the district's population in the economically active age group of 15-64 years, resulting in a high dependency ratio of 85. There is not much difference between the sexes in terms of the population by age. Sex ratio is quite high and averages 108.2. Sex ratio is higher than 100 in all ages except for ages 25-29, 30-34, 70-74 and 80 years and over where it is less than 100. This deviates from the national sex ratio of 95.2 and that of the Western Region which is recorded at 100. This could be explained by the male-dominated mining activities in the district which have the tendency to attract more male migrants (particularly the youth) than females to the district.

5.5.8 Culture and Tradition

Wassa is the dominant ethnic group in the district. However, there are other minor ethnic groups such as Nzema, Sefwi, Asante and Akyem. The Wassa are culturally homogeneous with respect to lineage, inheritance and succession. Like other Akan settlements, inheritance is through the matrilineal system. Funerals, chieftaincy and marriage rites are also purely of Akan origins. The language spoken by the people in the district is predominately Twi.

The institution of chieftaincy is an important component of the social organization of the district as in the rest of the country. The Wassa Amenfi Central District has a number of divisional chiefs who pay homage to the Paramount Chief (Omanhene) of the Wassa Amenfi Traditional Area at Wassa Akropong. Under the traditional setup, the Omanhene is the head of the Traditional Council. In all, there are more than forty divisional chiefs under the Omanhene.

The major Festival of the people in the district is the Yam Festival, which is celebrated annually between March and April to herald the harvest of the water yam. It is celebrated to offer thanks to the gods for bumper harvest and for protection throughout the year.

Christianity (82%) is the dominant religion in the district. Churches such as Methodist, Pentecost, Roman Catholic, Presbyterian and other denominations are found in the district. This is followed by Islamic Religion (10.1%) and Traditional Religion (0.8%).

Land Tenure System: In Wassa Amenfi traditional area, land tenure is generally based on communal ownership with rights granted by traditional leaders. Land use and inheritance are governed by customary laws, with the chief having substantial authority over land allocation.

5.6 Aowin Municipal Assembly

5.6.1 Location and Size

The project area is partly located in the mid-western part of the Western Region of Ghana between latitude five degrees twenty-five minutes and six degrees fourteen minutes North (5° 25' N and 6° 14' N) and longitude two degrees thirty minutes and three degrees five minutes West (2° 30'W and 3° 05'W). It covers a total land area of 2,607 square kilometres.

The project district share border with Aowin Municipal are Amenfi West Municipal to the east, Juaboso and Sefwi Akontombra Districts to the north, Jomoro Municipal to the south and the Republic of La Côte d'Ivoire to the west. The population of the Municipality according to 2021 population and housing census stands at 129,721 with 68,236 males and 61,485 females.

5.6.2 Topography and Drainage

Generally, the project area has undulating surface with more than half of the total area rising above 305 meters above sea level. The highest points are over 366 m above sea level. These highlands are located on the east of Enchi where they have formed a North-North West to South-South West alignment. The major perennial rivers that drain the district are Rivers Tano and Bia. There are a lot of tributary rivers which drain the Municipality. The well-known tributaries include Disue and Boin which drains north and south of the Municipality respectively and the proposed transmission crosses these two rivers (Appendix IX). The major rivers and their tributaries have formed a 'tree-like' network on the district landscape. Rivers and streams constitute an important source of water for domestic use in most communities.

5.6.3 Climate, Vegetation and Soils

Climate

The project area experiences Wet-Semi Equatorial Climatic conditions, with an annual average temperature of 26°C. March and April are the hottest months i.e. before the onset of the early rains. Rainfall pattern in the district is the bimodal type with June and October being the peak seasons. The annual rainfall average ranges between 1700mm and 2100mm. It is observed that the Northern part of the Municipality recorded annual average rainfall which was comparably less than what was in the southern part of the district. This can be attributed to the thick forests located in the southern part of the Municipality. Relative humidity is generally high, ranging between 75% and 80% during the wet season and decreasing to about 70% for the rest of the year.

Vegetation

The vegetation cover of the project is of two types namely the Tropical rainforest and the semi-deciduous forest. The main vegetation cover is the Tropical rainforest which covers almost the entire Municipality. The moist semi-decidous forest covers only a small portion on the north-eastern part of the Municipality which is very close to Sefwi Akontombra District and Sefwi Wiawso Municipality. The land along the proposed transmission line route is primarily used for agriculture, featuring extensive cocoa farms, palm plantations and rubber plantations. However, illegal mining activities, known as Galamsey has heavily impacted the area, resulting in significant environmental degradation.

Soil

Acrisols and Ferralsols are the predominant soil types in the Municipality with appreciable dotted quantities of Fluvisols. These soil types have developed as a result of the forest vegetation and the climatic condition of the Municipality. The soils are rich in humus and suitable for crop production such as cocoa, oil palm and food staples. It is noted that the Northern and middle belt of the Municipality is covered with Acrisols with dotted spots of Fluvisols whilst the southern part of the Municipality is covered with Ferralsols.

5.6.4 The Natural Environment

Although the project area is endowed with natural resources such as water bodies, rock deposits, forest and gold, the state of these resources are varied. Illegal felling of timber, encroachment of forest through farming activities and pollution of water bodies are some of the challenges confronting the existence of some of the natural resources. Farming and extensive logging for example have contributed to fast depletion of the forest resources in the area. There is evidence that forest reserves in the Municipality have been greatly encroached upon as a result of farming and logging activities. For example, the Tano-Ehuro Forest reserve, which is about 176.10 square km, has been degraded through farming and logging activities.

The forest reserves in the Municipality are among a few relics in the country. Their benefits in terms of providing natural habitats for fauna and flora of rare species, protection of watersheds, creation of micro-climatic conditions and contribution to the prevention of global warming are critical for human existence and therefore have to be protected to serve future generation.

Dumping of refuse along water bodies is also a major negative effect of human activities on this resource which serves as a source of water for household activities, fish farming and dry season farming. River Disue and Boin are said to be polluted by the settlements through which they flow namely Enchi, Achimfo, Boinso etc.

5.6.5 Water Supply and Sanitation

Enchi, the Municipal capital enjoys potable water supply from Small Town Water facility. With this facility under-ground water is pumped through pipe to the homes and factories of the people in the town. One of such projects is located at Old Yakase, a community located about 5km from Enchi. Jema and Dadieso have also been selected to benefit from similar facility with funding from the European Union with match up fund from the beneficiary communities.

Similarly, the Municipal Capital, Enchi, would under the same programme, benefit from the construction of a new facility with an increased capacity to enable it produce sufficient water to meet the ever-growing population. The Assembly through various development interventions such as Village Infrastructure Project, Social Investment Fund, HIPC Relief Benefit and Sefwi Wiawso Catholic Development Assistance has constructed an additional one hundred and ten (110) boreholes, fifty-eight (58) hand-dug wells with pumps throughout the district to increase access to potable water for good health and development. The Assembly has also stepped up efforts at improving sanitation at Enchi by procuring additional refuse containers and a tractor. Provision of household toilets in collaboration with house owners has been undertaken on a pilot stage and would be scaled up to include all major towns to solve the problem of inadequate liquid waste disposal facilities. The Assembly has also provided six (6) Public Toilets in the major towns to cater for travelers and strangers who visit these centres.

5.6.6 Climate Change

The project area's development is aided by concerns about climate change and natural disasters. Planning appropriately to reduce such hazards would be made possible by an examination of the local climate's changing characteristics.

Thousands of people are displaced by flooding. Humans, animals, and fowl are all injured or killed by fires. In addition to causing property damage, fires can destroy priceless items, records, workplaces, homes, schools, and clinics, leaving people without a place to live.

Because of leaching, erosion results in infertile soil. Roads, homes, and other structures are also harmed or destroyed by erosion. Water-borne illnesses like cholera and others are brought on by pollution of water bodies. Because illegal miners have contaminated most the municipality's water sources, it is dangerous to drink the water or use it for agricultural purposes.

5.6.7 Demographic Characteristics

Population

The short -medium term plan (for which period) of the district indicated a total of 117,886 persons in the Municipality, with the male and female proportions given as 61,262 and 56,624 respectively. The report indicated that, the proportion of the population in the various age groups decreases with increasing year, with the age group 0-4 years having the highest proportion of about 15 percent and those above 85 years forming just 0.5 percent.

Similar distribution of the population among the various age groups can be seen among both males and females. As males decrease from 14.7 percent among the 0-4 age group to 0.5 percent, females also decrease from 15.1 percent to 0.5 percent respectively. This distribution conforms to both the Regional and National age composition of Ghana's population.

According to the plan, more males (61,262) were recorded in the Municipality than females (56,624). This phenomenon was reflected among the age groups. However, high proportions of males and females (40.8%) were below 15 years, a situation that needs critical attention such as the provision of basic school and health infrastructure.

Again, a small proportion of the population was above 60 years (4.5%) reflecting a low life expectancy. The plan also clearly spelt out that significant proportion of the population are found between 15 and 59 years where the active labour force is constituted.

The analysis of the age and sex structure of the population is best represented. The Figure generally shows a broad base and a narrow peak indicating that the district has a youthful population, a built-in momentum for further rapid increase and therefore the need to strengthen efforts at managing the population. As the male population show a smooth gradient, that of the female is a little undulating indicating the probability of age misreporting among the females. The age dependency ratio of a population is the ratio of a population in the dependent ages to those in the economically productive ages in a population. Dependent ages are classified to be those under 15 years and 65 years and older while the economically productive ages are those 15 to 64 years. Age dependency shows the economic burden that falls on the working population as such, populations with higher birth rates (with more people below 15 years) tend to have more burdens.

About 77.8 percent of the population depends on 100 people. However, the female dependency (79.3) is higher than that of males (76.4%). Due to the large nature of the population below 15 years, 72.5 children depend on 100 working population while 5.3 elderly depend on the same population. Contrary to the total dependency ratio, there are more elderly male dependents on the working group than females.

5.6.8 Culture and Tradition

The project area is partly made up of two traditional areas namely Aowin Traditional Area with its seat at Enchi and Suaman Traditional area whose headquarters is located at Dadieso. The heads of the Traditional areas are called Paramount Chiefs who rule with the support of other divisional chiefs.

Historical records indicate that the Brusas are among the people who settled in Techiman from Sudan in the 12th-Century.

It is believed that when these settlers including the Brusas realised that their population was increasing rapidly, they moved out from Techiman to Moree on the Coast near Cape Coast. It is said that the Brusas among other settlers found big whales which transported them along the coastline. The other settlers such as the Nzemas settled in the Akobra Basins down to the present day Half Assini. The Brusas being typical farmers, moved north east to the forest zone. Another historical source has it that the Suaman people at the present day Dadieso migrated from neighbouring La Côte d'Ivoire and settled along River Bia.

Oral history tells that the River was so hostile that they lost a lot of people through drowning. They therefore decided to move to a safer place which is their present place of abode.

The Aowin divisional area has a traditional festival called "Ellue" or Yam Festival. The yam festival is celebrated annually. The festival ushers in the new farming season and it is used to thank the gods and pray for another bumper harvest.

Land Tenure System

In the Aowin Municipal traditional area of Ghana, land tenure is primarily governed by customary practices where traditional leaders allocate and manage land based on communal and family systems. Land ownership and use rights are typically derived from community consent and follow traditional inheritance patterns, which can be matrilineal or patrilineal. Efforts are underway to integrate statutory land registration and management systems to formalize and secure land transactions, though challenges persist in harmonizing these with customary practices.

5.7 Biodiversity along the Proposed 400/330 Côte d'Ivoire Ghana Transmission line Route

The biodiversity assessment, conducted as part of the Environmental and Social Impact Assessment (ESIA) for the 400/330 kV Côte d'Ivoire-Ghana Transmission Line reinforcement project (see Appendix X for detailed report), evaluated the potential impacts of the project on flora and fauna along a 125 km route spanning from Babianiha near Dunkwa to Omanpe. The study area covers a 40-meter-wide Right-of-Way (RoW) and includes a range of land uses, such as cocoa farms, oil palm and rubber plantations, food crop farms, fallow lands, and riparian marshes.

Ghana is renowned for its rich birdlife, with 36 Important Bird Areas (IBAs), several of which are located near the project area. The biodiversity assessment recorded 71 bird species along the transmission line route using visual and auditory identification methods during early morning and late afternoon surveys. While most bird species observed are of Least Concern according to the IUCN Red List, the project route does intersect critical bird habitats, particularly in the riparian and marshland areas where migratory bird species are known to frequent.

These notwithstanding, it is essential that the design of the transmission line includes bird beacons to prevent bird collisions, especially in areas near IBAs or where bird activity is high. Bird collisions with transmission lines pose a significant risk to both local and migratory bird populations. Incorporating bird beacons along the line will mitigate these risks and ensure the safety of bird species that traverse the region.

Flora and Endangered Tree Species

The vegetation within the RoW primarily consists of secondary and tertiary growth, largely shaped by human activity in agricultural areas. The survey identified 108 vascular plant species, with notable tree species such as *Milicia excelsa*, *Terminalia ivorensis*, and *Khaya ivorensis* all of which are crucial components of local ecosystems.

The IUCN Red List flagged seven plant species as globally threatened, including *Milicia excelsa and Nesogordonia papaverifera* (both classified as vulnerable). However, the assessment confirmed that no endangered tree species are located directly within the RoW or at the proposed substation site. Nevertheless, close monitoring during construction is recommended to ensure that no protected tree species are inadvertently affected.

5.8 Illegal Mining Activities (*Galamsey*) within the Project Right-of-Way

Analyses of arial images of the project Right-of-Way and its immediate environs and preliminary routing transmission line route suggest that there are approximately 42 informal small scale mining sites scattered across the proposed project Right-of-Way. Cumulatively, these activities occupy 29.9 acres (2.4%) of the project Right-of-Way. It is not very clear from the imagery whether these sites are active and abandoned but anecdotal evidence suggest that a large majority of these are inactive and illegal. They are concreted around seven (7) communities as detailed in Table 4 (Maps of the *illegal Small Scale (galamsey*) sites in the RoW are attached as Appendix xvi).

Table 4: Communities with Mining Pits/Areas

COMMUNITIES AVERAGE DISTANCES TO GALAMSEY SITES

S/NO:	COMMUNITY	AVERAGE DISTANCE TO THE GALAMSEY SITES
1	Nkonya	1 Km
2	Nananko	1.5 Km
3	Wassa Jakpa	1.6 Km
4	Wassa Dadieso	1.5km
5	Wassa Akropong	2.0 Km
6	Wassa Nsuaem	1.0 Km
7	Yirase	2.8 Km

In Ghana, *"galamsey"* refers to illegal small-scale mining activities. *Galamsey* illegal because it is undertaken without valid mining licenses from the Mineral Commission as stipulated in Minerals and Mining Act, 2006 (Act 703) and/or non-adherence to environmental and safety regulations as required by Environmental Assessment Regulations, 1999 (LI 2504). The illegal miners tend to be itinerants; their length of stay at a particular site is normally short between 2 to 6 months depending on the availability and quantity of gold deposits in the area. The illegal miners use simple tools such as pickaxes, sluice boxes, shovels and, occasionally, water pumps, explosives and washing plants in rudimentary designed mines but a few have mechanized their operations including the use of *Changfang motors*[1], excavators, and bulldozers. The miners either lease or forcefully annex the lands on which they operate.

Landowners were not willing to discuss the nature of lease or rental agreements between them and the illegal miners for fear of being exposed as supporting an illegality. Government decision to enforce the provisions of the Minerals and Mining Act, 2006 recently, has further driven these illegal miners underground making it extremely difficult to reach any of the groups within the vicinity of the Right-of-Way for engagement and comprehensive data collection. While *galamsey* provides income for those who participate in this activity in the project RoW and its environs, it has significantly far-reaching adverse environmental and social impacts/risks such as:

- Environmental damage: The activities of *galamsey* lead to deforestation, soil erosion, and contamination of water bodies with chemicals like mercury and cyanide used in gold extraction.
- Health hazards: The use of toxic chemicals and unsafe mining practices pose risks to the miners' health and the local communities where they operate.
- Impact on agriculture: *Galamsey* displaces farmlands, rendering them unsuitable for agriculture due to the extensive damage done to the soil and water systems.
- Social issues: There is a strong link between *galamsey* and other illegal activities, such as child

[1] large floating contraptions used by *galamsey* operators to wash the core during mining

labor, prostitution, drug addiction, conflicts, Gender Based Violence (GBV), Sexual Exploitation and Abuse (SEA), Sexual Harassment (SH) and unsafe working conditions. The practice also sometimes results in deadly mining accidents.

The prevalence of *galamsey* within the project zone of influence poses significant risks to the project's infrastructure. These mining activities (abandoned or active) often create pits and destabilize the soil structure, which can undermine the foundations of transmission towers. *Galamsey* is a national environmental and social problem in Ghana, outside the scope of this project.

6 PUBLIC PARTICIPATION / STAKEHOLDER ENGAGEMENTS

6.1 Public Consultations

The consultations carried out for the 400/330 kV Côte d'Ivoire-Ghana Transmission Line Project involved key stakeholders including the Wassa Amenfi Traditional Council, Upper Denkyira East, Wassa Amenfi West, Wassa Amenfi East, Aowin Municipal Assemblies, and the Wassa Amenfi Central District Assembly. These engagements included the 14 affected communities to raise awareness about the project and receive inputs, particularly on minimizing impacts on environmentally and socially sensitive areas such as shrines, sacred groves, cemeteries, and forest reserves. The consultations also discussed relevant issues relating the resettlement of project affected persons including eligibility criteria, PAPs entitlements and census cut-of-dates.

The report highlights general community consultations, it does not explicitly mention focus groups for vulnerable or marginalized groups, such as women, youth, or artisanal miners (also referred to as galamsey miners). Effective stakeholder engagement under the World Bank's Environmental and Social Standard 10 (ESS10) requires that all segments of society, including marginalized groups, are engaged in consultations to ensure their specific concerns are addressed. Furthermore, ESS5 mandates engagement with all project-affected persons (PAPs), especially those whose livelihoods may be impacted by the project. This included artisanal miners, as their activities may be affected by the acquisition of land and the establishment of the transmission corridor. In subsequent stakeholders engagement on the project, separate sessions will be held to ensure with vulnerable persons/groups identified in the SEP once it is approved by the Bank. The project will ensure that:

- Youth and women-focused groups are included in the consultation process to capture their perspectives on potential employment, compensation, and social impacts.
- Artisanal miners (galamsey miners), who may lose their livelihoods due to project-related land acquisition, are engaged directly, and their concerns are included in the Resettlement Action Plan (RAP).
- District authorities, who play a role in overseeing local development and land use, are continually engaged, particularly during land acquisition processe and grievance redress mechanisms.

Gender Equity Challenges

Women, especially in rural communities, often face greater barriers in access to compensation, participation in decision-making, and livelihood restoration. Thus, the engagement process in the course of the project implementation will be broadened to ensure that:

- Women are involved in decision-making at every stage of the project, particularly in compensation and livelihood restoration processes.

- Gender-based disparities in access to resources, jobs, and compensation under the project are addressed.
- A gender specialist is involved early in the design and consultation phases to ensure that women's needs and vulnerabilities are prioritized.
- artisanal miners during the RAP process are engaged to mitigate any adverse effects on their livelihoods and ensure proper restoration mechanisms are put in place.

6.2 Methodology

The process of identifying stakeholders began in December 2023 following the preliminary line route selection during which communities within the zone of influence of the project were identified in the Upper Denkyira East, Wassa Amenfi West, Wassa Amenfi East, Aowin Municipal Assembly and Wassa Amenfi Central District as being key stakeholders whose properties (crops, lands, and structures) and livelihoods would be adversely affected by the project implementation. A stakeholder engagement plan (SEP) was then designed for consultations. English and in some cases Twi languages with the help of interpreters mostly assemblymen from the local communities were used during the engagement of the stakeholders.

The Consultant, Studio Pietrangeli (SP) in collaboration with GRIDCo, made appointments with the Wassa Amenfi Traditional Council, Upper Denkyira East, Wassa Amenfi West, Wassa Amenfi East, Aowin Municipal Assembly and Amenfi Central District, and the affected communities. Meetings were held with these stakeholders where the detailed project scope and the rationale were disclosed to them for their concerns and inputs where necessary. The consultations started with the normal traditional greetings and pleasantries. At the end of each consultation especially in the affected communities the names, group photographs, and directions to the nearest villages were solicited from the community that had just been consulted. Pictures and attendance sheets and concerns of the consultations are attached as Appendices III, IV and V respectively. All stakeholders were allowed to ask questions for clarification or suggestions to better shape the decision-making process on the project design and implementation. There was also a high-level meeting involving representatives WAPP, GRIDCo, CI Energies, the Project Consultant and the World Bank Safeguards Team at Elubo to discussion mitigation measures for identified environmental and social risks of the project. This meeting, which took place at Elubo on the Ghana-Côte d' Ivoire border was preceded by routing the transmission line corridor on to observe environmental conditions and understand social context/issues within the project corridor (see Appendix VIII for minutes' of the meeting)

The public consultation on the project was deepened by the publication of a Scoping Notice (Appendix III) in line with the regulation 15 (1) of the LI 2504 in the February 12, 2024, edition of the Daily Graphic.

Based on the stakeholder engagements, key issues of concern were identified, and preliminary responses were given to them (Table 4). However, they were further investigated during the ESIA study. These are as follows:

- Community entry strategies
- Land tenure system and cultural heritage
- Land Acquisition & Compensation for Loss Property
- Grievance Redress Mechanisms
- Employment opportunities for community people
- Public and Occupational Health & Safety
- Environmental impacts

Table 5: Issues -Response matrix

Subject	Key issues raised
Community Entry	GRIDCo should ensure that the Project Contractor is introduced to the opinion leaders of the affected communities before project construction to ensure an effective community entry protocol.
The land tenure system and cultural heritage	The need to consult key stakeholders (chiefs, clans, and Family heads) to understand the land tenure system in the project area before the commencement of the acquisition processes. There must be a close collaboration with the chief and elders of the affected communities to ensure that the line route does not adversely impact the shrines and groves. Where necessary, the traditional leaders will advise on the required pacification rites to be performed in an event of an impact on cultural heritage.
Land Acquisition	The need to consult with the chiefs or families depending on the land tenure system of the communities for the Land acquisition. Property valuation should follow immediately after line survey works to prevent speculative developments Compensation for crops loss and landed properties on the project must reflect current market values. Compensation payment through banks should be properly streamlined in order not to disadvantage PAPs without bank accounts, where necessary such PAPs should be assisted to open a bank account for their compensation payment It was suggested that payment of compensations be through GCB Bank Limited which operates within the district. Inclusion of Community members in the land acquisition process to avoid impersonation. For the 'Abunu' and "Abusa" system, both parties (farmer and landowner) must agree on how they want the compensation in terms of who gets what during the payment because this is more of an agreement between both parties on the use of the land before the land acquisition.

Grievance Redress mechanisms	Use of Assembly members within project-affected communities and GRIDCo's project inspectors as focal persons for Grievance Redress. This mechanism will be available for all stakeholders to seek redress or clarifications on the project.
Employment	GRIDCo should put in place a mechanism for the employment of community members during project implementation. It was explained to stakeholders that employment opportunities on the project especially for skilled labour cannot be guaranteed as the construction of the line requires specialized formal training and expertise. The linear nature of the project will not also require unskilled labour services from the affected communities.
Health & Safety	Risk to Public Safety, Community Health & Security Issues Regulation of farming activities and other landed properties encroachment within Right of Way After Facility Development Continued Engagement During Construction & Operational Phase Effective Project Monitoring & Evaluation Process
Environmental Degradation	Project activities to avoid Environmental Degradation Communities to be assured that there will be no major changes in Land Use After Facility Development

6.3 Grievance Redress Mechanism

To facilitate resolutions that are mutually agreeable by the parties within a reasonable timeframe, GRIDCo will, as required, establish a grievance redress mechanism for the project. This procedure will allow institutions, communities, and individuals affected by project activities to formally communicate their specific concerns and grievances. Anyone may use the grievance procedure without worrying about or fearing reprisals.

6.3.1 Grievance Redress Procedure

A Grievance Mechanism is a system that allows not only grievances, but also queries, suggestions, positive feedback, and concerns of project-affected parties related to the environmental and social performance of a project to be submitted and responded to timeously. Such a mechanism aims to receive and facilitate the resolution of grievances raised by stakeholders in a timeous, transparent and balanced manner.

A GRM will be implemented to ensure that relevant parties are responsive to any concerns and complaints, particularly from affected people and communities; and to ensure that there is a central approach and record of grievances.

There shall be a comprehensive project wide GRM that will provide opportunities for affected parties channel their concerns, questions, and complaints to the various implementation agencies through multiple grievance uptake channels. The GRM will have a trained specialist to address any related issues and complaints. The project GRM aligns with the requirements of World Bank ESS10 and national law.

Essentially, the Grievance Redress Mechanism (GRM) will assist in resolving complaints and grievances in a timely, effective, and efficient manner that satisfies all parties involved. It will ensure transparent and credible process for fair, effective resolution of grievances thereby building trust and cooperation stakeholders. Specifically, the GRM:

- Ensures that appropriate and mutually acceptable redress actions are identified and implemented to the satisfaction of complainants.
- Avoids the need to resort to judicial proceedings as a way of seeking redress.
- Provides affected people with avenues for making a complaint or resolving any dispute that may arise during project implementation.

The GRM will consist of the following tiers, from lowest level, in this order:

1. Focal persons at the community level (Community Liaison Officers) to receive and transmit complaints to GRIDCo - PIU and provide feedback to aggrieved parties within the community.
2. Community-based Grievance Redress Committees (GRCs) to investigate, resolve and provide feedback to the PIU on localized aggrievances referred to them. It will be composed of representatives each from the traditional authority in the community, women in the community, Community-Based Organization, the police and the PAP, etc.
3. Country-based GRC in Ghana headed by Chief Executive of GRIDCo with the PIU Social Safeguards Specialist as the secretary. These GRCs will investigate and resolve issues beyond the Community-based GRCs. It shall consist of one representative from a national NGO, Lands Commission, Ministry of Gender, Children and Social Protection, Affected District/Municipal Assembly, a lawyer of good standing and representative of the PAP; and
4. A Project Grievance Redress Committee based in WAPP to handle inter-country and cross border conflicts, issues, and complaints.

The existence of this GRM structure does not preclude aggrieved parties from resorting to various in-country judicial system (Courts) to resolve grievances directly or in the event they are not satisfied with the outcomes of the project Grievance Redress Mechanisms.

6.3.2 The Grievance Redress Mechanism Process

The Social Safeguards Specialist at the PIU will lead in managing the GRM processes including disseminating all relevant information about the GRM processes to the various stakeholders from national to the districts and community levels. He/she shall provide systems for anonymous reporting in ways that the identifies of complainants will be protected. This will largely create an enabling environment to allow for grievances to be raised by project affected persons without fear of victimisation. A focal person (s) shall be assigned to man the call/documentation center and ensure timely escalation of complaints and grievances to the resolving officers.

Scope of the GRM

The GRM for the Financial Inclusion Project will be available for use by all project stakeholders including those directly and indirectly impacted-positively or negatively. This will offer an opportunity to project affected persons to submit questions, concerns/complaints, comments, suggestions and obtain resolution or feedback.

Implementation Steps of GRM

Grievance Redress Committees shall be established to ensure timely and appropriate resolution of grievances arising because of project activities. The coordination responsibility of the GRM shall rest with the Social Safeguards Specialist and the focal persons of the call/report centres or the Community Liaison Officer. Complaints can be registered through calls, text messages, emails or voice mail, and suggestion boxes etc. at all project sites and communities. Once complaints are received at the call or report centre(s) or the community liaison officers, they will be forwarded to the national PIU for documentation, sorting and classification and onward transmission to the appropriate quarters for resolution. When cases are forwarded to GRCs or the appropriate bodies, persons or pillar leads for resolution. Specifically, the following responsibilities shall be adhered to by the team:

i. Ensure that committees investigate grievances and propose appropriate measures to avoid or minimize adverse impacts of the interventions
ii. Ensure that the processes comply with existing safeguard procedures and policies
iii. Build the capacity of focal persons in effective community engagement, grievance handling, and negotiation and conflict resolution
iv. Build trust and maintain rapport by providing affected persons and the wider public with adequate information on the project and its GRM procedures
v. Follow up with GRM committee on the status of investigations and resolution of grievances, as well as communicating outcomes with complainants
vi. Regularly provide a report on GRM results to the project proponents and the World Bank.

The GRM implementation process will involve the following steps which have been summarized in Table 6.

Table 6 Steps in Project-Specific Grievance Handling Processes

GRM stages	Description of tasks	Responsibility	Timeline
Assign Focal Persons	The Social Safeguards Specialist liaise with stakeholders to identify Focal Persons (Community Liason Officers) to manage the designated grievance call/documentation centers.	Social Safeguards Specialist at the Country - Level PIU	Prior to project implementation
Train assigned focal persons on the design and operation of the GRM	Train Focal Persons on grievance redress processes	Social Safeguards Specialist	Prior to project implementation
Receive, transfer and register complaints	Focal Persons receives and register complaints into the grievances register .	Focal Persons (Community Liasson Officers and Digital Center Focal Persons)	1 working day after receiving complaint
Screen and refer complaints	Once complaints are received Focal Person will undertake preliminary assessment of the eligibility of complaints and acknowledge receipts of complaints to complainant within 2 workings days. The complaint will also be transferred at this stage to the resolving officer or party or grievance committee that will be set up.	Social Safeguards Specialist of the Country – Level PIU	2 working days after receiving complaints

Assess the complaint	Once transferred to the appropriate resolving officer, the focal person will undertake further assessment to establish the eligibility of the complaint, and hence determine its gravity (classified in terms of high, medium, and low severity	Social Safeguards Specialist of the Country – Level PIU	Ongoing 2 working days
Formulate an initial response	Once the assessment is completed, the concerned entity will formulate a response and communicate with the Social Safeguards Specialist, who would then contact the complainant. The communication should state whether the grievance has been accepted or rejected, providing reasons for the decision, and indicate next steps.	Social Safeguards Specialist of the Country – Level PIU	2 working days
Select a resolution approach	Where the complaint is not of fraud or corruption, working with the Social Safeguards Specialist, the GRM Committee will investigate and resolve complaints and where applicable to a specialised body or an appropriate pillar focal person will assign the complaint for mediation at different levels, engage in direct negotiations and dialogue, facilitate negotiations through a third party, conduct further investigation through the review of documents, etc.	GRM Committee	Ongoing 3 working days after receiving complaints for the Community and National Level GRCs
Settle the issues (or further escalate the issues)	The Social Safeguards Specialist will ensure that the GRM Committees take appropriate measures to remove the cause of	Social Safeguards Specialist Focal Person	

	the grievance and initiate a monitoring process to assess any further impacts of project-related work. Once settled, the social safeguards specialist and focal person record the complaint in the system as 'resolved', and inform the complainant of the outcome of the resolution process. Where not addressed, the complainant is informed about the next steps in the grievance redress process including options open to them, and the outcome recorded accordingly.	GRM Committees	Ongoing 5 working days after registering complaint
Monitor and evaluate grievance redress process	The PMU through the Social Safeguards Specialist Focal Persons will monitor the grievance redress process and the implementation of the decisions made. The Social Safeguards Specialist will work with focal persons to ensure that redress is granted to affected persons in a timely and efficient manner. They will also provide regular reports to the Bank, noting the progress of implementation of grievance resolutions, timelines of grievance redress, documentation procedures, etc. The project will capture in the grievance log, e.g. Name of the person submitting the complaint (unless kept confidential), Details of the complaint, Name of person assigned to deal with the	Social Safeguards Specialist Focal Person GRM Committee	On-going (throughout project implementation)

	complaint, Details of proposed resolution, including person(s) who will be responsible for authorizing and implementing any corrective actions, Details of whether the complainant was satisfied with the resolution, etc.		
Feedback to complainant and other interested parties	The GRM System will be updated once the complaint has been resolved so as to close the complaint in the GRM System. The PMU will contact the complainant, to evaluate if the complainant is satisfied with the resolution before the complaint is closed in the GRM system. If the complainant is not satisfied with the outcome of the investigation, a judiciary alternative could apply.	National Level PIU/WAPP PCU	On going

Special attention will be paid to the training of designated staff involved in the management of the grievance. This Grievance Mechanism covers non-employees (i.e. affected people and other relevant stakeholders such as local communities).

6.4 Gender-Based Violence and Sexual Exploitation and Abuse, Sexual Harassment (GBV/SEASH) Grievances

Gender-Based Violence (GBV) survivors can report incidents to various entities including the Community Liasson Officers, Domestic Violence and Victim Support Unit (DOVVSU) of the Ghana police Service, the nearest police station, or a health facility. They can also contact Community Liaison Officers for assistance, and it is recommended that at least one female liaison officer be appointed for this purpose. Survivors can also reach out directly via the DOVVSU helpline (055-100-0900) through calls or texts. After reporting, the Community Liaison Officer will forward the case to the Project Implementation Unit (PIU) Social Safeguards Specialist, ensuring confidentiality, who will guide the survivor through the support services and investigation processes.

Upon reporting, survivors will be referred to an accredited health facility for medical attention, if not already done. The case will be then relayed to DOVVSU for investigation with the survivor's consent. If the investigation finds grounds for prosecution, the case will be forwarded to court with the survivor's agreement, and the survivor will receive psychosocial support. The PIU Social Safeguards Specialist will monitor the progress of the case at every stage, ensuring timely medical, legal, and psychological support. All costs related to case management, including medical expenses and legal fees, will be covered by the GRIDCo. Once the court reaches a judgment and the case is resolved, it will be officially closed, with updates provided to both the survivor and PIU.

Gender-Based Violence and Sexual Exploitation and Sexual Harassment (GBV/SE/SH) grievances on the project will be handled in a sensitive, systematic, and comprehensive manner to ensure the safety and well-being of the survivor. The guiding principle will be the confidentiality and the survivor centre approach.

6.4.1 Biodiversity Management Plan

The BMP provides detailed measures to manage, mitigate, and monitor biodiversity impacts throughout the construction and operational phases of the project and ensures compliance with **World Bank ESS6 and national environmental requirements**. The BMP shall be implemented concurrently with project activities and forms an integral part of the overall Environmental and Social Management framework.

7 ASSESSMENT OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

7.1 Introduction

The proposed project is a linear one expected to exert environmental and social risks and impacts that will affect a wide area of influence because of a significant 125km length of the line and the 40m RoW acquisition associated with the project. The different locations of the various sections of the transmission line project may increase the potential adverse impacts of the project. In recognition of this fact and in fulfilment of the requirements of permitting and funding agencies, GRIDCo, in line with the law has incorporated this environmental assessment in its project cycle.

7.2 Methodology

This section of the Environmental Impact Statement deals with the methodology to be used to assess the potential impacts of the project and the results from the application of this methodology to the project, using project information and relevant baseline data. It also outlines the key potential environmental and social impacts that could result from pre-construction, construction, operational and decommissioning phases of the project to enable relevant mitigation and enhancement measures to be proposed to minimize significant risks and impacts. The main factors used in determining whether an impact may occur at each intersection between a project activity and a specific environmental medium included:

- Literature reviews (desk study)
- Field observations
- Consultations with local experts
- Consultations with stakeholders
- Experience from similar projects

The impact assessment methodology used for this project consists of five major steps:

Step 1: Identification and description of project activities and their interaction with environmental media.

Step 2: Comprehensive preliminary identification of potential impacts.

Step 3: Screening or comparative assessment of impact importance, identification of impacts that are likely to be significant (i.e., identification of focus areas for further study) through application of a basic set of impact significance criteria to the preliminary information available about each impact.

Step 4: Detailed assessment of the identified focus area and impact characterization techniques; quantification of impacts to the extent possible and rigorous qualitative characterization of impacts that cannot be quantified and

Step 5: Final assessment of the severity levels of impacts through application of the results of the rigorous quantitative and qualitative characterization of impacts developed in Step 4 to a set of objective impact severity criteria; identification of impacts warranting mitigation.

Consultations in the field coupled with the experience gained by the consultant on similar projects have informed the identification and quantification of the identified impacts. The potential impacts associated with each focus area will be qualitatively and where possible quantitatively described and evaluated under the three (3) major phases of the project cycle: Pre-construction, Construction and Operational phases. An evaluation of the residual impacts after implementation of the mitigation measures shall also be undertaken.

7.3 Results of Impact Identification Process

The proposed project may potentially result in impacts on the environment, socio-economic conditions, and/or health and safety. Each of the specific compartments of the environment listed in the Table 7 could potentially be affected by the impacts resulting from one or more of the project activities that have been discussed.

Table 7: Summary of key impacts

Environmental Component	Project Phase	Identified Impact	Impact Nature	Significance
Vegetation	Construction	Clearing of vegetation within the 40 m Right-of-Way (RoW) leading to loss of plant cover	Negative, Direct	Moderate
Vegetation	Construction	Loss of economically and ecologically important trees	Negative, Direct	Moderate
Wildlife	Construction	Disturbance and displacement of terrestrial fauna due to noise, human presence, and habitat clearing	Negative, Direct	Moderate
Wildlife	Operation	Risk of bird collision and electrocution along transmission lines	Negative, Direct	Moderate to High
Habitats	Construction	Habitat loss, degradation, and fragmentation within the project corridor	Negative, Direct	Moderate
Biodiversity	Construction	Reduction in local species abundance and diversity	Negative, Direct	Moderate

Environmental Component	Project Phase	Identified Impact	Impact Nature	Significance
Biodiversity	Operation	Long-term alteration of habitat structure and ecological connectivity	Negative, Indirect	Moderate
Ecosystems	Construction & Operation	Cumulative impacts on ecosystem services (habitat provision, ecological connectivity)	Negative, Cumulative	Moderate

7.4 Impact/Risk Evaluation

Once the environmental and social impacts/risks have been identified, the next stage is to evaluate them for their level of significance based on a pre-determined criterion. Prior to evaluation the nature impacts/risks

Table 8: Definition for Levels of Impacts/Risks

Term	Definition
Nature of Impacts/Risks	
Neutral	No overall environmental and social impact/risk.
Adverse	Negative environmental and social impact/risk.
Beneficial	Positive environmental and social impact/risk.
Duration of Impacts/Risks	
Short-term	Impact/risk persisting for six months or less
Medium-term	Impact/risk persisting for between six months and five years
Long-term	Impact/risk persisting for longer than five years

Scale of Impacts/Risks	
Small	Impact/risk is likely to affect less than 5% of the estimated population of the affected area
Medium	Impact/risk is likely to affect between 5-10% of the estimated population of the affected area
Large	Impact/risk is likely to affect less than 10% of the affected
Sensitivity/ Vulnerability/Importance of Receiving Media or Receptor	
High	Receptor/Media is rare, legally protected (national law or international law, treaty or convention) Receptor/Media susceptible to irreversible alteration/damage to its functioning (e.g. mortality, extinction, long term injury or morbidity due to the anticipated the impact/risk
Medium	Receptor/media susceptible to damage/alteration without comprise to its function and continued existence e.g. injury and short morbidity as a result of the impact or risk
Low	Receptor/media is not susceptible to any damage/alteration due to the impact/risk
*Extent of Impact/Risk	
Localised	Impact/Risk is limited to the site and 100m-radius (environs)
Regional	Impact/Risk within the boundaries of Ghana
Global/Transboundary	Impact/risk extends beyond Ghana

Magnitude of the impact is measured (high, medium, low) by considering the following variables: extent, duration, and scale of the impact or risk. Table 7 below indicates how these variables interact to determine the magnitude of impacts/risks for the project.

Table 9: Impact and Risk Evaluation Criteria

Impact Characteristics			Magnitude of impact
Extent	Duration	Scale	

Localised	Long term	Large	High
Localised	Long term	Medium	Moderate
Localised	Long term	Small	Low
Localised	Medium-term	Large	Moderate
Localised	Medium term	Medium	Moderate
Localised	Medium term	Small	Low
Localised	Short term	Large	Moderate
Localised	Short term	Medium	Low
Localised	Short term	Small	Low
Regional	Long term	Large	High
Regional	Long term	Medium	High
Regional	Long term	Small	Moderate
Regional	Medium term	Large	High
Regional	Medium term	Medium	Moderate
Regional	Medium term	Small	Moderate
Regional	Short term	Large	High
Regional	Short term	Medium	Moderate
Regional	Short term	Small	Low
Transboundary	Long term	Large	High
Transboundary	Long term	Medium	High
Transboundary	Long term	Small	Moderate
Transboundary	Medium term	Large	High
Transboundary	Medium term	Medium	High
Transboundary	Medium term	Small	Moderate
Transboundary	Short term	Large	High

Transboundary	Short term	Medium	Moderate
Transboundary	Short term	Small	Low

Based on the combination of magnitude and importance a number of possible outcomes can be obtained in terms of significance of an identified impact/risk (see Table 8). Impacts/risks rated moderately significant or higher will require further treatment.

Table 10: Evaluation Criteria

Magnitude	Sensitivity/ Vulnerability/ Importance		
	Low	Medium	High
Low	Insignificant	Moderately Significant	Moderately Significant
Moderate	Moderately Significant	Moderately Significant	Significant
High	Moderately Significant	Significant	Highly Significant

7.5 Constructional Phase Impacts/Risks

This section evaluates the environmental and social impacts/risks of project activities during construction phase based on the established criteria.

7.5.1 Beneficial/Positive Impacts

7.5.2 Increase in Employment Opportunities

The project is expected to provide temporary employment opportunities for up to 150 Ghanaians and foreigners during the construction phase, particularly in areas such as transportation, electrical work, and civil and mechanical works. Indirectly, food vendors and services providers in the informal sector are likely to experience patronage of their services.

Employment benefits would be moderate benefit in terms of magnitude, especially for local communities, as it offers a source of income and skill development. Employment benefits are rated medium scale, short term (limited to cycles during the construction phase) and transboundary as it will involve both Ghanaians and foreign national. In terms of sensitivity, rated medium. Employment generation during the construction phase is rated a moderately significant beneficial impact.

7.5.3 Boost to Local Econom

The influx of workers will have a positive impact on the local economy through the purchase of local foodstuffs and goods as well as rental accommodation. This increased demand could stimulate local businesses, including those in the catering, construction, and allied industries (e.g., cement and iron rod

production), leading to a multiplier effect on economic activities in the area. The impact of the proposed works on the local economy will have a regional spread but it will be limited to construction phase (Short term) and small scale because supply rigidities such as low capital formation will limit the capacity of local businesspeople to take full advantage of the opportunities that the proposed project will offer in the project districts making it low on magnitude. In terms of sensitive is also expected to be low, making this impact insignificant.

7.5.4 Adverse Impacts/Risks

7.5.5 Permanent Loss of Livelihood and Assets

The proposed project will impact negatively on farms, parcels of lands and some structures. It is expected that a total land area of 500 hectares will directly be affected by the proposed project. Different types of annual and perennial crops including some economic trees like cocoa, palm, rubber will also adversely be affected by the project. Farmers within the Right of Way will permanently lose the livelihood they derive from the land that will be acquired as the Right of Way for the transmission lines and the site for the sub-station. Land and property owners will also lose their structures permanently through compulsory acquisition of the 40-meter-wide Right of Way for the transmission lines and the sub-station. The scale of the acquisition is high, long-term and localized, making the magnitude of the impact high. Without compensation for the project affected persons, the effect of the loss of livelihood and assets (land) on them will be irreversible. Therefore, the sensitivity of this impact is high. As both magnitude and sensitivity of permanent loss of assets and livelihood is high, this impact is rated highly significant.

7.5.6 Incidence of Gender-Based Violence (GBV)/Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH)

The influx of construction workers poses a significant risk of GBV, including sexual exploitation, abuse, and harassment. Workers may perpetrate these acts within the local communities, leading to long-lasting psychological trauma, physical injuries, and potential transmission of sexually transmitted diseases like HIV/AIDS (long-term). Given the difficulty in detecting these incidents and the vulnerability of survivors, the occurrence of one event is rated large scale and it regional as survivors or perpetrators will be living in catchment communities in the project districts. This risk is medium in magnitude but highly sensitive due to the severe and lasting impacts on individuals and communities as well as existence of national laws and international protocols prohibiting Gender Based Violence.

7.5.7 Discriminatory Labor Practices and Incidence of Child Labor

There is a risk that workers may be subjected to unfair labor practices, such as being paid below the national minimum wage, working under poor conditions, or being denied their rights to join trade unions. Contractors and sub-contractors may employ minors to take part in aspects of the civil works against the prescriptions of national laws. These risks are highly sensitive due to national and international prohibitions

against exploitative labor practices and child/forced. They are likely to be large-scale as there is the possibility that at least 15 (10% of site workers of the estimated 150) workers can minors. It can also be transboundary as the minors and other project workers may be from neighboring countries such as Côte d' Ivoire. The health and safety risks of child labor and tendency for violent response from aggrieved workers suffering from poor working conditions can have long lasting effects (long-term). Hence the magnitude of these risks is high. With a high sensitivity and magnitude, discriminatory labor practices and incidence of child labor on this project is rated as highly significant.

7.5.8 Human Rights Abuse by Security Personnel

The presence of security personnel to manage potential conflicts with illegal miners and project affected persons during tower spotting, erection of towers and stringing transmission lines and related works may lead to human rights abuses, including unlawful detention, injury, or even death. While the magnitude of this risk is low due to its short term, localized (areas where towers will be sited within the proposed RoW) and small-scale nature (the number of clashes is expected to be few due to awareness about the project and use of the existing RoW as defined in 2014), it is highly sensitive because of the potential for permanent harm (injury) or loss of life during encounters with armed security personnel under conflict situation.

7.5.9 Incidence and Spread of Infectious Diseases

Overcrowding of site workers in small poorly ventilated rooms in substandard houses with poor and inadequate water, sanitation and cratering facilities and services will facilitate the outbreak and or spread of infectious and communicable diseases such as cholera, chicken pox and malaria. Poor housekeeping practices on site and personal hygiene among site workers will also exacerbate the situation. Incidence and spread of infectious diseases are highly sensitive as they involve mortality and long-term morbidity. It is limited to construction phase (short term) but regional in extent as these infectious diseases can spread within the project communities and adjoining regions within a short time. It is a medium scale risk on the account of the number of persons that be infected when outbreaks occur (between 5% to10% of the population of the project communities), even if response measures are initiated. Incidence and spread of infectious/communicable diseases are rated moderate in magnitude. With a moderate rating in terms of magnitude and high in terms of sensitivity, this risk is significant under this project.

7.5.10 Pressure on Social Services and Job Opportunities

The temporary influx of workers could put pressure on social amenities within project communities and also lead to social tensions, particularly if the number of workers exceeds the capacity of local services or if the workers are perceived to be taking jobs away from locals. This could result in conflicts or resentment within the project communities. The magnitude of the adverse impact of labor influx on social services and job opportunities of residents of project communities is small scales as the expectation is that not

more than 500 persons will migrate to the project districts in search job opportunities directly related to this project which will employ about 150 persons. The deterioration of social service as a result of labour influx into the project districts will be short term and regional as the migrants will be from other parts of Ghana and neighboring countries. As it involves conflicts with potential loss of life and can also lead to non-functional social services like water and sanitation services, it is rated moderately sensitive. Hence, this risk is moderately significant.

7.5.11 Destruction of Cultural Heritage Resources

Constructional activities such as surveying, clearing, digging and filling along the transmission line corridor and creation of tracks and access routes may lead to damage to areas of historic, scientific, social and amenity values, and also affect the aesthetics of cultural monuments and archaeological resources. This can occur where design and construction do not take account of such cultural heritage and resources. Damage may also be caused by construction related works such as locations of burrow sites, and unregulated access to cultural heritage sites. In case a high-tension transmission line's right-of-way (RoW) intersects a cemetery, the preferred approach is to re-route the line to avoid the site. If re-routing is not feasible, graves may be exhumed and relocated, following extensive consultation with affected families, religious leaders, and adherence to legal and cultural practices. Compensation and support are provided to the families for the disturbance. In some cases, a buffer zone might be established to protect the cemetery if the graves remain undisturbed. The entire process is handled with sensitivity and respect to minimize cultural and emotional impacts. The initial consultation did not identify any archaeological sites except cemeteries. At this stage, there has not been any identified or known cultural heritage site within the area of impact of the project. However, issues regarding cultural properties and the possibility of cultural and/or archaeological 'chance finds' are considered low on magnitude given the fact no shrines, sacred grooves and community places of worship were not encountered in the Project Right-of-Way during the Cultural Heritage Study (see Appendix XIII for the Detailed Report). The impact is therefore limited to chance finds during the construction of transmission line and substation.

From the forgone, destruction or discovery of chance finds rated is highly sensitive, if the discovered or impacted artifacts or sites have cultural, historical, or archaeological value, requiring legal compliance. Even if the finds are not important, they still necessitate documentation and proper management to avoid legal and/or community issues. Therefore, the impact significance is placed at moderate.

7.5.12 Traffic Disruptions

Potential impacts on traffic and transport during construction will arise as a result of additional traffic movements associated with the transportation of equipment and constructional materials to the project site.

Thus, there can be serious disruptions to local traffic and accidents during the construction period. This may result from the transportation of machinery and materials to the project site and during the stringing of the transmission lines across roads. The situation can be aggravated if carefully planned detours and road closures are not put in place. The sum effect of traffic disruptions may include increased travel time, congestion, social stress and agitations. The impact on traffic disruption is short term as they will occur intermittently over a few hours or a few during the construction, it localized and small scale given the low Average Daily Traffic (ADT) volumes on the feed roads within the project corridor. The traffic conditions can also be easily restored post any disruptions making sensitivity low, hence traffic disruptions under this project is expected to be insignificant.

7.5.13 Generation of Construction Waste

Different forms of solid and liquid waste including excavation spoils, vegetative matter, damaged/defective cables, packaging materials and oil spills from construction equipment will be generated. Liquid waste that may result from spilled oil, chemicals and paints are likely to be generated. Other forms of construction waste will be generated from Right of Way clearing and material waste from the excavation of about 320 pits for tower foundation each covering an area of about 100 square meters and depths of about 4 meters as well as the construction of the new sub-station. These wastes, if not properly disposed-off will litter the project zone cause accidents such as trips and falls and/or restrict movement on site.

These wastes, if not properly disposed-off will litter the project zone and can cause accidents such as trips and falls which can lead to long-term injury, morbidity, and mortality. In terms of magnitude, it is moderate because it is It will largely be limited to within the project's 40-meter Right of Way along the 125-kilometer stretch, the site for the substation and material stores (localized) for not more than one year (short term) and medium scale. The impact significance of poor waste management in the high-tension transmission line project is moderate. The impact of poor construction waste management in this high-tension transmission line project is considered moderately significant.

7.5.14 Intermittent Increase in Noise Levels and Vibrations

The use of heavy equipment such as crane trucks, bulldozers, excavators stringing equipment and hydraulic compressors during site preparation, installation of towers and stringing transmission lines will generate intermittent noise above the ambient levels and also minor vibrations with consequences hearing impairment and weakening the structural integrity of buildings within the project zone. General traffic movements in the project zone will also generate some intermittent noise. The increase in noise levels and companying vibrations from earthworks and equipment use may also displace some fauna species from habitats within the project zone.

The displacement of fauna from their natural environment due to increase in noise and vibration is considered low on sensitivity. The increase in noise levels and vibrations associated with this project will be intermittent and will not lead to significant hearing impairment and anxiety since the selected RoW does not traverse human settlements. In addition, the animals can migrate to other areas outside the project zone within the same eco-system, recover and continue to sustain themselves. The effects of noise and vibrations are expected to be localized within a radius of 500 meters from the source, short term and small scale-largely within the non-residential limits, making it low in terms of magnitude. With a low on both magnitude and sensitivity of impact, intermittent increase in noise levels and vibration are insignificant.

7.5.15 Decrease in Air Quality

Air pollution may adversely affect the health of people engaged directly or indirectly in the project activities. The effects may be due largely to point sources such as particulates from vehicular emissions and constructional equipment powered by gasoline or diesel as well as non-point sources such as silica in dust whipped up from the earth agitated by constructional equipment and construction vehicles plying un-tarred roads. The resultant effects are acute respiratory disorders, lung and heart diseases, the type of ailment depending on the size of particulates as well as the materials adsorbed on them. The project zone exhibits wet and humid conditions with short dry spells suppressing the magnitude of the effects on air pollution. Apart from this, transmission lines do not traverse densely populated human settlements. These notwithstanding, the use of construction equipment and vehicles during earthworks, erection of towers will result in the emission of fugitive dusts, and contaminants adhering to dust particles.

More minor air quality impacts can arise from the excavation of materials during construction, during access track grading and gaseous emissions from plant and vehicles used during the construction process. The impact significant on-air quality during high-tension transmission projects is generally short term, localized and small scale making it low in terms of magnitude, but it is moderate on sensitivity because of the potential health effects associated with exposure to polluted air making decrease in air quality is moderately significant.

7.5.16 Decrease in Water Quality

Construction activities of the nature of the proposed project involve the disturbance and removal of vegetation associated with creation of access tracks and excavation for foundation works for tower siting. When these activities are conducted in or close to waterbodies soil erosion and deposition into waterbodies occurs, increasing sediment loading. Other potential sources of water pollution under this project are cleansing construction and equipment near waterbodies and accidental spillage of hazardous materials such as oils, fuel, paint and adhesive in waterbodies. Water with high sediment loading contaminated with hazardous substances poses a threat to aquatic and human life. Contaminated water causes gastro-intestinal and skin diseases.

Decrease in water quality is short term but has regional implications because the catchments of the waterbodies that traverse the transmission line route extend beyond the project corridor but none of them crosses over to Côte d' Ivoire. Water pollution from project activities is also likely to medium scale compared to the threat posed by illegal mining activities in the project corridor making the overall magnitude of this impact high. Nonetheless, links to mortality, morbidity and threat of causing extinction or significant damage to aquatic life make this impact highly sensitive. From the foregone, the risk of water pollution from this project is significant.

7.5.17 Work related Accidents and Incidents

During the construction phase, accidents are likely to arise from moving machinery in the course of operation, unguarded parts of equipment, human errors, faulty equipment and a disregard for health and safety measures. These are likely to pose risks to the workers during activities such as excavation tower foundation, tower assembly and installation, and stringing of the transmission lines as well as constructing the substation. Other sources of injuries and death to workers through occupational hazards are electrocution, accidental falls from height during stringing of transmission lines, noise, vibration and heat, falling/swinging objects and also lubricants some of which contain solvents with potential to cause skin irritation and allergies, respiratory disorders and acute poisoning. Work-related accidents can occur frequently and affect many site works (large-scale) in the short-term within the construction zone and its immediate environs (localized). It is, therefore, high in terms of magnitude. appropriate mitigation measures. Work related accidents in the form of electrocution, hits, falls and cuts can lead to mortality and long-term injury such as spine and neurological problems, loss of vision and other permanent injuries/damage makes it highly sensitive. With a high sensitivity and magnitude rating, this impact is highly significant.

7.5.18 Accidents outside Work Zones

The transportation of construction materials, heavy plants and equipment through settlements and the presence of unprotected tower base excavations could pose potential safety problems such as falls for the local populace. Road traffic accidents can lead to long term injury, loss of lives and property making it highly sensitive. They are regional in nature because they can occur in project communities and along haulage routes and communities outside the project corridor. These notwithstanding, the number of crashes and other forms of road accidents on this project is likely to be low because of the untarred nature of roads and low traffic volumes (small scale) in the project corridor and short-term during haulage of equipment and material as well as general movement by site workers. These imply that in terms of magnitude it is low but with a high sensitivity, the overall significance level of this accidents is moderate.

7.5.19 Impact on Flora and Fauna

Noise and removal of vegetation during the construction of the sub-station and access roads as well as the demarcation of the centerline and 40m right of way for the transmission line will result in permanent and temporary loss of vegetation in these areas leading to potential faunal displacement as well as habitat loss. Another potential cause of fauna loss is accidentally killing animals in the wild and killing of game for meat by site workers. Birds in flight may also collide with the high-tension lines and tower leading to death or injury.

This impact is rated low in terms of magnitude as limited to the 40-meter band project Right of Way and substation site (localized), long term and small scale on the account the anticipated low frequency of collision, the absence of engender animal species and animal migratory routes within the project corridor as recorded during the Bio-diversity Assessment. However, it is highly sensitive because bird collision and direct attack on animals leads to injury and death, vegetation clearing can also lead to habitat loss and loss of plant species including vulnerable species. This impact is therefore moderately significant (low magnitude, high sensitivity)

7.5.20 Impacts due to Establishment of Work camps

The establishment of work camps and the presence of workers in local communities may result in the following potential adverse impacts:

- Increased Demand for Local Resources: The influx of workers may increase the demand for local resources such as water, food, and housing, putting pressure on community supplies and possibly leading to shortages or price increases.
- Social and Cultural Disruption: A large, temporary workforce can disrupt local communities, potentially leading to social tensions or cultural clashes. Differences in lifestyle and behavior may cause friction between workers and local residents.
- Spread of Communicable Diseases: The presence of external workers, particularly in large numbers, may introduce communicable diseases to the community, including respiratory infections, waterborne diseases, or sexually transmitted infections.
- Strain on Local Infrastructure: An increase in population due to workers renting homes in local areas could place additional strain on local infrastructure, such as roads, healthcare services, and waste management systems.
- Waste and Pollution: Work camps and increased residential demand may lead to improper waste disposal, contributing to environmental pollution. Poor sanitation practices could result in water contamination and general environmental degradation.
- Risk of Gender-Based Violence (GBV): The presence of a predominantly male workforce in proximity to vulnerable communities can increase the risk of gender-based violence, sexual harassment, or exploitation.

7.5.21 Impacts of Illegal Mining ("Galamsey") on Power Infrastructure

The prevalence of illegal mining ("*galamsay*") activities within the Right of Way of the transmission line and its immediate environs will have an adverse impact on the siting and construction of towers as these activities create pits and make the soil unstable. Extra cost will be incurred to redesign and re-enforce tower foundations in these areas or acquire additional land for route re-alignment during tower spotting to avoid such zones of instability. Site workers may accidentally fall in untended mining pits and get injured, trapped or die.

This impact is highly significant and will require mitigating measures. The magnitude of the impact of presence of active and/or abandoned mining pits/areas within the Right of Way of the power transmission line and its immediate environs is low on account of the '*galamsey*' sites observed within the project RoW and its immediate environs cumulatively occupied less than 3% of the entire project Right of Way (small scale and localized). It is long term because there are no attempts to reclaim and restore the degraded lands after the miners abandon the sites. The sensitivity of this impact is also rated high because of the prohibitive cost of restoration and its potential to cause long term injury or death as through accidents. The abandoned pits and soil degradation may require extra tower foundation-strengthening measures such as excavation and replacement of bad materials at extra cost and time to the project, if towers have to be installed there. Avoiding these zones of instability will also require additional land take and resettlement impacts.

7.6 Operational Phase

The operational phase of the proposed project may be environmentally sound and accident free if strict adherence to the non-encroachment requirement of the right of way is observed. However, there is the potential for adverse impacts during the proposed project's operational phase. These have been discussed below.

7.6.1 Destruction of Flora and Fauna

The safety and integrity of the transmission line requires the regular maintenance of the right of way. This will necessitate the cutting/pruning of trees deemed as potential threats to the transmission line and observing general weed control within the right of way. Vegetation control and management will involve physical or mechanical clearing of vegetative growth which could have adverse effects on flora and habitat of some animals. Apart from the towers standing at about 50 meters connected with cables may obstruct bird movements or cause collusion with birds

This low magnitude impact will occur on a small scale and short-term basis as the clearing will be intermittent and mostly involve brushing and pruning tall trees and secondary vegetation within the

demarcated Right-of-Way (localized). The vegetation is likely to re-establish itself after six months of clearing given the wet climatic conditions of the project zone implying that sensitive of the impact is low.

7.6.2 Waste Generation

During the construction phase of the 400/330 kV transmission line and substation, various types of waste will be generated. In addition to the solid waste typically associated with construction activities, such as debris, packaging materials, and excess soil, it is important to also consider:

- Cable Reels and Electrical Waste: Large quantities of cable reels, wiring, and electrical components will be used during the installation of transmission lines. These materials will generate waste once unpacked and installed, and proper disposal or recycling strategies must be implemented to handle the byproducts safely and efficiently.
- Construction Debris: Waste from demolition or clearing activities, along with materials such as concrete, wood, and scrap metal, will be generated during tower erection and substation construction.

The project must implement a comprehensive waste management plan to ensure that these materials are disposed of appropriately. Recycling options for materials such as cable reels and metals should be prioritized to minimize the environmental impact.

- Erosion control measures such as silt fences, riprap, and vegetation buffers to prevent soil displacement.

7.6.3 Soil Pollution by Leaking Oils

During both the operational phases, there is a risk of soil pollution from:

- Oil leaks from operational vehicles and machinery, which can contaminate the soil if not properly managed.
- Leaking oils from transformers and other oil-filled electrical equipment. Transformers, which use mineral oils or biodegradable ester-based oils for insulation and cooling, pose a risk of leakage, especially during installation or in the event of equipment failure.

Theis impact is moderately significant as it is low in magnitude and moderately sensitive in terms of sensitivity.

7.6.4 Work-related Accidents and Incidents

Test runs, routine maintenance and repairs works on the transmission line and substation as clearing and pruning of vegetation around the towers and under the transmission line, replacement of corroded towers and transmission line components and fixing anti-theft fasteners will expose workers to occupational health and safety risks such as falls, hits, electrocution from high voltage and snake falls, hits from and snakebites. These risks can lead to injuries, long term morbidity and mortality.

7.6.5 Community Health Safety Risks

Potential collapse of towers due to rainstorms and vandalism, electro-magnetic field effects, electrocution and fire outbreaks and burns from falling live conductors due to rust or lightning mechanical failure of an insulator string on the tower or snapping of the conductor are some of the community health and safety risks associated with the operation of power transmission systems.

The magnitude of this impact is low. The association of cancer with exposure to electro-magnetic fields from power transmission lines is inconclusive. Experiences from similar projects indicates that collapsing of towers, fire breaks, burns and electrocution from power transmission systems do not occur frequently (small scale). When they do, they are for a brief period (short-term) and limited to the site and its immediate environments (localized). They, however, lead to injury, death, long-term morbidity and devastation-making them overly (highly) sensitive. The foregone makes community health and safety risks associated with operating a power transmission system of this nature moderately significant.

Electromagnetic field (EMF) effects occurs whenever a voltage is present or whenever a current is flowing and its effect is minimal as detailed in Appendix XI.

7.6.6 Human Rights Abuse by Security Personnel

During Right of Way maintenance/protection operations, security persons from GRIDCo may encounter illegal miners, farmers and residents of catchment communities who are encroaching on the Right of Way of the transmission lines, attempting to vandalize, or tampering with the transmission lines and/or towers. In an attempt to evacuate encroachers and/or apprehending thieves, the security personnel may exert disproportionate force, engage in unlawful detention, violating the human rights of the individuals involved. This may lead to injury and/or death of the persons involved. Security personnel may become perpetrators of Gender Based Violence within communities in the project corridor.

Human rights volitation by security personnel within the project zone and communities within project corridor (regional) are not expected to be rampant (small scale) during the operational phase as they will be occasioned by intelligence reports of encroachment within the Right of Way of the transmission line of the substation acquisition, theft and vandalization of the towers and transmission line and snap checks on section of the projects RoW. Nonetheless, they will be long term. Therefore, the magnitude is moderate. In terms of sensitivity, it is rated high because activities of security personnel in project corridor can lead to long-term injury, mortality and gender-based violence. With high sensitivity and moderate magnitude, this risk is considered as a significant risk requiring mitigation actions.

8 IMPACTS/RISK MITIGATION & ENHANCEMENT MEASURES

This section of the report will outline measures to avoid and if not possible, minimize or mitigate the adverse environmental and social impacts/risks identified in the previous chapter.

8.1 Construction Phase

The project's construction phase involves activities that could impact significantly on the physical, biological, and socio-cultural/socio-economic environments within the project's area of environmental influence. The following mitigation measures have been proposed for the significant potential environmental and social impacts/risks during the construction phase of the project:

8.1.1 Measures to Compensate of Physical and Economic Losses

To minimize the adverse effects of the acquisition of the RoW on individuals, families and communities, GRIDCo will prepare and implement a Resettlement Action Plan proportionate to magnitude of the physical and economic displacement. The RAP, which will be in line with the requirements of World Bank ESS5 will be approved by the Bank prior to the commencement of works. The plan will guide the implementation of the resettlement program under this project.

As part of the preparation of the RAP, a property impact assessment will be undertaken within the 40m project RoW and the proposed site for the substation based on cut-off-dates agreed with the Project Affected Persons and duly disclosed to them. The property impact assessment will include a census and socio-economic survey of all Project Affected Persons as well as an inventory of assets that will be impacted by the proposed works. All the properties (crops, land and structure) will be enumerated, referenced, and valued for the purposes of paying compensation for the project-affected persons (PAPs) based on replacement cost. The property impact assessment will be carried out in compliance with GRIDCo's Resettlement Policy Framework to meet the requirements of World Bank Environmental and Social Standard (ESS5) on Land Acquisition, Restrictions on Land use and Involuntary Resettlement. The full replacement cost/value method will be used for the valuation of the affected properties within the 40m corridor. Persons, except illegal miners, who will lose their livelihood as result of the project will be due a livelihood restoration and transition allowance.

8.1.1 Mitigation for Measures for Mining (*Galamsey*) Related Impacts

The selected transmission line route largely avoided small-scale mining (*gamalsey*) sites as much as possible. In the limited areas, where avoidance was not possible during the route selection stage, GRIDCO will ensure that, as much as possible, mining and degraded areas are avoided tower spotting. In an extreme case where a mined area cannot be avoided, engineering solutions such as removing and replacing unsuitable materials and/or reinforcing the tower foundations with stronger base structures will be

employed to ensure stability; thus, deep excavation and backfilling with suitable materials within mining degraded areas will be adopted to mitigate the risk of tower collapse due to unstable ground conditions.

More importantly a Community Based Livelihood Restoration Programs (LRPs) in the form of and Awareness Campaigns would be developed as part of the Resettlement Action Plan (RAP) for the project. These campaigns will highlight the dangers that illegal mining activities pose to the construction and operation of high-voltage transmission lines, while also offering a community based alternative livelihood opportunities for the communities affected by the mining activities as of the census-out-off date.

The community-based Alternative Livelihood Scheme will be implemented in place Livelihood Restoration Plan in the seven (7) communities identified during the asset inventory undertaken as part of the preparation of the RAP. It will include components such as land reclamation, Right-of- Way protection and smart agriculture. It will be open to all community members including small-scale miners within the affected communities only. The Alternative Livelihood Scheme will be implemented by GRIDCo as part of RAP implementation.

8.1.2 Mitigation Measures for Labour related Risks

Preference shall be given to local communities in terms of employment for semi-skilled and unskilled labor e.g. artisans. In addition, the underlisted will be undertaken to mitigate labor related risks:

- All workers will be given contracts specifying the type of work they are to undertake and their remuneration package as well as the conditions of service in line with the Labour Act, 2023 and other Ghana labor laws
- Workers will be notified of their rights and processes involved in joining and forming workers' unions on site
- Contractual clauses against child and forced labor as well as discrimination by sex, ethnicity and religion will be inserted in the Contractor's Contract document.
- Environmental and Social Contractual clauses will be inserted in the Contract document prohibiting the Contractor, sub-contractors and their employees from child and forced labor and reporting all such cases to the nearest FSU office binding on the Contractor and Supervising Engineer
- All prospective workers will provide an identity card or other proof of identification meeting the age of employment before they are employed on-site
- A Code of Conduct (see Appendix IVX) will be prepared for and signed by the contractor's employees including those of any sub-contractors informing them of the sanctions for Child and Forced Labor. The Contractor will be required to consider alternative work schedules or shifts to accommodate the hiring of more female workers.
- Site workers will have access to an accessible, participatory time-bound work-based grievance

redress system with a focal point for reporting their grievances and receiving feedback

- The Resettlement Action Plan (RAP) conducted cataloged Project Affected Persons (PAPs) for compensation at a total cost to be defined after completion of the activities. Labour Influx Impacts/Risks.

8.1.3 Preventive and Mitigation Measures for Gender Based Violence

To prevent the incidence of GBV/SE/SH under the project GRIDCo will insert Contractual Clauses on mandatory and regular training for workers on required lawful conduct and legal consequences for failure to comply with laws on non-discrimination and GBV/SEA/SH into the Contract documents of the Contractor and Supervising Consultant. These Environmental and Social Contractual Clauses will have commitments ensuring the Contractor and Supervising Consultant to cooperate with law enforcement agencies (e.g. DOVVSU) investigating cases of gender-based violence including SEA/SH as well as clauses against rape, defilement, and other Gender-Based Violence as well as child and forced labor. Workers on site will sign a Code of Conduct with sanctions on rape defilement and other forms of Gender-Based Violence such as SEA/SH. GRIDCo, will also organize one (1) GBV/SEA/SH sensitization workshop will be undertaken for employees of the Contractor/Supervising Consultant and GRIDCo field staff as well as in each if the project communities every year.

The Contractor will paste prohibition posters on sexual exploitation, abuse and harassment as well as the contact numbers of the nearest DOVVSU office/DOVVSU help line/Community Liaison Officers within the immediate project and at vantage points with the project communities.

The Contractor will provide contact numbers of the nearest DOVVSU office/help line within the immediate project zone and prohibition posters on sexual exploitation, abuse and harassment will be pasted in and around the site.

8.1.4 Mitigation Measures Human Rights Abuses from Security Personnel

GRIDCo will also only deploy professional military and police personnel for Right-of-Way Protection operations as a last resort when a clear case of illegality has been established and consultations and negotiations have broken down or in response to threats of or acts of vandalism.

GRIDCo will assign a Memeneradum of Understanding with the security personnel establishing the ground rules and scope of the engagement and clearly affirming that GRIDCo will sign off the operational plan/strategy for each operation before the team is deployed on the field. In addition, GRiDCo will run a background check on all security personnel who will be involved in right of way protection operations and ensure that they are cleared of any criminal and GBV record.

All security personnel will be made to sign a code of Conduct to guide their actions during operations and attend training on community policing, GBV and human rights prior to their commissioning. They will prepare a formal brief for GRIDCo management after every assignment.

A transparent-accessible-time-bound grievance redress mechanism with multiple uptake points will be established in communities within the project corridor by GRIDCo. It will be advertised, and residents will be encouraged to use it report any the even they suffer human rights abuses from the security personnel.

8.1.5 Measures to Ensure Occupational Health and Safety of Site Workers

These mitigation measures will be adopted by the Contractor to ensure to prevent and minimize accidents and incidents on site during the construction phase:

d. Only well-trained professional technicians and Engineers will assign technical tasks such as working at heights
e. Site workers will undergo medical screening before they are deployed on-site.
f. Site workers will receive OHS training at least twice during the construction phase.
g. Workers will sign and agree to the Code of Conduct (see Appendix XIV) prepared for the sub project
h. Random checks will be done to prevent substance abuse
i. -Site workers will be provided with PPEs (e.g. body harness (working at height), hard hats, safety boots, earplugs, reflectors etc.) suitable for the assignment.
j. -Potable water will be provided for site workers at all times.
k. -Daily toolbox meetings will be organized for site workers
l. -An Environmental, Social, Health and Safety Officer will be employed to ensure compliance with occupational, health and safety protocols/rules on site e.g. enforcing the wearing of PPEs, facilitating toolbox meetings and ensuring good housekeeping, among other roles
m. -Prohibitive, warning and directional signs will be provided on site.
n. -The Contractor will be made to provide at least fire extinguishers and 2 First Aid Box for each gang
o. -Contact numbers of the nearest fire station will be pasted at vantage points on-site.
p. Clear sanctions and rewards for non-compliance and compliance respectively will be provided in the Code of Conduct (see Appendix XIV) to be signed by workers.
q. -Training of site workers in OHS, fire prevention and combating (including fire drills) as well as good housekeeping practices will be undertaken at least twice

a year during the construction phase

r. -The Contractor will notify the Supervising Engineer and the relevant authorities including SL-Police, Factories Inspectorate Department, GRIDCo and the Police of any accident/incident within 12 hours of its occurrence and provide a detailed accident/incident report in the subsequent monthly progress report.

s.

A Construction Environment & Social Management Plan (C-ESMP) shall be prepared and submitted by the contractor. This must be approved by the proponent before construction starts. This will provide guidance for the implementation of environmental, safety & health management in the construction of the transmission line and associated structures like the substation. The C-ESMP will also help the contractor establish, implement and integrate ESHP control, monitoring and mitigating measures for the project.

Education and awareness training are given to every worker upon employment. GRIDCo shall promote the need for safety awareness in all aspect of the work by conducting safety awareness programmes and campaigns, displaying posters and signs and using audio visuals. Weekly and monthly safety meetings are held in all the sections, both for workers of GRIDCo and the contractors.

GRIDCo will ensure that the contractor carries out the work in compliance with the relevant provisions of the Factories, Offices and Shops Act, 1970 (Act 328) and the Contractor Safety Rules to minimize the potential occupational safety and health hazards and prevent or minimize accidents. To further minimize the potential safety and health hazards, GRIDCo will ensure that the contractor employs properly trained and experienced operatives and adheres to all technical specifications relevant to safety measures in the execution of the works. In addition, the contractor will be expected to provide an "All Risk Insurance" cover for the contractor, subcontractors, project management staff and all other employees.

GRIDCo will ensure that the contractor conducts formal induction sessions for all workers on site, including issuing each of its employees and employees of its subcontractors with an induction health and safety booklet. Road safety signs be placed at appropriate places and approches to prevent accidents. Dangerous construction will zone shall be flagged with caution reflectors.

8.1.6 Measures to Protect Cultural Heritage Resources

The findings of a cultural heritage assessment conducted for the 330kV Côte d'Ivoire-Ghana Transmission Line reinforcement project. Indicated no significant cultural heritage sites, sacred groves, shrines, historical monuments, or community structures were identified within the RoW. The report concludes that the transmission line project poses no major threat to cultural heritage sites but emphasizes the importance of careful monitoring and adherence to mitigation strategies, especially in cases of "chance findings" during construction. The detail of the report is attached as Appendix XIII.

During tower spotting, the Contractor will ensure that culturally sensitive sites such as that may be chanced upon would be avoided wherever possible as sites for tower location. Wherever avoidance is not possible, the Contractor, GRIDCO and Consultant will consult with owner/owners of the cultural heritage resource and secure an official consent with conditions under which such cultural heritage sites and resources will be disturbed bearing in mind health and safety concerns. GRIDCo and the Contractor shall fulfil all agreed conditions.

In the event of a chance find, a Chance Find Procedure prepared in line with ESS8, relevant national laws and international best practices is attached as Appendix XV. Site workers will be sensitized to understand the measures in the Chance Find Procedure, so they can implement it in the event of a chance find.

8.1.7 Measures to Minimize Traffic Disruptions

Equipment and materials will be properly secured in vehicles while being transported to avoid the falling of such items on public roads to create potential hazards or safety problems for the public. Also, trucks and vehicles conveying such materials will display appropriate road safety signals- red flag and flashing amber lights. GRIDCo will ensure that deliveries are only made during daylight hours. Construction vehicles and haulage trucks will drive at speeds not more than 40km/hr.

To minimize traffic conflicts at the junction where the access tracks join public roads GRIDCo will ensure that road signs are erected at appropriate distances on either side of the junction to warn motorists of the potential danger of heavy-duty trucks turning into and off the main road. Obstructing vegetation at the junctions will be cleared to allow drivers to properly view and assess situations before joining main roads.

Also, warning notices like **"NO ENTRY" or "NO TRESPASSING ALLOWED"** will be placed at entry to access tracks. In addition, random security patrols will be carried out to ensure that the local people do not unduly endanger their safety.

Furthermore, certain constructional activities like the stringing of transmission lines across public roads will cause temporary traffic disruptions. Traffic wardens will be employed to direct traffic during such times to avoid confusion and prevent accidents. As indicated earlier, the proposed transmission line will encounter various roads, some with asphalted surfacing. It is therefore important to ensure coordination with the road agency and GRIDCo to minimise interference between installation and operation of the transmission lines follow guidelines of the ***"Road Reservation Management: Manual for Coordination" (June 2001).*** Thus, in all cases, where line stringing will cross public roads, the Contractor will duly notify the public and appropriate authorities (Ghana Highway Authority and/or District Assemblies) at least one week prior to the activity with a repeat notify at least 48 hours (about 2 days) ahead.

8.1.8 Mitigation Measures for Waste Generation

Solid wastes in the form of trees, tree stumps and wooden containers will be gathered together and made available to the local communities as fuel wood. Metal waste will be collected and disposed of appropriately and/or recycled. Solid waste in the form of paper, food material, etc. shall be disposed of in dustbins that will be provided at the various sections for each gang and Contract's offices. They will be disposed of at approved landfill sites within the project communities.

Excavated material will be used as fill material for towers footing. Bad material and the excess will be used to fill pits or spread to level sections of the Right-of-Way.

The Contractor will be responsible for managing all waste generated during the construction phase, including tree stumps, cable reels, and other materials. Tree stumps will be distributed to local communities for use. All metal waste, such as damaged cables and scrap, will be collected, recycled, or properly disposed of in compliance with local regulations. The contractor's responsibilities include ensuring proper transportation and handling of waste to prevent environmental damage.

8.1.9 Measures to Minimize the Impact of Noise and Vibration

Noise impacts from construction activities will be temporary, limited only to the construction phase of the project. All equipment and vehicles will be new. GRIDCO will have a contractual arrangement with the contractor, hence their ability to generate undesirable sound will be very low. All the equipment to be used in the construction of the line shall be required to emit very low noise in order to ensure that noise does not have an impact both on workers and the public at large. All such equipment and vehicles will undergo periodic routine maintenance to reduce vibrations and other faults that ultimately lead to the generation of noise. Particular attention will be paid to all noise-reducing devices or mufflers to ensure that they are in good working condition to minimize noise generation.

The unnecessary tooting of horns during transportation of equipment and materials through settlements will be avoided as much as possible. Construction site workers will also be advised to avoid unnecessary noise making. In addition, night-time work, especially near communities, will be avoided as much as possible to prevent undue noise impacts on local communities. Construction crew near noisy machinery and power tools will be provided with earmuffs to protect them from hearing loss damage.

It is expected that the full implementation of the measures outlined above will minimize the potential impact of noise on the workers as well as the local communities.

8.1.10 Mitigation Measures for Air Pollution

To minimize air quality impacts on sensitive facilities during high-tension transmission projects, construction activities should be scheduled to avoid peak hours when these facilities are most active. Implementing dust control measures, such as water spraying and using dust suppressants, helps reduce

particulate matter. Additionally, maintaining equipment in good working condition and utilizing barriers or enclosures can help contain emissions and further protect nearby sensitive areas from air quality degradation.

Wind carrying dust from exposed unprotected land surfaces will be minimized by limiting land clearance to minimum area requirements for the construction activities. For instance, excavation of the tower base areas will be restricted to the required dimensions of 6m x 6m and utmost 9m x 9m. To further reduce dust pollution, regular dousing of the substation site and areas where tower foundations are being constructed will be carried out to reduce the effect of wind pick-up of dust particles. GRIDCo will ensure that all exposed surfaces, access road and working areas, are sprayed with water twice a day as part of regular construction activities. This shall be done, when necessary, with water bowsers. The frequency of spraying will be increased during the dry season. In addition, construction machinery and equipment will be maintained regularly to minimize the release of soot and exhaust fumes. Furthermore, trucks that supply sand, gravel and stone aggregates will have their buckets properly covered with tarpaulin during transit to prevent wind pick-up of dust, spill of materials and the release of dust into the atmosphere.

These measures, when fully implemented, are expected to minimize the potential impact of dust pollution on local communities.

8.1.11 Measures to Control Soil Pollution

Mitigating the impact on soil erosion during a high-tension transmission project involves implementing erosion control measures such as silt fences, terracing, and vegetation buffers to prevent soil loss and degradation. Proper site management practices, including limiting the area of land disturbance and using matting or geotextiles, help minimize soil compaction and maintain soil structure. Restoring disturbed areas with native vegetation post-construction aids in soil stabilization and reduces the risk of further erosion. Careful handling and disposal of construction materials prevent soil contamination from hazardous substances. Overall, these mitigation strategies are essential to preserving soil health and preventing long-term environmental damage.

The substation site will be designed and constructed to have a comprehensive stormwater management system to prevent waterlogging and soil erosion. The contractor will construct a drainage system to redirect water away from critical areas, ensuring the site remains stable, unflooded and environmentally compliant.

8.1.12 Measure to Control Soil Erosion

Activities during the constructional phase will expose the disturbed ground surface, which is at least temporarily unprotected, to the agents of soil erosion such as heat, wind and rain. Erosion of soil from exposed unprotected land surfaces will be minimized by limiting land clearance to the minimum area requirements for the constructional activities. For example, excavation of the tower base areas will be

restricted to the required dimensions of 9.6m x 9.6m. Also, the erection of towers/tower footings on steep slopes will be avoided as much as possible to prevent slip erosion.

GRIDCo will apply erosion control practices such as re-grading, compaction and early re-vegetation in relevant areas of the proposed substation to promote soil conservation.

The substation will be designed and constructed with an integrated drainage system to conform with the topography of the area to avoid flooding the area. Other mitigating measures such as silt fences, terracing, and vegetation buffers to prevent soil loss and degradation. The works will be designed and supervised by a competent professional architectural, electrical and civil engineering firm.

8.1.13 Mitigation Measures for Pollution of Waterbodies

Clearing and grading of access and tower corridor tracks and the excavation of tower base areas will be limited to the minimum area requirements. Other measures proposed in other sections of this report for minimizing erosion and managing excavated materials, wastewater and accidental spillage of oil, fuel and paints are valid for the prevention of pollution of water bodies as well as. GRIDCo will use culverts across water bodies to allow access to avoid blockage of streams, rivers and other water bodies. Under no circumstances shall water bodies be blocked to provide for construction access and the erection of towers. Removal of stream bank vegetation (especially bamboo/mangrove) shall be avoided as much as possible. GRIDCo will not employ herbicides/weedicides for weed control or vegetation clearing hence any potential pollution from this source is eliminated. Additional measures to minimize and mitigate against water pollution that will be implemented by the Contractor are as follows:

- Construction equipment and vehicles will be cleansed at 100 meters away from local streams and waterbodies
- Oils, fuel and other lubricants will be stored at least 100 meters away from water bodies
- Screens, oil/grease traps or inceptors will be installed on drains from material storage areas and work zones where activities that can cause potential oil spillage will be occurring and at outfalls into local waterbodies
- One mobile toilet and two refuse bins will be provided for each gang in working at a section
- Toilet facilities will be kept clean and well-maintained at all times and raw sewerage will not be discharged into waterbodies.

GRIDCo will ensure that the contractor does not establish a camp within 500m of a waterbody to minimize the incidence of water pollution.

The measures outlined above are expected to minimize the possibility of water pollution and its effects on downstream users and aquatic life. Effective management practices, such as installing silt fences, using

containment measures, and adhering to proper waste disposal protocols, are essential to protect water bodies and maintain water quality.

8.1.14 Biodiversity Mitigation Measures

In accordance with World Bank Environmental and Social Standard 6 (ESS6) and international best practice and applies the mitigation hierarchy of avoidance, minimization, restoration, and compensation. Measures defined in the BMP include, but are not limited to:

- Minimization of vegetation clearing strictly within the approved RoW;
- Protection of sensitive habitats and ecological corridors;
- Installation of bird diverters and insulation of energized components to reduce avifauna collision and electrocution risks;
- Restoration of disturbed areas using native species;
- Long-term biodiversity monitoring and adaptive management.

Implementation of the BMP will ensure that biodiversity impacts are effectively mitigated during construction and operation of the project.

8.1.15 Measure to Mitigate Adverse Impact on Flora and Fauna

Care will be taken to minimize the area that will be cleared and the number of trees that will have to be cut. Construction workers will be closely supervised to ensure that only the minimum area requirements, as given earlier, for access trucks, tower corridor track and tower base areas are cleared of vegetation to minimize potential impacts on flora and fauna. Also, surveys conducted, and desk studies carried out during the baseline study have not revealed the presence of any floral and faunal species of conservation concern that will be irreversibly impacted by the proposed project (Appendix X). Felling of trees will also be properly supervised to ensure that only trees that are, of necessity, to be felled are felled. Where possible, pruning of trees will be opted for as against felling of trees. Effective mitigation measures, such as habitat restoration, wildlife protection plans, and careful planning to avoid sensitive areas, are crucial to minimize adverse effects on local ecosystems and biodiversity.

Bird beacons will be installed along sections of the transmission line where bird activity is high. This measure will reduce bird mortality and mitigate adverse impacts on avian species.

8.1.16 Measures to Minimize Loss of Vegetation

The method that will be used for vegetation control to manage vegetative growth within the RoW will be physical or mechanical clearing. Threatening trees outside the RoW will be cut only to a height of not exceeding 1m. Chemicals such as weedicides or herbicides shall not be used to control vegetational growth

within the RoW. This is to eliminate the potential harmful effects of these often-persistent chemicals on the environment. In addition, the physical clearing will enable the management of vegetative growth within the RoW to be done in a more controlled manner limiting the clearing strictly to the tower corridor track. This is expected to have a limited effect on vegetation.

In addition, the non-use of chemicals will eliminate issues of potential pollution of nearby surface water bodies and possible seepage of chemicals into ground water. In addition, all potential risks to workers arising from improper handling of these chemicals will be eliminated.

8.1.17 Work Camp Establishment and Management

The contractor will establish one or two work camps near the transmission line route to house a portion of the workers. Additionally, some workers will rent houses in the nearby project communities, depending on proximity and availability of accommodation. This arrangement ensures that workers are adequately housed while minimizing disruption to local communities.

GRIDCo shall ensure that the contractors do not establish work camps close to any water body to avoid water pollution problems. The camp will also be established at least 500m from the closest settlement to minimize noise impacts on the community. The Contractor will also ensure that employees from the local communities are not accommodated at the camp to minimize congestion. Other mitigation measures include the following:

- Ensuring the camps are well-stocked with essential resources (e.g., water, food, sanitation) to minimize the impact on local supplies.
- Conducting regular consultations with local leaders and communities to foster positive relationships and address any arising concerns.
- Implementation of health screening and awareness programs to prevent the spread of diseases, along with the provision of adequate healthcare in the work camps.
- Setting up of robust waste management systems for both camps and rented accommodations, ensuring proper disposal and minimal environmental impact.
- Establishing clear policies and training to prevent gender-based violence, with mechanisms for reporting and addressing any incidents.

8.1.18 Measures to Reduce Pressure on Social Amenities, Outbreak Spread of Infectious/Communicable Diseases in the Project Affected Communities

To minimize pressure social amenities and spread of communicable and infectious diseases in the project affected communities, the Contractor will rent sandcrete buildings with well-ventilated rooms for site workers. The rented accommodation will have the under-listed facilities:

- Clean, safe, and enclosed toilet facilities
- enclosed bathrooms
- kitchens
- eating areas
- potable water
- electricity
- 2 refuse bins are to be emptied daily and disposed of at the approved landfill site by a private waste collector and disposed of at the approved landfill site
- The Contractor shall not put more than three (3) workers in a standard (12 square meters) room.

8.2 Operational Phase

This section of the report presents the proposed mitigation measures put forward to minimise the significant potential environmental impacts that are expected to be associated with the operational or maintenance phase of the proposed project.

8.2.1 Mitigation Measures for Waste Management

During the operational phase, solid waste in the form of trees, tree stumps and wooden containers from periodic right-of-way of clearing, routine line maintenance and repairs will be gathered together and made available to the local communities as fuel wood. Other solid wastes such as damaged cables, conductors and insulators, rags and paper cartons will be collected and kept at the GRiDCO storeroom and returned to the supplier sites or disposed at the approved landfill after inspection.

Accidental spillage of oil at the substation will be avoided as much as possible. Any spilt materials will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at approved landfill site.

8.2.2 Mitigation Measures for Occupational Health and Safety Risks

GRIDCo will use its own certified and trained engineers and technicians for routine maintenance and repairs of the transmission system. Measures shall be designed and adhered to GRIDCo's occupational health and safety policy/standards to mitigate occupational, health and safety risks during the operational phase of the project. Comprehensive safety protocols, regular training, and stringent adherence to safety standards are crucial to minimize accidents and ensure worker safety. Electromagnetic fields (EMF) are generated whenever voltage is present or current is flowing, both naturally (e.g., lightning) and through man-made sources such as electricity transmission equipment, household wiring, and electrical appliances. Since the advent of public electricity in the 1880s, exposure to EMF has increased, and its ubiquitous nature makes complete avoidance nearly impossible. The debate over EMF's impact on human health, particularly from power lines, has led to conflicting conclusions, with ongoing research needed to understand potential risks.

The Environmental Health Division of the Minnesota Department of Health has compiled global research results to address these concerns. Public safety measures should include monitoring EMF exposure and implementing safety standards to mitigate potential health risks and reduce accidents and incidents associated with EMF-related activities. Health and safety measures outlined in the construction phase will be carried out in the operational phase as well. For specific hazards, the underlisted measures will be implemented:

a. Occupational noise

Construction workers working with or near noisy equipment like pumps and power tools will be provided with earmuffs to protect them against noise-induced hearing loss or damage.

b. Injuries from falling/swinging objects

Protective clothing such as hard hats and safety boots will be provided for all employees at the proposed project site for protection against falling and/or swinging objects. Additionally, exclusion zones will be marked around where objects are being lifted. Lifting objects will also be firmly secured to avoid falling. Tree felling will be done by competent and adequately trained workers. Adequate warning will be given to ensure that safety of workers is not compromised.

c. Accidental falls from height

Due to the hazard of potential accidental falls from heights during routine maintenance and repair works, all workers who will be required to climb and work on the towers will be provided with the necessary safety equipment such as body harnesses, (climbing belts). Fall hazards must be minimized through the use of fall prevention or fall protection. Fall prevention refers to using permanent engineering controls so that hazards associated with working at elevated locations are reduced or eliminated.

d. Snakebites

Construction workers will be protected from the potential hazard of snakebites by providing them with safety boots long enough to cover the leg up to the knee. Workers will be required to wear these boots at all times during working hours

e. Accidents outside work zone

Enhanced road maintenance, improved signage, and better traffic management are necessary to reduce accident rates and improve overall road safety in these districts.

8.2.3 Measures to Ensure Community Health and Safety

GRIDCo will carry out the operation and maintenance of the proposed transmission line based on accepted international standards, such as those of the International Electrotechnical Commission (IEC) as well as

GRIDCo's own 'Corporate Safety Rules. However, some specific potential occupational safety and health hazards expected during the operational phase of the project are deal.

Towers rarely collapse. But when they do the hazardous effects (e.g. falling on people and electrocution) are normally felt within the RoW. Therefore, the public safety will be ensured by restricting public access to the Right-of-Way. In line with existing good practice, all towers will be clearly marked with a red inscription on white background - **"*DANGER – 400,000 Volts*"** to ward off trespassers and prevent them from exposing themselves to the potential dangers of electrocution.

Routine maintenance and repairs on the transmission lines, towers and substation will minimize corrosion and wear out of parts of the towers and their accessories. GRIDCo already has comprehensive, planned and emergency maintenance programs for the existing transmission lines. The same level of care to the new transmission lines to be constructed shall apply.

In addition, tower members will be secured and improved by anti-theft fasteners to check acts of vandalism and its harmful consequences on the towers. Security patrol will be conducted on sections of the transmission line against acts of vandalism and theft. It is expected that the patrols will ensure early detection of any acts of vandalism and signs of tower corrosion. Prompt and necessary remedial actions will be taken to repair the structures to forestall the possible collapse of towers.

GRIDCO will undertake one community sensitization programs in the communities within the project corridor every year to educate residents on the dangers associated with unauthorized entry into the demarcated Right-of-Way, especially going close to the towers and transmission line.

The transportation of heavy plant and equipment through settlements will be done in a manner not to jeopardize the safety of the local people. Equipment and materials will be properly secured when being transported to prevent them from falling and posing potential danger to people. (It is important to note that it is not the constructed towers that will be transported to tower locations but rather the tower members or parts). Legally mandated speed limits (40km/hr.) on the roads and highways shall be strictly observed.

Also, tower base excavations in or near settlements or farms will be protected or clearly marked to prevent people from inadvertently falling into these excavations. For areas with animal populations, these excavations will be guarded with boards to ensure no animals fall into the pits. Tree felling will be done by qualified and competent workers. Adequate warning will be given to ensure that public safety is not compromised during this activity.

The transmission line poses potential public health and safety hazards if the local populace is not properly educated with regard to the potential hazards, such as collapse of towers, which actually occurs rarely. In addition to the hazards posed to the public due to transportation of equipment and materials, other hazards

such as potential exposure to Electromagnetic field (EMF) effects, potential collapse of towers and electrocution exists. These potential hazards require mitigation to ensure the safety of the public.

Since the hazardous effects (e.g. falling on people and electrocution) of the collapse are normally felt only within the RoW public safety is ensured by restricting public access to the right-of-way. In line with existing practice, the towers have been clearly marked with a red inscription on white background - ***"DANGER – 330,000/400,000 Volts***" to warn off trespassers and prevent them from exposing themselves to the potential dangers of electrocution. Further, regular maintenance ensures the minimization of corrosion and wearing out of parts of the towers and their accessories. During the field surveys, the various community groups were briefed in very simple terms on the current state of knowledge about EMF effects to allay their fears. This impact is expected to be insignificant at the operational phase of the project.

8.2.4 Public safety

Tower members will be secured and improved by anti-theft fasteners to check acts of vandalism and its harmful consequences on the towers. Furthermore, anti-climbing guards will be installed to discourage adventurous individuals from endangering their lives and limbs. The shattering of insulators, which could pose potential danger to passers-by, will be minimized using quality insulators as well as the periodic washing of the insulators.

Measures proposed earlier to minimize public safety hazards relating to transportation and potential tower collapse are valid for ensuring public safety. These measures will be fully implemented to enhance public safety.

Threatening trees will be felled or pruned as stated earlier in the report to prevent them from falling onto the transmission lines during stormy weather conditions. This will minimize the potential of the fall of live electrical conductors, which could pose safety hazards to the public. Insulator pins will also be checked regularly for signs of rusting and any defective pins found will be promptly replaced to prevent the live electrical conductors from falling from the towers.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (ESMP) details active remedial measures and monitoring activities to be continuously carried out to prevent or minimize impacts on the physical, biological, and socio-economic/socio-cultural environments as well as to promote occupational safety and health of employees on the project.

9.1 Environmental Policy

GRIDCo has a Corporate Environmental Policy, which aims at safeguarding the environmental quality and mitigating or offsetting the adverse impacts on the environment of all its activities in conformity with national and international environmental management standard and regulation in a sustainable manner.

9.2 Environmental and Social Management System

In order to maintain control over the implementation of the project and also ensure that mitigation measures and commitments made in the ESIA and accompanying ESMP are acted upon in a comprehensive and acceptable manner, an Environmental and Social Risk Management and Training Programme will be developed in this section. This programme will help to identify personnel, responsibilities and training requirements for the Project Implementation Unit (PIU) to be constituted.

The Project PIU Management Team will be responsible for the following:

- Ensuring project's compliance with all relevant environmental, social, health and safety regulations;
- Liaising with all relevant regulatory bodies and organisations such as the EPA, Factories Inspectorate Department, Energy Commission (Inspectorate Unit), etc;
- Formulation and review of environmental and social policies and practices associated with projects;
- Liaising with relevant GRIDCo Departments on all health, environmental, safety and social matters connected to projects.
- Assist in the education and training of project staff in environmental, social and safety awareness.
- Put forward budgetary estimates for projects' environmental programmes for approval
- Undertaking environmental and social monitoring activities for projects.

9.3 Environmental Management Structure

The Lands and Environment (LEM) Section of the Engineering Department is responsible, among others, for pre-project development as well as the post project implementation of the project. Where necessary, the traditional leaders will advise on the required pacification rites to be performed in an event of cultural heritage impact. It is headed by a manager (Chart 1).

In pursuance of the objective of ensuring compliance with national environmental and social regulations, an Environmental Risk Management Specialist and a Social Development Specialist who are a staff of LEM have been appointed to coordinate the E&S activities of the Project Implementation Unit (PIU) for the proposed project. Membership of the PIU will include a Project Valuation Officer. The Project Environmental Coordinator will report through the Project Engineer.

The PIU will be directly responsible for all environmental and occupational safety and health matters arising from the project. The post-construction or operational phase environmental management will be incorporated into GRIDCo's Corporate Environmental Management Plan and implemented by the LEM, Environmental and Social Safeguards Specialists, Procurement Specialist, Financial Management Specialist, Monitoring and Evaluation (M&E) Officer, Health and Safety Officer, Legal Advisor, Land Acquisition and Resettlement Specialist, Community Liaison Officer, Administrative Support Staff

9.3.1 Qualifications of the Project Implementation Unit

The Project Implementation Unit (PIU) for the proposed project will be composed of key specialists, including a Project Engineer, Office Engineer, Environmental Coordinator, Valuation Officers, and Field Technicians. Each of these roles will be filled by personnel with appropriate expertise to ensure effective project management. The PIU will be led by the Director of Engineering, who will oversee all project activities. To maintain high standards of environmental management, all members of the PIU will receive the necessary training. This structure is designed to ensure that the project is managed efficiently and in compliance with all relevant environmental regulations.

9.3.2 Environmental Management Specialist (EMS)

The Environmental Management Specialist (EMS)for the project will be responsible for all environmental issues in connection with the project. He will report through the Manager, Lands and Environment Management to the Director, Engineering. He will work closely with the other members of the Project Implementation Unit.

The EMS should have experience in environmental and social impact assessment, health, safety and environmental (HSE) management. The EMS is responsible for:

- Monitoring all environmental and social programmes for pre-construction, construction, and operational phases of the project, including those related to bio-physical and socio-economic/cultural components.
- Working closely with project contractors to ensure that all monitoring and mitigation guidelines, recommendations for the project are strictly adhered to. This includes compliance with all health, social and safety guidelines outlined and following strictly the GRIDCo's environmental policy guidelines;

- Working closely and coordinating efforts with the EPA and other enforcement bodies to ensure full compliance with all legal and regulatory requirements;
- Organizing activities to motivate and maintain the interest of the project staff in environmental and social issues and assisting to increase project staff awareness of environmental issues through training programmes and review meetings;
- Coordinating investigations into/of all types of accidents;
- Conducting environmental and social audits in accordance with project monitoring guidelines;
- Serving as liaison between project contractors, GRIDCo and relevant regulatory agencies;
- Developing a work plan for the implementation of the ESMP;
- Establishing and running a reporting system on progress (or otherwise) in implementing mitigation measures (including contractors' obligations), training, etc.;
- Production of reports.

9.3.3 Social Development Specialist (SDS)

The structure we have agreed on between the Bank and GRIDCo includes a Social Development Specialist (SDS) who will work in tandem with the Environmental Management Specialist.

The SDS is responsible for: ensuring that the social dimensions of the project are managed responsibly and equitably, protecting communities and promoting sustainable development outcomes. He/She play a pivotal role in balancing development objectives with social justice and human rights concerns. Key functions of an SDS include:

i. Conducts assessments to identify potential social risks and impacts of the project on local communities, such as displacement, loss of livelihoods, and changes in community dynamics. The SDS analyzes demographic, economic, and cultural factors to understand the social context in which the project will operate.

ii. Facilitates meaningful engagement with local communities, government agencies, and other stakeholders throughout the project lifecycle. SDS ensures that stakeholder concerns are incorporated into the project design and that there is ongoing communication to maintain trust and transparency.

iii. Develops, implements, and manages a grievance redress mechanism to address complaints and concerns from affected individuals or communities promptly and effectively. He/She ensures that grievances are tracked, resolved, and reported back to the communities and project management.

iv. Oversees resettlement action plans (RAP) and ensure that displaced individuals are fairly compensated and provided with necessary support, such as alternative housing or land, livelihood restoration programs, and legal assistance. They further ensure compliance with international standards such as the World Bank's Environmental and Social Framework (ESF).

v. Develops and implements programs that help communities restore or improve their livelihoods post-project implementation, especially for those who lose land, assets, or employment opportunities.

vi. Ensure that the project complies with social safeguard policies, including laws related to labor, human rights, and indigenous peoples, as well as international standards and guidelines. Monitor the social impacts of the project and the effectiveness of mitigation measures as outlined in the ESMP.

vii. Build the capacity of project staff, contractors, and local communities to understand and address social risks, mitigation measures, and the importance of social safeguards. SDS also provides training on issues like gender equity, cultural sensitivity, and conflict resolution.

viii. Regularly monitors the social aspects of the project to assess the effectiveness of mitigation measures, identify any new social risks, and ensure compliance with the ESMP. They also prepare social performance reports and share updates with relevant stakeholders, ensuring transparency and accountability in the project's social outcomes.

ix. Mediates and resolves conflicts that arise between the project team and affected communities or within the community itself, helping to maintain harmonious relations throughout the project lifecycle.

x. Ensures that the needs and perspectives of vulnerable groups (such as women, children, the elderly, and marginalized populations) are considered in the project. SDS also implements specific programs that promote gender equity and protect the rights of vulnerable individuals.

9.3.4 Gender Specialist (GS)

The structure we have agreed on between the Bank and GRIDCo includes a Gender Specialist who will work in tandem with the Environmental Management Specialist.

The GS is responsible for ensuring that gender considerations are integrated into the environmental and social management processes of a project. The primary responsibility is to ensure that both men and women are equitably involved, considered, and benefit from the project's activities, while mitigating any potential gender-related risks or impacts. The following are the key responsibilities of a GS:

- Analyse how environmental changes affect men, women, and vulnerable groups differently, considering potential gender-specific impacts.
- Highlight gender inequalities, such as increased burden on women due to resource scarcity, and propose strategies to mitigate risks.
- Collaborate with the Environmental Management Specialist to incorporate gender considerations into all stages of the Environmental and Social Management Plan (ESMP).
- Ensure both men and women, particularly marginalized groups, are represented and involved in stakeholder consultations and decision-making processes.
- Create a Gender Action Plan outlining strategies to promote gender equality, ensuring equitable

distribution of project benefits.

- Implement gender-sensitive mitigation measures like safe spaces for women and addressing risks such as gender-based violence (GBV).
- Provide training to staff and communities on gender issues and ensure gender sensitivity is part of the project's culture.
- Track progress on gender equity with gender-sensitive indicators and assess the project's gender-related outcomes in collaboration with the EMS.
- Adhere to national and international gender equality standards, including SDG 5, and meet donor and regulatory requirements.
- Ensure both men and women participate equally in resource management, decision-making, and climate change resilience efforts.

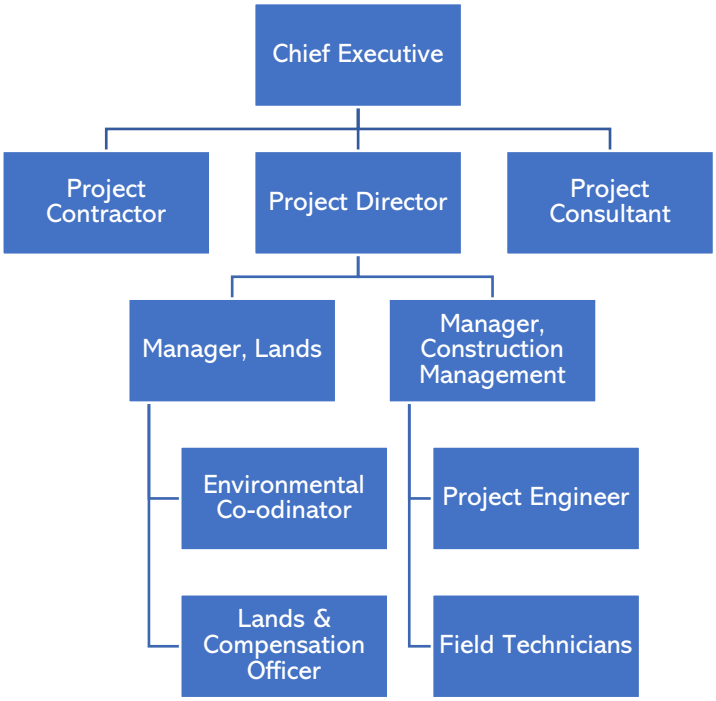


Chart 1: Organisational chart-Project Environmental Management

8.4 General Health and Safety Procedures

Occupational safety and health measures will be guided by GRIDCo's Corporate Safety Rules, the Safety Manual, and the Factories, Offices and Shops Act, 328 (1970), complemented by the occupational safety and health recommendations provided in the Environmental and Social Impact Assessment (ESIA). Relevant issues covered in the Corporate Safety Rules include:

- Manual lifting
- Hearing protection

- Use of personal protective equipment (PPE)
- Housekeeping standards
- Fire prevention measures
- Prevention of falls from heights
- Electrical hazards and safety
- Machinery operation safety
- Welding precautions
- Head and foot protection
- First aid provisions

All the provisions of the Factories, Offices and Shops Act, 328 (1970) will be fully adhered to during project implementation, and mitigation measures outlined in the ESIA will also be implemented to ensure full compliance with health and safety standards.

8.4.1 Fire Prevention System

To mitigate the risk of fire:

- Post **"**No Smoking**"** signs will be installed at sensitive locations such as fuel storage areas.
- Adequate fire extinguishers will made available on-site.
- Store flammable materials, like oil-soaked rags, in appropriate containers for safe disposal.
- Limit the handling of flammable materials to qualified personnel.
- Install emergency fire alarm systems in key areas.
- Conduct fire prevention training for selected project employees to ensure they are equipped with the necessary knowledge and skills.

8.4.2 Monitoring

Environmental and social monitoring will adhere to the recommendations provided in the ESIA, covering key parameters such as:

- Implementation of the Resettlement Action Plan (RAP), including compensation payments.
- Effectiveness of the Grievance Redress Mechanism (GRM) e.g. status reports on case
- Incidence of Gender-Based Violence (GBV) and Sexual Exploitation and Abuse (SEA).
- Occupational health and safety compliance, including PPE usage.
- Public safety measures.
- Incidence of Child labour
- House keeping
- Number and types of accidents/incidents and near misses
- Water, noise and air quality monitoring.
- Management of solid and liquid wastes.

The monitoring will enable GRIDCo to take corrective action where necessary, and the E&S and Gender Team will receive training on parameters, sampling methods, and monitoring frequency. Monitoring will be undertaken daily and reported monthly as part of monthly progress reporting. Reporting to the Bank will be undertaken every quarter.

8.5 Training and Development

To ensure effective implementation of all environmental management programs, a comprehensive training program will be provided for the project's **Environmental Management Team** and key contractor personnel. The training will focus on environmental awareness and occupational health and safety issues.

8.6 Environmental and Social Awareness

Awareness creation will include topics such as:

- Basic environmental terminologies.
- Ghana's Environmental Impact Assessment (EIA) procedures.
- Relevant environmental laws and regulations.
- Gender Based Violence (GBV), Sexual Abuse and Exploitation (SEA) and Sexual Harassment (SH)
- Introduction to environmental management planning, impact assessment, monitoring, and mitigation measures.

8.7 Occupational Safety and Health

Key areas of focus for occupational safety and health include compliance with the Factories, Offices and Shops Act, 328 (1970), fire prevention, and fire-fighting methods.

8.8 Information, Education, and Communication (IEC)

The project will implement continuous Information, Education, and Communication (IEC) programs to ensure public safety. These programs will raise awareness among community members about project-related risks, such as uncontrolled bushfires, tower climbing, and adherence to warning signs.

8.9 Record Keeping

GRIDCo will maintain a General Register as required by the Factories, Offices and Shops Act, 1970. The register will include records of accidents, fire system testing, and inspections of pressure vessels and lifting equipment.

8.10 Scheduling and Reporting

Monitoring will be documented, detailing data handling, analysis requirements, and reporting responsibilities. GRIDCo will ensure regular reporting to management, relevant stakeholders, and government authorities, including:

- Monthly reports on environmental protection activities.
- Emergency reports to GRIDCo Management, EPA, and the World Bank in case of emergencies.
- Biannual and annual environmental reports submitted to relevant authorities.

10 EMERGENCY RESPONSE PROCEDURES DURING CONSTRUCTION PHASE

Response measures have been proposed for the following emergencies, which may arise during project implementation:

t. Fire.
u. Medical emergencies or Accident; and
v. Oil Spills.

10.1 Fire Emergency

10.1.1 Small Fires

In the event of a small fire, these steps will be followed:

w. The first person to detect the fire must raise the alarm by shouting "FIRE!" or activating the fire alarm on-site.
x. Only workers trained in using fire extinguishers should attempt to extinguish the fire.
y. All others should evacuate the area immediately.
z. Fire should be tackled at its source in its early stages, ensuring your own and others' safety.
aa. Ensure a clear escape route and avoid situations where the fire blocks exits or the fire's source cannot be determined.
bb. If the fire is contained, the Environment, Social Health, and Safety Officer (ESHSO) of the contractor will investigate the cause and organize clean-up.

Report the incident to the Supervising Engineer for further safety precautions.**9.1.2 Large Fires:**

Raise the alarm immediately by shouting "FIRE!" or activating the alarm.

Evacuate the building or site to the ASSEMBLY POINT.

Notify the ESHSO and contact the National Fire Service (NFS).

The contact details of the nearest fire station must be displayed prominently on-site.

The ESHSO will oversee a calm and secure evacuation, ensuring all workers are accounted for through a headcount.

If there are any injuries, the casualties will be transported to the nearest medical facility.

All injuries and the fire event must be documented and reported to the Supervising Engineer.

10.1.2 Large Fires

These are fires that cannot be put out by trained fire volunteers and the SNFS will have to be called to fight them. The evacuation procedures to follow include:

- The first person to sight the fire must sound the fire alarm if at the premises or shout, 'FIRE!! FIRE!! FIRE!'
- Evacuate the building or area and report at the ASSEMBLY POINT;
- Immediately notify the Environment, Social Health and Safety Officer of the Contractor and call the National Fire Force;
- Contact numbers of the nearest fire station will be conspicuously displayed at offices, storerooms, workshops, and security posts;
- The Environment, Social Health, and Safety Officer of the Contractor has to check on the remaining workers and carry out a fast, calm, and secured evacuation;
- A head count will be conducted to ensure all workers are safe and present;
- If there have been any casualties, they will be conveyed to the nearest health facility; and
- Keep records of any injuries and the fire event and report to the Supervising Engineer

10.2 Medical Emergencies and Accidents

In the event of an accident or injury, follow these steps:

- For minor injuries where the victim can move, report to the ESHSO for first aid treatment.
- If the injury requires further treatment, the ESHSO will arrange for transport to the nearest health facility.
- If the injured person cannot move, stabilize the person and call for medical assistance from the nearest health facility.
- All accidents must be investigated, documented, and reported to the Supervising Consultant.

10.3 Bites from Reptiles or Insects

In case of snake bites, scorpion stings, or other insect bites:

- Identify the snake or scorpion (color, length) from a safe distance if possible.
- Keep calm and position the bite below the level of the heart.
- Clean the bite with soap and water, remove jewelry, and cover the wound with a clean, dry dressing.
- Transport the victim to the nearest health facility immediately for treatment with anti-venom.
- The following actions should be avoided: applying a tourniquet, cutting the wound, sucking out

venom, using ice or alcohol, and administering pain relievers like aspirin.

10.4 Oil/Solvent Spills

10.4.1 Spillage on Hard Surfaces

- Contain the spill using sawdust provided on-site to prevent spreading.
- Collect used sawdust for appropriate disposal, clean the surface with water and disinfectant, and report the incident to the ESHSO.

10.4.2 Spillage on the Ground

cc. Use a shovel to scoop the contaminated soil into a container and ensure all contaminated soil is removed.
dd. Dispose of the contaminated soil at an approved landfill site.
ee. Report the incident to the ESHSO, and if any contact with the body occurred, wash the affected area thoroughly.

11 ESMP BUDGET

11.1 Assumptions

The assumptions underlying this budget are as follows:

1. **Disclosure of Environmental & Social Impact Assessment Report ($10,000.00):** This cost assumes the need for public disclosure and stakeholder engagement activities required to share the findings of the Environmental and Social Impact Assessment (ESIA) with affected communities and other stakeholders.
2. **Environmental Monitoring, ($150,000.00):** This budget item is based on continuous monitoring of environmental parameters throughout the construction and operational phases to ensure compliance with environmental standards, medical care, psychological support, legal assistance and to mitigate potential impacts.
3. **Cost of Implementation of EIS, RAP, and ESMP ($75,000.00):** This covers the costs associated with implementing the Environmental Impact Statement (EIS), Resettlement Action Plan (RAP), and Environmental and Social Management Plan (ESMP) over the project's life cycle, including monitoring and mitigation measures.
4. **Training of Environmental Management Team ($50,000.00):** This allocation is for the training and capacity building of the environmental management team to ensure they are equipped with the skills and knowledge required to manage the project's environmental and social aspects effectively.
5. **Unforeseen Pacification Rites ($20,000.00):** This budget item accounts for unexpected cultural or social rites that may need to be conducted to appease local communities or address unforeseen cultural issues that arise during the project.
6. **Decommissioning and Reclamation of Lay Down Areas ($85,000.00):** This is for the restoration and reclamation of areas used as temporary laydown yards or construction sites at the end of the project, ensuring these areas are returned to their original condition or better.

11.2 ESMP Budget

The budget outlined in Table 11 covers the necessary environmental and social management activities for the project over the duration.

Table 11: Environnemental management Plan budget estimate

Nº	ITEM	US $
1.	Disclosure of Environmental & Social Impact Assessment Report	10,000.00
2.	Environmental Monitoring	150,000.00
3.	Cost of implementation of EIS and ESMP	75,000.00
4.	Training of environmental management team	50,000.00
5.	Unforeseen pacification rites	20,000.00
6.	GBV Sensitization and Support Services	20,000.00
	Establishment and Maintenance of Grievance Redress System (including training of GRCs)	15,000.00
6.	Decommissioning and reclamation of lay down areas	85,000.00
	Total estimates for environmental issues	425,000.00

12 DECOMMISSIONING PLAN

12.1 Introduction

The proposed transmission line is expected to be operational for more than fifty years and it is likely that this period may be extended. The current trend in the power industry is by upgrading older equipment with more efficient ones and ancillary equipment. However, if not upgraded the transmission line and associated substation will be decommissioned. The purpose of this conceptual Decommissioning Plan (DP) is to describe the general objectives for the post project land use, and the planning processes leading to development of a Final DP Plan. The specific objectives in managing the decommissioning process will be:

- To ensure that rehabilitation and decommissioning are carried out in a planned sequential manner, consistent with best practice,
- To ensure that agreed post-project land-use outcomes are achieved, and
- To avoid on-going liability

Removal of machinery, equipment, and all other materials related to the project is to be completed within one year of decommissioning. Thus, within twelve (12) months of initiating the decommissioning, the relevant project components will have been removed from the acquired land.

12.2 Decommissioning During Construction

While not expected and considered to be extremely unlikely, if construction of the proposed project and associated work may not be completed, the project would be decommissioned in a manner as described in this report. Further, mitigation measures as described in the Chapter 7 would be implemented.

12.3 Decommissioning After Ceasing Operation

The decommissioning of the power facility will follow GRIDCo's Health & Safety Policy along with any applicable national, and the relevant District Assembly's Regulations and standards. During decommissioning activities, the Physical Planning Department of the five Assemblies namely Upper Denkyira East, Wassa Amenfi East, Wassa Amenfi West, Aowin municipal Assemblies and Wassa Amenfi Central District Assembly and the EPA Office shall have access to the site, pursuant to reasonable notice, to inspect the results of complete decommissioning. All decommissioning and restoration activities will be in accordance with all applicable state and local permits and requirements.

12.4 Restoration of Land and Water Negatively Affected by Facility

Once all the facilities are removed, the remaining work to complete the decommissioning will consist of shaping and grading of the areas to as near as practicable to the original contour prior to construction of the power facilities. All areas will be restored as near as practical to their original condition with native soils

and revegetated. The decommissioning will affect the agricultural practices directly around the access roads, substation locations, but only during their removal.

Like the construction phase, the decommissioning will follow a storm water protection plan that will ensure proper steps are followed to mitigate erosion and silt/sediment runoff. As with the project's construction, noise levels around the decommissioning work will be higher than average. Proper steps will be followed to minimize this disturbance, such as working only during daylight hours. Also, as with the project's construction, road traffic in the area will increase temporarily due to crews and heavy equipment movements.

12.5 Procedures for Managing Waste and Materials

GRIDCo shall aim to engage a contractor for this assignment, and the option of the 3Rs of the Environment (Reuse, Reduce & Recycling) shall guide the process.

12.6 Decommissioning Notification

The process for notification of decommissioning activities will be the same as the process for notification of construction activities. EPA will be formally notified of the process to enable them to provide relevant guidance as required. A report describing the performance of the final DP Plan in working towards its objectives, based on monitoring results, and the extent to which it has been complied with, will be submitted to the EPA. The report will be provided to relevant stakeholders and be available to any entity or person(s) upon request. Files and documents used to collate information regarding closure commitments, licenses, approvals, and other information concerning closure will be catalogued and maintained in accordance with standard GRIDCo practices.

12.7 Conditions of Approval

GRIDCo will ensure that the decommissioning stage of the proposed facility is carried out in accordance with EPA/Energy Commission as well as the District Assembly's requirements and the measures/practices as described in this report. The DP Plan will be finalised and submitted to the relevant authorities for approval at least six months prior to closure of the site.

12.8 Calculations for Decommissioning Costs

To provide financial assurance before the end of the useful life of the equipment, GRIDCo agrees to deliver to relevant agencies prior to the decommission and closure phase, a financial instrument with an aggregate initial face amount equal to the decommissioning cost estimate prepared and certified by a professional engineer in accordance with national and respective local laws.

APPENDIX I: COPY OF THE EXPIRED ENVIRONMENTAL PERMIT

Tel: (0302) 664697 / 664698 / 662465
667524 / 0289673960 / 1 / 2
Fax: 233 (0302) 662690
Email: info@epa.gov.gh

Environmental Protection Agency
P. O. Box MB 326
Ministries Post Office
Accra
Website: http://www.epa.gov.gh

Permit No. CE0019720102

ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL PERMIT

ENVIRONMENTAL ASSESSMENT REGULATIONS 1999 (LI 1652)

This is to authorize

GHANA GRID COMPANY LIMITED

To commence the proposed 120Km 330kV Cote D'Ivoire – Ghana Interconnection Reinforcement Project (Ghana Section) as per the attached schedule

Located across four Districts (Wassa Amenfi West, Wassa Amenfi East, Aowin Suaman and Upper Denkyira East) of the Western and Central Regions

Date Issued: March 13, 2015

Expiry Date: September 12, 2016

E. APPAH-SAMPONG
Ag. DEPUTY EXECUTIVE DIRECTOR (TECHNICAL)
FOR: EXECUTIVE DIRECTOR

NB: **This Permit is only valid with the Seal of the Environmental Protection Agency and conditioned upon obtaining other permits from relevant institutions among others**

Tel: (0302) 664697 / 664698 / 662465
667524 / 0289673960 / 1 / 2
Fax: 233 (0302) 662690
Email: info@epa.gov.gh

Environmental Protection Agency
P. O. Box MB 326
Ministries Post Office
Accra
Website: http://www.epa.gov.gh

SCHEDULE TO THE ENVIRONMENTAL PERMIT

1.0	CONTACT	:	THE CHIEF EXECUTIVE
2.0	PROPONENT	:	GHANA GRID COMPANY LIMITED (GRIDCo) P. O. BOX CS 7979 TEMA.
3.0	REGISTRATION NO.	:	CE: 1972/01/02
4.0	PERMIT NO.	:	CE0019720102

5.0 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
PROPOSED 120KM 330KV COTE D'IVOIRE – GHANA INTERCONNECTION REINFORCEMENT PROJECT (GHANA SECTION)

In pursuance of the Environmental Protection Agency Act 1994, Act 490 Sections 2(i) and 12(1) and the Environmental Assessment Regulations, 1999, LI 1652 and, on the basis of the information provided in the Environmental Impact Statement (January 2014), this Environmental Permit is issued authorizing **GHANA GRID COMPANY LIMITED (GRIDCo)** to commence work on the proposed 120Km 330kV Cote D'Ivoire – Ghana Interconnection Reinforcement Project (Ghana Section) upon obtaining the necessary development permits from the relevant District Assembly.

6.0 CONDITIONS OF PERMIT

6.1 Commitment to Project Specification

- Comply with all project specifications, mitigation, monitoring and other environmental management provisions as indicated in the project (EIS). The project involves the construction of the proposed 120Km, 330kV Cote d'Ivoire – Ghana Interconnection reinforcement project with the following components:
- Construction of high voltage transmission line(118.8km) from Bibianiha near Dunkwa-on-Offin to Omanpe on the border with Ivory Coast
- Construction of 330/161kVsubstation at Bibianiha

6.2 Location

- The proposed construction of the transmission line will be carried out across four districts of the Central and Western Regions. These are Wassa Amenfi West, Wassa Amenfi East, Aowin Suaman and Upper Denkyira East Districts.

6.3 Acquisition and Protection of Right of Way (ROW) and Compensation

- A detailed survey of all Project Affected Persons (PAPS) and properties should be compiled and valued and the appropriate compensation paid for their loss prior to start of construction activities.
- Buildings, land and crops should be duly compensated for in accordance with the provisions of the law at the appropriate values in line with (GRIDCo)/Land Valuation Board procedures.
- Institute local-level grievance committees to deal with disputes over compensation and

resettlement. A grievance registration form should be used by the committee in order to standardize the records,
- Provide a tracking system for dispute resolution.
- Take steps to restrict public access to Right-of-Way (ROW).
- Prevent the construction of unauthorized structures in the ROW.

6.4 Compliance with Factories, Offices and Shops Act.
- Comply with the requirements of the Factories, Offices and Shops Act, 1970 (Act 328), Consult with the Factories Inspectorate Department in order to satisfy the requirements of the Act and the Department.

6.5 Occupational Health and Public Safety Measures

Occupational health and safety measures should include among others:
- Environmental awareness training programmes to sensitise workers on the need to follow laid down procedures and the handling of equipment/machinery etc.
- Provision of appropriate personal protective clothing/gear such as helmets, earmuffs, climbing belts, wellington boots, hand gloves etc. to workers.
- Provision of a well-stocked first aid kit with all items prescribed by the Factories, Shops and Offices Act 328 for minor injuries that might occur in the course of construction.
- Towers should be clearly marked with a "DANGER- 161,000 Volts" signal in red on white background to warn off trespassers.
- Tower base excavations in or near settlements or farms should be protected or clearly marked to prevent people from falling into these excavations.
- All potentially hazardous machinery should undergo statutory examination by a certified engineer.
- Carry out the operation and maintenance of the transmission line based on acceptable international best practice.

6.6 Archaeological and Cultural Heritage
- Project construction should avoid, as much as possible the destruction of any sacred, cultural and/or archaeological sites/items.
- Where cultural properties (e.g. cemeteries) are affected by the project construction, the necessary performance of pacification rites should be undertaken under an agreement with the local communities.
- Procedures for managing chance finds from archaeological discoveries should be in line with procedures of the National Museum Degree 1969 (NLCD 387).

6.7 Traffic Management
- Drivers delivering equipment/materials should be provided with guidelines on how to minimize increased risk of accidents.
- Speed limits should be imposed on the sensitive sections of roads through settlements as well as the use of speed ramps at those locations.
- Trucks and vehicles conveying construction materials should display appropriate road safety signals (e.g. red flags and flashing amber lights).
- Traffic wardens should be employed to direct traffic during the stringing of transmission lines across public roads.
- Due notification should be given to the general public and appropriate authorities (GHA and DUR) where line stringing will cross public roads.

6.8 Compliance with the requirements of the Chemicals Control and Management Centre (CCMC) of the EPA

- Ensure that transformer units, transformer cooling systems and transformer oils do not contain PCBs (Polychlorinated Biphenyls) or ODS (Ozone Depleting Substances).
- Purchase transformer units, transformer cooling systems and transformer oils that meet international requirements on environmental, Health and Safety guidelines
- Ensure that there is no soil and water contamination caused by the leakage/spillage of non-polluting transformer oils or no ODSs cooling refrigerants in transformer cooling systems.
- PCB-containing transformer oils and ODSs-containing cooling systems (refrigerants) will be eliminated from (GRIDCo)/ECG operating systems.

6.9 Noise

- Noise from construction activities should be within EPA permissible limits for the various areas and zones.

6.10 Pollution of Water Bodies

- Appropriate measures should be adopted to prevent wastewater from excavations and accidental spillage of oil from polluting water bodies.
- Work camps should not be established close to any water body.

6.11 Work Camps/Sites Management

- Approval must be sought and obtained from the relevant EPA Regional Office in the selection and siting of work camps or sites.
- Under no circumstance should the siting and operation of work camps create any social, health or environmental nuisance.
- Work camps and worksites must be re-instated to blend with the surrounding natural conditions.
- Establish work camps 500m away from water bodies and closest settlement to prevent water pollution and minimize noise on the community.
- Prevent accidental spillage of oil, fuel and lubricants from contaminating the soil and water bodies.

6.12 Environmental Monitoring

- Monitor the following parameters and activities during the operational phase of the project:

  - Occupational health and safety monitoring
  - Accidents and public safety
  - Right of Way
  - Transmission line

- Submit Annual Monitoring Reports to the Agency for review.

6.13 Completion Notice

- Notify EPA on the completion of the project infrastructure (i.e. before the 120Km 330kV Cote D'Ivoire – Ghana Interconnection Reinforcement Project (Ghana Section) Transmission Line Project commences operations).

6.14 Notification of Changes

- Notify EPA of any major changes in the planned development of the project contrary to the information provided in the EIS.

6.15 Annual Environmental Report

- Submit Annual Environmental Report on the transmission line operations after 12 months from the issuance of this permit and thereafter every 12 months to the Agency in accordance with Regulation 25 of LI 1652.

6.16 Environmental Management Plan

- Submit within eighteen (18) months on commencement of operations, an Environmental Management Plan on the project in accordance with Regulation 24 of LI 1652.

6.17 Environmental Certificate

- An Environmental Certificate must be obtained within 24 months **(i.e. before March 13, 2017)** of satisfactory performance and compliance with relevant permit conditions, in accordance with Regulation 22 of LI 1652.

6.18 Other Relevant Permits

- Notwithstanding this permit, the project is further subject to other relevant regulations and permits pertaining to the sector and must be observed.

6.19 Validity Period

- This permit is valid for a period of eighteen (18) months from the date of issue and shall expire on ***September 03, 2016.***

6.20 Permit Renewal

- This permit shall be renewed by submitting the necessary renewal application to the Agency.

6.21 Permit Transferability

- This permit is not transferable. It covers only **Ghana Grid Company Limited's (GRIDCo)'s** proposed 120Km 330kV Cote D'Ivoire – Ghana Interconnection Reinforcement Project (Ghana Section) located across the four Districts of the Western and Central Regions

6.22 Penalty for Breach of Conditions of Environmental Permit

Provision of false information or failure to comply with or observe all of the permit conditions above shall:

- Attract administrative penalties as shall be prescribed by the Agency.
- Attract the necessary fines as prescribed under Regulation 26 of the Environmental Assessment Regulations 1999, LI 1652.
- Render this Environmental permit invalid.
- Lead to the suspension or revocation of this permit.

7.0 Ag. Deputy Executive Director (Technical) ..... **E. Appah-Sampong** **For: Executive Director** **March 13, 2015** **Date Issued**

8.0 NOTIFICATION

The Hon. Minister, Ministry of Environment, Science, Technology and Innovation, Accra
The Hon. Minister, Ministry of Power, Accra
The Executive Secretary, Energy Commission, Accra
The Regional Director, Town & Country Planning Department, Central Region, Cape Coast
The Regional Director, Town & Country Planning Department, Western Region, Sekondi
The Regional Director, EPA, Western Region, Sekondi
The Regional Director, EPA, Central Region, Cape Coast

GRIDCo, Ghana-Cote d'Ivoire Interconnection Reinforcement (Ghana Section), CE0019720102 Page 4 of 4

APPENDIX II: EPA RESPONSE TO APPLICATION FOR RENEWAL OF ENVIRONMENTAL PERMIT

EPA Response to Application for Renewal of Environmental Permit pending.

Let's not forget to provide the attachment

APPENDIX III: SCOPING NOTICES IN NATIONAL DAILIES

GRIDCo®
Backbone to Power Delivery

SCOPING NOTICE

The West African Power Pool (WAPP), a specialized institution of the Economic Community of West African States (ECOWAS), headquartered in Cotonou, Republic of Benin, has applied financing from the World Bank the **330kV Ghana - Côte d'Ivoire Double Circuit Interconnection Project**. The Interconnection transmission line in Ghana will start from proposed Second Bulk Supply Point at Dunkwa- on-Offin in the Central Region to …….. at the border of Côte d'Ivoire in the Western region. The approximately 125km stretch of the transmission line within Ghana will traverse five (5) administrative municipalities/districts namely: Aowin Municipality, Wassa Amenfi East Municipality, Wassa Amenfi West Municipality, Amenfi Central District and Upper Denkyira East Municipality. The development is known as the **"400/330kv Wapp Ghana-Côte D'ivoire Interconnection Reinforcement Project"**

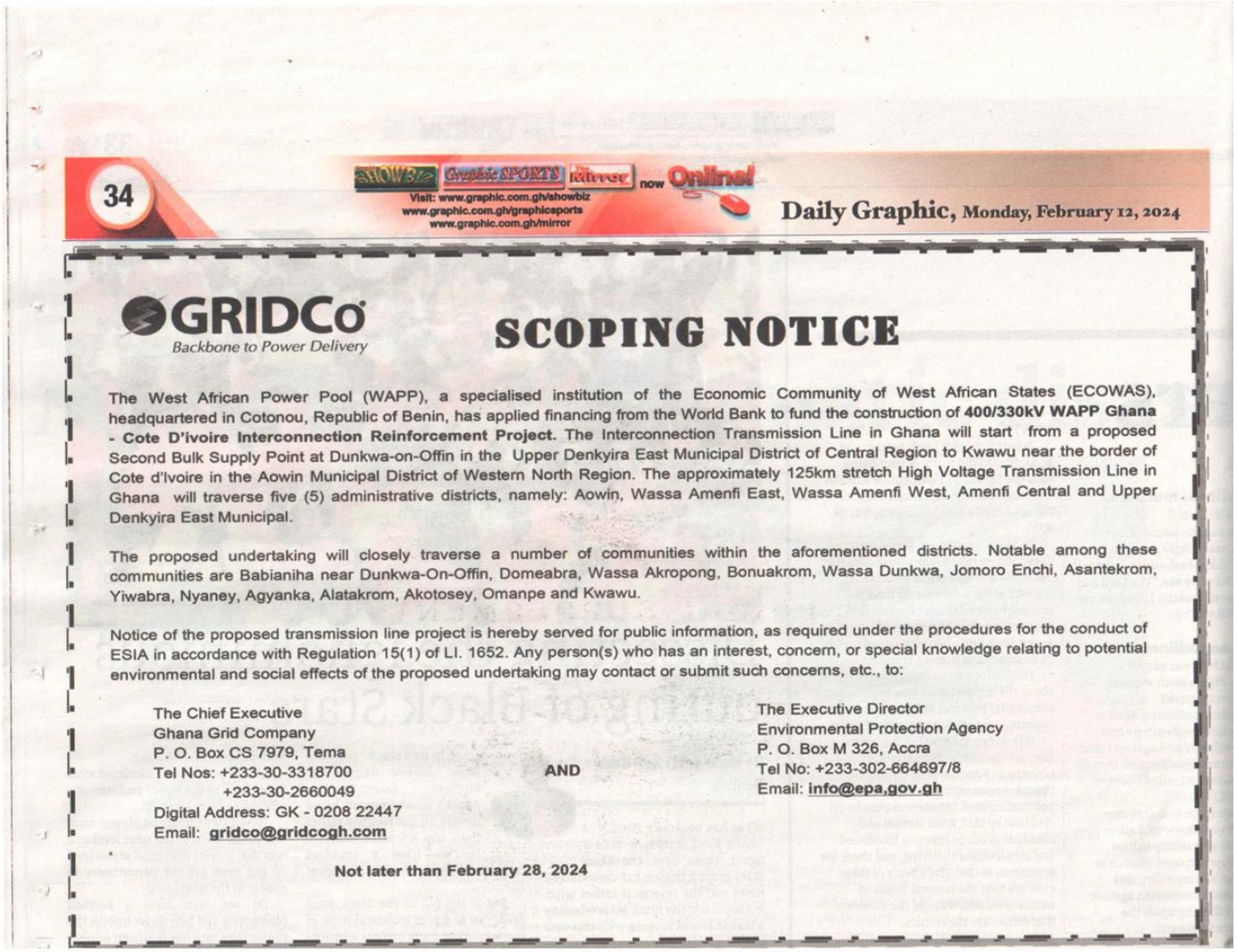
The proposed undertaking would traverse a number communities within the aforementioned districts /municipalities; notable among them are Kwawu, Enchi-Jomoro, Domeabra, Sureso, Anyinabirem, Dadieso, Bibianiha.

Notice of the proposed transmission line project is hereby served for public information, as required under the procedures for the conduct of ESIA in accordance with Regulation 15(1) of LI. 1652. Any person(s) who have an interest, concern, or special knowledge relating to potential environmental and social effects of the proposed undertaking may contact or submit such concerns, etc., to:

:hief Executive
a Grid Company
Box CS 7979, Tema
os: +233-30-3318700
+233-30-2660049
l Address: GK - 0208 22447
gridco@gridcogh.com

:xecutive Director
ɔnmental Protection Agency
Box M 326, Accra
ɔ: +233-302-664697/8
nfo@epa.gov.gh

ıter than February 4, 2024



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Daily Graphic, Monday, February 12, 2024

GRIDCo
Backbone to Power Delivery

SCOPING NOTICE

The West African Power Pool (WAPP), a specialised institution of the Economic Community of West African States (ECOWAS), headquartered in Cotonou, Republic of Benin, has applied financing from the World Bank to fund the construction of **400/330kV WAPP Ghana - Cote D'ivoire Interconnection Reinforcement Project.** The Interconnection Transmission Line in Ghana will start from a proposed Second Bulk Supply Point at Dunkwa-on-Offin in the Upper Denkyira East Municipal District of Central Region to Kwawu near the border of Cote d'Ivoire in the Aowin Municipal District of Western North Region. The approximately 125km stretch High Voltage Transmission Line in Ghana will traverse five (5) administrative districts, namely: Aowin, Wassa Amenfi East, Wassa Amenfi West, Amenfi Central and Upper Denkyira East Municipal.

The proposed undertaking will closely traverse a number of communities within the aforementioned districts. Notable among these communities are Babianiha near Dunkwa-On-Offin, Domeabra, Wassa Akropong, Bonuakrom, Wassa Dunkwa, Jomoro Enchi, Asantekrom, Yiwabra, Nyaney, Agyanka, Alatakrom, Akotosey, Omanpe and Kwawu.

Notice of the proposed transmission line project is hereby served for public information, as required under the procedures for the conduct of ESIA in accordance with Regulation 15(1) of LI. 1652. Any person(s) who has an interest, concern, or special knowledge relating to potential environmental and social effects of the proposed undertaking may contact or submit such concerns, etc., to:

The Chief Executive
Ghana Grid Company
P. O. Box CS 7979, Tema
Tel Nos: +233-30-3318700
+233-30-2660049
Digital Address: GK - 0208 22447
Email: gridco@gridcogh.com

AND

The Executive Director
Environmental Protection Agency
P. O. Box M 326, Accra
Tel No: +233-302-664697/8
Email: info@epa.gov.gh

Not later than February 28, 2024

APPENDIX IV: PICTURES OF THE STAKEHOLDER ENGAGEMENT

APPENDIX V: ATTENDANT SHEETS OF PARTICIPANTS DURING THE STAKEHOLDER CONSULTATIONS

LIST OF COMMUNITIES where stakeholders' consultations were held between 17th and 20th of January:

ff. Aboe nkwanta
gg. Anyinabirem
hh. Asantekrom
ii. Asankrangwa
jj. Bibianiha
KK. Bonnakrom
ll. Bonuama
mm. Dadieso
nn. Domeabra
oo. Enchi
pp. Jakpa
qq. Jomoro enchi
rr. Kwawu
ss. Manso Amenfi
tt. Nananko
uu. Sureso
vv. Wassa akropong
ww. Yiwabra

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization Asutekrom ---------------- District ----------------
Date 18th January 2024 Time 9:52

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

[illegible]
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization Acqutekrom ---------------- District ----------------
Date 18th January 2024 Time

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

Mr. Kwame Owusu-Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization – Asuadetsom – – – – – District – – – –
Date – 18th January 2024 – – – Time – – –

No.	Name	Designation	Contact
1	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

Mr. Kwame Owusu-Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization – Asantesgua – – – – – District Amenfi West Municipal
Date – 17th January 2024 – – Time – – –

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]
10			
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12			
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[illegible]			

[illegible]
Name and Signature of Community Representative

Mr. Kwame Owusu-Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization Aboe Nkwanta District
Date 17 January 2024 Time 1:30 – 2:00pm

No.	Name	Designation	Contact
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Name and Signature of Community Representative

Mr. Isaac Owusu-Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization Somero Fachi District
Date 17th January 2024 Time 5:36 – 6:26

No.	Name	Designation	Contact
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Name and Signature of Community Representative

Mr. Isaac Owusu-Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization – Jomoro Inchi – – – – – – District – – – – – – – – – –
Date – 8th January 2024 Time – – –

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

Mr. Kwame Owusu-Boadi
GRIDCo Representative

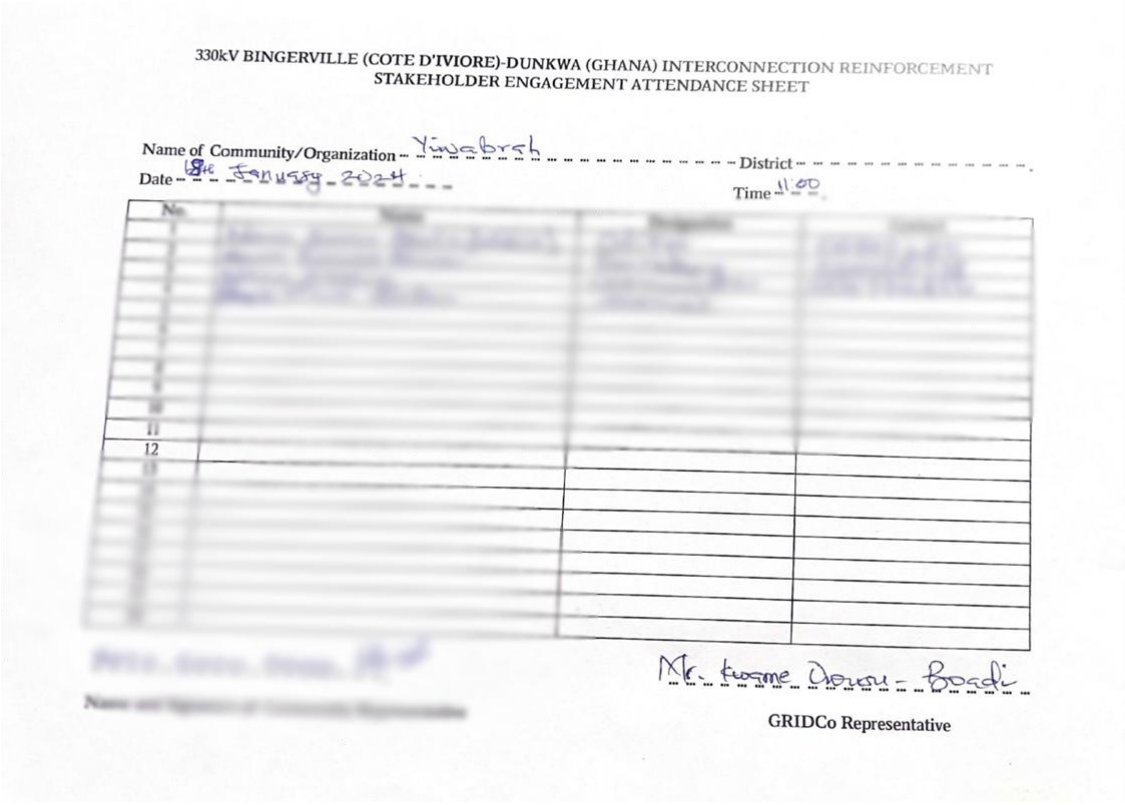
330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization Domeabra – – – – – – District – – – – – – – – – –
Date – 18th January 2024 Time 7:56 – 8:33

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

Mr. Kwame Owusu-Boadi
GRIDCo Representative



330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization Yiwabrah District
Date 18th January 2024 Time 11:00

No.	Name	Designation	Contact
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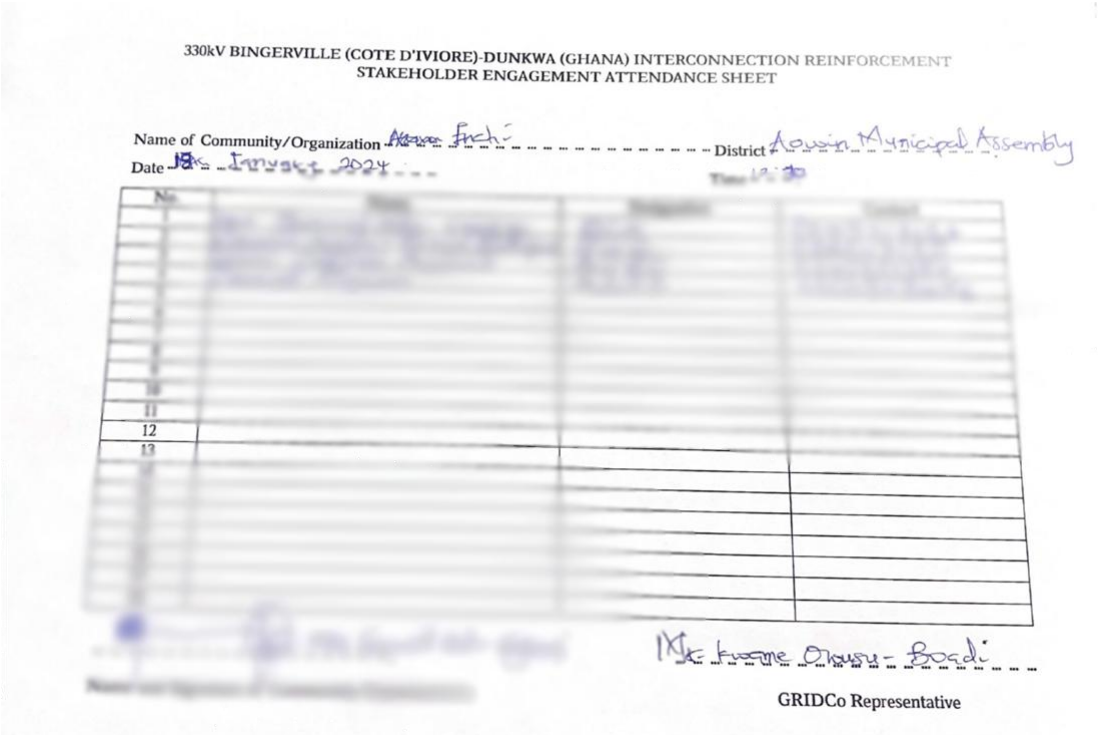
Mr. Kwame Owusu-Boadi

Name and Signature of Community Representative

GRIDCo Representative



330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization Akanfuchi District Aowin Municipal Assembly
Date 18th January 2024 Time 12:30

No.	Name	Designation	Contact
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12			
13			

Mr. Kwame Owusu-Boadi

Name and Signature of Community Representative

GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization: Kwaawu District:
Date: 18th January 2024 Time: 3:00

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

Mr. Kwame Owusu - Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization: Kwaawu District:
Date: 18th January 2024 Time:

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

Mr. Kwame Owusu - Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization: Suaeso District: Amenfi Central
Date: 19th January 2024 Time: 8:00

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

Mr. Kwame Owusu-Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization: Wassa Anyinabrem District:
Date: 19th January 2024 Time: 12:25

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

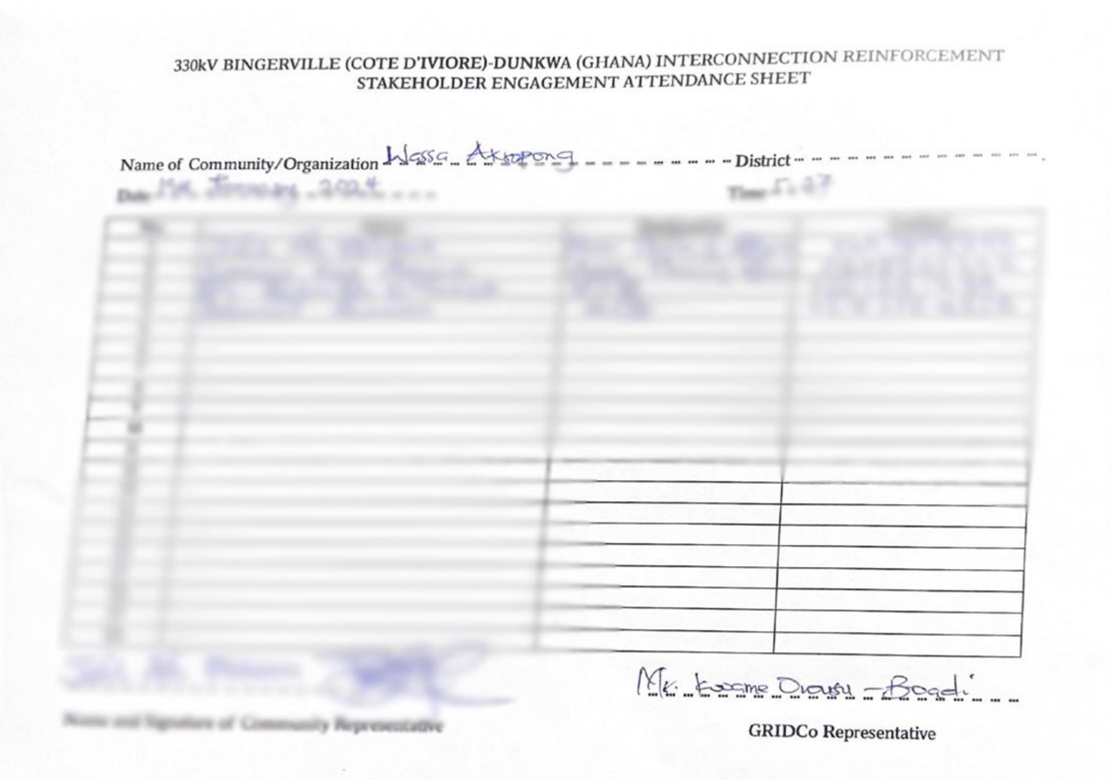
Mr. Kwame Owusu-Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization: Wassa Anyinabrim District:
Date: 17th January 2024 Time:

Mr. Kwame Owusu-Boadi

Name and Signature of Community Representative GRIDCo Representative

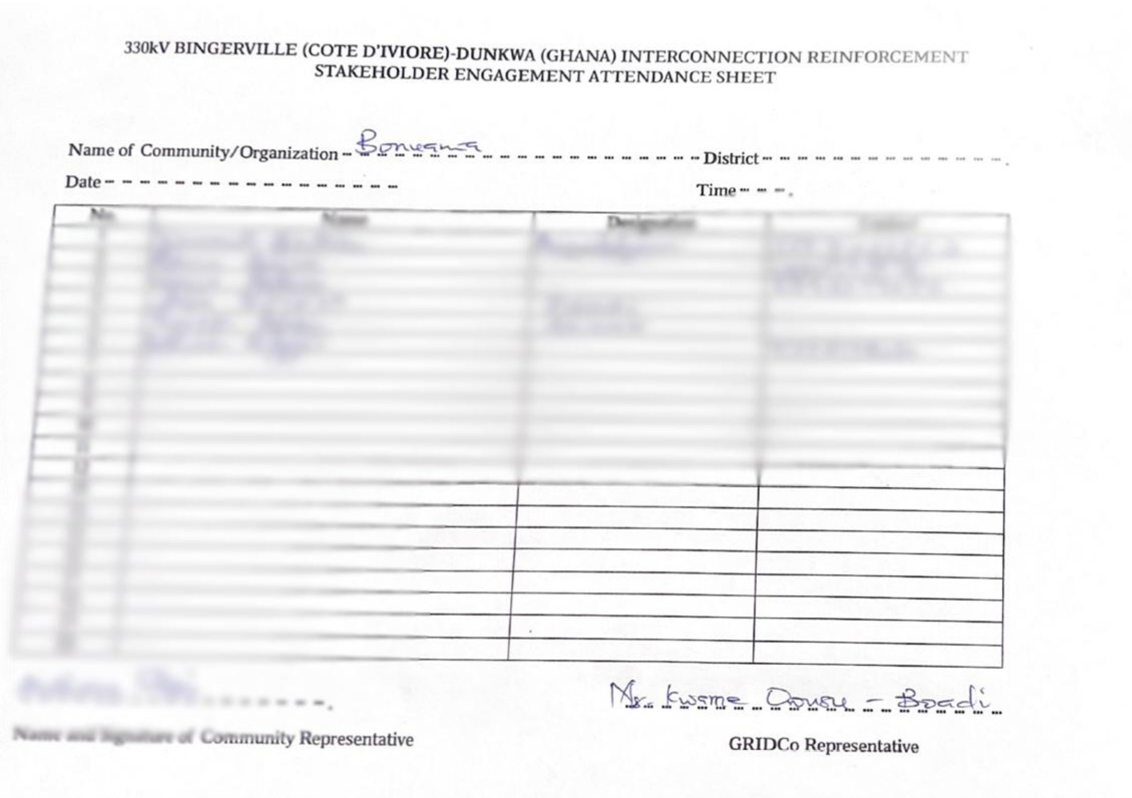


330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization: Wassa Akropong District:

Mr. Kwame Owusu-Boadi

GRIDCo Representative



330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization – Bonuana – District –
Date – Time –

No.	Name	Designation	Contact

Name and Signature of Community Representative

Mr. Kwame Owusu - Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization – Bonuama – District –
Date – Time –

No.	Name	Designation	Contact

Name and Signature of Community Representative

Mr. Kwame Owusu - Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization: Bonusma District: Amenfi Central
Date: 19th January 2024 Time: 10:30

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

Ms. Essame Owusu-Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization: Jakpa District: Amenfi East
Date: 20th January 2024 Time: [illegible]

No.	Name	Designation	Contact
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]
Name and Signature of Community Representative

Ms. Essame Owusu-Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization: Nankanto District:
Date: 20th January 2024 Time: 12:00

No.			

Name and Signature of Community Representative

Mr. Kwame Owusu - Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization: Bibiancha District: Upper Denkyira East
Date: 20th January 2024 Time: 2:00

No.			
10			
11			
12			

Name and Signature of Community Representative

Mr. Kwame Owusu - Boadi
GRIDCo Representative

330kV BINGERVILLE (COTE D'IVIORE)-DUNKWA (GHANA) INTERCONNECTION REINFORCEMENT
STAKEHOLDER ENGAGEMENT ATTENDANCE SHEET

Name of Community/Organization Dadieso District

Date 20th January 2024 Time 6:00

No.	Name	Designation	Contact
1			

Name and Signature of Community Representative

Mr. Eugene Oppong-Boadi

GRIDCo Representative

APPENDIX VI: GENERAL CONCERNS OF THE DISTRICTS AND COMMUNITIES

Consultations with District Assemblies

The districts through whose jurisdictions the proposed transmission line is expected to traverse were all and consulted on the project and its impacts on the communities in the area of environmental influence. They all pledged their support to the project and requested that local communities which will be affected must be adequately compensated. They further requested that the survey team, during their operation, must be careful of the 'galamsay' operators and land acquisition – intensive education was recommended.

Consultations with the Communities

The following concerns raised were unanimous across all communities:

- **prompt, equitable, and sufficient provision of compensation to impacted properties.**
- **creation of jobs for young people. There was a recurring demand for jobs, especially for unskilled labor, to be found in the several impacted localities.**
- **activities that are allowed in the corridor. Communities wanted to know if farming in particular was permitted in the 40 m right-of-way.**
- **restitution for arable land inside the proposed route that is impacted. In every community that was visited, a request was made to recompense the arable lands within the planned corridor rather than just the crops and building features.**
- **the distribution of electricity to areas not yet serviced by the national grid.**
- **preservation and observance of communal values (honoring the customs, holidays, and places of worship that are part of the community's cultural legacy).**
- **the proposed high-voltage line's potential health effects on the surrounding populations due to electromagnetic field emissions.**
- **request for the supply of fundamental social amenities, regardless of the project that is being suggested.**
- **all compensations were to be paid prior to the project's actual start date, according to requests.**
- **payment must be made for crops that the survey team would destroy.**
- **make sure that trees cut down outside of the 40-meter corridor receive enough recompense for their construction-related damages, as it is thought that doing so could harm the line.**
- **the parties impacted by the project should have access to a document that details all compensation policies and legislation related to forced land acquisition.**
- **Every community that was interviewed remembers a study of a route that was completed. The team destroyed farmers' crops, but they did not receive any payment.**

Appendix VIII: Meeting to exchange views with Stakeholders in the Ghana-Côte d'Ivoire High Tension Transmission

WEST AFRICAN POWER POOL

SYSTÈME D'ÉCHANGES D'ÉNERGIE ÉLECTRIQUE OUEST AFRICAIN

400/330 kV WAPP GHANA-CÔTE D'IVOIREINTERCONNECTION REINFOCEMENT PROJECT

MEETING TO EXCHANGE VIEWS ON THE TECHNICAL, ENVIRONMENTAL AND SOCIAL ASPECTS OF THE PROJECT AND ON THE PROGRESS OF PROJECT PREPARATION STUDIES

Meeting minutes

MICROSOFT TEAMS, August 2, 2024

I.INTRODUCTION

1. Following the meeting of participants on the reconnaissance mission for the 400/330 kV Côte d'Ivoire-Ghana interconnection line was held at the GRIDCo Substation at Elubo near Ghana-Côte d'Ivoire border on Friday, July 26, 2024, a follow up meeting was held on August 02, 2024.
2. The meeting was attended by representatives from the Republic of Côte d'Ivoire (CI-ENERGIES), the Republic of Ghana (Ghana Grid Company LTD. / GRIDCo), the World Bank, the WAPP Secretariat and Studio Pietrangeli Srl (SP).

xx.

3. The list of participants is attached in Appendix A.

yy.

4. The meeting was moderated by Mr. Alphonse EMADAK, Senior Environmental Safeguards Specialist at the World Bank
5. The adopted agenda is attached in Appendix B.

I PROJECT TIMELINES - ESIA

1. World bank noted that the ESIA needed to be disclosed 120 days before the bank meets in December ,2024. The World Bank therefore inquired on the status of the ESIA report.
2. SP confirmed it had received relevant inputs from its CIE on the draft ESIA Report but none from GRIDCo. GRIDCo noted that it found the ESIA largely acceptable ESIA since it incorporated its previous comments and the second round of comments, after the site visit with the World Bank the previous week, would be issued soon.
3. World Bank noted that due to the tight deadlines it would disclose the current draft version of the ESIA report prior to any additional comments could be provided for incorporation. SP advised that it would submit the draft ESIA report to WAPP Secretariat on August 6, 2024. GRIDCo indicated that the final draft version will be submitted to WAPP by August 7, 2024World Bank comments will be received not later than August 30, 2024. The final ESIA, which incorporates all relevant comments, would be expected to be ready by October 30, 2024.
4. The meeting noted that the Stakeholder Engagement Plan (SEP) would be included in the ESIA Report as a summary
5. The World Bank confirmed the following important dates for the Project:
6. Project Appraisal Mission - September 4-16 2024
7. Negotiation from October 8-11, 2024
8. The following documents were expected to be provided before September 4, 2024 for the Appraisal Mission:
9. SEP and ESCP - draft by mid August, 2024
10. SEP and ESCP - final version before end of August 2024
11. GRIDCo noted that during the site visit from July 24-28 2024, the World Bank raised issues on

grievance mechanisms and critical issues such as the challenges with galamsey. GRIDCo was therefore reviewing the submitted documentation to incorporate these comments and would provide them to the WAPP Secretariat soon.

12. SP noted that its reports had a lot of documentation on grievance mechanism and this would also be further discussed in the RAP report. The World noted that grievance was not only related to RAP issues and advised that it should also be critical for the SEP.
13. SP noted that the requirements of the SEP were different in both countries and requested the Utilities to verify the requirements of the SEP with its respective sub consultants for each country.
14. World bank noted that the guidance for SEP is in the ESS 10 document and the SEP needed to contain some outcomes of stakeholder engagement as well as how the engagements have shaped the remainder of the exercise and evidence of the preliminary consultations to be included.
15. SP will empower the local consultant with GRIDCo to produce a good draft of SEP before August 15, 2024. SEP/ESCP to be transmitted to the World Bank by August 16, 2024
16. World Bank confirmed that both utilities would have to disclose the draft of the ESIA Report on their websites.

II- PROJECT TIMELINES - RESETTLEMENT ACTION PLAN (RAP)

1. World Bank noted that it had learnt that SP was preparing an RPF for Côte d'Ivoire and not a RAP. SP clarified that RPF would only cover rural electrification and it would undertake the detailed RAP for Côte d 'Ivoire.
2. For Ghana, SP had received a list of towns to consider for rural electrification but none for Côte Ivoire
3. GRIDCo noted that an introductory letter was provided to SP more than a month previously but no activity seemed to have been taking place. GRIDCo therefore requested for a confirmation from SP that it would meet the deadline
4. SP advised that it had issues with undertaking the pillaring of the line route. It was covering the Ghana activities with support from an Ivoirian Contractor for pillaring. SP advised that it was ready to commence activities on the RAP and that it was in line with the WAPP timeline of September 29, 2024 for the RAP report.
5. GRIDCo proposed for SP to consider using a team of surveyors to cut a strip along the proposed line route and define the center line before the pillaring to expedite the preparation of the RAP
6. The World bank also suggested that defining the center line, enumeration of the PAP's and community engagements should be done for communities during the same period of time. The World Bank also suggested for SP to consider using multiple gangs to crush a lot of time for the PAP preparation
7. GRIDCo noted that waiting for pillaring before undertaking the RAP would prevent SP from meeting

the required timeline. SP advised that it would engage to its subconsultants to talk to GRIDCo on the strategies to expedite the RAP workers

8. The meeting noted that the RAP needed to be as accurate as possible for implementation
9. GRIDCo inquired if the estimates for the RAP could be considered at the project appraisal mission. World Bank noted that the Project Appraisal Mission would note that the RAP would be in progress. The team could discuss the provision of the compensation for the RAP to be included in the project cost at the project negotiations

III- RECOMMANDATIONS

The following recommendations were made:

- World Bank recommended the utilities to work together with SP's subconsultant on the review of the documents to lengthening the review process with back and forth reviews.
- The World Bank would share a sample SEP and template for the ESCP with the team to expedite review and preparation of the relevant reports
- World bank requested GRIDCo to formalize the request to the Bank for the Bank to consider financing the RAP

IV- ACKNOWLEDGEMENTS

1. The participants expressed their sincere thanks to the Ministry of Energy of Ghana for the warm welcome and hospitality extended to them and for the provision of adequate resources which contributed to the success of the meeting.
2. The participants expressed their sincere thanks to the WAPP General Secretariat for the coordination and development of the project between the stakeholders and insisted that the partners involved in the project meet regularly for its follow-up.
3. The participants in the meeting also expressed their deep gratitude to the People and Government of Ghana, and in particular to His Excellency, Mr Nana Addo Dankwa Akufo-Addo , President of the Republic of Ghana, Head of State, for the warm hospitality extended to them during their stay in Ghana.
4. After three hours of fruitful exchanges to the satisfaction of all project stakeholders, the meeting ended with words of thanks from Ms. Nicholina N. N. YEMBILAH Director, Project Implementation Unit (PIU), who appreciated the relevance and quality of the exchanges.
5. Finally, she wished each delegation a safe journey home. The meeting was officially closed with a family photo (see Appendix C).

Done Online at Microsoft Teams, August 2, 2024.

Signed by:

Pour CI-ENERGIES	**Pour la Compagnie GRIDCo**	**Pour le Consultant SP (Représentant ENVAL)**	**Pour la Banque mondiale**	**Pour le WAPP**
Abou OUTTARA (Cadre Environnementaliste)	Nichollina N.N. YEMBILAH (Director PIU)	Gédéon SAVANE (Expert social ENVAL)	Alphonse EMADAK (Senior Environmental Specialist)	Sotelle HOUESSOU (Expert Résident en Environnement)

Annex A: List of participants

LISTE DES PARTICIPANTS A LA REUNION D'ELUBO LE 26 JUILLET 2024

N°	PRÉNOM(S) & NOM	FONCTION	CONTACTS	E-MAIL
	GRIDCo			
1	Nicholina N. N. YENBILAH	Director Procurement, PIU	+233 (0)207700090	n.yembilah@gridcogh.com
	Abdul Samed Ibrahim	Project Manager, PIU		Samed.ibrahim@gridcogh.com
2	Martin Kain Kasanga	Principal Electrical Engineer	+233 (0)243664772	martin.kasanga@gridcogh.com
3	Rashid Alhassan	Surveyer	+233 (0) 509511159	rashid.alhassan@gridcogh.com
4	Kwame Owusu-Boadi	Principal Environment Officer	+233 (0) 244845124	kwame.owusu-boadi@gridcogh.com
	CI-Energies			
5	Dognymé M.M. Ouattara	Ingénieur Planification Transport	+225 0759325650	douattara@ciernegies.ci
6	Ouattara Abou	Cadre Environnementaliste	+2250708270905	abouattara@energies.ci
	BANQUE MONDIALE			
7	Alphonse OMADAK	Senior Environmental Speialist	+2250779995122	aemadak@worldbank.org
8	Emmanuel A. Abeke	Senior Social Specialist	+233208115495	eabeke@worlbank.org
9	Kobina Oku Okyne	Environmental Specialist	+233 (0) 208245297	kokyne@worldbank.org
10	Ahmed Siba Shani	Social Développement Specialist	+233 (0) 549946220	ashani@worldbank.org
11	Marie Kouabenan	Jeune Assistant	+2250544602274	mkouabenan@worldbank.org
	CONSULTANT STUDIO PIETRANGELI (ENVAL)			

N°	PRÉNOM(S) & NOM	FONCTION	CONTACTS	E-MAIL
12	Gégéon SAVANE	ROP	+225 05 96 63 49 49	bsavane@evalgroup.com
	WAPP / EEEOA			
11	Sotelle Houessou	Expert Résident en Environnement	+229 97141651	shouessou@ecowapp.org
12	Rodrigue Capo-ChiChi	Expert social Résident	+229 97 57 56 10	rrcapochichi@ecowapp.org

Annexe B : Adopted Agenda

WEST AFRICAN POWER POOL
SYSTÈME D'ÉCHANGES D'ÉNERGIE ÉLECTRIQUE OUEST AFRICAIN

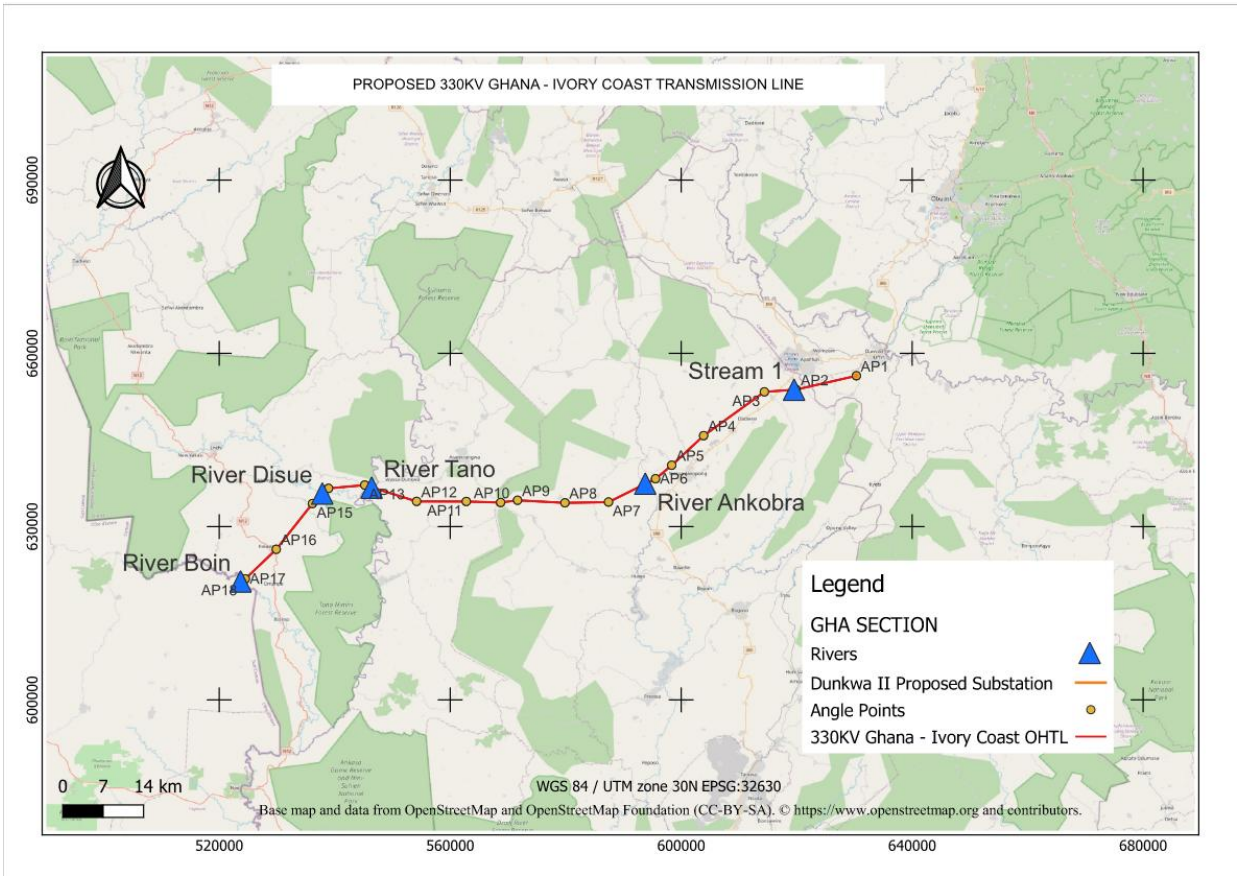
400/330 kV WAPP CÔTE D'IVOIRE GHANA INTERCONNECTIO Project

Ordre du jour adopté

ELUBO (Ghana) Vendredi 26 juilet 2024	
15h 15 – 18h15	ITEMS ON THE AGENDA
I	Introduction of meeting participants
II -	Project Timelines – ESIA
III	Project Timelines – RAP
IV -	Others

NB: Ghana Time = GMT.

APPENDIX IX: MAP OF THE LINE ROUTE



APPENDIX X: REPORT OF SURVEY OF VEGETATION AND FAUNAL ASSESSMENT

400/330KV CÔTE D'IVOIRE-GHANA INTERCONNECTION REINFORCEMENT PROJECT

SURVEY OF VEGETATION AND FAUNA WITHIN THE 40M BY 125KM RIGHT OF WAY (ROW)

SUMMARY

The report presents a comprehensive biodiversity assessment conducted as part of the Environmental and Social Impact Assessment (ESIA) for the 400/330kV Côte d'Ivoire-Ghana Transmission Line reinforcement project. The project route spans 125 km from Babianiha near Dunkwa in the Central Region to Omanpe in the Western Region, traversing various land use types. The assessment focuses on documenting vegetation and fauna within a 40-meter-wide right-of-way (ROW) to evaluate the potential impact on local biodiversity. The objectives of the study were as follows:

- Document and analyze vegetation and structural characteristics along the ROW;
- Quantify flora and fauna species diversity and abundance;
- Assess direct and indirect impacts on biodiversity, especially critical habitats and endangered species;
- Propose mitigation measures to minimize biodiversity loss;
- Create a framework for ongoing monitoring.

The method used were as follow: Field Surveys were conducted across 21 sampling sites at 6 km intervals along the 125 km route, using GPS to navigate the ROW. The assessment focused on vertebrate fauna (birds, mammals, amphibians, reptiles) and vascular plants. Bird surveys were conducted in the early morning and late afternoon, using visual and auditory identification methods. Mammals were surveyed through direct and indirect sightings (e.g., tracks, nests). Herpetofauna were examined by exploring refuges like logs and water bodies. The Rapid Botanical Survey (RBS) method was used to evaluate plant diversity, and trees with a diameter of ≥10cm were counted. The IUCN Red List was applied to assess the conservation status of species.

Results of the study indicated that the ROW primarily passes through off-reserve agricultural areas, with land uses including cocoa farms, oil palm and rubber plantations, food crop farms, fallow lands, and riparian marshes. The survey identified 108 vascular plant species, including trees like *Milicia excelsa*, *Terminalia ivorensis*, and *Khaya ivorensis*. The vegetation is largely secondary and tertiary growth due to significant human activity. Fauna communities were sparse due to intensive agriculture and human presence. Bird surveys recorded 71 species, while mammals included *Maxwell's Duiker* and *Bushbuck*. The herpetofauna community was limited, consisting of 16 species. The area holds both local and global conservation significance: Most species are classified as "Least Concern" on the IUCN Red List. Exceptions include herpetofauna such as the dwarf crocodile and Gabon viper, which are vulnerable. Seven plant species are listed as globally threatened, including *Milicia excelsa* and *Nesogordonia papaverifera* (both vulnerable). Many species have rare conservation status based on Ghana's Star Rating system. The construction will involve vegetation clearance, leading to habitat fragmentation and biodiversity loss. Specific impacts include: Clearing vegetation and preventing regrowth will alter the landscape, affecting species' habitats; disturbed areas may promote the spread of invasive species like *Broussonetia papyrifera*; large mammals and reptiles are expected to be more

vulnerable due to habitat disturbance and hunting pressure. Recommendations have been made to control invasive species as part of the maintenance regime; Implement erosion control in areas prone to soil erosion; engage stakeholders to prevent the spread of crop pests and diseases; Avoid routing access roads through sensitive areas like marshes.

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INTRODUCTION

As part of the Environmental and Social Impact Assessment (ESIA) for the GRIDCO High Tension Transmission Line project, a comprehensive biodiversity baseline study was conducted. This study focuses on the proposed 400/330kV Côte d'Ivoire-Ghana Transmission Line reinforcement project, which extends 125 kilometers from Babianiha near Dunkwa in the Central Region to Omanpe in the Western Region of Ghana. Given the substantial environmental and social impacts anticipated from the construction and operation of this transmission line, it is crucial to assess the potential effects on local flora and fauna within the project's corridor.

The study initially planned for two field surveys one during the dry season and one during the wet season, which includes both 'wet' and 'wetter' phases typical of Ghana's high forest zone. However, due to the expectation of minimal seasonal variation in the fauna community for this area, only one field season of data collection was conducted.

OBJECTIVES

1. To document and analyze the current vegetation types and their structural characteristics along the 40-meter wide by 125-kilometer-long transmission line corridor.
2. To identify and quantify the species diversity and abundance of both flora and fauna within the designated right of way, highlighting any significant ecological patterns.
3. To assess the potential direct and indirect impacts of the transmission line construction on local biodiversity, including effects on critical habitats and endangered species.
4. To propose effective mitigation measures to minimize adverse impacts on the identified flora and fauna and ensure the conservation of key biodiversity areas during and after construction.
5. To design a framework for ongoing monitoring of vegetation and fauna to track changes and assess the effectiveness of implemented mitigation measures.

METHODOLOGY

A biodiversity assessment was conducted along the transmission line's right-of-way, focusing on vertebrate fauna and vascular plants. The assessment covered the entire line route, with 21 sampling sites systematically selected at 6.0 km intervals, representing different topographies, land uses, and vegetation covers. The route was navigated using a KMZ shapefile on a Locus Map app, and assessments were carried out within a 40m for a distance of 3.0km at each site, with the transmission line route forming the central line.

Fauna assessment employed the transect count method, a reliable and cost-effective approach, conducted from August 21 to September 5, 2024. Observations took place from 6:00 am to 5:30 pm each day, focusing on identifying vertebrate species within the transmission line's right-of-way. Bird surveys took place from 6:00 am to 9:00 am and 3:00pm to 5:30 pm each day on species identification, through direct

observation and sound, using binoculars and field guides for unfamiliar species and calls African Birds Sounds (Chappuis, 2000), whereas taxonomic order and nomenclature follow Borrow and Demey (2010).

Large mammals were surveyed using transect walks along trails, footpaths, and access routes at each site, recording both direct sightings and indirect signs such as tracks, footprints, feacal droppings and nests. These mammals play crucial ecological and socio-cultural roles, including seed dispersal and biological control, but are vulnerable in areas with high human population density. Kingdon (1997) was used as the main field to confirm the identity of species encountered and nomenclature follows same.

Herpetofauna, particularly amphibians and reptiles, were surveyed by examining refuges like rocks, fallen logs, and water bodies. Amphibians are early indicators of environmental health due to their sensitivity to pollutants. Identification followed standard references, focusing on species that are often the first to decline in degraded environments. Nomenclature followed Hughes (1988) and Leache et al. (2006) while reptiles followed Hoogmoed (1974) and Chippaux (1999)

Vascular plant species and vegetation cover were assessed using the Rapid Botanic Survey (RBS) method, which provides a detailed evaluation of plant diversity and distribution within the landscape. The survey included counting trees with a diameter at breast height (dbh) of ≥ 10cm or Girth of 31.5cm, with plant taxonomy following updated nomenclature standards (Hawthorne & Jongkind, 2006).

DATA ANALYSIS

Where field data collection methods permitted, species diversity and richness were assessed for each taxon. The conservation significance of each taxon was determined using the IUCN Red List of Threatened Species, while the Ghana Wildlife Conservation Regulation was applied to evaluate the protection status of species in Ghana. All fauna species listed in Appendix I of the Wildlife Conservation Regulation are fully protected, making it illegal to hunt or capture them at any time of the year.

Checklists of recorded fauna species were created for each taxon using the most relevant taxonomic references. Bird species checklists for each plot were compiled using Borrow and Demey (2010), which also provided the avifauna taxonomy, nomenclature, and information on the conservation status, abundance, relative abundance, density and relative density of the birds recorded. The global and national conservation status of each bird species was evaluated using the 2024 IUCN Red List of Threatened Birds and Ghana's Wildlife Conservation Regulation 1971 (LI 685), with a particular focus on globally threatened, biome-restricted, and range-restricted species. All IUCN threat categories were considered in the conservation status assessment of the recorded species.

The checklist for large mammals was created using Kingdon (1997). Due to the data collection methods and the nature of the acquired data, assessments of species diversity and richness were not feasible. Data analysis concentrated primarily on evaluating the global conservation and national protection significance of the recorded species, utilizing the IUCN Red List and Wildlife Conservation Regulation 1971 (LI 685).

Checklists of recorded flora were created for each taxon using the most relevant taxonomic references (Hawthorne & Jongkind, 2006). Information on the conservation status, abundance, relative abundance, density and relative density of the flora recorded. The rarity of plant species identified in the study was assessed using Ghana's Star Rating system and the IUCN Red List.

RESULTS AND DISCUSSIONS

Land Cover Types Along the Transmission Line

The transmission line traverses an off-reserve agricultural area within Ghana's high forest zone. The vegetation in this region is largely modified, consisting of secondary and tertiary succession stages of the once-lush high forest. The remaining vegetation is primarily farm bush and farmlands Along the right of way, four distinct land use types were identified: plantation agriculture, food crop farms, farm fallows, and riparian marshes.

Cocoa farms, oil palm, and rubber plantations were the primary forms of plantation agriculture observed along the transmission line. Among these, cocoa farms were the most widespread, with plantations at various stages of maturity. Oil palm and rubber plantations were common, but appearing only sporadically along the route. The farms and plantations were intermixed with characteristic tree species typical of the moist evergreen and moist semi-deciduous forest zones.

Tree species like Milicia excelsa, Terminalia ivorensis, Khaya ivorensis, Khaya anthotica, Nauclea diderrichii, Petersianthus macrocarpus, and Nesogordonia papaverifera were frequently found in some of the cocoa farm patches.

Riparian forest patches, characterized by typical riparian vegetation along streams and riverine areas, were among the most common habitat types along the transmission line (Figure 1). These patches seemed to represent areas of disturbed natural vegetation within the transmission line's landscape.

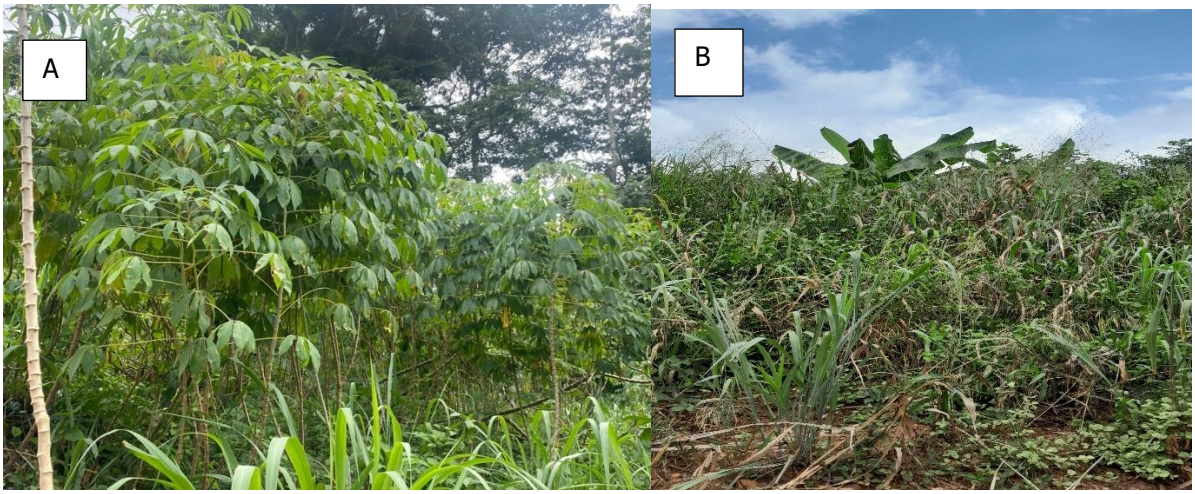
Picture of Riparian Forest

These areas are generally unsuitable for farming due to their seasonal or permanent inundation. They were found in almost all 21 sampling sites evaluated and contained characteristic flora species typical of the moist semi-deciduous and moist evergreen vegetation zones.

Food crop farms growing staples like cassava, plantains, maize, and mixed crops were a prominent and widespread land use along the transmission line. Rice fields in wet valleys were also frequently observed along the route. While food crop farms were mixed with economic crops, some areas featured extensive stretches of food crops, especially cassava, maize, and rice.

Adjacent to these food crop farms were fallow lands in various stages of regeneration. These fallow areas were not continuous but were scattered among the cultivated lands. The fallow areas were characterized by vegetation in different stages of regeneration, with species like *Chromolaena odorata, Alchornea cordifolia, Trema orientalis, Cecropia peltata, Rauvolfia vomitoria, Macaranga barteri* and *Musanga cecropioides* being prominent in the flora community.

Cocoa farms



Cassava forms(a) and fallow lands (b)

Pictures of Oil Palm plantation

Fauna Species Community in the Proposed Line Route Corridor

In heavily cultivated regions, fauna communities are typically sparse, with low species diversity and richness. This is largely due to the high human activity, intense farming practices, significant hunting pressure, and the absence of secure refuges, which make fauna, particularly large mammals, more vulnerable as they are often hunted for food. The decline of fauna communities in Ghana's off-reserve cultivated landscapes is driven by rapid deforestation and habitat degradation. Wildlife in many cultivated areas within the high forest zone is now mainly limited to small rodents, common birds, and herpetofauna associated with open habitats. This is partly due to the widespread use of inappropriate farming practices, including herbicides, weedicides, and burning.

Avifauna

Birds are among the most prevalent and easily observed fauna in most terrestrial ecosystems. A bird survey conducted along the right of way of the transmission line recorded 71 species from 26 avian families. The species identified were primarily common birds associated with cultivated areas in the high forest zone. Although the high forest zone is the most biodiversity-rich area in Ghana, the birds observed were mostly those linked to open habitats within this zone. Species diversity and richness were relatively low, likely due to the high intensity of farming and human activities across the transmission line landscape.

The bird species observed in the study were those typically found in both closed and open habitats within forest areas, reflecting the general vegetation cover at the sites. Although the sites are within Ghana's high forest zone, known for its rich diversity of flora and fauna, the intense human activity has significantly altered the vegetation. Since birds are often specific to particular habitats, changes in habitat conditions usually lead to changes in the bird community. The conservation value of the area, in terms of avifauna, was relatively low; none of the 71 bird species recorded is of conservation concern, with all being classified as "Least Concern" on the IUCN Red List of Threatened Species.

Mammals

The presence of large mammals in and around the right of way of the transmission line was minimal. The area, dominated by food and cash crop cultivation, experiences high human activity and habitat disturbance, compounded by hunting pressure, resulting in the near absence of large mammals. The mammal assessment recorded the presence of some medium mammal species indirectly such as Maxwell's Duiker (*Philantomba maxwellii*) Bay Duiker (*Cephalophus dorsalis*); Black Duiker (*Cephalophus niger*); Bushbuck (*Tragelaphus scriptus*); Brush-tailed Porcupine (*Atherurus africanus*) and few of African Palm Squirrel (*Epixerus ebii*) were observed directly. Signs were at sampling sites 2, 3, 8,12 and evidence of grass cutter (*Thryonomys swinderianus*) feeding in fallow farm areas across several sites.

Grass-cutter was the most commonly observed species and tree hyrax were heard in night hours in the project area. Droppings of civet cats and trails of brush-tailed porcupines were some of the signs of large mammals noted at certain sites. The situation with the large mammal community is typical of cultivated landscapes, where hunting pressure and human activities have greatly reduced their presence. However, a rare sighting of a bushbuck was made in a cocoa farm at transect 19. None of the large mammal species encountered in the study is of conservation concern, with all listed as "Least Concern" on the IUCN Red List of Threatened Species.

Herpetofauna

Despite the presence of some water bodies within the transmission line area, herpetofauna species were relatively scarce. The recorded herpetofauna community, consisting of snakes, lizards, and frogs, included species that are commonly found throughout Ghana's high forest zone. However, this community was notably limited, likely representing remnants of a once more diverse herpetofauna population that has been significantly reduced due to probably years of intense agricultural activities. The apparent scarcity of herpetofauna species can be attributed to the extensive use of agrochemicals, particularly herbicides, which have had a detrimental impact on fauna in the area.

The study identified 16 herpetofauna species belonging to 10 families, comprising seven amphibians and eight reptiles. Among the reptiles, there were four snakes and five lizards. The herpetofauna species observed were predominantly common species, likely the remnants of a previously thriving community

that has been decimated by intense land use, adversely affecting the herpetofauna population. Details of a Check list of the herpetofauna species found in *Appendix 2*.

A picture of male Agama agama (agama lizard)

Flora

Despite Ghana's high forest zone being home to numerous permanent forest reserves, the proposed transmission line route does not intersect any of these reserves. Instead, the entire 125 km stretch traverses through off-reserve, cultivated land. The vegetation along the transmission line route has been significantly altered due to various human activities. The remaining plant communities in the right of way primarily consist of secondary and tertiary successions of the original climax flora that once dominated the area. The land use along the transmission line includes mainly food crops and cash crops, with cocoa plantations being the most prominent. Other identified land uses include food crop farms, oil palm plantations, and rubber plantations. Among these cultivated areas, there are also fallow lands left to regenerate. Riparian buffers around rivers and streams, with their distinctive plant communities, show remnants of the natural vegetation that once covered the landscape.

Throughout the transmission line's length, the multilayered canopy typical of Ghana's high forest zone has been replaced by an open, discontinuous canopy with isolated trees in cocoa plantations and various shrubs and climbers in fallow areas. The plant composition includes a mix of deciduous and evergreen species, along with species characteristic of degraded forest zones.

Flora Community Composition

A rapid botanical survey conducted at 21 sampling sites along the transmission line recorded a total of 108 vascular plant species across several families. The distribution of these species was relatively uniform among the 21 sampling sites, with many species appearing throughout but varying in frequency. Species richness was 1,173 at the density of 18.6 tree/km site. The other plant life forms recorded included 29 species of shrubs, herbs, climbers, and lianas with abundance of 315 and density of 5.0/km.

Conservation Significance Along the Transmission Line Route

The conservation significance of an area is determined by the value of its flora and fauna. As noted earlier, the fauna community's conservation value is relatively low, with the exception of two herpetofauna species listed on the Red List of Threatened Species. All other fauna recorded are classified as Least Concern on the IUCN Red List.

In contrast, the flora community's conservation value is notable due to its high diversity. Out of the 108 recorded vascular plant species, seven (7) are listed as globally threatened on the IUCN Red list including two Near Threated and five Vulnerable as follows: *Entandrophragma angolense:* Vulnerable (VU)*; Guarea cedrata:* Vulnerable (VU)*; Milicia excelsa:* Near Threatened (NT)*; Milicia regia:* Near Threatened (NT)*; Nauclea diderrichii:* Vulnerable (VU)*; Nesogordonia papaverifera:* Vulnerable (VU)*; Terminalia ivorensis:* Vulnerable (VU). In addition to the species of global conservation concern, many of the plant species recorded within the transmission line's right of way are classified with Red, Scarlet, or Pink Star ratings, indicating their rarity. Thus, despite the significant modification of vegetation around the transmission line, there are still plant species that are rare in their occurrence and distribution within their geographic range (Appendix 3,4).

Expected Impact of the Proposed Transmission Line

The proposed transmission line project will involve clearing vegetation within the designated right-of-way, which will disrupt local ecosystems, leading to habitat fragmentation and loss for various species. The impact of this construction will vary depending on the terrain and existing land uses. For instance, significant habitat disruption is anticipated in areas with pristine forest as vegetation is removed for the construction. To maintain the right-of-way, tree removal and prevention of regrowth will create a long stretch of open land with altered vegetation structures. In agricultural regions, the use of heavy machinery may halt agricultural production.

The route for the 400/330 kV Côte d'Ivoire-Ghana transmission line primarily traverses off-reserve cultivated land. While no pristine forests are affected, the construction and operation of the power line will modify land use within the right-of-way. The 40-meter-wide right-of-way along the 125 km transmission line will undergo changes during and after construction, likely becoming unsuitable for farming due to the removal and suppression of vegetation. Consequently, one expected impact is the reduction in farming opportunities within the right-of-way.

Additionally, the construction and maintenance of the above-ground power transmission line may have potential adverse effects on wildlife, especially birds. Although the baseline assessment did not find any congregator bird species that could be disrupted by the transmission line, it is anticipated that wildlife, particularly large mammals and reptiles, may become more vulnerable. The baseline assessment revealed limited presence of these species.

The transmission line route features intensive food and cash crop cultivation. The construction of the line could result in the formation of a long stretch of open area with altered vegetation structures, potentially facilitating the spread of invasive species such as *Broussonetia papyrifera*, which is already expanding in other parts of the high forest zone.

Moreover, constructing the transmission line close to existing lines could further create open habitats in vital cocoa production areas, possibly triggering the spread of the cocoa swollen shoot virus disease (CSSVD) in cocoa farms along the route. The construction and maintenance could also increase edge effects, potentially impacting cocoa farms and other parts of the landscape.

Expected Impact on Local Biodiversity and Species of Conservation Concern

Despite the significant conservation value of the areas along the transmission line, the construction and maintenance of the line are not expected to adversely affect local biodiversity. The transmission line area is part of a larger landscape where the fauna and flora are distributed over a broader geographic range. The species recorded have wide distributions beyond the construction area, meaning that while there will be some localized impacts during and after construction, these are not expected to affect the broader landscape's biodiversity.

Although the area includes species of global conservation concern, particularly among the flora, the expected impact will be localized and not severely affect the overall biodiversity and conservation value of the region. This is because no species of global conservation significance is endemic to this area or even to Ghana; they have broader distributions within the Upper Guinea forest biome.

Critical habitats, such as riparian vegetation in wet marshes and along streams, are not anticipated to be negatively impacted by the construction and maintenance of the above-ground transmission line for several reasons:

1. Above-Ground Construction: The transmission line will be built above ground, reducing direct physical disturbance to riparian and wetland areas. This avoids excavation and grading that could damage sensitive vegetation and soil.
2. Selective Vegetation Management: Vegetation management around transmission lines typically involves selective clearing rather than widespread deforestation, allowing critical riparian vegetation to be preserved, especially where it is crucial for ecosystem stability and water quality.
3. Buffer Zones: Buffer zones are often established around critical habitats to ensure construction

and maintenance activities occur at a safe distance, protecting the integrity of riparian zones.

4. Use of Existing Routes: Construction activities are planned to use existing access routes, minimizing the creation of new paths that could disrupt riparian vegetation and limit additional intrusion by humans and machinery.
5. Environmental Management Plans: These plans usually include measures to protect sensitive areas, such as riparian zones, including erosion control, runoff management, and careful placement of transmission towers.
6. Small Footprint: The physical footprint of transmission towers is relatively small, and with careful placement, these towers can avoid critical habitats. Maintenance activities can be performed with minimal disturbance, often using techniques that do not require heavy machinery near sensitive areas.
7. Ongoing Monitoring: Continuous monitoring during and after construction can help identify and address any unforeseen impacts on riparian habitats, with adaptive management strategies allowing adjustments to mitigate negative effects.

RECOMMENDED MITIGATION MEASURES

i. Integrate the identification and control of invasive species into the regular maintenance schedule for the transmission line.

ii. Implement erosion control measures, such as planting cover crops, in areas prone to soil erosion, especially where there are significant elevation changes.

iii. Where feasible, consider planting trees to mitigate edge effects in sensitive cocoa-growing regions.

iv. GRIDCO should collaborate with organizations such as the Department of Crop Services under the Ministry of Food and Agriculture and the Ghana Cocoa Board to prevent and manage the spread of crop pests and diseases.

v. Exercise caution when constructing the transmission line through riparian zones and marsh forests to minimize impacts on delicate habitats and ecosystems. Install culverts over streams to prevent localized flooding.

vi. Whenever possible, GRIDCO should avoid routing maintenance access roads through marsh forests and areas that are seasonally inundated along the transmission line.

Appendix 1: Checklist of avian species encountered during the survey

Common Name/Family	Scientific Name	Cons. Status	Abundance	R. Abundance	Density	R.Density
Phasianidae						
Ahanta francolin	Pternistis ahantensis	LC	21	1.05	0.33	1.05
Columbidae						
Tambourine Dove	Turtur tympanistria	LC	20	1.00	0.32	1.00
Blue-headed Wood-Dove	Turtur brehmeri	LC	23	1.15	0.37	1.15
African Green-Pigeon	Treron calvus	LC	32	1.60	0.51	1.60
Laughing Dove	Spilopelia senegalensis	LC	14	0.70	0.22	0.70
Musophagidae						
Yellow-billed Turaco	Tauraco macrorhynchus	LC	23	1.15	0.37	1.15
Cuculidae						
Black-throated Coucal	Centropus leucogaster	LC	6	0.30	0.10	0.30
Blue Malkoha	Ceuthmochares aereus	LC	14	0.70	0.22	0.70
Dideric Cuckoo	Chrysococcyx caprius	LC	10	0.50	0.16	0.50
African Emerald Cuckoo	Chrysococcyx cupreus	LC	17	0.85	0.27	0.85
Apodidae						
Black Spinetail	Telacanthura melanopygia	LC	48	2.40	0.76	2.40
Sabine's Spinetail	Rhaphidura sabini	LC	16	0.80	0.25	0.80
African Palm-Swift	Cypsiurus parvus	LC	42	2.10	0.67	2.10
Sarothruridae						
White-spotted Flufftail	Sarothrura pulchra	LC	26	1.30	0.41	1.30
Accipitridae						
Red-thighed Sparrowhawk	Accipiter erythropus	LC	6	0.30	0.10	0.30
Black Goshawk	Accipiter melanoleucus	LC	9	0.45	0.14	0.45
Bucerotidae						

African Pied Hornbill	Lophoceros fasciatus	LC	51	2.54	0.81	2.54
White-crested Hornbill	Horizocerus albocristatus	LC	17	0.85	0.27	0.85
Piping Hornbill	Bycanistes fistulator	LC	12	0.60	0.19	0.60
Alcedinidae						
African Dwarf Kingfisher	Ispidina lecontei	LC	18	0.90	0.29	0.90
Blue-breasted Kingfisher	Halcyon malimbica	LC	13	0.65	0.21	0.65
Meropidae			0	0.00	0.00	0.00
Little Bee-eater	Merops pusillus	LC	28	1.40	0.44	1.40
Coraciidae			0	0.00	0.00	0.00

Appendix 1 Continued

Common Name/Family	Scientific Name	Cons. Status	Abundance	R. Abundance	Density	R.Density
Blue-throated Roller	Eurystomus gularis	LC	22	1.10	0.35	1.10
Lybiidae						
Yellow-billed Barbet	Trachyphonus purpuratus	LC	15	0.75	0.24	0.75
Naked-faced Barbet	Gymnobucco calvus	LC	21	1.05	0.33	1.05
Speckled Tinkerbird	Pogoniulus scolopaceus	LC	12	0.60	0.19	0.60
Red-rumped Tinkerbird	Pogoniulus atroflavus	LC	6	0.30	0.10	0.30
Yellow-throated Tinkerbird	Pogoniulus subsulphureus	LC	25	1.25	0.40	1.25
Hairy-breasted Barbet	Tricholaema hirsuta	LC	9	0.45	0.14	0.45
Picidae						
Fire-bellied Woodpecker	Chloropicus pyrrhogaster	LC	12	0.60	0.19	0.60
Buff-spotted Woodpecker	Campethera nivosa	LC	13	0.65	0.21	0.65
Oriolidae						
Western Black-headed Oriole	Oriolus brachyrynchus	LC	32	1.60	0.51	1.60
Black-winged Oriole	Oriolus nigripennis	LC	12	0.60	0.19	0.60
Platysteiridae						
West African Wattle-eye	Platysteira hormophora	LC	24	1.20	0.38	1.20

Red-cheeked Wattle-eye	Platysteira blissetti	LC	14	0.70	0.22	0.70
Dicruridae						
Velvet-mantled Drongo	Dicrurus modestus	LC	9	0.45	0.14	0.45
Monarchidae						
Blue-headed Crested-Flycatcher	Trochocercus nitens	LC	14	0.70	0.22	0.70
Black-headed Paradise-Flycatcher	Terpsiphone rufiventer	LC	25	1.25	0.40	1.25
Nicatoridae						
Western Nicator	Nicator chloris	LC	26	1.30	0.41	1.30
Macrosphenidae						
Kemp's Longbill	Macrosphenus kempi	LC	13	0.65	0.21	0.65
Gray Longbill	Macrosphenus concolor	LC	17	0.85	0.27	0.85
Green Hylia	Hylia prasina	LC	19	0.95	0.30	0.95
Tit-hylia	Pholidornis rushiae	LC	22	1.10	0.35	1.10
Cisticolidae						
Yellow-browed Camaroptera	Camaroptera superciliaris	LC	18	0.90	0.29	0.90
Olive-green Camaroptera	Camaroptera chloronota	LC	17	0.85	0.27	0.85

Appendix 1 Continued

Common Name/Family	Scientific Name	Cons. Status	Abundance	R. Abundance	Density	R.Density
Hirundinidae						
Fanti Sawwing	Psalidoprocne obscura	LC	30	1.50	0.48	1.50
Pycnonotidae						
Slender-billed Greenbul	Stelgidillas gracilirostris	LC	11	0.55	0.17	0.55
Swamp Greenbul	Thescelocichla leucopleura	LC	28	1.40	0.44	1.40
Red-tailed Greenbul	Criniger calurus	LC	16	0.80	0.25	0.80
Gray Greenbul	Eurillas gracilis	LC	13	0.65	0.21	0.65

Yellow-whiskered Greenbul	Eurillas latirostris	LC	23	1.15	0.37	1.15
Little Greenbul	Eurillas virens	LC	55	2.74	0.87	2.74
Common Bulbul	Pycnonotus barbatus	LC	58	2.89	0.92	2.89
Pellorneidae						
Brown Illadopsis	Illadopsis fulvescens	LC	12	0.60	0.19	0.60
Sturnidae						
Splendid Glossy Starling	Lamprotornis splendidus	LC	36	1.80	0.57	1.80
Nectariniidae						
Collared Sunbird	Hedydipna collaris	LC	16	0.80	0.25	0.80
Blue-throated Brown Sunbird	Cyanomitra cyanolaema	LC	10	0.50	0.16	0.50
Olive Sunbird	Cyanomitra olivacea	LC	25	1.25	0.40	1.25
Buff-throated Sunbird	Chalcomitra adelberti	LC	13	0.65	0.21	0.65
Ploceidae						
Black-necked Weaver	Ploceus nigricollis	LC	32	1.60	0.51	1.60
Red-vented Malimbe	Malimbus scutatus	LC	20	1.00	0.32	1.00
Village Weaver	Ploceus cucullatus	LC	223	11.13	3.54	11.13
Viellots Weaver	Ploceus nigerrimus	LC	150	7.49	2.38	7.48
Blue-billed Malimbe	Malimbus nitens	LC	36	1.80	0.57	1.80
Red-headed Queala	Quelea erythrops	LC	57	2.84	0.90	2.84
Estrildidae						
Orange-cheeked Waxbill	Estrilda melpoda	LC	54	2.69	0.86	2.69
Black-and-White Mannikin	Spermestes bicolor	LC	6	0.30	0.10	0.30
African Firefinch	Lagonosticta rubricata	LC	49	2.45	0.78	2.45
Black-bellied Seedcracker	Pyrenestes ostrinus	LC	17	0.85	0.27	0.85
Bronze Mannikin	Spermestes cucullata	LC	106	5.29	1.68	5.29
Chestnut-breasted Nigrita	Nigrita bicolor	LC	27	1.35	0.43	1.35

Appendix 1 Continued

Common Name/Family	Scientific Name	Cons. Status	Abundance	R. Abundance	Density	R.Density

Gray-headed Nigrita	Nigrita canicapillus	LC	18	0.90	0.29	0.90
TOTAL			2004	100.00	31.81	100.00

Appendix 2: Checklist of Herpetofauna during the survey

Common Name	Scientific Name	IUCN	Abundance	R. Abundance	Density	R.Density
DICROGLOSSIDAE						
Crowned Bullfrog	Hoplobatrachus occipitalis	LC	17	10.56	0.27	10.56
HYPEROLIIDAE			0	0.00	0.00	0.00
Hallowell's sedge frog	Hyperolius concolor	LC	7	4.35	0.11	4.35
PHRYNOBATRACHIDAE			0	0.00	0.00	0.00
Ahl's river frog	Phrynobatrachus latifrons	LC	23	14.29	0.37	14.29
Boutry river frog	Phyrnobatrachus calcaratus	LC	18	11.18	0.29	11.18
Natal puddle frog	Phrynobatrachus natalensis	LC	14	8.70	0.22	8.70
BUFONIDAE			0	0.00	0.00	0.00
Common toad	Sclerophrys regularis	LC	26	16.15	0.41	16.15
REPTILES			0	0.00	0.00	0.00
AGAMIDAE			0	0.00	0.00	0.00
Agama lizard	Agama agama	LC	13	8.07	0.21	8.07
GEKKONIDAE			0	0.00	0.00	0.00
Nigeria leaf-toed gecko	Hemidactylus ansorgii	LC	5	3.11	0.08	3.11
SCINCIDAE			0	0.00	0.00	0.00
Senegal mabuya	Trachylepis affinis	LC	10	6.21	0.16	6.21
Guinea mabuya	Trachylepis albilabris	LC	10	6.21	0.16	6.21
VARANIDAE			0	0.00	0.00	0.00
Nile Monitor	Varanus niloticus	LC	6	3.73	0.10	3.73
Snakes			0	0.00	0.00	0.00
VIPERIDAE			0	0.00	0.00	0.00
bush viper	Atheris broadleyi	LC	1	0.62	0.02	0.62
spotted night adder	Causus maculatus	LC	4	2.48	0.06	2.48
ELAPIDAE			0	0.00	0.00	0.00

West Africa Greenv Mamba	Dendroaspis viridis	LC	3	1.86	0.05	1.86
TESTUDINIDAE			0	0.00	0.00	0.00
Forest hinged-backed tortoise	Kinixys erosa	LC	4	2.48	0.06	2.48
Total			161	100.00	2.56	100.00

Appendix 3: Checklist of tree species enumerated along the transmission line route

Name of tree	Family	Guild	Star rating	IUCN rating	Abundance	R. Abundance	Density	R. Density
Aidia genipiflora	Rubiaceae	Shade-b	gn	LC	6	0.5	0.1	0.5
Albizia adianthifolia	Fabaceae	NPLD	gn	LC	19	1.6	0.3	1.6
Albizia ferruginea	Fabaceae	NPLD	Sc	LC	18	1.5	0.3	1.5
Albizia zygia	Fabaceae	NPLD	gn	LC	21	1.8	0.3	1.8
Alchornea cordifolia	Euphorbiaceae	Pioneer	gn	LC	21	1.8	0.3	1.8
Allanblackia parviflora	Clusiaceae	NPLD	Pk	LC	3	0.3	0.0	0.3
Alstonia boonei	Apocynaceae	Pioneer	gn	LC	21	1.8	0.3	1.8
Amphimas pterocarpoides	Fabaceae	NPLD	gn	LC	13	1.1	0.2	1.1
Anthocleista nobilis	Loganiaceae	Pioneer	gn	LC	9	0.8	0.1	0.8
Anthocleista vogelii	Loganiaceae	Pioneer	gn	LC	9	0.8	0.1	0.8
Antiaris toxicaria	Moraceae	NPLD	gn	LC	14	1.2	0.2	1.2
Artocarpus altilis	Moraceae	Exotic		LC	7	0.6	0.1	0.6
Bambusa vulgaris	Apocynaceae	Swamp	gn	LC	12	1.0	0.2	1.0
Baphia nitida	Fabaceae	Shade-b	gn	LC	19	1.6	0.3	1.6
Baphia pubecens	Fabaceae	Pioneer	gn	LC	13	1.1	0.2	1.1
Blighia sapida	Sapindaceae	NPLD	gn	LC	10	0.9	0.2	0.9
Blighia welwitschii	Sapindaceae	NPLD	gn	LC	6	0.5	0.1	0.5
Bombax buonoposenze	Bombacaceae	Pioneer	gn	LC	10	0.9	0.2	0.9
Bridelia grandis	Euphorbiaceae	Pioneer	gn	LC	9	0.8	0.1	0.8
Canarium schweinfurthii	burseraceae	Pioneer	Pk	LC	7	0.6	0.1	0.6
Carapa procera	Meliaceae	Shade-b	gn	LC	9	0.8	0.1	0.8
Carpolobia lutea	Polygalaceae	Shade-b	gn	LC	6	0.5	0.1	0.5
Cedrela odorata	Meliaceae	Exotic		LC	6	0.5	0.1	0.5
Ceiba pentandra	Bombacaceae	Pioneer	gn	LC	21	1.8	0.3	1.8

Celtis mildbraedii	Ulmaceae	Shade-b	gn	LC	13	1.1	0.2	1.1
Celtis zenkeri	Ulmaceae	NPLD	gn	LC	11	0.9	0.2	0.9
Chassalia kolly	Rubiaceae	Pioneer	gn	LC	12	1.0	0.2	1.0

Appendix 3 Continued

Scientific Name	Family	Guild	Star rating	IUCN Redlist	Abundance	R. Abundance	Density	R. Density
Cleistopholis patens	Annonaceae	Pioneer	gn	LC	4	0.3	0.1	0.3
Cola gigantea	Sterculiaceae	NPLD	gn	LC	8	0.7	0.1	0.7
Cola millenii	Sterculiaceae	NPLD	gn	LC	7	0.6	0.1	0.6
Cola nitida	Sterculiaceae	Shade-b	Pk	LC	6	0.5	0.1	0.5
Cordia platythyrsa	Boraginaceae	Pioneer	gn	LC	4	0.3	0.1	0.3
Daniella ogea	Fabaceae	Pioneer	Pk	LC	14	1.2	0.2	1.2
Dialium dinklaigei	Fabaceae	NPLD	gn	LC	13	1.1	0.2	1.1
Diospyros heudelotii	Ebenaceae	Shade-b	bu	LC	7	0.6	0.1	0.6
Distemonanthus benthamianus	Fabaceae	NPLD	Pk	LC	6	0.5	0.1	0.5
Dracaena arborea	Agavaceae	Pioneer	gn	LC	3	0.3	0.0	0.3
Dracaena fragrans	Agavaceae	Shade-b	gn	LC	8	0.7	0.1	0.7
Drypetes afzelii	Euphorbiaceae	Shade-b	gn	LC	4	0.3	0.1	0.3
Drypetes principum	Euphorbiaceae	Shade-b	gn	LC	5	0.4	0.1	0.4
Elaies guineensis	Arecaceae	Pioneer	Pk	LC	21	1.8	0.3	1.8
Entandropragma angolense	Meliaceae	NPLD	R	VU	9	0.8	0.1	0.8
Ficus exasperata	Moraceae	Pioneer	gn	LC	21	1.8	0.3	1.8
Ficus ottonifolia	Moraceae	Strangler	gn	LC	6	0.5	0.1	0.5
Ficus sur	Moraceae	Pioneer	gn	LC	7	0.6	0.1	0.6
Ficus thonningii	Moraceae	Pioneer	gn	LC	3	0.3	0.0	0.3

Funtumia africana	Apocynaceae	Pioneer	gn	LC	17	1.4	0.3	1.4
Funtumia elastica	Apocynaceae	NPLD	Pk	LC	14	1.2	0.2	1.2
Glyphaea brevis	Sterculiaceae	Pioneer	gn	LC	1	0.1	0.0	0.1
Grewia mollis	Malvaceae	Pioneer	gn	LC	15	1.3	0.2	1.3
Guarea cedrata	Meliaceae	NPLD	R	VU	5	0.4	0.1	0.4
Hallea ledermannii	Rubiaceae	NPLD	R	LC	9	0.8	0.1	0.8
Hannoa klaineana	Simaroubaceae	Pioneer	gn	LC	9	0.8	0.1	0.8
Harunguna madagascariensis	Guttiferae	Pioneer	gn	LC	10	0.9	0.2	0.9
Hollarhena floribunda	Apocynaceae	Pioneer	gn	LC	10	0.9	0.2	0.9
Khaya grandifoliola	Meliaceae	NPLD	R	LC	5	0.4	0.1	0.4
Khaya ivorensis	Meliaceae	NPLD	Sc	LC	6	0.5	0.1	0.5
Lantana camara	Verbenaceae	Pioneer	gn	LC	11	0.9	0.2	0.9

Appendix 3 Continued

Common Name/Family	Scientific Name	Guild	Cons. Status	IUCN Redlist	Abundance	R. Abundance	Density	R.Density
Maesopsis eminii	Rhamnaceae	Pioneer	gn	LC	7	0.6	0.1	0.6
Margaritaria discoidea	Euphorbiaceae	Pioneer	gn	LC	12	1.0	0.2	1.0
Microdesmis puberula	Pandaceae	Shade-b	gn	LC	10	0.9	0.2	0.9
Milicia excelsa	Moraceae	Pioneer	Sc	NT	20	1.7	0.3	1.7
Milicia regia	Moraceae	Pioneer	Sc	NT	9	0.8	0.1	0.8
Monodora myristica	Annonaceae	Shade-b	gn	LC	9	0.8	0.1	0.8
Morinda lucida	Rubiaceae	Pioneer	gn	LC	21	1.8	0.3	1.8
Morus mesozygia	Moraceae	Pioneer	gn	LC	5	0.4	0.1	0.4

Musanga cecropiodes	Moraceae	Pioneer	gn	LC	12	1.0	0.2	1.0
Myrianthus arboreus	Moraceae	Shade-b	gn	LC	16	1.4	0.3	1.4
Myrianthus libericus	Moraceae	Shade-b	gn	LC	9	0.8	0.1	0.8
Nauclea diderrichii	Rubiaceae	Pioneer	sc	NT	6	0.5	0.1	0.5
Nesogordonia papaverifera	Sterculiaceae	Shade-b	Pk	VU	10	0.9	0.2	0.9
Newbouldia laevis	Bignoniaceae	Pioneer	gn	LC	21	1.8	0.3	1.8
Panicum maximum	Poaceae	Pioneer	gn	LC	11	0.9	0.2	0.9
Pentaclethra macrophylla	Fabaceae	NPLD	gn	LC	16	1.4	0.3	1.4
Persea americana	Lauraceae	Exotic		LC	4	0.3	0.1	0.3
Petersianthus macrocarpa	Lecythidaceae	Pioneer	gn	LC	10	0.9	0.2	0.9
Phyllocosmus africanus	Ixonanthaceae	NPLD	gn	LC	5	0.4	0.1	0.4
Piptadeniastrum africanum	Fabaceae	NPLD	Pk	LC	9	0.8	0.1	0.8
Psydrax subscordata	Rubiaceae	NPLD	gn	LC	12	1.0	0.2	1.0
Pterygota macropcarpa	Sterculiaceae	NPLD	R	LC	7	0.6	0.1	0.6
Pycnanthus angolensis	Myristicaceae	NPLD	Pk	LC	18	1.5	0.3	1.5
Raphia palma-pinus	Raphia Palm	NPLD	Gold	LC	21	1.8	0.3	1.8
Rauvolfia vomitoria	Apocynaceae	Pioneer	gn	LC	14	1.2	0.2	1.2
Rhaphia hookeri	Arecaceae	Swamp	gn	LC	11	0.9	0.2	0.9
Ricinodendron heudelotii	Euphorbiaceae	Pioneer	gn	LC	14	1.2	0.2	1.2

Appendix 3 Continued

Scientific Name	Family	Habit	Star Rating	IUCN Redlist	Abundance	R. Abundance	Density	R.Density
Rothmania hispida	Rubiaceae	Shade-b	gn	LC	7	0.6	0.1	0.6
Scottellia klaineana	Flacourtiaceae	Shade-b	Pk	LC	6	0.5	0.1	0.5
Solanum erianthum	Solanaceae	Pioneer	gn	LC	15	1.3	0.2	1.3
Solanum torvum	Solanaceae	Pioneer	gn	LC	9	0.8	0.1	0.8
Spathodea campanulata	Bignoniaceae	Pioneer	gn	LC	18	1.5	0.3	1.5
Spondias mombin	Anacardiaceae	Exotic		LC	7	0.6	0.1	0.6
Sterculia rhinopetala	Sterculiaceae	NPLD	Pk	LC	8	0.7	0.1	0.7
Sterculia tragacantha	Sterculiaceae	Pioneer	gn	LC	19	1.6	0.3	1.6
Strombosia glaucescens	Olacaceae	Shade-b	gn	LC	8	0.7	0.1	0.7
Terminalia ivorensis	Combretaceae	Pioneer	Sc	VU	18	1.5	0.3	1.5
Terminalia superba	Combretaceae	Pioneer	Pk	LC	21	1.8	0.3	1.8
Tetrapleura tetraptera	Fabaceae	Pioneer	gn	LC	11	0.9	0.2	0.9
Tetrochidium didymostemon	Euphorbiaceae	Pioneer	gn	LC	12	1.0	0.2	1.0
Trema orrientalis	Ulmaceae	Pioneer	gn	LC	13	1.1	0.2	1.1
Trichilia monadelpha	Meliaceae	NPLD	gn	LC	19	1.6	0.3	1.6
Trichilia preureana	Meliaceae	NPLD	gn	LC	7	0.6	0.1	0.6
Trichilia tessmannii	Meliaceae	NPLD	gn	LC	6	0.5	0.1	0.5

Trilepesium madagascariense	Moraceae	NPLD	gn	LC	1	0.1	0.0	0.1
Triplochiton scleroxylon	Sterculiaceae	Pioneer	Sc	LC	17	1.4	0.3	1.4
Voacanga africana	Apocynaceae	Pioneer	gn	LC	8	0.7	0.1	0.7
Xylia evansii	Fabaceae	NPLD	bu	LC	7	0.6	0.1	0.6
Xylopia aethiopica	Annonaceae	Swamp	bu	LC	12	1.0	0.2	1.0
Zanthoxylon gilletii	Rutaceae	Pioneer	gn	LC	12	1.0	0.2	1.0
Total					1173	100.0	18.6	100.0

Appendix 4: Checklist of climbers, shrubs and herbaceous plants enumerated along the transmission line route

Species Name	FAMILY	Habit	Guild	Star rating	Abundance	R. Abundance	Density	R. Density
Acacia kamerunensis	Fabaceae	Cl	NPLD	gn	21	6.7	0.3	6.7
Anchomanes difformis	Araceae	Hb	Shade-b	gn	7	2.2	0.1	2.2
Ataenidia conferta	Marantaceae	Hb	Shade-b	gn	7	2.2	0.1	2.2
Baissea zygodoides	Apocynaceae	Cl	Shade-b	bu	7	2.2	0.1	2.2
Chromolaena odorata	Asteraceae	Hb	Pioneer	gn	19	6.0	0.3	6.0
Cnestis ferrugimea	Connaraceae	Cl	Pioneer	gn	11	3.5	0.2	3.5
Costus afer	Zingiberaceae	Hb	Pioneer	gn	9	2.9	0.1	2.9
Costus dubils	Zingiberaceae	Hb	Pioneer	gn	10	3.2	0.2	3.2
Culcasia angolensis	Araceae	Cr	NPLD	gn	6	1.9	0.1	1.9
Culcasia scandens	Araceae	Cr	Shade-b	gn	7	2.2	0.1	2.2
Culcasia striolata	Araceae	Cr	Shade-b	gn	10	3.2	0.2	3.2
Dalbergia saxatilis	Fabaceae	Cl	NPLD	gn	7	2.2	0.1	2.2
Dioscorea bulbifera	Dioscoreaceae	Cl	NPLD	Pk	9	2.9	0.1	2.9
Flagellaria guineensis	Flagellariaceae	Cl	Pioneer	gn	10	3.2	0.2	3.2
Griffonia simplicifolia	Fabaceae	Cl	NPLD	gn	21	6.7	0.3	6.7
Mimosa pudica	Fabaceae	Cl	Pioneer	gn	19	6.0	0.3	6.0
Morinda morindoides	Rubiaceae	Cl	Pioneer	gn	14	4.4	0.2	4.4
Olyra latifolia	Poaceae	CR	Shade-b	gn	10	3.2	0.2	3.2
Palisota hirsuta	Commelinaceae	Hb	Pioneer	gn	11	3.5	0.2	3.5

Parquetina nigrescens	Phytolaccaceae	Cl	Pioneer	gn	9	2.9	0.1	2.9
Paullinia pinnata	Sapindaceae	Cl	Pioneer	gn	19	6.0	0.3	6.0
Piper guineense	Piperaceae	Cl	Shade-b	Pk	15	4.8	0.2	4.8
Sida acuta	Malvaceae	Hb	Pioneer	gn	9	2.9	0.1	2.9
Smilax krausiana	Smilaceae	Cl	Pioneer	gn	12	3.8	0.2	3.8
Stachytapheta cayennensis	Verbenaceae	Hb	Pioneer	gn	5	1.6	0.1	1.6

Appendix 4 Continued

Common Name/Family	Scientific Name	Habit	Guild	Star rating	Abundance	R. Abundance	Density	R. Density
Strophanthus hispidus	Apocynaceae	L	Pioneer	Pk	7	2.2	0.1	2.2
Tetracera alnifolia	Dilleniaceae	L		gn	9	2.9	0.1	2.9
Thaumatococcus danielii	Marantaceae	Hb	Pioneer	R	10	3.2	0.2	3.2
Zornia glochidiata	Fabaceae	Hb	Pioneer	gn	5	1.6	0.1	1.6
Total					315	100.0	5.0	100.0

APPENDIX XI: ELECTROMAGNETIC FIELD (EMF) EFFECTS

Electromagnetic fields (EMF) (properly called electric and magnetic fields) occur whenever a voltage is present or whenever a current is flowing. In nature EMF effects occur, as in lightning and in other phenomena such as the northern lights (aurora borealis) caused by the interaction of solar wind and the earth's magnetic field.

Since the early 1880s when public electricity supplies were introduced, man has lived increasingly in electric and magnetic fields that vary with time (oscillate). However, electricity transmission, distribution and generating equipment are by no means the only source of man-made EMF. Such fields are everywhere, and are created by wiring circuits in homes, including currents that are induced in water and gas pipes. In addition, all electrical appliances and equipment, together with electric trains and other forms of transport, even the motorcar, all produce EMF. It is almost impossible to avoid man-made electric and magnetic fields.

Over the last two decades, debate has raged over the impact of electro-magnetic fields (EMF) on human health. Power lines in particular have become a focus for conflicting conclusions. The Environmental Health Division of the Minnesota Department of Health (USA) has collated the current available results of research into EMF and health carried out worldwide. The information is readily available at their web site www.health.state.mn.us. In the table below, the conclusions from the available research information have been duly summarized and presented.

Summary of research findings on EMF and health

No.	Research Institution	Country	Year	Main Conclusions
1	American Physical Society	USA	2001	No plausible biophysical mechanisms for the systematic initiation or promotion of cancer by power line fields have been identified.
2	National Research Council	USA	2010	The conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human health hazard.
3	National Institute of Environmental Health Science	USA	2009	The scientific evidence suggesting that EMF exposures pose any health risk is weak. However EMF exposure cannot be said to be entirely safe.

No.	Research Institution	Country	Year	Main Conclusions
4	Institute of Electrical and Electronic Engineers + Engineers in Medicine and Biology	USA	2009	There is not enough relevant scientific data to establish whether common exposure to power-frequency fields should be considered a health hazard. There is general agreement that more research is needed to define safe limits of human exposure to EMF.
5	National Radiological Protection Board	UK	2021	Laboratory experiments have provided no good evidence that EMF causes cancer. However, the possibility remains that intense prolonged exposure to EMF can increase the risk of leukaemia in children.
6	International Agency for Research on Cancer	10 Countries US, UK, Japan etc	2021	There is no evidence that EMF is associated with childhood leukaemia, and there is no consistent relationship between EMF and childhood brain tumours.
7	Health Council of the Netherlands	Holland	2021	It is not likely that children (or adults) living near to high voltage power lines are at risk through exposure to EMF generated by those lines.
8	Japan EMF Research Program	Japan	2021	There is little evidence of any adverse effects from EMF exposure. Very high intensity EMF (over 10000 times higher than real-world environments) can have certain biological effects, which are positive.

Source: Minnesota Department of Health, Environmental Health Division: www.health.state.mn.us

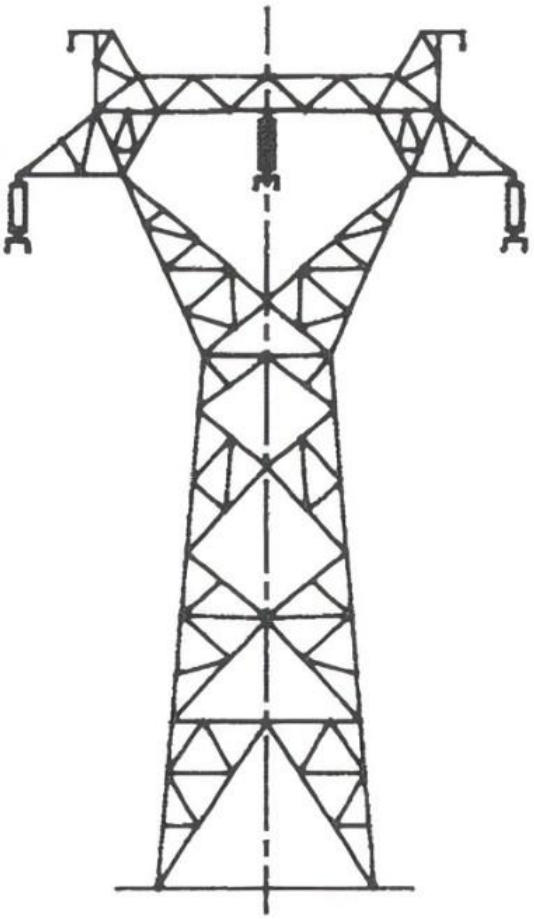
According to the International Commission for Non-Ionization Radiation Protection (ICNIRP), research evidence for EMF causing long-term, chronic, diseases such as cancer is not clear and therefore there are no guidelines based on this potential risk. The guidelines are based on short term, immediate health consequences such as stimulation of the peripheral nerves and muscles, and micro-shocks.

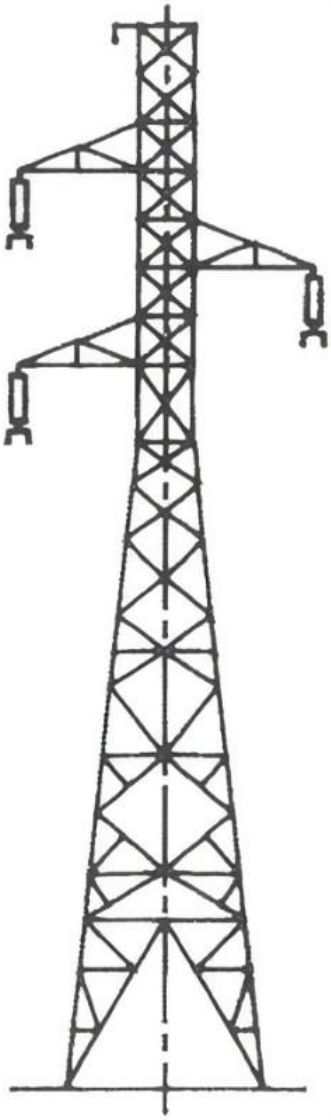
Only the higher voltage transmission lines at 400 kV would, under steady-state conditions, and directly beneath the lines, create a magnetic field maximum of 100 μT (the ICNIRP reference value). However,

typical values are approximately a tenth of this field value. The same applies to electric field for 400 kV transmission lines, where maximum, steady-state, values could be above the reference value of 5 kV/m, but the typical values might only reach this. The magnetic and electric fields drop rapidly with distance from the centre lines of the power line.

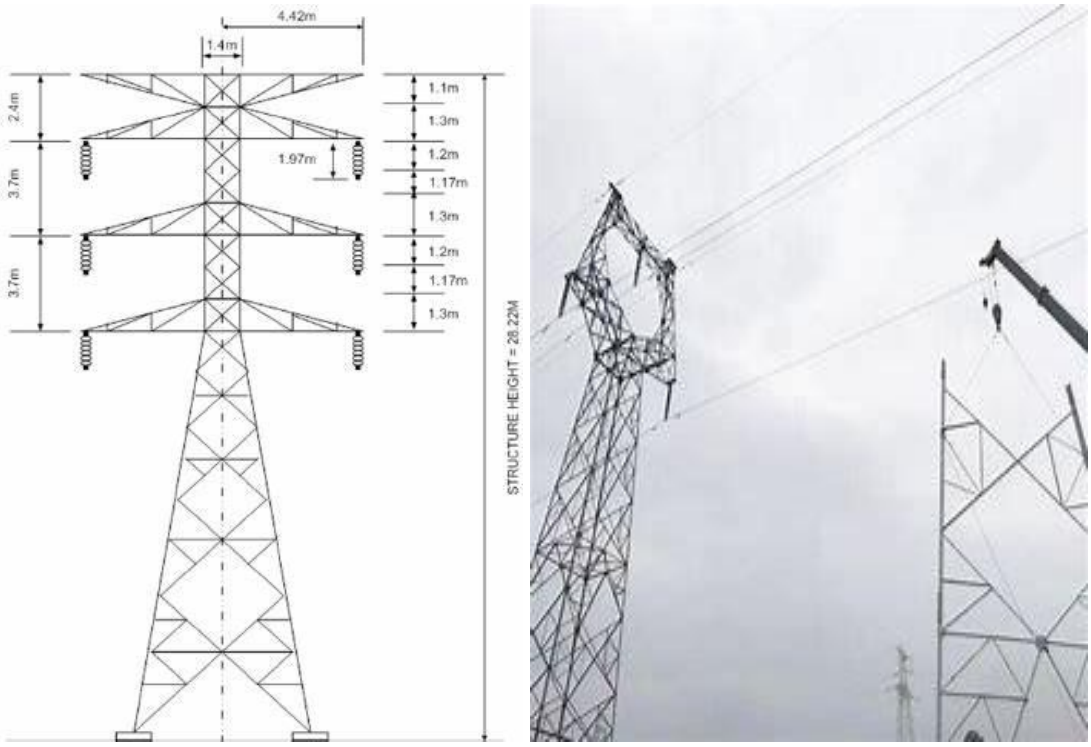
In the light of the findings presented it is not expected that the proposed 330/400 kV Transmission line will have any adverse impacts on human health.

APPENDIX XII: PICTURES OF HIGH-TENSION TOWER CONFIGURATION TOWERS

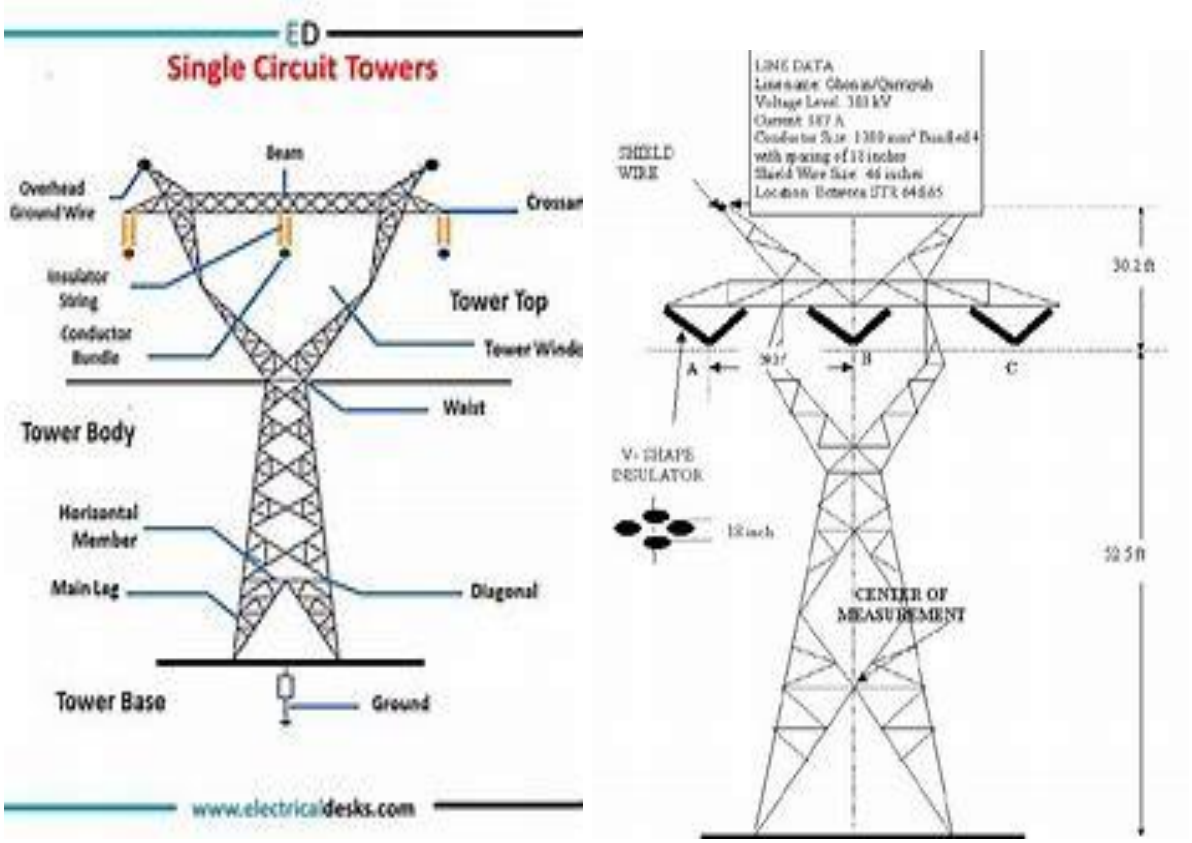




Triangular configuration with two earth wires



Cat's Head Configuration Tower



Horizontal configuration towers

APPENDIX XIII: CULTURAL HERITAGE ASSESSMENT REPORT

400/330kV Côte d'Ivoire-Ghana Interconnection Reinforcement Project

Cultural Heritage Assessment Report

September, 2024

Abstract

This report presents the findings of a cultural heritage assessment conducted for the 330kV Côte d'Ivoire-Ghana Transmission Line reinforcement project. The project spans 125 kilometers across five districts in Ghana, including Upper Denkyira East, Wassa Amenfi East, Wassa Amenfi West, Wassa Amenfi Central, and Aowin Municipal Assembly, all under three traditional authorities. The assessment aimed to identify, document, and evaluate cultural heritage sites such as sacred groves, shrines, historical monuments, and archaeological sites within the 40-meter proposed Right-of-Way (RoW). Through a combination of desk-based research, field surveys, and community consultations, no significant cultural heritage sites, sacred groves, shrines, historical monuments, or community structures were identified within the RoW. However, potential archaeological sites were noted, particularly in Upper Denkyira East, though none were directly impacted by the proposed transmission line route. Mitigation measures recommended include route adjustments to avoid culturally significant sites, the establishment of buffer zones, continuous collaboration with local communities, archaeological monitoring during construction, and thorough documentation in case relocation of any heritage elements becomes necessary. The report concludes that the transmission line project poses no major threat to cultural heritage sites but emphasizes the importance of careful monitoring and adherence to mitigation strategies, especially in cases of "chance findings" during construction.

1. Introduction

The 330kV Côte d'Ivoire-Ghana Transmission Line reinforcement project is a key infrastructure initiative designed to enhance the power supply and distribution network between Ghana and Côte d'Ivoire. The proposed 125km transmission line route passes through five districts in Ghana, namely Upper Denkyira East, Wassa Amenfi East, Wassa Amenfi West, Wassa Amenfi Central, and Aowin Municipal Assembly. These Districts are controlled by three Traditional Authorities namely, Denkyira, Wassa Amenfi and Aowin Traditional Authorities. This report presents the findings of a cultural heritage assessment conducted along the transmission line route within 40m proposed Right-0f-Way, with a focus on identifying, documenting, and preserving cultural and historical assets that may be impacted by the project.

2. Objectives of the Assessment

- To identify and document all cultural heritage sites, including sacred groves, shrines, historical monuments, and archaeological sites, along the proposed transmission line route.
- To assess the potential impacts of the transmission line construction on the identified cultural heritage sites.
- To engage with local communities and stakeholders to understand the cultural significance of the sites and incorporate their views into the assessment.
- To recommend strategies and measures to mitigate any negative impacts on cultural heritage sites.
- To ensure that the project complies with national and international regulations regarding the conservation of cultural heritage.

3. Methodology

The cultural heritage assessment was conducted using a combination of desk-based research, field surveys, and community consultations. The assessment took place from 20th August to 8th September, 2024. The following steps were taken:

- **Literature Review:** A thorough review of existing records, including previous heritage assessments, historical documents, and archaeological surveys, was conducted to gather information on known heritage sites in the project area.
- **Field Surveys:** Field surveys were carried out along the transmission line route to identify and document cultural heritage sites.
- **Community Consultations:** Meetings were held with local chiefs, elders, and community members to gather insights into culturally significant sites and to understand the potential impact of the transmission line on these sites in 14 communities along the line route.
- **Impact Analysis:** The potential impacts of construction activities on cultural heritage sites were analyzed, taken into account the proximity of the sites to the transmission line RoW (20m ta each side of the central line) and the nature of the construction activities.

4. Findings

The cultural heritage assessment identified no significant sites along the proposed transmission line route, which are detailed as follows:

- **Sacred Groves:** No Sacred groves were identified along the route. These groves are revered by the local communities and are used for spiritual rituals and as burial sites but none was identified within the corridor.
- **Shrines:** Several shrines dedicated to local deities and ancestral spirits were mentioned but none was located within the proposed RoW. These shrines hold deep cultural significance and are actively used for religious ceremonies.
- **Historical Monuments:** The route did not contained any historical monuments nor remnants of colonial-era structures and war memorials, which are important to the local historical narrative.
- **Archaeological Sites:** Preliminary investigations suggest the presence of archaeological sites, particularly in Upper Denkyira East, where artifacts from pre-colonial civilizations may be found. However, none of them were located in the proximity of the proposed line route.
- **Community Structures:** No community structures, such as traditional meeting places and communal gathering spots, were also identified as culturally significant within the RoW.

5. Impact Assessment

The construction of the 330kV transmission line could have potentially impacted any identified cultural heritage sites in the following ways:

- Physical Damage: Construction activities, such as land clearing, excavation, and the erection of pylons, could result in physical damage to sacred groves, shrines, and historical monuments.
- Disturbance of Sacred Sites: Construction noise, dust, and increased human activity could disturb sacred sites, potentially leading to conflicts with local communities and disruption of traditional practices.
- Loss of Archaeological Artifacts: There is a risk that construction could have disturbed or destroy archaeological sites, leading to the loss of valuable cultural artifacts.
- Alteration of Cultural Landscapes: The visual and physical intrusion of the transmission line could alter the cultural landscape, affecting the integrity of sites that are valued for their undisturbed natural settings.

6. Recommendations

To mitigate the potential impacts on cultural heritage sites that would be 'Chance find', the following measures are recommended:

- *Route Adjustment*: Where feasible, the transmission line route should be adjusted to avoid significant cultural heritage sites, particularly sacred groves and shrines.
- *Establish Buffer Zones*: Buffer zones should be established around identified cultural heritage sites

to protect them from direct construction activities. These zones should be clearly marked and respected by all construction personnel.

- *Community Collaboration:* Ongoing collaboration with local communities is essential to ensure that their concerns are addressed and that cultural heritage sites are protected. Regular consultations should be held throughout the project lifecycle.
- *Archaeological Monitoring*: Archaeologists should be present during construction activities in areas where archaeological sites would be 'chance find' to monitor and document any such findings. This will help in preserving cultural artifacts.
- *Documentation and Relocation*: If avoidance is not possible, thorough documentation of the cultural heritage sites should be conducted. In some cases, it may be necessary to relocate certain cultural elements, such as shrines, with the consent of the local community.
- *Training and Awareness*: Construction workers should be trained on the importance of cultural heritage preservation and made aware of the significance of the sites they may encounter.
- *Management of any "Chance Findings" during Construction*: If there are any accidental or "chance findings" during the project implementation the contractor shall immediately inform the project developer which in this case is the GRIDCo.

7. Conclusion

The cultural heritage assessment along the 125km route of the 330kV Côte d'Ivoire-Ghana Transmission Line has not identified any culturally significant sites that may be affected by the project.

APPENDIX XIV: CODE OF CONDUCT FOR WORKERS

CODE OF CONDUCT FOR WORKERS

This Code of Conduct outlines the standards of behavior and professional conduct expected of all employees. By signing this document, you agree to abide by these guidelines while employed by the company or project.

1. Respect for Others
- **All employees must treat colleagues, supervisors, clients, and community members with respect, dignity, and fairness.**
- **Discrimination or harassment of any kind, including on the basis of gender, race, ethnicity, religion, age, disability, or sexual orientation, is strictly prohibited.**
- **Bullying, intimidation, or any form of abusive behavior will not be tolerated.**

2. Integrity and Honesty
- **Employees are expected to act with honesty, integrity, and transparency in all professional dealings.**
- **Fraud, theft, or any dishonest behavior will lead to disciplinary actions, including potential termination.**
- **All company assets, information, and resources must be used responsibly and for work-related purposes only.**

3. Health, Safety, and Environmental Responsibility
- **Every employee is responsible for maintaining a safe and healthy workplace by following safety regulations, wearing appropriate protective gear, and reporting any hazards or incidents.**
- **Employees must adhere to environmental policies and procedures aimed at reducing environmental impacts and promoting sustainability.**
- **Misconduct or negligence that results in harm to the environment or workplace safety will lead to disciplinary measures.**

4. Anti-Corruption and Anti-Bribery
- **Employees must not engage in any form of bribery or corrupt practices.**
- **All employees must reject and report any requests or offers for bribes or other corrupt behavior, whether by colleagues, contractors, or external partners.**

5. Gender Equality and Non-Discrimination
- **The company is committed to promoting gender equality and ensuring an inclusive workplace for all.**
- **Any form of gender-based violence, harassment, or unequal treatment will not be tolerated.**
- **Employees must contribute to a gender-sensitive working environment by treating all individuals fairly, regardless of their gender or background.**

6. Conflict of Interest
- **Employees must avoid situations where personal interests could conflict, or appear to conflict, with their professional responsibilities.**
- **Any potential conflict of interest must be disclosed immediately to a supervisor.**

7. Confidentiality
- **Employees must maintain the confidentiality of any proprietary or sensitive information related to the company, clients, or colleagues.**
- **Sharing or misusing confidential information for personal or external gain is strictly prohibited.**

8. Attendance and Punctuality
- **Employees are expected to be punctual and maintain regular attendance as scheduled.**
- **Unjustified absences or consistent tardiness will lead to disciplinary actions.**

9. Substance Abuse
- **The use, possession, or distribution of illegal substances on company premises or while conducting business is strictly prohibited.**
- **Employees must not be under the influence of alcohol or drugs while at work.**

10. Grievance Redressal and Reporting

- **Employees are encouraged to report any breaches of this Code of Conduct, unethical behavior, or concerns regarding workplace conduct to their supervisor or through the designated grievance mechanism.**
- **The company will ensure that reports are handled confidentially and that no retaliation occurs against those who report in good faith.**

11. Compliance with Laws and Regulations

- **All employees must comply with applicable local, national, and international laws and regulations.**
- **Failure to adhere to legal requirements may result in termination and legal consequences.**

Declaration

I, the undersigned, acknowledge that I have read and understood the above Code of Conduct. I agree to comply with these guidelines and understand that failure to adhere to them may result in disciplinary actions, including termination of employment.

Name: _____
Position: _____
Signature: _____
Date: _____

APPENDIX XV: CULTURAL HERITAGE CHANCE FINDS PROCEDURES

CULTURAL HERITAGE CHANCE FINDS PROCEDURES

A chance finds procedure is a project-specific procedure which will be followed if previously unknown cultural heritage is encountered during project activities. It will be included in all contracts relating to construction of the project, including excavations, demolition, movement of earth, flooding, or other changes in the physical environment. The chance finds procedure sets out how chance finds associated with the project should be managed. The procedure includes a requirement to notify relevant authorities of found objects or sites by cultural heritage experts; to fence-off the area of finds or sites to avoid further disturbance; to conduct an assessment of found objects or sites by cultural heritage experts; to identify and implement actions consistent with the requirements of this ESS and national law; and to train project personnel and project workers on chance find procedures.

Steps to be taken during construction upon identification and/or exposure

During construction, through accidental exposure, cultural heritage may be identified. As soon as this occurs, the Contractor will carry out the procedure below to avoid any further damage:

1. **Stop the construction activities in the area of the chance find**

Where a suspected Chance Find is identified work must stop at the affected site and the Contractor's HSE Manager must be informed immediately that this is the case. Work may continue on other sites not affected by the find.

2. **Delineate the discovered site or area**

The area in which the artifact has been discovered will be marked out to protect the area and prevent accidental disturbance from site activity.

3. **Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the National Museum takes over;**

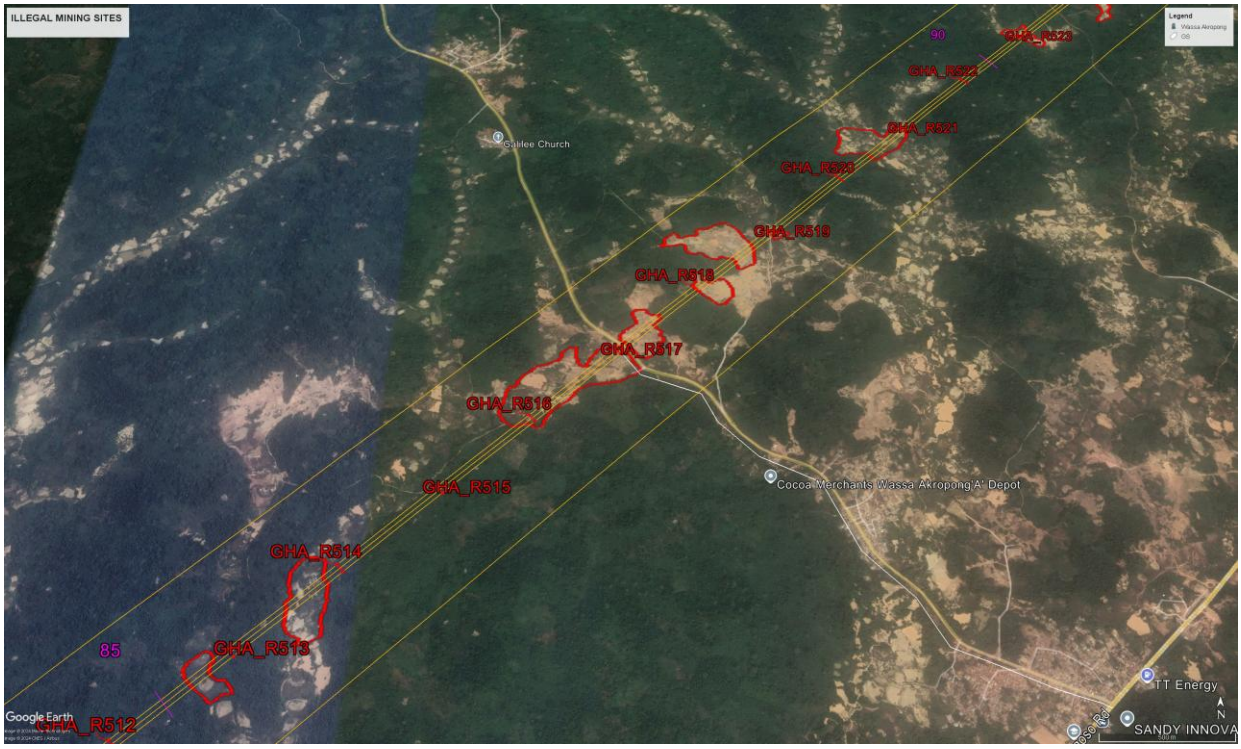
The Contractor's HSE Manager will instruct the security provider to post a guard at the site to ensure that the site is protected until the site can be handed over.

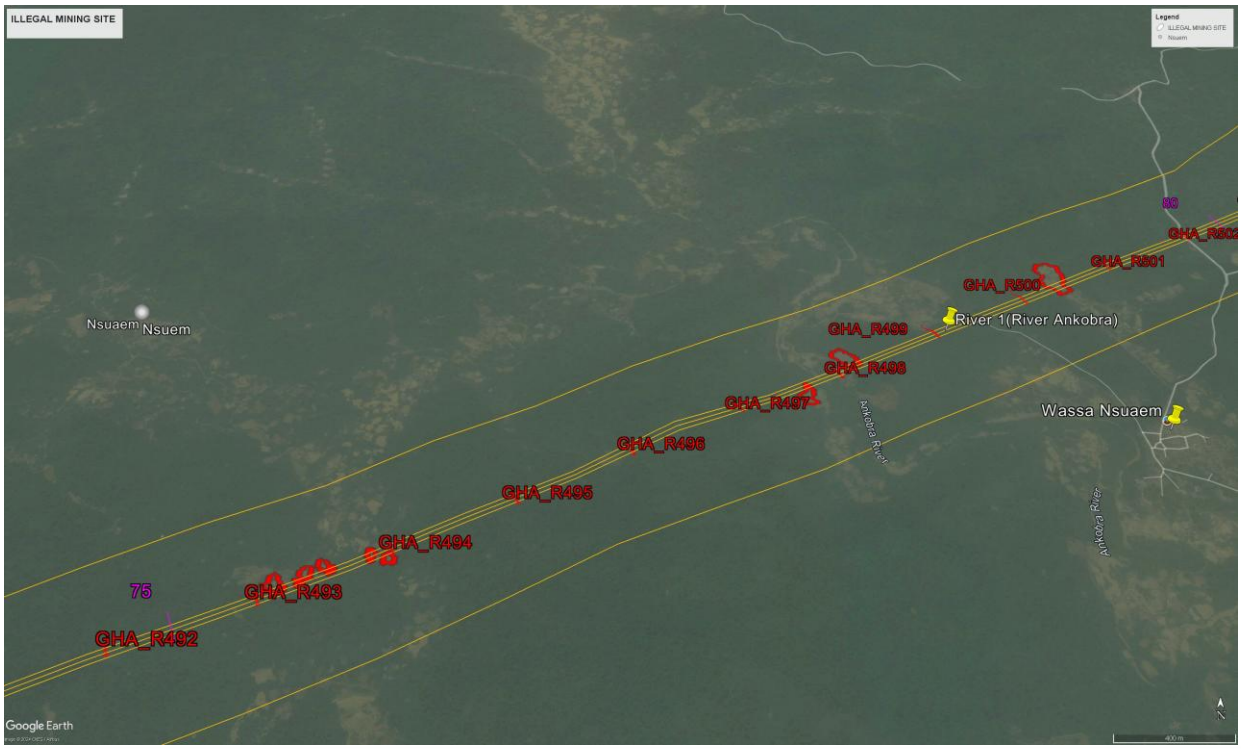
4. **Notify the Construction Supervision Consultant who in turn will notify responsible local or national authorities in charge of the Cultural Property (within 24 hours or less)**

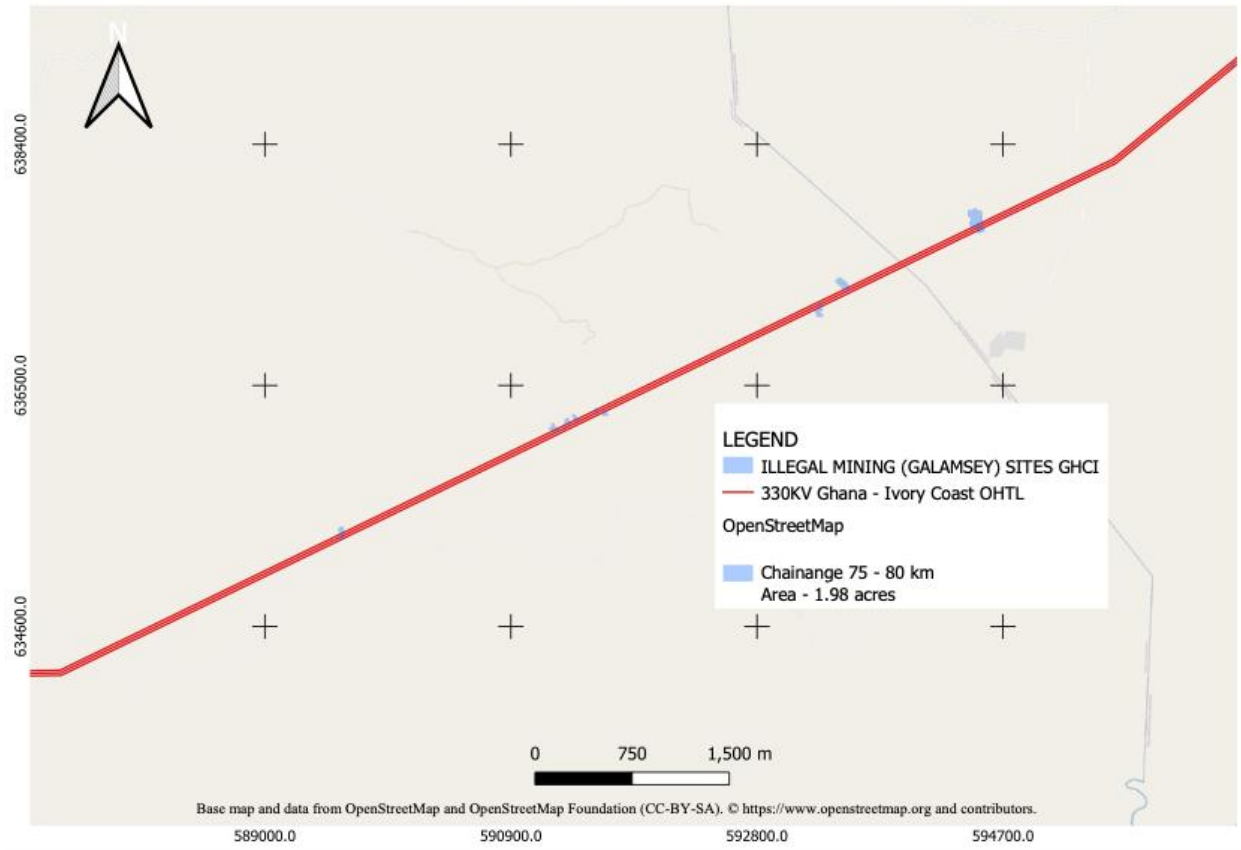
The Contractor's HSE Manager will notify the Client's Engineer of the potential find as soon as possible and within 4 hours of works stopping.

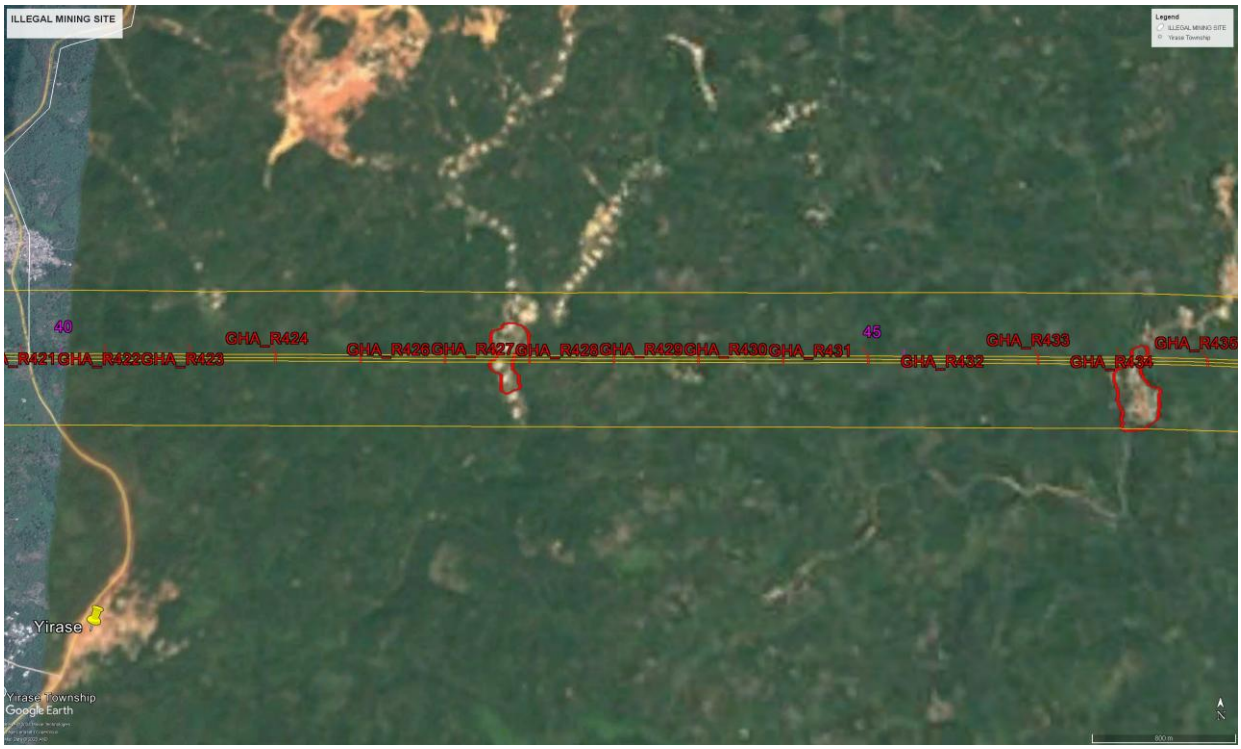
The Client's Engineer will be responsible for reporting the potential find to GRIDCo and the Ghana Museums and Monuments Board to determine the next steps. This must be achieved within 24 hours.

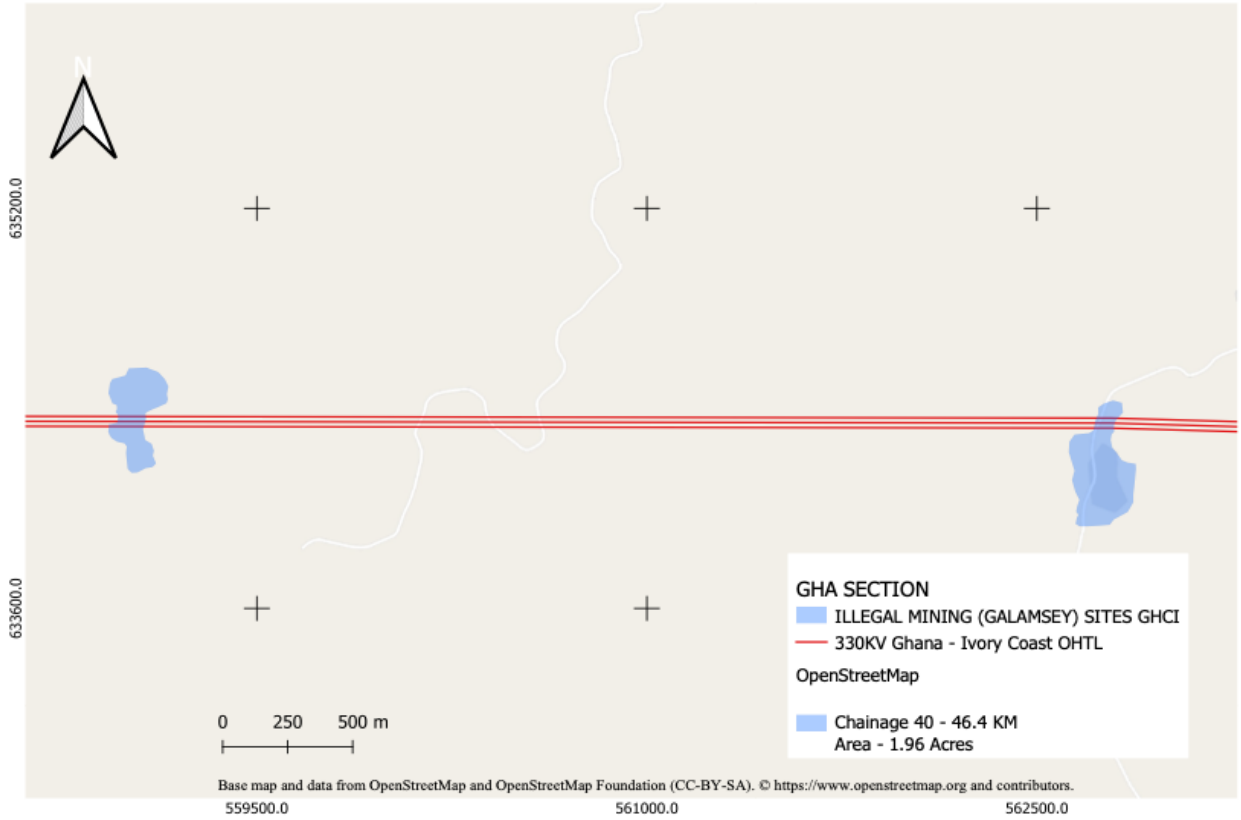
APPENDIX XVI: MAPS OF GALAMSEY SITES WITHIN THE ROUTE

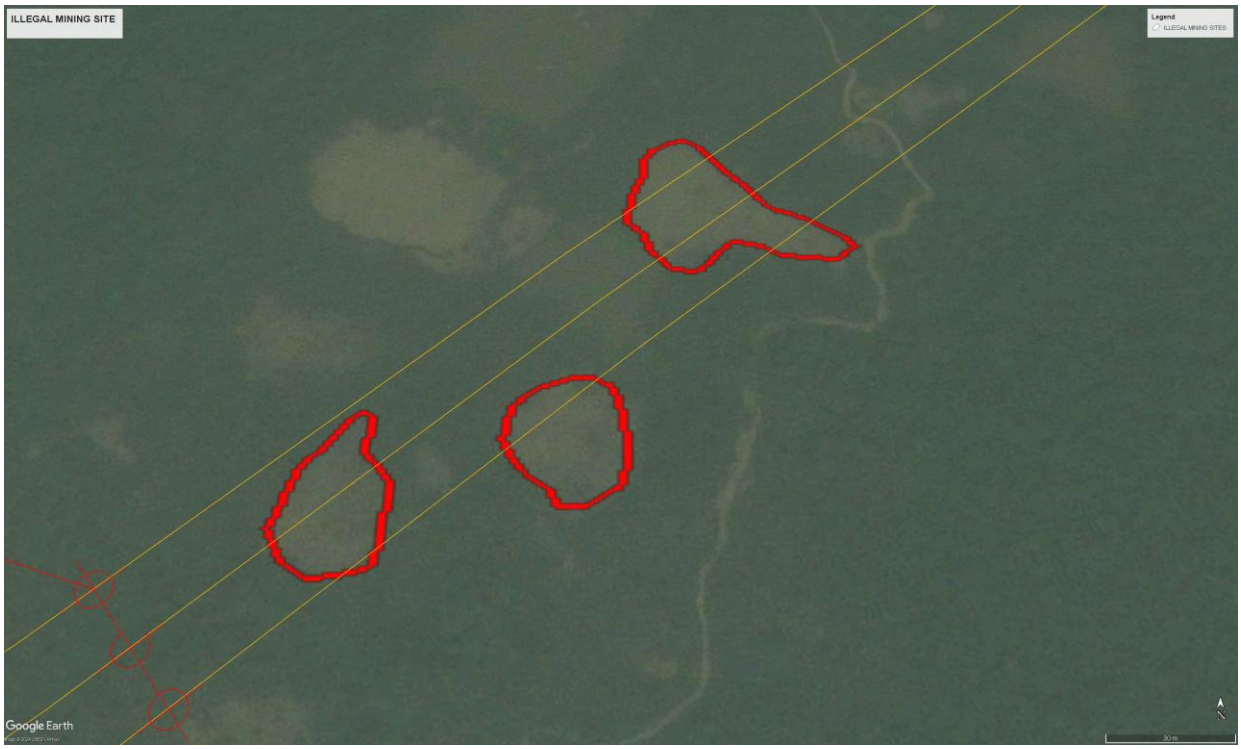


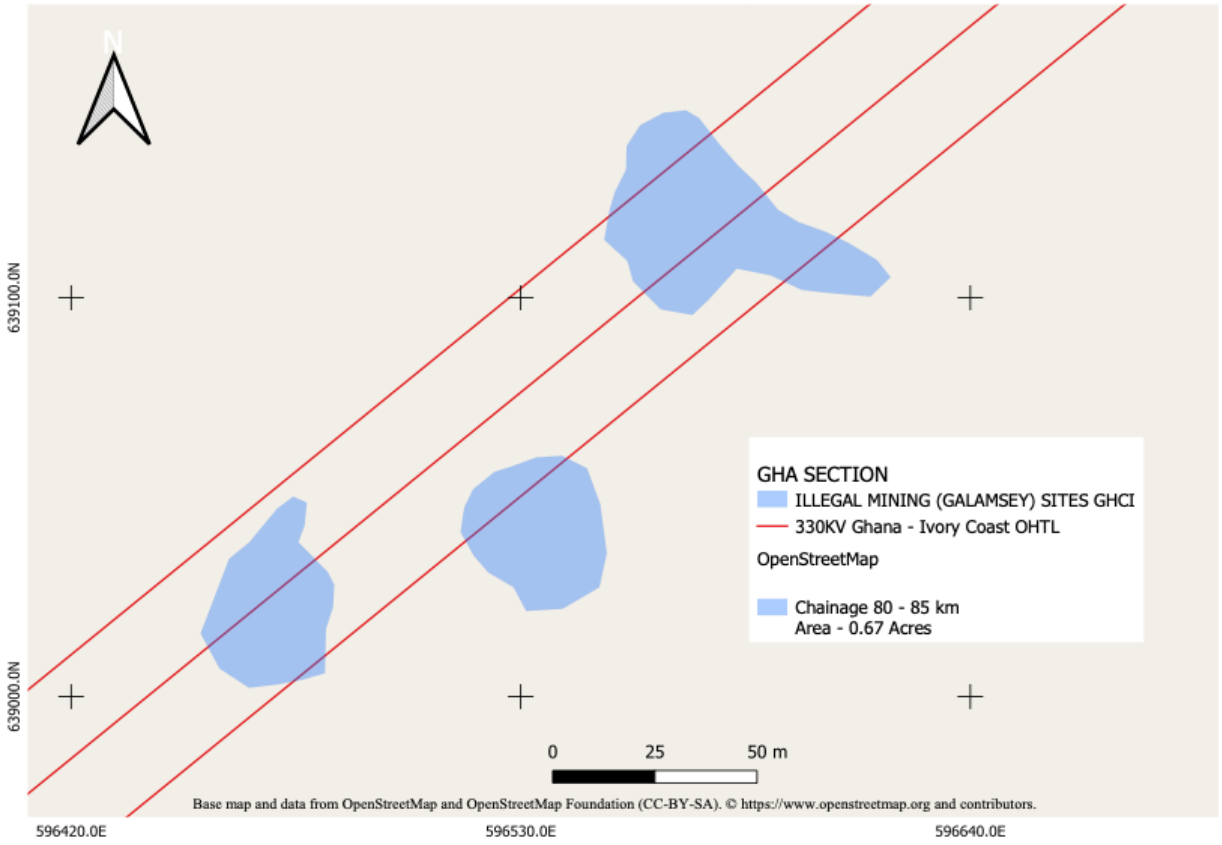

ILLEGAL MINING SITE
Legend
ILLEGAL MINING SITE
Nsuaem
Nsuaem
GHA_R502
GHA_R501
GHA_R500
River 1(River Ankobra)
GHA_R499
GHA_R498
GHA_R497
Wassa Nsuaem
GHA_R496
GHA_R495
GHA_R494
75
GHA_R493
GHA_R492
Ankobra River
Google Earth

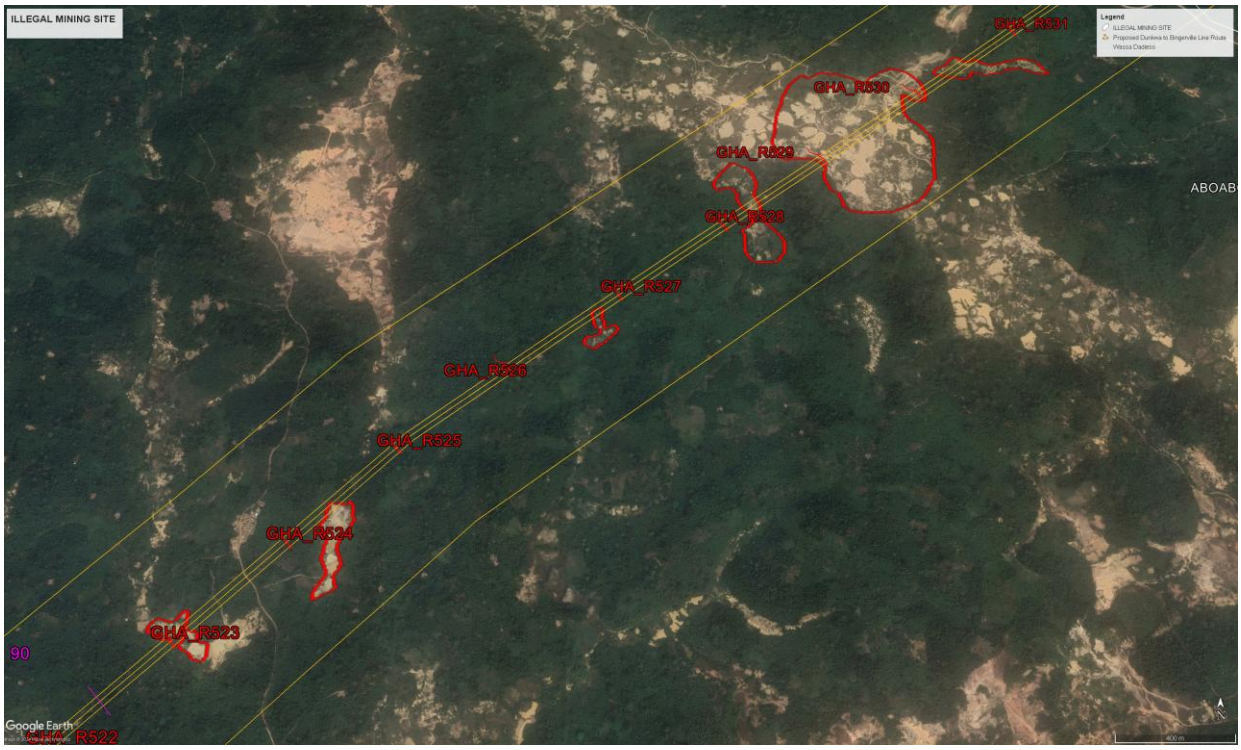

N
638400.0
636500.0
634600.0
LEGEND
ILLEGAL MINING (GALAMSEY) SITES GHCI
330KV Ghana - Ivory Coast OHTL
OpenStreetMap
Chainange 75 - 80 km
Area - 1.98 acres
0
750
1,500 m
Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © https://www.openstreetmap.org and contributors.
589000.0
590900.0
592800.0
594700.0

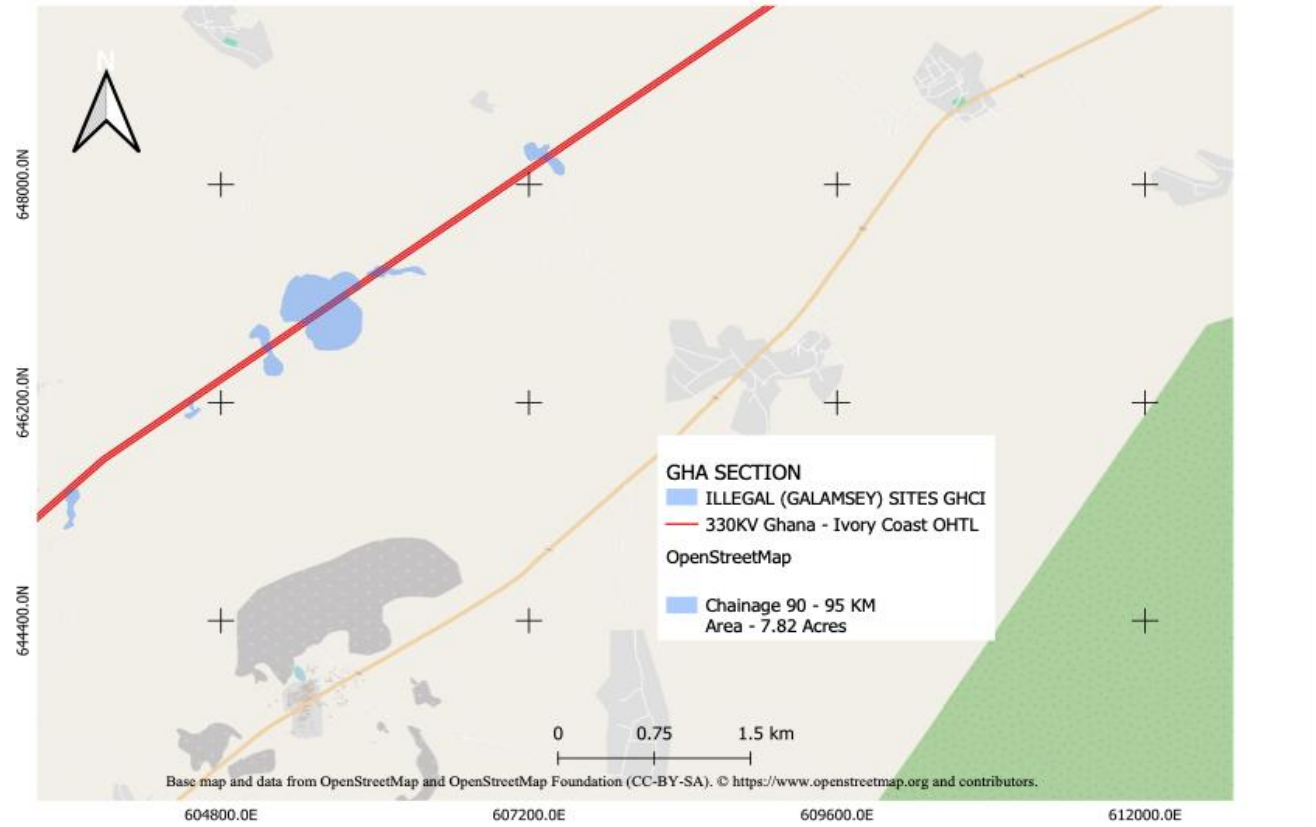

ILLEGAL MINING SITE
40
GHA_R424
GHA_R426GHA_R427GHA_R428GHA_R429GHA_R430GHA_R431
45
GHA_R432
GHA_R433
GHA_R434
GHA_R435
Yirase
Yirase Township
Google Earth

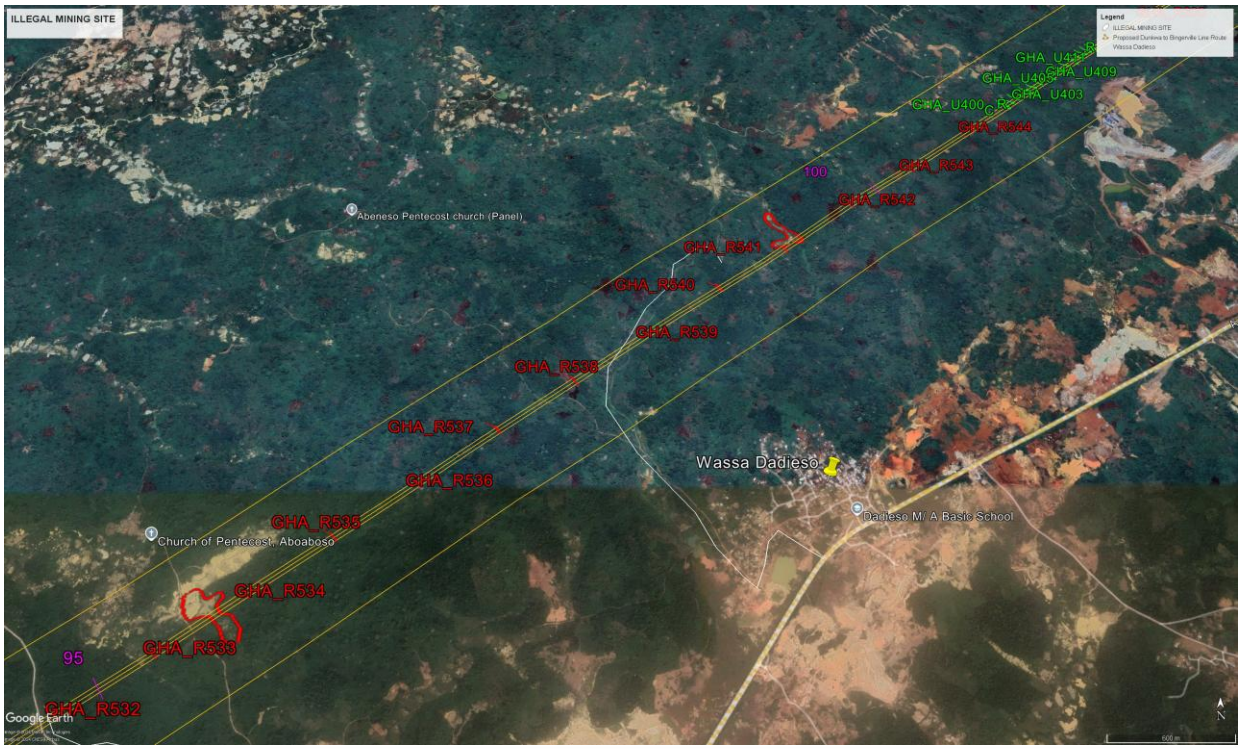

N
635200.0
633600.0
GHA SECTION
ILLEGAL MINING (GALAMSEY) SITES GHCI
330KV Ghana - Ivory Coast OHTL
OpenStreetMap
Chainage 40 - 46.4 KM
Area - 1.96 Acres
0 250 500 m
Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © https://www.openstreetmap.org and contributors.
559500.0
561000.0
562500.0


ILLEGAL MINING SITE
Legend
ILLEGAL MINING SITES
Google Earth
N

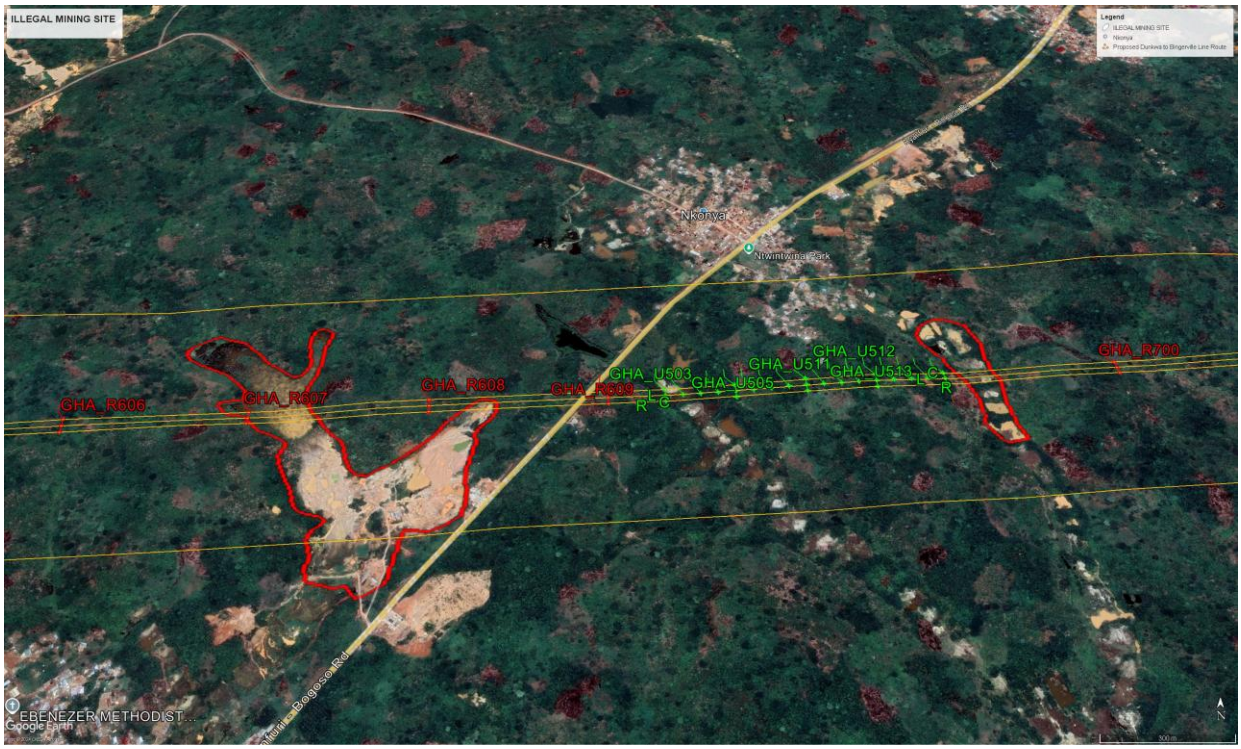

N
639100.0N
639000.0N
GHA SECTION
ILLEGAL MINING (GALAMSEY) SITES GHCI
330KV Ghana - Ivory Coast OHTL
OpenStreetMap
Chainage 80 - 85 km
Area - 0.67 Acres
0
25
50 m
Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © https://www.openstreetmap.org and contributors.
596420.0E
596530.0E
596640.0E

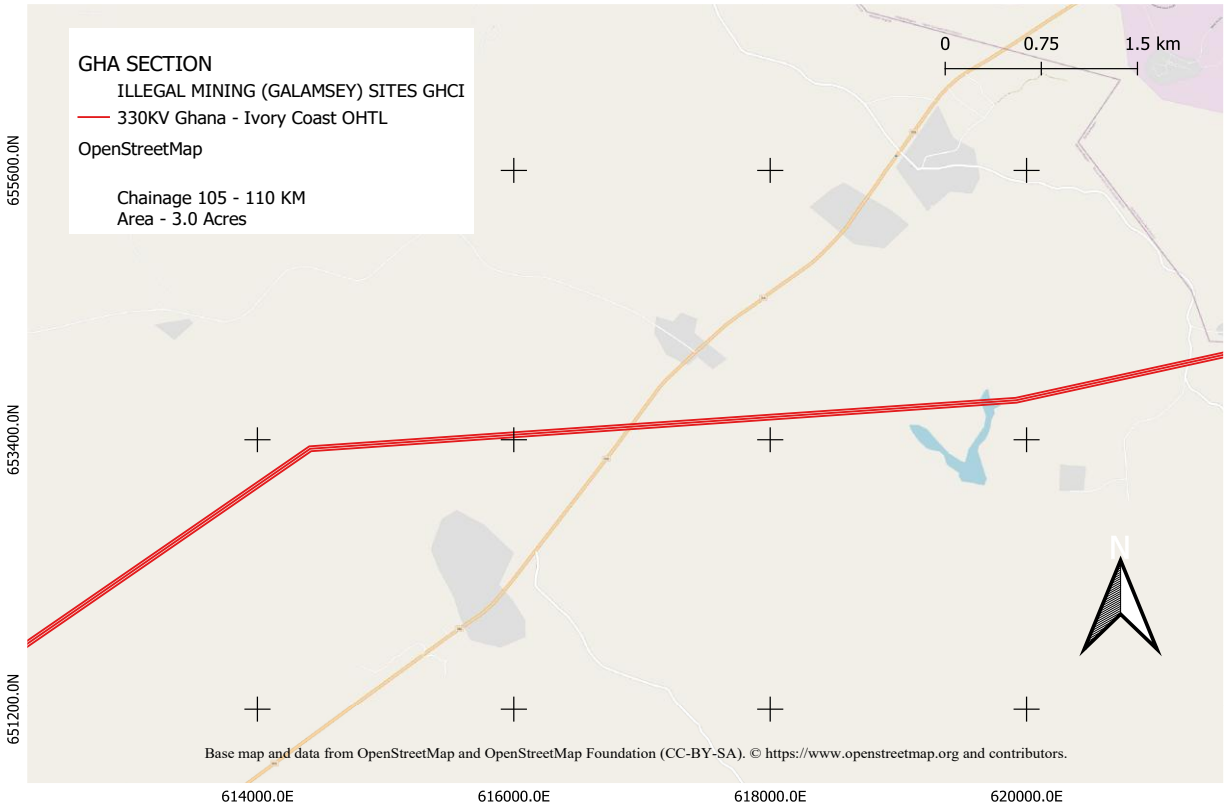

ILLEGAL MINING SITE
GHA_R531
GHA_R530
GHA_R529
GHA_R528
GHA_R527
GHA_R526
GHA_R525
GHA_R524
GHA_R523
GHA_R522
90
Google Earth


N
648000.0N
646200.0N
644400.0N
GHA SECTION
ILLEGAL (GALAMSEY) SITES GHCI
330KV Ghana - Ivory Coast OHTL
OpenStreetMap
Chainage 90 - 95 KM
Area - 7.82 Acres
0
0.75
1.5 km
Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © https://www.openstreetmap.org and contributors.
604800.0E
607200.0E
609600.0E
612000.0E


ILLEGAL MINING SITE
Legend
ILLEGAL MINING SITE
Proposed Dunkwa to Bingerville Line Route
Wassa Dadieso
GHA_U410
GHA_U409
GHA_U405
GHA_U403
GHA_U400
GHA_R544
GHA_R543
100
GHA_R542
Abeneso Pentecost church (Panel)
GHA_R541
GHA_R540
GHA_R539
GHA_R538
GHA_R537
GHA_R536
Wassa Dadieso
Dadieso M. A Basic School
GHA_R535
Church of Pentecost, Aboaboso
GHA_R534
GHA_R533
95
GHA_R532
Google Earth
N


N
652000.0N
650000.0N
648000.0N
GHA SECTION
ILLEGAL MINING (GALAMSEY) SITES GHCI
330KV Ghana - Ivory Coast OHTL
OpenStreetMap
Chainage 95 - 100 KM
Area - 1.70 Acres
0
0.75
1.5 km
Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © https://www.openstreetmap.org and contributors.
608400.0E
611000.0E
613600.0E


ILLEGAL MINING SITE
Nkonya
Ntwintwina Park
GHA_R606
GHA_R607
GHA_R608
GHA_R609
GHA_U503
GHA_U505
GHA_U511
GHA_U512
GHA_U513
GHA_R700
EBENEZER METHODIST...


GHA SECTION
ILLEGAL MINING (GALAMSEY) SITES GHCI
330KV Ghana - Ivory Coast OHTL
OpenStreetMap
Chainage 105 - 110 KM
Area - 3.0 Acres
0
0.75
1.5 km
N
655600.0N
653400.0N
651200.0N
614000.0E
616000.0E
618000.0E
620000.0E
Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © https://www.openstreetmap.org and contributors.

APPENDIX XVII: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)