SELJEN CONSULT

ENVIRONMENTRAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED 95MW SOLAR POWER PROJECT AT LOAGRI IN THE WEST MAMPRUSI MUNICIPALITY OF THE NORTH EAST REGION UNDER PHASE 2 OF VRA'S REDP

ENVIRONMENTAL SCOPING REPORT & TERMS OF REFERENCE FOR THE EIA

Prepared For

VOLTA RIVER AUTHORITY

Prepared BY

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CORPORATE ENVIRONMENTAL POLICY STATEMENT

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

In respect of the above, VRA will:

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

VRA will thus pursue the following specific objectives:

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

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

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

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

Approved: Date: 18 – 6 – 2019

Emmanuel Antwi-Darkwa
CHIEF EXECUTIVE

VOLTA RIVER AUTHORITY

SIGNATURE PAGE

PROJECT NAME	95 MW LOAGRI SOLAR POWER PROJECT		
CLIENT NAME	VOLTA RIVER AUTHORITY		
REPORT TYPE	ENVIRONMENTAL SCOPING REPORT		
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TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

LIST OF ABBREVIATIONS AND ACRONYMS

AC	Alternating Current
BID	Background Information Document
BSP	Bulk Supply Point
CWSA	Community Water and Sanitation Agency
DC	Direct Current
ECG	Electricity Company of Ghana
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESIA	Environmental and Social Impact Assessment
GNFS	Ghana National Fire Service
GoG	Government of Ghana
GRIDCo	Ghana Grid Company
GS	Ghana Standards
GSA	Ghana Standards Authority
GWL	Ghana Water Limited
HIV/AIDS	Humano Immune Virus/Acquired Immune Deficiency Syndrome
IFC	International Finance Corporation
ISO	International Organization for Standardization
LI	Legislative Instrument
LP	Low Pressure
MMDA	Metropolitan Municipal and District Assembly
MoU	Memorandum of Understanding
NEDCo	Northern Electricity Distribution Company
NITS	National Interconnected Transmission System
O&M	Operation and Maintenance
PAPs	Project Affected Persons
PS	Performance Standard
PURC	Public Utilities Regulatory Commission
PV	Photovoltaic
RCC	Regional Coordinating Council
R&D	Research & Development
RE	Renewable Energy
REDP	Renewable Energy Development Programme
REMP	Renewable Energy Master Plan
SCL	Seljen Consult Limited
STDs	Sexually Transmitted Diseases
SHE	Safety Health and Environment

ToR	Terms of Reference
VRA	Volta River Authority
WRC	Water Resources Commission

EXECUTIVE SUMMARY

Introduction

The Government of Ghana (GoG) formulated a Renewable Energy (RE) policy with the objective of providing ten (10) percent of Ghana's electricity demand from renewable energy sources by 2030. To achieve the objectives set out in the renewable energy policy, the Renewable Energy Development Programme (REDP) was formulated. The target of phase 1 of the REDP was to develop about 22.04 MW of solar photovoltaic (PV) plants and 150MW of wind power plants. VRA has constructed solar PV plants in Navrongo, Kaleo and Lawra, all in the northern part of the country, to meet its solar PV capacity target in the first phase of the REDP.

The Phase 2 of REDP is the first part of VRA renewable energy and net zero transition plan. The plan seeks to deploy 750 MW of RE from 2024 to 2028 with at least 425 MW of this capacity being solar PV. The development of the 95 MW Solar Power Project in Loagri is one of the projects to attain the target set for solar PV capacity in Phase 2 of the REDP and to meet an increase in demand for Renewable Energy sources.

In accordance with the requirements of the Environmental Assessment Regulations, 1999 (LI 1652), an environmental permit is required for the proposed solar power project at Loagri. Consequently, the VRA registered the proposed project with the Environmental Protection Agency (EPA) in March 2023 (the initial proposal registered with the EPA was for a 70 MW solar project), and the Agency requested the preparation of an environmental impact assessment of the proposed project. The preparation of this Scoping Report with draft Terms of Reference (ToR) for the EIA is in response to the project registration with the EPA, and also to enable the EPA provide useful comments on the conduct of the EIA, and for the Agency to agree with the proponent on the ToR for the EIA.

<u>Objective of the Scoping Study</u>

The primary objective of this scoping study is to identify key adverse physical, biological and social environmental impact issues that can affect the solar project viability and sustainability. The outcome of the scoping study is also to assist VRA/Ministry of Energy to consider the

consequences of a range of actions early in the planning process, to choose the most appropriate action on environmental/social grounds.

Methodology and Approach for the Scoping Study

The methodology and approach for the scoping study included:

☒ Reconnaissance visits to project site and adjacent areas

☒ Desktop study/Literature review;

☒ Consultations with some identified stakeholders; and

☒ Report preparations.

Policy/ Legal Framework

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

National Policy framework

- National Land Policy, 1999;
- National Environmental Policy, 2012;
- National Climate Change Policy, 2013;
- National Water Policy, 2007;
- Strategic National Energy Plan, 2006-2020;
- National Energy Policy, 2010;
- Health, Safety and Environmental Policy for the Energy Sector, 2016.
- Ghana Renewable Energy Master Plan, 2019;
- National Energy Transition Framework (2022-2070);
- Health, Safety and Environmental Policy for the Energy Sector, 2016;
- National Workplace HIV/ AIDS Policy, 2012;
- National Employment Policy (NEmP), 2014; and

- National Gender Policy, 2015.

National Legal framework

- The Constitution of the Republic of Ghana, 1992;
- Volta River Development Act, 1961 (Act 46);
- Volta River Development Amendment Act, 2005 (Act 692);
- Energy Commission Act, 1997 (Act 541);
- Electricity Transmission (Technical, Operational and Standards of Performance) Rules, 2008, (LI 1934);
- Electricity Supply and Distribution (Standards of Performance) (LI 1935);
- Electricity Regulations, 2008, (LI 1937);
- The National Electricity Grid Code, 2009;
- Renewable Energy Act, 2011 (Act 832);
- Public Utilities Regulatory Commission Act, 1997 (Act 538);
- Public Utilities Regulatory Commission (Amendment) Act, 2010 (Act 800);
- Lands Commission Act, 2008 (Act 767);
- The Land Act, 2020;
- The Lands (Statutory Wayleaves) Act, 1963;
- Land Use and Spatial Planning Authority (LUSPA) Act, 2016 (Act 925);
- Environmental Protection Agency (EPA) Act, 1994 (Act 490);
- Environmental Assessment Regulations, 1999 (LI 1652);
- Fees and Charges (Miscellaneous Provisions) Act, 2022 (Act 1080);
- Hazardous and Electronic Waste Control and Management Act, 2016 (Act 917) and Hazardous, Electronic and other waste (Classification), Control and Management Regulations 2016, LI2250;
- Water Resources Commission Act, 1996 (Act 522);
- Water Use Regulation (WUR), 2001 (LI 1692);

- Local Governance Act, 2016 (Act 936);
- National Building Regulations 1996, LI 1630;
- The Fire Precaution (Premises) Regulations, 2003 (LI 1724);
- Factories, Offices and Shops Act, 1970 (Act 328);
- The Labour Act, 2003 (Act 651);
- Workmen's Compensation Law 1987;
- Children's Act 1998, Act 560;
- Persons with Disability Act, 2006 (Act 715);
- Road Traffic Act, 2004 (Act 683);
- Public Health Act, 2012 (Act 851); and
- Alternative Dispute Resolution Act 2010 (Act 798).

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

- GS 1236:2019 Environment and Health Protection –Requirements for Ambient Air Quality
- GS 1222:2018 Health Protection –Requirements for Ambient Noise Control.

Relevant International Guidelines/Standards

- IFC Performance Standards, 2012;
- The World Bank Group General EHS Guidelines (2007);
- IFC EHS Guidelines for Electric Power Transmission and Distribution (2007); and
- Equator Principles, 2020.

Project Description

The key components of the solar power project are provided in the table below.

Table 0-1: Key components of the Project

Project component/Scope	Brief Description
Project Capacity	95 MWp
Project Area	81.15 hectares

Average annual irradiation	About 2100kWh/m2
Technology Type	Photovoltaic (PV) Monocrystalline technology
Plant layout	Fixed East -West Arrays @95 MWp
Orientation	10^{o} @95 MWp
Module Power (Wp)	400
Modules in String	23
Total Modules	237,820
Module Area (m2)	461,370
No. of Inverters	630
Infrastructure	● PV solar panels/modules (arranged in arrays) ● Fixed PV module mountings ● DC-AC electricity inverters and transformers ● On-Site buildings (including Array Transformer Station; Security Post; Warehouse; Offices and Control Building; Switchyard & Parking Area)

The proposed site is located about 500m near Loagri Township within the West Mamprusi Municipality in the North East Region of Ghana, and the site is located west of the N10 road from Tamale to Bolgatanga. The solar plant will be constructed on an approximately 81.15 hectares/200.52 acres of land. A substation will be constructed at the site as part of the project to break into the nearby 161kV line to connect the solar plant to the grid.

The process of solar power generation is basically using a photovoltaic technology to produce solar power. Solar panels, also known as modules, contain photovoltaic cells that transform incoming sunlight into electricity. When enough electricity is generated, a cable directs it to an electrical inverter, which changes the direct current that was produced into an alternating current before the plant is connected to the grid. To maintain efficiency, PV Modules are washed on a regular basis with water.

A contractor will be procured for the construction and installation of the power plant. VRA will be responsible for the operation and maintenance of the power plant. It is expected to take about 12 months to complete the construction of the solar power plant. Construction will commence in the first quarter of 2026.

Alternative Considerations

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

- Energy/Power Source Options;
- Solar Power Technology Options;
- PV Technology Options;
- Solar PV Module Technology Options;
- Inverter Configuration Options; and
- No Action Option.

Environmental Baseline Conditions

The project area is situated in the Tropical Continental Climatic Zone with mean-annual temperature ranging between 28 and 31 degrees Celsius. It experiences a single maximum rainy season, which starts in late April with little rainfall characterized by severe winds and storms. The second and third quarters of the year generally record the heaviest rainfall rising to its peak in July-August. Annual rainfall ranges between 950mm -1,200mm. The humidity level between April and October is generally high in the night and falls low during the day. The Ghana irradiation map show that Loagri has about 2100kWh/m2 value of irradiation, and this is above the preferred minimum of 1600kWh/m2/year.

The topography of the proposed site is generally flat. There nearest Stream is about 500m to the west of the project site. The project site is basically agricultural land and also serve as animal grazing area. During the rainy season, maize, groundnut and soyabean are mostly cultivated. The vegetation is largely grass, with few shrubs and isolated trees.

The population of West Mamprusi Municipal, according to the 2021 Population and Housing Census is 175,755 with 90,043 females (51.2 percent) and 85,712 males (48.8 percent). The Mamprusi make up around 75% of the district's overall population and are the majority of those who live in the project area. Other ethnic groups in the project area include the Builsa, Frafra, Kesena, Fulanis among others (GSS, 2010 PHC). The Fulanis are herdsmen for the indigenous

people. The "Bugun" (fire festival) and "Damba" festivals are the two most significant traditional festivals observed in the district. The dominant religious group is Islam, followed by Christianity.

The major economic activities in the West Mamprusi Municipal area are basically primary activities and these include; Agriculture, trading in foodstuff such as maize, beans, rice and other grains, sand winning mostly for construction work, quarrying, fishing along the White Volta, Shea processing and petty trading such as provision stores. Small and Medium Enterprises operating in the Municipal to boost the local economy include hairdressing, canteen and restaurant services, tailoring and dressmaking, metal-based-blacksmithing, welding, art-based such as pottery, basketry, weaving, painting & sign writing, drawing etc.

The Municipality has a total of 85 pre-schools and 89 primary Schools, 57 Junior High Schools, 4 Senior High Schools and 1 Vocational/Technical school. The Municipal health infrastructure is made up of Two Hospitals at Walewale and Janga, one Polyclinic at Kpasenkpe; Six Health centers, Sixteen functional CHPS compounds. There are two private clinics, one at Loagri and the other at Kparigu. Malaria, Upper Respiratory Tract Infections and Diarrhea have been the dominant reported diseases from 2018 to 2020.

According to the 2019 data from the Ghana AIDS Commission, the West Mamprusi Municipal is not within the top 10 districts/municipalities with high HIV infection in the country. With regard to the prevalence rate in the adult population, the West Mamprusi Municipal has 0.23% prevalence rate. The North East Region has 0.24% prevalence rate with estimated 774 living with the virus.

Stakeholder Consultations

Initial consultations from been carried out with the following stakeholders:

- West Mamprusi Municipal Assembly;
- Environmental Protection Agency (EPA), Walewale Regional Office;
- Ghana Grid Company (GRIDCo);

- Northern Electricity Distribution Company (NEDCo);
- Forestry Commission;
- Lands Commission;
- Department of Social Welfare and Community Development;
- Land Use and Spatial Planning Authority;
- Ghana National Fire Service (GNFS);
- National Commission for Civic Education);
- Chief and Elders of Loagri;
- Assemblyman for Loagri;
- Land owners/land users.

The main concerns of stakeholders included:

- Employment for the locals
- Loss of farmlands and livelihoods and compensation for land acquisition
- Destruction of crops and payment of adequate compensation issues
- Communication on when access to farmlands will be restricted
- Security and safety of project site and Fencing of the project land
- Ensuring completion of project and not abandon it midstream
- Replanting of indigenous trees to be destroyed at the site in other places
- Land documentation: Documentation of land acquisition to prevent any future disputes and objections to any agreement reached on the acquired project land
- Fire safety: Provision of adequate fire cover for the project

Potential Environmental/Social Impacts and Risks

Potential Positive or Beneficial Impacts

Preparatory and Construction Phases

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

Operational and Maintenance Phase

- Stabilisation of electricity through provision of 95 MW of electric power for the project catchment area and the North East Region
- Reduction in VRA's total GHG emissions from its power plants
- Reliable power supply to support socioeconomic activities and businesses in the West Mamprusi Municipality and economic growth in general
- Improvement in the local community infrastructure/facilities from corporate social responsibility interventions.

Potential Adverse/Negative Impacts -Preconstruction and Construction Phases

Physical Environment

The likely impact issues to arise during the pre-construction and construction phases include:

- Air pollution from movement of vehicles/ trucks on unpaved roads through local communities, operation of construction equipment, light vehicles, and standby diesel-powered generator;
- Noise and vibration from movement of vehicles/trucks and operations of electrical generators and maintenance activities;
- Impact on water resources: No direct pollution of stream expected. However, improper disposal of waste and storm runoffs may carry fuel spills and waste into the Naani stream
- Water use for construction activities and potable/domestic usage expected;

- Impact on topography and drainage – site is generally flat but limited trees at the site to be removed and will be replaced with solar panel mountings and other infrastructure. Storm drains will be constructed around the solar plant and will collect storm-runoffs direct such runoff water into the environment.
- Impact on soil resources from site clearance, topsoil removal due to earthworks/excavations; exposure of soil leading to erosion during rainfalls and wind action; soil contamination from fuel handling, improper disposal of used lubricants/dirty oil and accidental fuel spills from construction equipment/machinery and vehicles, and painting of solar panels;
- Waste generation and disposal;
    - Generation of various streams of waste including biomass, garbage, scraps, sewage/human waste, spent lubricating oil, rubber seals, concrete debris, food wastes, disused packaging materials etc
    - Improper disposal of hazardous and non-hazardous waste concerns

Biological Environment

- Impact on terrestrial flora and fauna:
    - Destruction and loss of vegetation/habitat and trees from site clearing. Faunal habitat for rodents, insects, birds and general wildlife may be impacted.

Social Environment

- Anxiety/agitation on the part of affected farmers and local people
    - Affected farmers are in expectation of receiving adequate compensation
    - Local people can agitate on accidents/incidents occurring as a result of the project
- Displacement of farmers
    - Farmers on the project site will have to relocate or find new farmlands
- Risk of not acquiring all relevant statutory permits
- Labour influx/job seekers and illicit behaviours

- Job seekers will throng the area to look for some construction jobs or be taken as labourers. These job seekers and those employed may put pressure on the community facilities and resources, and may not abide by sociocultural norms in the area creating conflict or tension.
- Labour influx can also result in gender-based violence issues especially when married women and local people's girl/boy friends are taken over by construction workers

- Labour agitations/issues- Construction workers can lay down their tools if their condition of service is not good and this can affect project implementation timelines and cost;
- Visual intrusion/ attraction- Site clearance and construction activities that are in public view attract local people and commuters alike.
- Disruption in land use - Current land use largely for crop farming and animal grazing will change and be converted into a solar power plant
- Worker health/safety concerns
  - Worker injuries, bites from insects/animals, STI transmissions; accidents could result in fatalities, dust/fumes inhalation can cause respiratory problems, noise nuisance can cause hearing challenges etc
- Public/community health and safety, and security concerns
  - Increased potential for spread of infectious diseases, including HIV/AIDS. Short term migration increases the chances of sexual relationship with multiple partners, thus becoming a critical factor in the propagation of HIV/AIDS and other STDs.
  - Domestic violence, sexual violence or divorces may result in the local communities when migrant workers on the project go in for married women in the local community.
  - Improper disposal of sanitary waste is a community health threat.
  - Dust inhalation can cause respiratory diseases; dust generation from untarred roads can dirty washed clothes on drying lines in the community;
  - Noise nuisance can affect the peaceful resting and relaxation of people;

- Potential traffic incidents/accidents on the public/community roads from transportation of material, equipment/machinery and plant components to site can cause loss of life/death, damage to vehicles and properties, cause traffic congestions.
- Security/threats and human right abuses – theft of project property by both workers and job seekers; project site security personnel can abuse the human rights of trespassers and residents alike; workers coming to work and going out after close of work can be attacked or robbed on the way.

Operational Phase Potential Adverse Impacts

Physical Environment

- Air Pollution from vehicular movement on unpaved roads through local communities. There will be no GHG emissions from the Plant.
- Noise from movement of vehicles/trucks, operation of standby generators, vocal noise from workers, and from routine maintenance activities.
- Impact on water resources: No direct pollution of stream expected. Water contamination may occur from improper disposal of waste and storm runoffs carrying fuel spills into nearby stream. Ground water will be abstracted to support operational activities.
- Impact on soil resources due to erosion from storm runoffs on exposed areas which were not properly stabilized after construction work, and soil contamination from vehicular fuel spills and improper disposal of spent oil/lubricants from project vehicles.
- Impact on landscape and visual intrusion: -the currently crop farming and animal grazing site will change into solar power infrastructure of panels, substation and buildings.
- Waste generation and disposal.
    - Generation of various streams of waste including garbage, scraps, sewage/human waste, etc.
    - Disposal of hazardous wastes concerns.

Biological Environment

- Impact on fauna- there is a particular risk to birds mainly from operation of the high voltage overhead lines from the substation onsite to the High Voltage National Grid. Birds utilize transmission towers for nesting by placing the nests across wires or using holes in the tower itself.
- Impact on flora- trees that can reach the high-tension lines will be periodically removed or destroyed.

Social Environment

- Worker health and safety concerns
  - Worker injuries from handling of equipment/machinery, electrical installations, slips, falls etc
  - Worker health issues associated with exposure to electro-magnetic radiation, and noise
  - Major accidents from electrocution/electrical shock, fire hazards, and traffic incidents
- Labour agitation issues- Poor working conditions of workers can result in poor moral at workplaces.
- Impact on gender and the vulnerable: - workers with good economic power may go in for married women and local peoples' girl/boyfriends and this may lead to gender-based violence, divorces or separations and affecting the social and family cohesion that existed.
- Public/community health and safety and security concerns
  - Increased potential for spread of infectious diseases, including HIV/AIDS.
  - Increased potential for traffic incidents/accidents on the public/community roads
  - Security/threats and human right abuses
- Sustainability risk
  - Poor working conditions
  - Lack of maintenance affecting efficient and effective operation of the Plant
  - Emergency situations and equipment/plant failure

<u>Decommissioning Phase Potential Adverse Impacts</u>

Post-construction phase

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

Post-operational phase

- Loss of employment and labour/community agitations
    - Laying-off workers, ending contracts
- Other environmental impacts such air/noise pollution, waste generation, community health and safety concerns among others.

Draft Terms of Reference for the EIA

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

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

- Development of Environmental Monitoring Measures;
- Development of Provisional Environmental Management Plan; and
- Development of a Provisional Decommissioning Plan.

Conclusion

This Environmental Scoping Report for the EIA of the proposed Project has been carried out in line with the Environmental Assessment Regulations, 1999, Legislative Instrument (LI) 1652. The Scoping Report has identified key environmental/social and health/safety risks and impacts and risks that may arise from the implementation of the proposed project. These identified risks and impacts will be subjected to in-depth analysis and evaluation during the EIA for the development of comprehensive mitigation, monitoring and management measures to address the likely adverse impacts on local communities and the environment in general.

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

1.0 INTRODUCTION

1.1 Background

The project applicant, Volta River Authority (VRA) is proposing to design, construct and operate the 95 MW Solar Photovoltaic Power Project and associated infrastructure without storage batteries at Loagri in the West Mamprusi Municipality of the North East Region under Phase 2 of VRA's Renewable Energy Development Programme (REDP) (see Figure 1). The associated infrastructure includes photovoltaic solar panels, buildings and electrical grid infrastructure (EGI) such as, a substation.

Under the provisions of the Ghana Environmental Assessment Regulations, 1999 (LI 1652), power generation and transmission projects are categorized as environmentally critical projects for which an Environmental Permit is required from the Ghana Environmental Protection Agency (EPA). Section 2.2 of the Environmental Impact Assessment (EIA) Guidelines for the Energy Sector, Volume 1, dated September 2011, indicates that ground-mounted PV power plant/system, either stand-alone, hybrid, or grid-tied with a total surface area of array exceeding twenty (20) hectares requires the undertaken of a full-blown environmental impact assessment and the preparation of an Environmental Impact Statement (EIS).

In view of the above, the VRA registered the proposed Loagri Solar Power Project (the initial proposal was for a 70 MW solar project) with the Environmental Protection Agency (EPA) in February 2023. The EPA in a response letter referenced CE: 8497/01/02 and dated March 09, 2023, which is presented as Annex 1-1 of this report confirmed the preparation of an environmental impact assessment of the proposed Loagri solar power project as per the provisions of the Environmental Assessment Regulations 1999, LI 1652. And prior to that, a scoping exercise should be undertaken to generate relevant Terms of Reference (ToR) to guide a satisfactory EIA study of the proposed project. The administrative flow chart of the Ghana Environmental Assessment Procedures is provided in Annex 1-2.

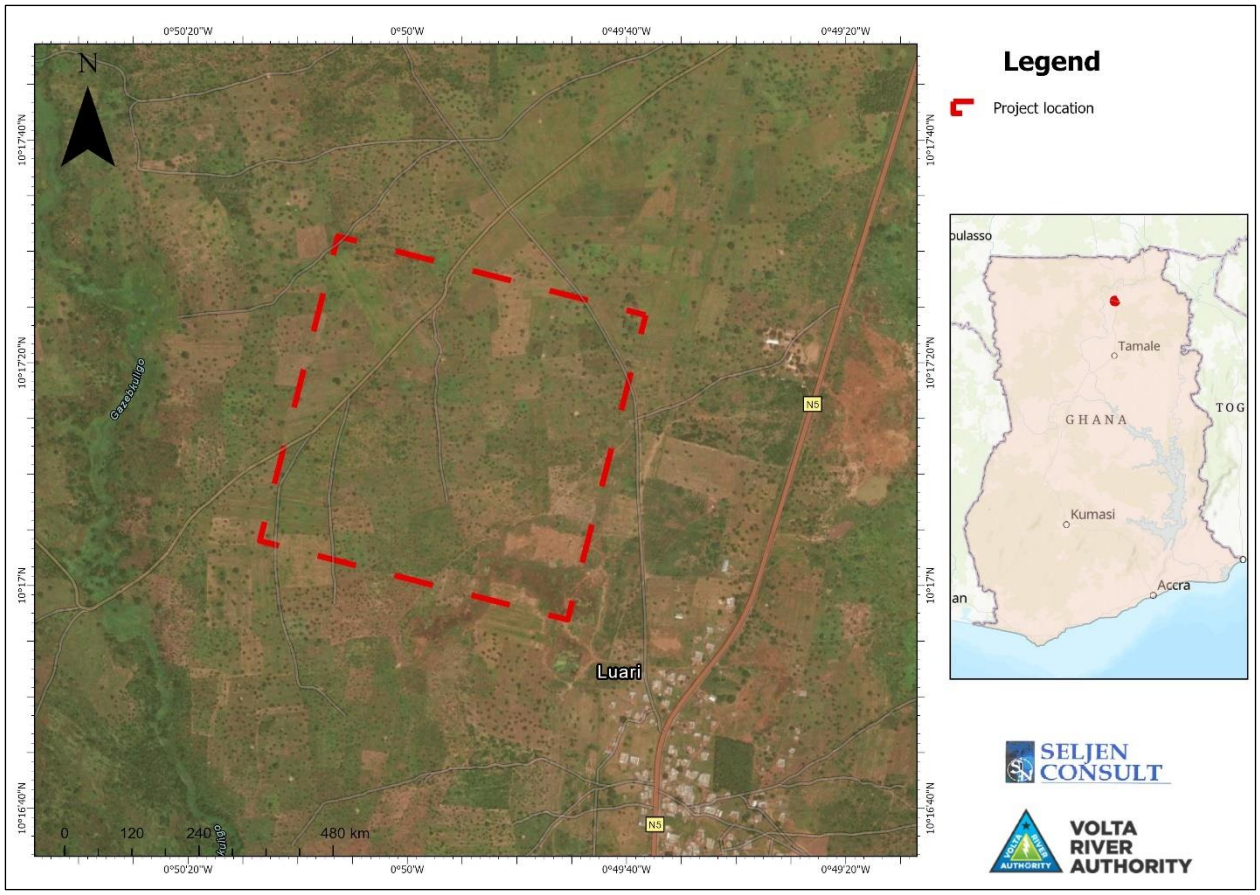


Figure 1-1: Google Map Location of the 95 MW Loagri Solar Power Project

This Environmental Scoping Report with draft Terms of Reference (ToR) for the EIA has been carried out in line with the Environmental Assessment Regulations 1999, LI 1652, as well as international best environmental assessment practices and focuses on the key issues, concerns and decision areas for the EIA study.

1.2 Project Context

The Government of Ghana (GoG) formulated a Renewable Energy (RE) policy with the objective of providing ten (10) percent of Ghana's electricity demand from renewable energy sources by 2030. Subsequently, the Renewable Energy Act (Act 832) was passed in November 2011 to provide the necessary legal and regulatory framework for promoting the provision of energy including electricity from renewable sources. In line with the GoG's policy on renewable energy, the Volta River Authority (VRA) formulated a Renewable Energy Policy in November 2016 with the following objectives:

- Promote the sustainability of the VRA by generating power from sustainable sources, and using renewable energy as a means of reducing VRA's exposure to fuel price volatility and fuel supply risks
- Promote the use of renewable energy in conjunction with energy efficiency as a means of reducing energy cost by setting an example in their use in VRA's Corporate Residential, Non-residential facilities as well as those of the VRA's Subsidiaries
- To expand and diversify VRA's generation portfolio in a sustainable manner whiles maintaining a low carbon footprint
- To develop renewable energy generation capacity to meet the needs of its consumers either through purchase obligations or voluntary requirements
- To set ten-year Renewable Energy capacity projections and five-year Renewable Energy targets
- To improve partnerships to become a provider of choice in Renewable Energy Power and Services.

To achieve the objectives set out in the VRA RE policy, the Renewable Energy Development Programme (REDP) was formulated. The target of phase 1 of the REDP was to develop about 22.04 MW of solar photovoltaic (PV) plants and 150 MW of wind power plants. Currently, VRA has constructed a 2.5 MW solar PV plant in Navrongo, in the Upper East Region of Ghana and 6.54 MW and 13 MW at Kaleo and Lawra in the Upper West Region of Ghana respectively. These projects have enabled VRA to meet its solar PV capacity target in the first phase of the REDP.

The Phase 2 of REDP is the first part of VRA renewable energy and net zero transition plan. The plan seeks to deploy 750 MW of RE from 2024 to 2028 with at least 425 MWp of this capacity being solar PV. The development of the underlisted solar PV projects is part of the strategy to attain the target set for solar PV capacity in the Phase 2 of the REDP.

Table 1-1: REDP Phase 2 Solar Power Projects

No.	Project Name and MW	District	Region
1	68 MW Sawla Solar Power Project	Sawla-Tuna-Kalba	Savannah
2	20 MW Sherigu Solar Power Project	Bolgatanga	Upper East
3	20 MW Zebilla Solar Power Project	Bawku West	Upper East
4	95 MW Loagri Solar Power Project	West Mamprusi	North East
5	50 MW Akuse Floating Solar Power Project	Lower Manya Krobo	Eastern

1.3 Purpose of the Scoping

The primary purpose of the scoping study is to determine the scope and focus of the EIA preparation process. It helps to define the boundaries of the EIA study, identifying the key environmental issues, detailing the plan of study and establishing the methodology for assessing potential impacts.

The scoping process provides the platform to initiate discussions between the project proponents, regulatory agencies and other relevant stakeholders including Interested and Affected Parties (I&APs) to determine and define the feasible alternatives to mitigating any potential environmental concerns associated with the implementation of the proposed project, in order for the proposed project to meet all applicable legislative, socioeconomic and cultural requirements.

1.4 Objectives of the Scoping Study

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

The objectives of the study are to:

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

This is achieved through parallel initiatives of consulting with:

- The lead authorities involved in the decision-making for this EIA application;
- The public to ensure that local issues are well understood; and

The EIA specialist team to ensure that technical issues are identified

1.5 Approach and Methodology

The methodology and approach for the scoping study included:

☒ Reconnaissance visit;

- Project site inspections and trekking to confirm baseline environmental issues, challenges and conditions to be affected or likely to develop from project implementation.

☒ Desktop study/Literature review;

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

☒ Consultations;

- Consultations and discussions with stakeholders including relevant government institutions/regulatory agencies, traditional authorities/local communities, non-governmental organisations and project affected persons as well as other I&APs.
- Publication of a scoping notice on the proposed project in the Daily Graphic to invite public comments.

☒ Report preparations;

- Preparation of an Environmental Scoping Report and draft Terms of Reference (ToR) for the conduct of the EIA study.

1.5.1 Reconnaissance Visit

A field visit to the project area was undertaken on 12th to 17th September 2024. Site inspections/reconnaissance surveys were carried within this period. The EIA team also used the 1:50,000 topographical maps, alongside with google maps/images for ground-truthing to confirm the actual situations on the field.

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

- socio-economic and cultural settings of the project area, project affected persons, local communities and relevant districts.
- bio-physical environment, including:
  - nature of the terrestrial ecology in the project area;
  - land use of the project area;
  - access routes to the project area;

- water resources and drainage in the project area;
- topography and relief of the project area; and
- nature of existing infrastructure and facilities at or near the project area.

1.5.2 Desktop Study/Literature Review

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

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

- The 1992 Constitution of Ghana;
- Relevant Policies, Acts and Laws of Ghana;
- Environmental Impact Assessment Guidelines for the Energy Sector (September 2011), Volume 1. Volume 2 of the Guidelines provides systematic procedures on EIS/EMP preparations for the energy sector as well as guidelines on common potential impacts and mitigation measures;
- Environmental Impact Assessment Guidelines for the General Construction and Services Sector (2011);
- Ghana Environmental Impact Assessment Procedures;
- IFC Performance Standards, 2012;
- Equator Principles, 2020;
- Loagri Solar Project-Feasibility Study, March 2023;
- Topographical and Google maps of the Project area;
- VRA SHE Standards for Contractors, January, 2013;
- West Mamprusi Municipal Assembly Composite Budget for 2023-2026 Programme Based Budget Estimates for 2023;

- West Mamprusi Municipal Assembly Composite Budget for 2024-2027 Programme Based Budget Estimates for 2024; and
- West Mamprusi Municipal Assembly Medium Term Development Plans- 2018-2021.

1.5.3 Consultations

Initial consultations and discussions have been held with relevant government institutions, landowners, local community stakeholders and land-users/project affected farmers between 12th and 17th September 2024. Information was obtained from the consultation process to confirm or otherwise information obtained from the desktop study or observations made from the field inspections.

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

☒ West Mamprusi Municipal Assembly;

☒ Environmental Protection Agency (EPA), Walewale Regional Office;

☒ Ghana Grid Company (GRIDCo);

☒ Northern Electricity Distribution Company (NEDCo);

☒ Forestry Commission;

☒ Lands Commission;

☒ Department of Social Welfare and Community Development;

☒ Land Use and Spatial Planning Authority;

☒ Ghana National Fire Service (GNFS);

☒ National Commission for Civic Education);

☒ Chief and Elders of Loagri;

☒ Assemblyman for Loagri;

☒ Land owners/land users.

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

☒ Ghana Water Limited;

☒ Community Water and Sanitation Agency;

☒ Road Agencies - Ghana Highway Authority/Department of Urban Roads;

☒ Water Resources Commission (WRC);

☒ Department of Factories Inspectorate;

☒ Ghana Police Service;

☒ Ghana Health Service; and

☒ NGOs/CSOs/CBOs.

1.5.4 Reporting

The format of the Scoping Report is in line with the Ghana Environmental Assessment Regulations LI 1652 of 1999 and contains information as required under Section 3.4 of the Volume 2 of the EIA Guidelines for the Energy Sector as follows:

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

- Bibliography
- Annexes

2.0 POLICIES, LEGAL AND INSTITUTIONAL FRAMEWORK

The relevant national policies, legal and institutional framework that will guide the proposed construction and operation of the Solar Power Project to ensure sustainable development and compliance with national and international regulations have been identified and reviewed below.

VRA may seek international funding to support the implementation of the solar power project. Relevant international standards including IFC Performance Standards (PS) for Environmental and Social Sustainability, relevant World Bank Group (WBG) Environmental, Health & Safety Guidelines, WBG specific guidelines for Electric Power Transmission & Distribution, as well as Equator Principles have been reviewed for its applicability to this project and compliance by VRA.

2.1 National and Sector Policies and Plans

The relevant national and sector policies and plans identified include:

- National Land Policy, 1999;
- National Environmental Policy, 2012;
- National Climate Change Policy, 2013;
- National Water Policy, 2007;
- Strategic National Energy Plan, 2006-2020;
- National Energy Policy, 2010;
- Ghana Renewable Energy Master Plan, 2019;
- National Energy Transition Framework (2022-2070);
- Health, Safety and Environmental Policy for the Energy Sector, 2016;
- National Workplace HIV/ AIDS Policy, 2012;
- National Employment Policy (NEmP), 2014; and
- National Gender Policy, 2015.

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

2.2 National Legal Framework

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

- The Constitution of the Republic of Ghana, 1992;
- Volta River Development Act, 1961 (Act 46);
- Volta River Development Amendment Act, 2005 (Act 692);
- Energy Commission Act, 1997 (Act 541);
- Electricity Transmission (Technical, Operational and Standards Of Performance) Rules, 2008, (LI 1934);
- Electricity Supply and Distribution (Standards of Performance) (LI 1935);
- Electricity Regulations, 2008, (LI 1937);
- The National Electricity Grid Code, 2009;
- Renewable Energy Act, 2011 (Act 832);
- Public Utilities Regulatory Commission Act, 1997 (Act 538);
- Public Utilities Regulatory Commission (Amendment) Act, 2010 (Act 800);
- Lands Commission Act, 2008 (Act 767);
- The Land Act, 2020;
- The Lands (Statutory Wayleaves) Act, 1963;
- Land Use and Spatial Planning Authority (LUSPA) Act, 2016 (Act 925);
- Environmental Protection Agency (EPA) Act, 1994 (Act 490);
- Environmental Assessment Regulations, 1999 (LI 1652);
- Fees and Charges (Miscellaneous Provisions) Act, 2022 (Act 1080);
- Hazardous and Electronic Waste Control and Management Act, 2016 (Act 917) and Hazardous, Electronic and other waste (Classification), Control and Management Regulations 2016, LI2250;

- Water Resources Commission Act, 1996 (Act 522);
- Water Use Regulation (WUR), 2001 (LI 1692);
- Local Governance Act, 2016 (Act 936);
- National Building Regulations 1996, LI 1630;
- The Fire Precaution (Premises) Regulations, 2003 (LI 1724);
- Factories, Offices and Shops Act, 1970 (Act 328);
- The Labour Act, 2003 (Act 651);
- Workmen's Compensation Law 1987;
- Children's Act 1998, Act 560;
- Persons with Disability Act, 2006 (Act 715);
- Road Traffic Act, 2004 (Act 683);
- Public Health Act, 2012 (Act 851); and
- Alternative Dispute Resolution Act 2010 (Act 798).

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

Table 2-1: Relevant National and Sector Policies and Plans

Policy Framework	Summary of core requirements/description	Applicability/ relationship to proposed project
National and Sector Policies and Plans		
National Land Policy, 1999	The National Land Policy provides for the protection of water bodies and the environment in the long-term national interest under any form of land usage be it for human settlements, industry and commerce, agriculture, forestry and mining. Key aspects of Section 4.4 (Ensuring Sustainable Land Use) of the Policy relevant to the Project are provided below: The use of any land in Ghana for sustainable development, the protection of water bodies and the environment and any other socioeconomic activity will be determined through national land use planning guidelines based on sustainable principles in the long-term national interest. Land categories outside Ghana's permanent forest and wildlife estates are available for such uses as agriculture, timber, mining and other extractive industries, and human settlement within the context of a national land use plan. Unless approved by the appropriate public authority, no land use change of any kind will be countenanced. All land and water resources development activities must conform to the environmental laws in the country and where Environmental Impact Assessment report is required this must be provided. Environmental protection within the polluter pays principle will be enforced.	The Solar Power Project is environmentally friendly industrial projects that will not pollute any water body in the project area. The land to be used for the development of the proposed solar photovoltaic power project will conform to the environmental laws in the country and will be based on sustainable principles in the long-term national interest.
National Water Policy, 2007	The National Water Policy, approved in June 2007, is to provide the framework for the sustainable development of water resources in Ghana. The overall goal of the policy is to "achieve sustainable development, management and use of Ghana's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations."	Groundwater will be explored and exploited for use under the project during construction phase

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

Policy Framework	Summary of core requirements/description	Applicability/ relationship to proposed project
National Energy Policy, 2010	The 2010 National Energy Policy outlines the Government of Ghana's policy direction regarding the current challenges facing the energy sector. The document provides a concise outline of the Government's policy direction in order to contribute to a better understanding of Ghana's Energy Policy framework. Within the context of energy sector vision, the goal of the energy sector is to make energy services universally accessible and readily available in an environmentally sustainable manner. The policy objectives to achieve this goal are to: i. Secure long term fuel supplies for the thermal power plants; ii. Reduce technical and commercial losses in power supply; iii. Support the modernisation and expansion of energy infrastructure to meet growing demands and ensure reliability; iv. Increase access to modern forms of energy; v. Improve the overall management, regulatory environment and operation of the energy sector; vi. Minimise the environmental impacts of energy supply and consumption through increased production and use of renewable energy and make energy delivery efficient; vii. Ensure cost recovery for energy supply and delivery; viii. Ensure the productive and efficient use of energy; ix. Promote and encourage private sector participation in the energy sector; and x. Diversify the national energy mix by promoting renewable energy sources, nuclear and coal.	The proposed solar power project is in line with the Energy policy of diversifying the national energy mix by promoting renewable energy sources. The solar power project will contribute to making renewable energy supply readily available in an environmentally sustainable manner in the West Mamprusi Municipal.
Ghana Renewable Energy Master Plan (REMP), 2019	The specific objectives of the REMP are to achieve the following by 2030: • Increase the proportion of renewable energy in the national energy generation mix from 42.5 MW in 2015 to 1363.63 MW (with grid connected systems totaling 1094.63 MW); • Reduce the dependence on biomass as main fuel for thermal energy applications; • Provide renewable energy-based decentralised electrification options in 1000 off-grid communities; • Promote local content and local participation in the renewable energy industry.	The REMP is a targeted plan with clear roadmap for the long-term development and promotion of the different energy forms of renewable energy sources including solar power plants.

Policy Framework	Summary of core requirements/description	Applicability/ relationship to proposed project
National Energy Transition Framework (2022-2070)	The National Energy Transition Framework is a document to guide Ghana's commitment to net-zero GHG emissions in order to combat climate change and its effect among other things. The document lays out a framework for decarbonizing the energy sector and reaching net zero emissions by 2070 while ensuring socioeconomic growth and the use of Ghana's natural resources. The specific objectives of the Framework are to: ● Identify viable pathways for the country to transition towards carbon-neutrality within a secure and efficient energy sector; ● Harness the opportunity for a fair and equitable energy transition as the country relies on carbon-intensive industries for economic growth; ● Evaluate the impacts of energy transition on the economy (infrastructure, government revenue, jobs and social development); ● Develop medium to long-term targets and policies for achieving a carbon-neutral economy; and ● Estimate the cost of implementing the framework and identify financing options for the realization of the stated objectives.	The proposed project is a solar power plant which rely on the sun energy supply, and therefore solar power plants do not emit GHG. As the Framework seeks to commit Ghana to achieve a net-zero GHG emissions by 2070, it is more likely that solar power plants may be or form a key component of Ghana's energy production system after 2070.
Health, Safety and Environmental Policy for the Energy Sector (2016)	The policy describes the elements necessary to develop, implement and maintain a high level of safety in all energy sector activities. The policy develops relevant regulations and standards, which will ensure that operators take into account relevant information about hazards, environmental effects, safety and security threats to their operations. To achieve this outcome, regulators are to ensure that, energy sector activities are carried out in an efficient manner that strives for continuous improvement of HSSE performance.	The implementation of the proposed solar power project will comply with the policy's objective to ensure that there is minimal harm to property, people and the environment.

Policy Framework	Summary of core requirements/description	Applicability/ relationship to proposed project
National Environmental Policy, 2012	The Ghana National Environmental Policy was launched in November 2012 with the vision to manage the environment in a sustainable way to benefit Ghanaian society. The objective of this policy is to promote healthy lifestyles and reduce risk factors that arise from environmental, economic, social and behavioural causes thereby promoting healthy lifestyles in a healthy environment. The policy notes that proper management of Ghana's resources requires that efforts should be redirected into more environmentally sustainable programmes and practices. Such programmes should protect and preserve the resource base for use by present and future generations. Assessment of the potential environmental impacts of development projects and planning in advance to mitigate or eliminate these impacts will decrease environmental costs to the economy and make more cost-effective use of the country's resources. The ultimate aim of the National Environmental Policy of Ghana is to improve the surroundings, living conditions and the quality of life of the entire citizenry, both present and future. It seeks to promote sustainable development through ensuring a balance between economic development and natural resource conservation. The policy thus makes a high-quality environment a key element supporting the country's economic and social development.	VRA has put in place an environmental policy that outlines various operational policies and strategies for the protection of the environment and resources. There is a monitoring system for resource utilization to safeguard all the resources and the environment.
National Climate Change Policy, 2013	The National Climate Change Policy provides strategic direction and coordinates issues of climate change in Ghana. The three objectives of the Policy are (1) effective adaptation, (2) social development and (3) mitigation. To address the adaptation issues in Ghana, five thematic areas have been prioritized. These are (1) energy and infrastructure, (2) natural resources management, (3) agriculture and food security, (4) disaster preparedness and response and (5) equitable social development.	Constructional activities will contribute to limited mobile combustion and vegetation removal, thus contributing to limited GHG emissions. During operation, the solar power plant will not rely on fossil fuel to generate energy. The power generation process will therefore not release gases such as carbon dioxide, methane and nitrous oxide.

Policy Framework	Summary of core requirements/description	Applicability/ relationship to proposed project
National Workplace HIV/ AIDS Policy, 2012	The policy goal is to provide broad national guidelines to direct the formulation and implementation of workplace HIV and AIDS policies and programs. The broad objectives of the policy are to: o provide protection from all forms of stigma and discrimination in the workplace, to people with real or perceived HIV infection. o prevent the spread of HIV amongst workers and their families and dependents; and o provide access to treatment, care and support for persons infected and affected by HIV and AIDS.	The Project will provide awareness creation on HIV/ AIDS and STDs prevention for construction workers and supervising engineers and other relevant stakeholders.
National Employment Policy (NEmP), 2014	The National Employment Policy indicates that poverty is still high at about 28.5% and that there is a strong correlation between the employment situation and poverty. The policy states that the key source of demand for labour emanates from the productive sectors of the economy, namely, agriculture, industry and service. The policy focuses on employment components such as entrepreneurial development, private sector competitiveness, linking agriculture to the other sector of the economy, research and innovation, vocational and technical skills development, productivity improvement, harnessing opportunities in labour migration and the green economy, among others.	Implementing the solar power project will be in line with employment generation and skills development objectives of this policy
National Gender Policy, 2015.	The National Gender Policy aims at mainstreaming gender equality concerns into the national development processes by improving the social, legal, civic, political, economic and socio-cultural conditions of the people of Ghana. It also seeks to empower the vulnerable groups particularly women, children, and people with special needs such as persons with disabilities and the marginalized.	The employment of Ghanaians under the project will not discriminate against women and the vulnerable. The criteria for selecting workers will include gender and disability in as far as the person can perform the task assigned.

Table 2-2: National Legal Framework

Legal Framework	Summary of Core requirements/Description	Applicability/ Relationship to proposed project
NATIONAL LEGAL FRAMEWORK		
The Constitution of the Republic of Ghana, 1992	The Constitution includes some provisions to protect the right of individuals to private property, and also sets principles under which citizens may be deprived of their property in the public interest (described in Articles 18 and 20). Article 18 provides that "Every person has the right to own property either alone or in association with others." In Article 20, the Constitution describes the circumstances under which compulsory acquisition of immovable properties in the public interest can be done: "No property of any description, or interest in, or right over any property shall be compulsorily taken possession of or acquired by the State unless the following conditions are satisfied: i. The taking of possession or acquisition is necessary in the interest of defense, public safety, public order, public morality, public health, town and country planning or the development or utilization of property in such a manner as to promote the public benefit; and ii. The necessity for the acquisition is clearly stated and is such as to provide reasonable justification for causing any hardship that may result to any person who has an interest in or right over the property." Articles 268 and 269 make provision for the protection of natural resources of the country.	The proposed site for the solar power plant is a private land and will be properly acquired, and appropriate compensation paid to the land owners to ensure that these land owners are not deprived of their property in the public interest without adequate and prompt compensation payment as required by the Constitution.
Volta River Development Act 1961, Act 46	The Act establishes the Volta River Authority (VRA) and defines its functions and responsibilities. Part 4, Section 17 (2) (d) of the Act authorizes the VRA to acquire land necessary "for the proper discharge of the Authority's Functions" Provision has, also, been made in the Act for the payment of compensation or resettlement of affected people as may be applicable.	The VRA is the key proponent for this project, and responsible for the operation of the solar power plant.
Volta River Development Amendment Act 2005 (Act 692)	Allowed for the setting up of the GRIDCo, a separate transmission utility responsible for the National Intersection Transmission System.	GRIDCo is a key stakeholder for this project, will be the up-taker of the solar power produced by VRA.

Legal Framework	Summary of Core requirements/Description	Applicability/ Relationship to proposed project
Energy Commission Act 1997, Act 541	The Energy Commission Act 1997 (Act 541) sets up the Energy Commission and defines its functions as relating to the regulation, management, development and utilization of energy resources in Ghana including the granting of licenses for the transmission, wholesale supply, distribution and sale of electricity and natural gas.	The proposed solar power plant falls in the category of projects regulated by the Energy Commission.
Electricity Transmission (Technical, Operational and Standards of Performance) Rules, 2008, (LI 1934)	The Electricity Transmission (Technical, Operational and Standards of Performance) Rules, 2008 (LI 1934) establishes the procedures for operating the high voltage national interconnected transmission system. These rules shall apply to the Electricity Transmission Utility and persons connected to the transmission system including: (a) Wholesale electricity suppliers licensed by the Commission, (b) Electricity distribution utilities licensed by the Commission, and (c) Bulk customers of electricity duly authorised by the Commission.	VRA, GRIDCo and NEDCo are required to comply with the rules of Electricity Transmission under this Act as the solar power plant will be interconnected to the national transmission system.
Electricity Supply and Distribution (Standards of Performance) (LI 1935)	The regulations apply to electricity supply and distribution utilities licensed by the Commission. These regulations define the "electricity supply and distribution utility" as a person licensed under the Act to distribute and sell electricity without discrimination to consumers in an area or zone designated by the Commission. The regulations also provide performance benchmarks for electricity supply and distribution in conformity with the provisions of Electricity Supply and Distribution (Technical and Operational) Rules, 2005 (LI 1816).	The regulation will guide licensed operators or persons involved with the distribution and sale of electricity produced from the solar power project.
Electricity Regulations, 2008, (LI 1937)	Electricity Regulations, 2008 (LI 1937) provides for the planning, expansion, safety criteria, reliability and cost effectiveness of the national interconnected transmission system; regulates the Wholesale electricity market, the technical operations of the Electricity Transmission Unit; define the minimum standards and procedures for the construction and maintenance of facilities and installations; the protection of electrical installations and services; life, property and the general safety of the public in respect of electricity services; define the minimum reserve margins to satisfy demand and the development and implementation of programmes for the conservation of electricity.	The regulations provide minimum standards to guide the construction and maintenance of the solar power plant; and will also regulate the marketing of the wholesale electricity supply from the solar power plant.
The National Electricity Grid Code, 2009	The National Electricity Grid Code of Ghana referred to in this document as the Grid Code, establishes the requirements, procedures, practices and standards that govern the development, operation, maintenance and use of the high voltage transmission system in Ghana. The purpose of the Grid Code is to ensure that the NITS provides fair, transparent, non-discriminatory, safe, reliable, secure and cost-efficient delivery of electrical energy.	Power from the proposed solar power plant will be evacuated into the national interconnected transmission system at the nearest GRIDCo substation to the project site.

Legal Framework	Summary of Core requirements/Description	Applicability/ Relationship to proposed project
Renewable Energy Act, 2011 (Act 832)	The purpose for this regulation is to provide for the development, management and utilisation of renewable energy sources for the production of heat and power in an efficient and environmentally sustainable manner and to attract investment in renewable energy sources.	The Act serves to promote the development of solar power plant in the country. Solar power plant is a renewable energy source (i.e. depending solely on the sun energy).
Public Utilities Regulatory Commission Act, 1997 (Act 538)	The PURC Act, 1997 (Act 538) created PURC 'to provide guidelines on, and examine and approve, rates chargeable for the provision of utility services; protect the interest of consumers and providers of utility services; monitor standards of performance for provision of utility services; and promote fair competition among public utilities. The Act repeals VRA's power to set electricity rates contained in the VRA Act. It also includes the preparation of guidelines in fixing rates; a prohibition against demanding rates other than those approved by the Commission; notification to the Commission of any revision in rates; and publication of approved rates.	The operation of the proposed power plant will increase the electricity available for supply and distribution. The PURC will be involved with utility pricing or rates to be charged for electricity consumptions.
Lands Commission (LC) Act 2008, Act 767	This act provides for the management of public lands and other lands and for related matters. The Commission manages public lands and any other lands vested in the President by the Constitution or by any other enactment or the lands vested in the Commission. The act advises the Government, local authorities and traditional authorities on the policy framework for the development of particular areas to ensure that the development of individual pieces of land is coordinated with the relevant development plan for the area concerned. The Minister may, with the approval of the President, give general directions in writing to the Commission on matters of policy in respect of the management of public lands. The commission has the following divisions: ● Survey and Mapping; ● Land Registration; ● Land Valuation; ● Public and Vested Lands Management; and ● Any other Division the Commission may determine.	The Commission will be involved in the approval of the site plan and transfer of project land ownership from the land owners to VRA/ Ministry of Energy as appropriate.

Legal Framework	Summary of Core requirements/Description	Applicability/ Relationship to proposed project
The Land Act, 2020, Act 1036	The Land Act (Act 1036) of 2020 repeals the State Lands Act (Act 125) of 1962, and other laws. The Lands Act (Act 1036) vests in the State the authority to compulsorily acquire land for public purposes via an Executive Instrument (EI) and shall ensure the prompt payment of fair and adequate compensation for the acquisition. It also declares that the Lands Commission shall act on behalf of the State with regard to the compulsory acquisition of land under the Act.	The proposed site for the solar power plant is a private land. Compulsory acquisition of land will be necessary under this project. VRA will ensure prompt payment of fair and adequate compensation for the acquisition in line with this Act.
The Lands (Statutory Wayleaves) Act, 1963	This Act describes the process involved in occupation of land for the purpose of the construction, installation and maintenance of works of public utility, and for creation of rights of way for such works. The provisions include among others: ● The owner/ occupier of the land must be formally notified at least a week in advance of the intent to enter, and be given at least 24-hour notice before actual entry; ● Any damage due to entry must be compensated in accord with the procedures established by the Minister unless the land is restored or replaced; and Where a right of way must be established in the public interest, the President may declare the land to be subject to such statutory wayleave.	Due process will be used to occupy the site for the construction and installation of the solar power plant and transmission of the power produced to GRIDCo substation.
Land Use and Spatial Planning Authority (LUSPA) Act 2016, Act 925	The LUSPA Act 2016, Act 925 seeks to ensure the orderly and progressive development of land, town and other areas whether urban or rural for conserving and developing resources and to preserve and improve amenities thereof, and for related matters. It seeks to promote sustainable human settlements developments based on principles of efficiency, orderliness, safety and healthy growth of communities. This Act applies to both public and private institutions, which are responsible for human settlement, spatial planning and use of land, and issues development permit prior to undertaking any physical development of land within a district in which the land is situated.	LUSPA is a decentralised body at the MMDA level. The Physical Planning Department of the West Mamprusi Municipal Assembly will be informed about the project to enable them incorporate or update their land use plans.
Environmental Protection Agency (EPA) Act 1994, Act 490	The Environmental Protection Agency (EPA) Act 1994 (Act 490) gives mandate to the Agency to ensure compliance of all investments and undertakings with laid down Environmental Assessment (EA) procedures in the planning and execution of development projects, including compliance in respect of existing ones	The EPA will issue an Environmental Permit for project implementation by the proponent, i.e. VRA/Ministry, after review and approval of the project Environmental Impact Statement submitted by VRA.

Legal Framework	Summary of Core requirements/Description	Applicability/ Relationship to proposed project
Environmental Assessment Regulations 1999, LI 1652	The regulations for undertakings requiring registration and issue of environmental permit may include: 1. (1) No person shall commence any of the undertakings specified in Schedule 1 to these Regulations or any undertaking to which a matter in the Schedule relates, unless prior to the commencement, the undertaking has been registered by the Agency and an environmental permit has been issued by the Agency in respect of the undertaking. 2. No person shall commence activities in respect of any undertaking which in the opinion of the Agency has or is likely to have adverse effect on the environment or public health, unless prior to the commencement, the undertaking has been registered by the Agency and an environmental permit has been issued by the Agency in respect of the undertaking. <u>Environmental impact assessment</u> 3. No environmental permit shall be issued by the Agency for any of the undertakings mentioned in Schedule 2 to these Regulations unless there is submitted by the responsible person to the Agency, an environmental impact assessment in accordance with these Regulations in respect of the undertaking.	The proposed project falls in the category for which an EIA is mandatory, as per the regulations.
Fees and Charges (Miscellaneous Provisions) Act, 2022 (Act 1080)	The Fees and Charges (Miscellaneous Provision) Act 2022 provides comprehensive rates, fees and charges collectable by Ministries, Department and Agencies (MDAs) for goods and services delivered to the public. It contains the stipulated fees and charges to be paid by proponents with respect to Environmental Permits and Certificates or provides a guide for its determination.	All stipulated fees and charges shall be paid in order to obtain the environmental permit from the EPA for project implementation.
Hazardous and Electronic Waste control and Management Act 2016 (Act 917) and Hazardous, Electronic and other waste (Classification), Control and Management Regulations 2016, LI 2250	The Hazardous and Electronic Waste and Control Act 2016 (Act 917) provides list of hazardous and other waste. It also provides control, management and disposal of electrical and electronic waste. Hazardous waste generally refers to waste with properties that makes it potentially dangerous or harmful to human health or the environment and they include liquids, solids or gases which cannot be treated or disposed of by common means. The Act will also ensure that harmful elements associated with hazardous and other waste products are captured and processed safely to preserve critical ecological components such as the soil, groundwater, flora and fauna.	The Act will guide the project on hazardous and electronic waste management and disposal during project implementation.

Legal Framework	Summary of Core requirements/Description	Applicability/ Relationship to proposed project
Water Resources Commission Act 1996 (Act 522)	The Water Resources Commission Act 1996 (Act 522) establishes and mandates the Water Resources Commission as the sole agent responsible for the regulation and management and the utilization of water resources and for the co-ordination of any policy in relation to them. Section 13 prohibits the use of water (divert, dam, store, abstract or use water resources or construct or maintain any works for the use of water resources) without authority. Section 16 empowers the Commission to grant Water Rights (water use permits) to prospective users. The Act states under Section 24 that, except in accordance with the provisions of this Act or with the approval of the Environmental Protection Agency, any person who pollutes or fouls a water resource beyond the level that the EPA may prescribe, commits an offence and is liable on conviction to a fine or a term of imprisonment or both.	Water use permit will be required for groundwater abstraction.
Water Use Regulation (WUR) 2001, LI 1692	The Water Use Regulations, 2001 (LI 1692) list such activities for which water use permit is required and this includes domestic, commercial, municipal, industrial water use among others. The Regulations also prescribe the raw water charges and processing fees to be paid by prospective water users with respect to the water use permits.	Any utilization of groundwater resources for the proposed project will require a water use permit.
Local Governance Act 2016, Act 936	This Act re-establishes and regulates the local government system and gives authority to the RCC and the Metropolitan, Municipal and District Assemblies to exercise political and administrative power in the Regions and Districts, provide guidance, give direction to, and supervise all other administrative authorities in the regions and districts respectively. The Assembly is mandated to initiate programmes for the development of basic infrastructure and provide municipal works and services as well as be responsible for the development, improvement and management of human settlements and the environment in the district.	The proposed site for the power plant is situated in the West Mamprusi Municipal Assembly.
National Building Regulations 1996, LI 1630	The National Building Regulations, LI 1630 provides guidance and standard to any person who intends to erect any building; or make any structural alteration to any building; or executes any works or installs any fittings in connection with any building. As per clause 14.14 of the National Building Regulations, "…buildings of four floors and over shall be subject to such requirements as may be laid down by the District Planning Authority for each particular case". The process of obtaining a development permit makes it contingent on the issuance of an environmental permit by the EPA.	The implication of this Act is that a Development/Building Permit will have to be obtained from the Municipal Assembly
The Fire Precaution (Premises) Regulations 2003, LI 1724	The Fire Precaution (Premises) Regulations 2003 (LI 1724) requires all premises intended for use as workplaces to have Fire Certificates.	Fire permit will be obtained for the construction and operation of the solar power plant

Legal Framework	Summary of Core requirements/Description	Applicability/ Relationship to proposed project
Factories, Offices and Shops Act 1970, Act 328	The Factories, Offices and Shops Act of 1970 (Act 328), as amended by the Factories Offices and Shops (Amendment) Law 1983 PNDCL 66, the Factories Offices and Shops (Amendment) Law 1991 PNDCL 275 s.1 (a), and the Ghana National Fire Service Act, 1997 (Act 537) requires all proponents to register every factory/workplace with the Chief Inspector of Factories Inspectorate Division. The Act requires all factories, offices and shops among others, notify the Chief Inspector of accidents, dangerous occurrences and industrial diseases, display at a prominent position in every factory the prescribed abstract of the Act and other notices and documentations, as well as outlines the regulations to safeguard the health and safety of workers.	The solar power project will be registered with the Factories Inspectorate Division and any accident reported as per Act 328, 1970 during construction and operation.
The Labour Act 2003, Act 651	Section 118(1) of the Labour Act 2003 (Act 651) stipulates that it is the duty of an employer to ensure that every worker employed works under satisfactory, safe and healthy conditions. Act 651 contains a number of specific provisions relating to an employer's duty of care to its workers. These include providing and maintaining "at the workplace, plant and system of work that are safe and without risk to health" and taking "steps to prevent contamination of the workplaces by, and protect the workers from, toxic gases, noxious substances, vapours, dust, fumes, mists and other substances or materials likely to cause risk to safety or health". A worker is required to report situations that he believes may pose "an imminent and serious danger to his or her life, safety or health".	VRA will ensure compliance with this Act for all workers to be engaged on the implementation of the solar power project. The provisions of the labour laws are incorporated into various policies and procedures of VRA such as environmental policy, occupational health and safety policy, recruitment or employment policy, conditions of service etc.
Workmen's Compensation Law 1987	It is to provide for the payment of compensation to workmen for personal injuries caused by accidents arising out and in the course of their employment. The tenets of the law place a large share of the burden of supporting workers injured at the workplace on the shoulders of the employers.	This will apply to the project and the safety of all workers will be the responsibility of VRA.
Road Traffic Act, 2004 (Act 683)	The Act deals with restrictions on road use in the interest of Road safety, registration and licensing of motor vehicles and trailers, licensing of drivers of motor vehicles, test of vehicles and issuance of road use certificates and licensing of drivers of commercial vehicles. Under the Act, it is an offence for any drivers plying on the road to use a mobile phone, put a child on their lap whilst driving, put a child below the age of fifteen to sit on a passenger seat beside the driver. The Act also requires drivers to carry on their vehicles all necessary accessories like fire extinguishers and genuine driving license. Again, no driver would be allowed to drive when he or she is improperly dressed.	The project will ensure that all drivers/ operators engaged are trained or have the necessary knowledge and experience to comply with the requirements of this law.

Legal Framework	Summary of Core requirements/Description	Applicability/ Relationship to proposed project
Persons with Disability Act 2006, (Act 715)	The Act covers key thematic provisions such as rights, accessibility, employment, education and transportation for PWDs amongst others. Section 6 states that the owner or occupier of a place to which the public has access shall provide appropriate facilities that make the place accessible to and available for use by a person with disability. Section 10 of the Act 10. (1) The Government shall grant a person who employs a person with disability an annual tax rebate of the taxable income in respect of each person with disability employed as shall be prescribed in Regulations made under this Act.	The project will ensure that its buildings have disability friendly accesses.
The Children's Act 1998, (Act 560)	The Act spells out the rights of the child, quasi-judicial/ judicial child adjudication, parentage/ custody/ access/ maintenance, fosterage/ adoption and employment of children issues. The Act defines a child as a person below the age of 18 years. The minimum age for admission of a child to employment is fifteen years and the minimum age for the engagement of a person in hazardous work is eighteen years. No person shall engage a child in exploitative labour; labour is exploitative of a child if it deprives the child of its health, education or development.	The VRA and contractors will be guided by this Act in the employment of labour for the proposed project and will ensure all labour engaged by the contractors are not below the minimum age of 18 years.
Public Health Act 2012, (Act 851)	This Act consolidates the laws relating to public health and is intended to prevent disease, promote, safeguard, maintain and protect the health of humans and animals and to provide for related matters. The Public Health Act 2012, Act 851 seeks to ensure disease prevention, promote, safeguard, maintain and protect the health of humans and animals and effectively regulate matters related to public health. It also provides temporary recommendations for the implementation of health measures and protection of all individuals from spread of diseases.	The Project will ensure that noxious or offensive practices that may cause damage to lands, crops, cattle among others are prohibited.
Alternative Dispute Resolution Act 2010 (Act 798)	The purpose of the Act is to "…provide for the settlement of disputes by arbitration, mediation and customary arbitration, to establish an Alternative Dispute Resolution Centre and to provide for related matters." The Act further defines Alternative Dispute Resolution "as the collective description of methods of resolving disputes otherwise than through the normal trial process" (Section 135). The ADR Act covers both domestic and international arbitration in Ghana and the enforcement of both domestic and foreign arbitral awards within the jurisdiction.	The project intends to use alternative dispute resolution mechanism as much as possible to resolve disputes and conflicts between the project and community members /PAPs. As a result, a grievance redress mechanism will be developed and included in the EIS.

2.3 National Institutional Framework for the implementation of the proposed Project

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

Table 2-3: National Institutional Framework

Institutional Framework	Key objective /function	Relationship to Project
Ministry of Energy	The Ministry of Energy is responsible for formulating, monitoring and evaluating policies, programs and projects in the power sector. It is also the institution charged with the implementation of the National Electrification Scheme (NES) which seeks to extend the reach of electricity to all communities in the long term.	The proposed Project falls directly under this Ministry. The ministry is responsible for policy formulation and monitoring policy execution. The ministry has a supervisory role and would not be directly involved in the project implementation but would have oversight.
Energy Commission	The Energy Commission is responsible for the regulation, management, development and utilization of energy resources in Ghana. The Commission, in addition to being responsible for technical regulations in the power sector, also advises the Minister for Energy on matters relating to energy planning and policy.	The construction and operation of the power plant will be under the technical regulation of the Energy Commission. The Commission will provide various licenses/permits including siting, construction, and operation.
Ghana Grid Company (GRIDCo)	The National Interconnected Transmission System (NITS) for electricity is owned and operated by the Ghana Grid Company (GRIDCo). GRIDCo is a state-owned company. Responsible for transmission of electricity from facilities of wholesale suppliers to bulk customers or distribution companies and utilities in Ghana and West Africa without discrimination, among other functions.	GRIDCo is responsible for the operation and maintenance of substations near these proposed solar power plant sites. GRIDCo would additionally undertake the Grid impact study for the project. Power from the Solar Power Plant will be sold to GRIDCo into the National Interconnected Transmission System managed by GRIDCo.
Northern Electricity Distribution Company (NEDCo)	Northern Electricity Distribution Company (NEDCo), is a subsidiary of VRA. NEDCo is responsible for the distribution of electricity in the northern part of Ghana namely, Ahafo, Bono, Bono East, Northern, North East, Savannah, Upper East and Upper West Regions.	NEDCo will play a key role in power distribution from GRIDCo to the beneficiary communities in the project area.

Institutional Framework	Key objective /function	Relationship to Project
Public Utilities and Regulatory Commission (PURC)	The Public Utilities Regulatory Commission of Ghana (PURC) is responsible for the economic regulation of the power sector with the mandate to provide guidelines for rates to be charged for the provision of utility services and approve rates for electricity sold by electricity distribution utilities.	PURC will regulate the pricing of the utility services provided by GRIDCo and NEDCo as utility service providers under this project.
Environmental Protection Agency	The EPA is the body responsible for regulating the environment and ensuring the implementation of government policies on the environment. The functions of the Agency include: ▪ ensuring compliance with any laid down environmental impact assessment procedures in the planning and execution of development projects, including compliance in the respect of existing projects; ▪ promoting effective planning in the management of the environment; ▪ imposing and collecting environmental protection levies in accordance with the Environmental Protection Agency Act 1994, Act 490 or regulations made under the Act; and ▪ acting in liaison and co-operation with government agencies, District Assemblies and other bodies and institutions to control pollution and generally protect the environment.	The EPA will ensure that the projects follow the environmental assessment procedures, and will issue environmental permit for the construction and operation of the solar power plant following review and approval of the environmental impact statement for the project. VRA will follow and abide by the EPA schedules to the permit during construction and operation of the solar power plant.
Local Government Authority	The Metropolitan /Municipal/District Assemblies (MMDAs) are responsible for the overall development of the metropolis/ municipality/ district as established by Acts 936 and 480. With regard to environmental management at the district level, the District Environmental Management Committees (DEMC) has been set up by law (Act 936) to among other things: ▪ Plan and recommend to the DA, strategies and activities for the improvement and protection of the environment with emphasis on fragile and sensitive areas, river courses etc.	The Loagri solar power project is under the West Mamprusi Municipal Assembly. The Assembly will play a key role in the successful implementation of the project especially with regard to providing building/development permits, waste management and managing encroachers and resolving grievances.
Lands Commission	The functions of the Lands Commission include amongst others; ▪ advise the Government, local authorities and traditional authorities on the policy framework for the development of particular areas of the	The Lands Commission will be involved in the approval of the site plan or update of the land documents and facilitate transfer

Institutional Framework	Key objective /function	Relationship to Project
	country to ensure that the development of individual pieces of land is coordinated with the relevant development plan for the area concerned; ▪ ensure that through sound, sustainable land use planning, socio-economic activities are consistent with sound land use through sustainable land use planning in the long-term national development goals; and ▪ promote community participation and public awareness at all levels in sustainable land management and development practices to ensure the highest and best use of land.	of land for the project from land owners to the VRA.
Land Use and Spatial Planning Authority (LUSPA)	Regulator for land use and spatial planning. The Land Use and Spatial Planning Authority confirms zoning status of areas earmarked for development and provides development approvals for physical development of land within a district within the jurisdiction in which the land is situated.	LUSPA is decentralised at the MMDA level, and the project is situated within the jurisdiction of the West Mamprusi Municipal. The Physical Planning Unit of the Assembly will confirm and issue any development approvals required.
Ghana National Fire Service (GNFS)	The GNFS is a national institution responsible for the prevention and management of undesired fire. GNFS is responsible to ensure that the facility has a fire permit/ certificate.	The GNFS will be informed about the project and any associated premises or workplaces. The Fire Service will provide fire permit for both construction and operation of the facilities.
Department of Factories Inspectorate	Regulations for health and safety of workers.	The Department of Factories Inspectorate will be informed about the project and any workplaces associated with the project. Factories Inspectorate will issue certificate of registration as a form of permit for the site.
Water Resources Commission	Water Resources Commission (WRC) is the sole agent responsible for the regulation and management and the utilization of water resources.	The WRC will issue drilling license to the borehole drilling company to be engaged for the construction of borehole at the project site; and water use permit for the abstraction of groundwater for use by the project
Traditional Authorities	In Ghana, people of common descent owe allegiance to a symbol of collective authority, such	The proposed solar power plant is located in the Loagri community.

Institutional Framework	Key objective /function	Relationship to Project
	as the 'stool' for the Akans of southern Ghana or the 'skin' for the northern peoples. Traditional authorities play a role in the administration of the area. At the village level, family and land disputes and development issues are also traditionally dealt with by the village chief and elders. In addition to providing an important leadership role, especially in the more rural areas, chiefs act as custodians of stool/skin land, can mobilise their people for developmental efforts and arbitrate in the resolution of local disputes.	The chief and elders of the community are stakeholders and will be involved in project implementation.

2.4 Relevant Environmental/Safety and Operational Permits/Licenses

Regulatory body	Permits/licenses and certificates	Project Phase	Remarks
Environmental Protection Agency	Environmental Permit	Prior to Construction Phase	After acceptance of the updated EIS by the EPA.
	Environmental Certificate	Within 24 months of commencement of Operations	After preparation of first EMP. Renewable every three years.
Energy Commission	Wholesale Electricity Supply License (Provisional) and Certificate of Authorization for Local Content and Local Participation	During the planning and design stage	-
	Acquisition of siting clearance (siting permit)	Prior to commencement of construction works	Requires Environmental Permit
	Acquisition of construction work permit (authorization to construct)	Prior to commencement of construction works	After obtaining Environmental Permit
	Acquisition of operational licence	Prior to commencement of operation	After obtaining Environmental Permit
Ghana National Fire Service	Fire Permit/ Certificate	For both construction and operational phases. Construction of office buildings/ facilities and for contractor work camp/ storage facilities	Renewable on annual basis
Factories Inspectorate Department	Certificate of Registration	Construction and Operation phases. For contractor work camp/storage facilities and plant office/buildings and	Renewable on annual basis

Regulatory body	Permits/licenses and certificates	Project Phase	Remarks
		facilities	
West Mamprusi Municipal Assembly	Development and building permit (for office buildings/ facilities	Prior to construction of facilities/buildings	-
Water Resources Commission	Borehole drilling license Water abstraction permit	Construction or Operational Phase	Drilling license for borehole drilling contractor. Groundwater abstraction permit (i.e. water use permit) for VRA borehole

2.5 Key Guidelines for Environmental Impact Assessment

The following environmental guidelines will be considered:

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

2.6 Key National Environmental Quality Standards

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

- GS 1236:2019 Environment and Health Protection –Requirements for Ambient Air Quality: *This will be relevant during the construction phase to ensure that dust emissions or generations from construction activities does not exceed acceptable limits.*

- GS 1219:2018 Environment and Health Protection –Requirements for Motor Vehicle Emissions – *relevant for VRA, consultants and contractor vehicles to comply with emission levels*
- GS 1222:2018 Health Protection –Requirements for Ambient Noise Control- *relevant during construction phase to ensure that ambient noise levels are not impacted adversely beyond acceptable levels from construction activities.*

2.6.1 Ambient Air Quality

Ghana Standard (GS 1236: 2019) for Environment and Health Protection- Requirement for Ambient Air Quality

The Ghana Standard on Environment and Health Protection – Requirement for Ambient Air Quality. It specifies the requirements and methods of analysis for ambient air (see **Table 2-4**).

Table 2-4: Requirement for Ambient Air Pollutants (GS 1236: 2019)

Substance (µg/m$^{3)}$	**Maximum Limits**	**Averaging Time**	**Test Method**
Sulphur Dioxide (SO_2)	520 µg/m^3 50 µg/m^3	1 hr 24hr	AS 358.4.10 Determination by Direct reading instrumental method
Nitrogen Oxides (Measured as $N0_2$)	250 µg/m^3 150 µg/m^3	1 hr. 24 hr.	ISO 7996 Determination by Chemiluminiscence method
Total Suspended Particulate	150 µg/m^3 80 µg/m^3	24 hr 1 yr	ASTM D4096-17 determination by High Volume Sampler Method
PM_{10}	70 µg/m^3 70 µg/m^3	24 hr 1 yr	ASTM D4096-17 determination by High Volume Sampler Method
$PM_{2.5}$	35 µg/m^3	24 hr	ASTM D4096-17 determination by High Volume Sampler Method
Black Carbon	25 µg/m^3 25 µg/m^3	24 hr 24 min	ASTM D6602-13 Standard practice for sampling
Benzene, µg/m^3	5	1 yr	ASTM D5466 -15 determination by canister sampling method
Lead, µg/m^3	0.5 µg/m^3 1	1 yr 24hr	ISO 9855 determination by Atomic absorption method

During construction period, relevant parameter of interest is dust emissions (i.e. Total Suspended Particulates, PM_{10}, $PM_{2.5}$.) from construction and excavation activities.

2.6.2 Ambient Noise Level

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

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

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

ZONE	DESCRIPTION OF AREA OF NOISE RECEPTION	PERMISSIBLE NOISE LEVEL IN dB(A)	
		DAY 0600 - 2200	NIGHT 2200 - 0600
A	Residential areas	55	48
B	Educational and health facilities, office and law courts	55	50
C	Mixed Use	60	55
D	Areas with some light industry	65	60
E	Commercial areas	75	65
F	Light industrial areas	70	60
G	Predominantly heavy industrial areas	70	70
Ensure that maximum noise level near the construction site does not exceed 66dB(A) in other areas and 75dB(A) in an industrial area			

(Source: GSA, 2018)

2.7 International Standards/Guidelines

2.7.1 IFC Performance Standards 2012

International Finance Corporation (IFC) applies the Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards may also be applied by other financial institutions electing to apply them to projects in emerging markets. VRA may commit to meeting the requirements of the IFC Performance Standards as an international best industry practice. The eight Performance Standards are summarised in **Table 2-6**.

Table 2-6: Summary of IFC Performance Standards and Potential for Trigger under the Project

No	IFC Performance Standards	Summary of core requirements	Potential for Trigger under the project
PS 1	***Assessment and Management of Environmental and Social Risks and Impacts***	Identify and evaluate environmental and social risks and impacts of the project and adopt measures anticipate, avoid and when avoidance is not possible, minimise and or compensate Project Affected People/Communities and Environmental Area of Influence. The achievement of the above, Clients should establish an effective ESMS, which ensures stakeholders/community participation and grievance redress mechanisms.	Triggered
PS 2	***Labour and Working Conditions of workers***	Management of projects should ensure workers safety promote the fair treatment, non-discriminatory and equal opportunity of workers and establish, maintain and improve the worker-management relationship, and comply with national employment and labour laws of host country.	Triggered
PS 3	***Resource Efficiency and Pollution Prevention***	Avoid or minimise adverse impacts on human health and the environment through avoidance or minimisation of pollution including release of greenhouse gases from project and promote sustainable use of resources such as energy and water. Clients are also expected to ensure the use of efficient pollution abatement machinery to reduce pollution.	Triggered
PS 4	***Community Health, Safety and Security***	To evaluate the risks and impacts to the health and safety of the Affected Communities during the project lifecycle and establish preventive and control measures consistent with Best International Practices and commensurate with their nature and magnitude of impacts.	Triggered
PS 5	***Land Acquisition and Involuntary Resettlement***	As much as possible project siting and activities should not displace people. However, where avoidance is not possible, displacement should be minimised by alternative project design considerations. No force eviction should be undertaken by client. Land acquisition should be done in a manner as to minimise adverse social and economic impacts through the provision of compensation packages and to ensure a humane resettlement procedure, disclosure of information, consultation and participatory of PAPs. It should be the client's duty to ensure the physical and economic wellbeing of displaced people are not worst of than their pre displaced lives.	Triggered
PS 6	***Biodiversity Conservation and Sustainable Management of***	All clients should identify both direct and indirect project related impacts that could potentially threaten biodiversity and ecosystem services. The following indicators should be used as a guide: habitat loss, degradation and fragmentation, invasive alien species,	Triggered

No	IFC Performance Standards	Summary of core requirements	Potential for Trigger under the project
	Living Natural Resources	overexploitation, hydrological changes, nutrient loading, and pollution.	
PS 7	***Indigenous People***	The client will identify, through an environmental and social risks and impacts assessment process, all communities of Indigenous Peoples within the project area of influence who may be affected by the project, as well as the nature and degree of the expected direct and indirect economic, social, cultural (including cultural heritage), and environmental impacts on them. Adverse impacts on Affected Communities of Indigenous Peoples should be avoided where possible. Indigenous People are defined as a social group with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population.	Not triggered
PS 8	***Preservation of Cultural Heritage***	Client must protect cultural heritage from the adverse impacts of project activities and support its preservation. Clients should also promote the equitable sharing of benefits from the use of cultural heritage.	Triggered

IFC categorizes projects to determine the level of environmental and social assessment that will be required as follows:

Category A – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented;

Category B – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and

Category C – Projects with minimal or no adverse environmental and social risks and/or impacts

The proposed solar power plants are most likely to fall under Category B. That is a project "with potential limited adverse social or environmental impacts that are few in number, site-specific, largely reversible, and readily addressed through mitigation measures".

2.7.2 World Bank Group (WBG) EHS Guidelines

2.7.2.1 World Bank Group General EHS Guidelines (2007)

The World Bank Group General Environmental, Health, and Safety (EHS) Guidelines (2007) identifies detailed EHS management and technical recommendations with Good International Industry Practice (GIIP) which are applicable for all development projects. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines

which provide guidance to users on EHS issues in specific industry sectors. The following Environmental, Health & Safety Guidelines will be followed:

Air Emissions and Ambient air quality: This guideline applies to facilities or projects that generate emissions to air at any stage of the project life-cycle. It complements the industry-specific emissions guidance presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines by providing information about common techniques for emissions management that may be applied to a range of industry sectors. This guideline provides an approach to the management of significant sources of emissions, including specific guidance for assessment and monitoring of impacts. Emissions of air pollutants can occur from a wide variety of activities during the construction, operation, and decommissioning phases of a project. It provides additional information on approaches to emissions management in projects located in areas of poor air quality, where it may be necessary to establish project- specific emissions standards. The construction of the solar power plant is expected to generate some level of dust.

Wastewater and Ambient Water Quality: This guideline applies to projects that have either direct or indirect discharge of process wastewater, wastewater from utility operations or stormwater to the environment. Projects with the potential to generate process wastewater, sanitary (domestic) sewage, or stormwater should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment. The EIA will include measures to avoid, minimize or mitigate any potential impacts surface water quality.

Water conservation: The guidelines provide that water conservation programs should be implemented commensurate with the magnitude and cost of water use. The construction of the solar power plants will involve the drilling of boreholes in some places. The project will promote the continuous reduction in water consumption to achieve savings in the water pumping costs in the operations and maintenance process. Storm/Rainwater harvesting may be considered where appropriate.

Waste Management. These guidelines apply to projects that generate, store, or handle any quantity of waste across a range of industry sectors. It is not intended to apply to projects or facilities where the primary business is the collection, transportation, treatment, or disposal of wastes. Construction and operational waste expected to be generated from the construction site

and during operation and maintenance of the solar power plant makes this guideline relevant to the project's implementation.

Noise Management. This guideline addresses impacts of noise beyond the property boundary of the facilities or projects being implemented. Thus, it seeks to addresses the public health risks of noise generated from the project and not the occupational health risks.

Occupational Health and Safety: This guideline provides guidance and examples for employers and supervisors to implement reasonable precautions to protect the health and safety of workers. The guideline provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities. Contractors to be hired by the project will be obliged to manage the occupational health and safety issues of their employees.

Community Health and Safety: EHS Guidelines provides specific guidelines under traffic safety, water quality and availability, disease prevention and construction and decommissioning relevant to the implementation of the project activities.

Construction and Decommissioning. This guideline provides specific guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle.

2.7.2.2 Specific EHS Guideline for Electric Power Transmission and Distribution

Applicable specific EHS guideline is the:

- IFC EHS Guidelines for Electric Power Transmission and Distribution (2007)

This EHS Guidelines for Electric Power Transmission and Distribution include information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas.

This in particular could be applicable for the associated facilities of the Project (i.e. sub-transmission line for connection with the grid). The Guideline identifies the key E&S impacts that should be investigated and provides detailed management and technical recommendations with regards to Industry-Best Practice. The EHS Guidelines identifies the following key issues:

- Biodiversity (to include birds and bats)
- Electric and magnetic fields
- Hazardous materials
- Occupational health and safety
- Community health and safety

2.7.2.3 Air Emission Levels and Ambient Air Quality

The air emission levels and ambient air quality guidelines recommended by IFC are that of the World Health Organization (WHO), and these are provided in the table below. Dust emissions (Particulate Matter (PM10) and Particulate Matter (PM2.5) during construction phase is relevant to this assignment.

Table 2-7: WHO Ambient Air Quality Guidelines

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

2.7.2.4 IFC Ambient Noise Level Guidelines

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

*Table 2-8**: IFC Ambient Noise Level Guidelines***

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

Industrial; Commercial	70	70

2.7.3 Equator Principles 2020

The Equator Principles are a voluntary set of guidelines developed by leading financial institutions for managing environmental and social issues in project finance lending. The guidelines are based on the environmental and social standards of the IFC (i.e. IFC Performance Standards). These principles are intended to serve as a common baseline and framework for financial institutions to identify, assess and manage environmental and social risks when financing Projects.

The Equator Principles aim is to ensure that prior to agreeing to provide financing, (a) a project has been subject to an appropriate level of environmental and social assessment in accordance with the requirements of the IFC Performance Standards and World Bank Group EHS Guidelines, and (b) that the project will implement appropriate measures for the management of environmental, social and health issues during construction, operation and decommissioning phases. The principles are summarized in **Table 2-9** with comments on the respective projects.

Table 2-9: Summary of Equator Principles and Potential for Trigger under the Projects

No	**Equator Principle**	**Summary Description**	***Potential for Trigger***
1.	Principle 1: Review and Categorization	As part of the Equator Principles Financial Institutions (EPFI) internal environmental and social review and due diligence, projects will be categorized into (A-C) depending on the severity of impacts with Project in Category A being ranked as high-risk projects and Category C being ranked as low risk projects. Such categorisation is based on the International Finance Corporation's (IFC) environmental and social categorisation process).	Triggered. These solar projects are likely Category B projects.
2.	Principle 2: Environmental and Social Assessment	Environmental and Social Impact Risk of proposed projects should be conducted. The Environmental and Social Impact Assessment (ESIA) should identify impacts and risk, and propose measures to minimise, mitigate and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed project. The client is expected to include assessments of potential adverse Human Rights impacts and climate change risks as part of the ESIA or other Assessment CO_2 emissions exceeding 100,000 tonnes, should require alternative analysis for less Green House Gases (GHG).	Triggered

No	Equator Principle	Summary Description	*Potential for Trigger*
3.	Principle 3: Applicable Environmental and Social Standards	ESIA process should in the first and foremost comply with relevant host country laws, regulations and permits with respect to environmental and social issues. IFC Performance Standards on Environmental and Social Sustainability and World Bank Environmental and Safety Guidelines should apply to projects in Non-Designated countries whilst host country laws, regulations and permits pertaining to environmental and social issues should apply to Designated countries.	Triggered
4.	Principle 4: Environmental and Social Management System and Equator Principles Action Plan	Environmental and Social Management System (ESMS) should be developed and maintained by the client for Category A and B Projects. Secondly, an Environmental and Social Management Plan (ESMP) should be prepared by the client to address issues raised in the ESIA for the same Project Categories.	Triggered .
5.	Principle 5: Stakeholder Engagement	The client should demonstrate an effective Stakeholder Engagement with affected communities and other stakeholders in a structured and culturally acceptable manner. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. Risks and impact of the Project phase development, Preference language of affected communities, Decision-making processes, needs of disadvantaged and vulnerable groups, should form the core issues for discussions.	Triggered
6.	Principle 6: Grievance Mechanism	The borrower will establish an effective grievance mechanism as part of the management system for all category A and some category B projects which are designed for use by Affected Communities and Workers, as appropriate, to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance.	Triggered.
7	Principle 7: Independent Review	For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, will carry out an Independent Review of the Assessment process including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence and determination of Equator Principles compliance.	Triggered
8	Principle 8: Covenants	For all Projects, where a client is not in compliance with its environmental and social covenants, the EPFI will work with the client on remedial actions to bring the Project back into compliance. If the client fails to re-establish compliance within an agreed grace period, the EPFI reserves the right to exercise remedies, including calling an event of default, as considered appropriate.	Triggered.

No	Equator Principle	Summary Description	*Potential for Trigger*
9	Principle 9: Independent Monitoring and Reporting	For all Category A and, as appropriate, Category B Projects, in order to assess Project compliance with the Equator Principles after Financial Close and over the life of the loan, the EPFI will require independent monitoring and reporting. Monitoring and reporting should be provided by an Independent Environmental and Social Consultant; alternatively, the EPFI will require that the client retain qualified and experienced external experts to verify its monitoring information, which will be shared with the EPFI in accordance with the frequency as required.	Triggered
10	Principle 10: Reporting and Transparency (Client Reporting Requirements)	The following client reporting requirements should be observed: For all Category A and, as appropriate, Category B Projects: ● The client will ensure that, at a minimum, a summary of the ESIA is accessible and available online and that it includes a summary of Human Rights and climate change risks and impacts when relevant. ● The client will publicly report GHG emission levels during the operational phase for projects emitting over 100,000 tonnes of CO_2- equivalent annually.	● Triggered ● Not triggered

2.8 Other International Treaties Relevant to the Proposed Project

- African Charter on Human and Peoples' Rights (adopted 1998, entered into force 2005)
- Africa Union Agenda 2063;
- Sustainable Development Goals;
- United Nations Framework Convention on Climate Change (UNFCCC), (adopted 1992, entered into force 1994);
- Kyoto Protocol to the Convention United Nations Framework on Climate Change (adopted 1997, entered into force 2005);
- The Paris Agreement
- GHA-Nationally Determined Contributions (NDCs): 2020 – 2030
- United Nations Convention on Biological Diversity (adopted 1992, entered into force 1994)
- International Labour Organization Fundamental Conventions

- Convention Concerning the Protection of Workers against Occupational Hazards in the Working Environment due to Air Pollution, Noise, and Vibration (ILO No. 148) 1987;
- Freedom of association and collective bargaining; conventions 87 (1950) and 98 (1951)
- Elimination of forced and compulsory labour; conventions 29 (1932) and 105 (1959)
- Elimination of discrimination in respect of employment and occupation; conventions 100 (1953) and 111 (1960)
- Abolition of child labour; conventions 138 (1976) and 182 (2000)

3.0 DESCRIPTION OF THE PROPOSED PROJECT

This Chapter provides a description of the proposed Project, and the project information provided under this chapter is obtained mainly from the Feasibility Study Report for the proposed Project. The purpose of this chapter is to present sufficient project information on the proposed project to inform the Environmental Impact Assessment Process in terms of design parameters applicable to the project.

It is important to note that the project description and specification details are preliminary at this stage. It is likely that some of the specification details presented herein may change during the detailed design phase and upon further engineering investigations, however, the information provided below is seen as the worst-case scenario for the project

3.1 Location of Proposed Project and Accessibility

The proposed site is located within the West Mamprusi Municipality in the North East Region of Ghana. The closest community settlement to the Project site is Loagri, located about 500m South East of the Project site, as shown in **Figure 3-1,** and is located west of the N10 road from Tamale to Bolgatanga.

The footprint of the project will be constructed on an approximately 81.15 hectares/200.52 acres of land. The extent of the 200.52 acres is the basis of all specialist studies. The land acquisition process is still ongoing. The site coordinates are provided in the table below, and the site plan is provided in **Annex 3-1**.

Table 3-1: Site Coordinates

Point	Latitude	Longitude
1	10° 17' 31.27"N	0° 50' 6.38"W
2	10° 17' 24.06"N	0° 49' 38.68"W
3	10° 16' 56.79"N	0° 49' 45.68"W
4	10° 17' 3.88"N	0° 50' 13.68"W

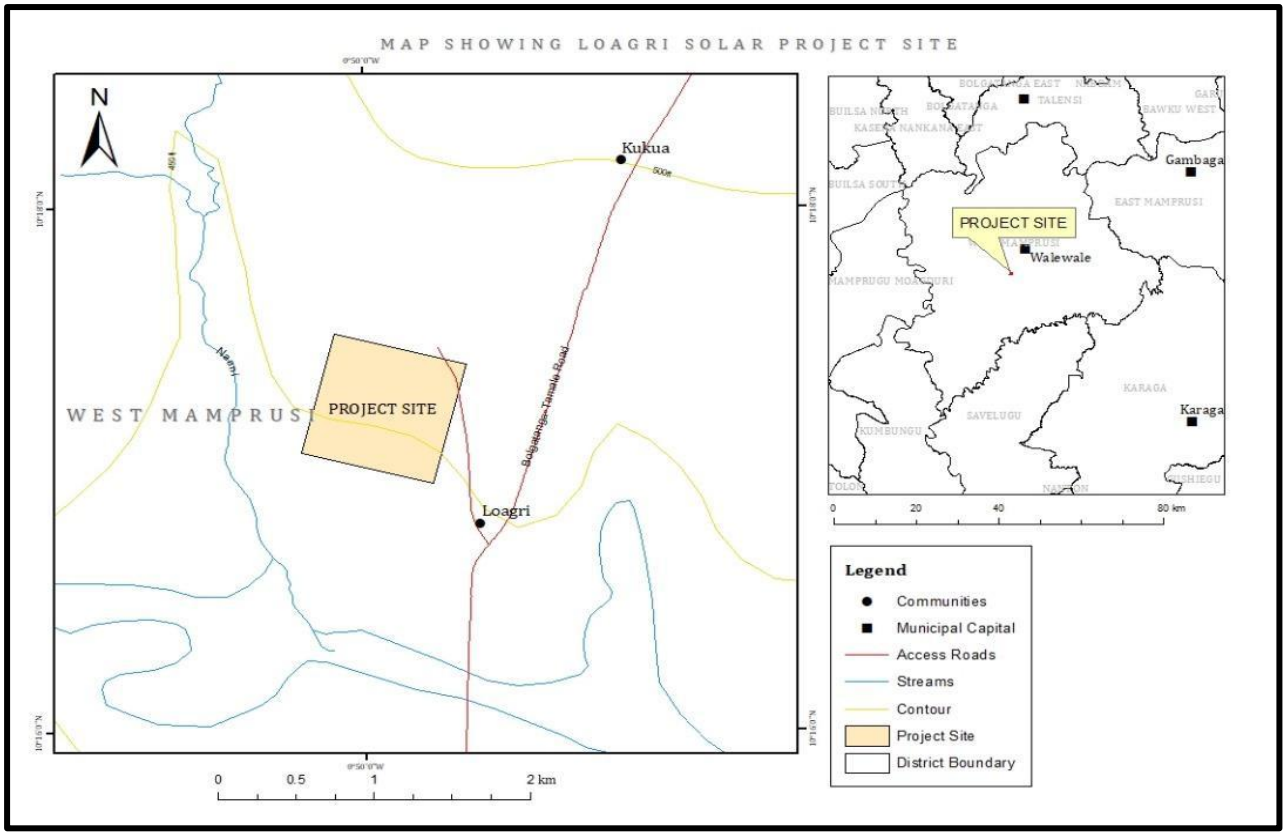


Figure 3-1: Location Map of the proposed site for the Loagri Solar Power Project

The site is located to West of the Tamale-Bolgatanga highway, which is the main access road to the project site, and is between the 330kV pylon number 289 and pylon number 294. The site shares a boarder with the Western boundary of the 330kV right of way. The 161kV line is near the South of the 330kV line and on the side of the Bolga –Tamale highway (See **Plate 3-1**).

Plate 3-1: Photo showing 330kV and 161kV GRIDCo lines passing close to the Loagri Site

3.2 Site Selection Criteria

The following environmental/social and technical issues were considered for the selection of the proposed site for the project:

- Land availability – potential for future expansion.
- Solar irradiation levels - A solar irradiation level of about 1600kWh/m^2/year or greater is usually preferred.
- Land use – cost of land, compensation issues and impact on environmental sensitivity areas and other land users on the site should be minimal.
- Topography – generally flat.
- Accessibility – proximity to existing roads is essential, and extent of new roads required should be minimal.
- Proximity to settlements – avoidance of residential areas or impact on residential facilities should be minimal as much as possible.
- Grid connection – proximity to electrical grid is important, and the capacity of the GRID at that point to evacuate the power.

3.3 Solar Energy Production Process

The process of solar power generation is basically using a photovoltaic technology to produce solar power. Photovoltaic means electricity from light, i.e., photo meaning light and voltaic meaning electricity. Solar panels, also known as modules, contain photovoltaic cells made from silicon that transform incoming sunlight into electricity rather than heat. Solar PV plants generate electricity from solar radiation using a PV Module, which comprises of several solar cells.

Solar cells produce Direct Current (DC), which is converted to Alternating Current (AC) in inverters before the plant is connected to the grid. During this process, the photovoltaic cells absorb the particles of light known as photons.

As the photons of the sunlight beat down upon these cells, they knock the electrons off the silicon. The negatively charged free electrons are preferentially attracted to one side of the silicon cell, which creates an electric voltage that is collected and channelled. The energy produced will then be released during the process of absorption and will be transferred as the electrical current. A simplified setup of the proposed PV plant is as shown in **Figure 3-2**.

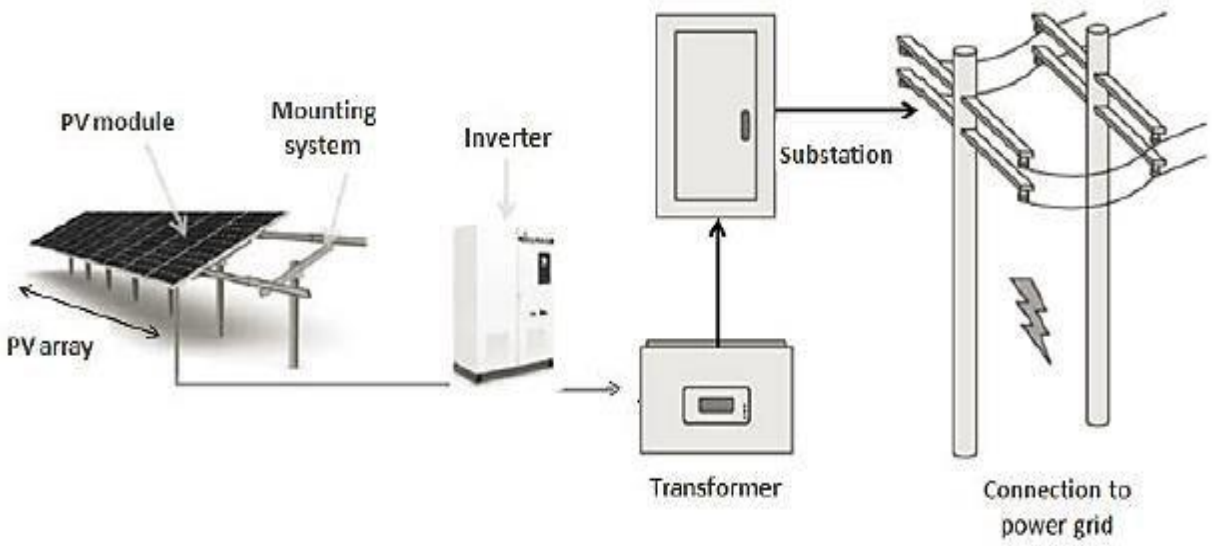


Figure 3-2: Setup of a Typical Solar PV Plant

A single solar cell is not be able to produce a useful amount of electricity so a number of solar cells are linked together. This current is gathered by wiring the individual solar panels together in series to form a solar photovoltaic array. These collections of solar cells are mounted into a panel to create a module. When enough electricity is generated, a cable directs it to an electrical inverter, which changes the direct current that was produced into an alternating current. Alternating current is the standard type of electricity being used in the power outlets, so all the inverter does is make the energy into a usable form. To maintain efficiency, PV Modules are washed on a regular basis with water.

3.4 Project Components/Scope and Facilities

3.4.1 Summary of Key Components

The key components of the solar power project are provided in **Table 3-2.** The layout plan for the project is provided in **Annex 3-2.** The construction phase of the project will run up to 12 months, and the proposed facility will generate electricity for approximately 20 years.

It is important to note at the outset that the exact specifications of the proposed project components will be determined during the detailed engineering phase. In line with the precautionary approach and in order to ensure that any environmental impacts which may arise as a result of the project

are adequately assessed during the EIA Phase, worst-case scenarios and estimates have been provided in this section.

Table 3-2: Key components of the Solar Power Project

Component	Description
Solar Field	
Type of Technology	Photovoltaic (PV) Monocrystalline technology
Generation Capacity (Maximum Installed)	95 MW
Approximate area of the PV Array (i.e. Area occupied by the PV Modules)	160 acres
Total developable area that includes all associated infrastructure within the fenced off area of the PV facility	200.52 acres
PV Panel Structure (with the following possible tracking and mounting systems): ▪ Single Axis Tracking structures (can be aligned east-west or seasonal north-south. The east-west is the more popular one); ▪ Fixed Axis Tracking (aligned east-west); ▪ Dual Axis Tracking (aligned east-west and north-south); ▪ Fixed Tilt Mounting Structure; or ▪ Bifacial Solar Modules.	Fixed East -West Arrays
Building Infrastructure	
Warehouse/Workshop	▪ Footprint: Approximately 1000 m^2 ▪ Height: Up to 10 m
Site Offices	▪ Footprint: Approximately 250 m^2 ▪ Height: Up to 10 m
Operational and Maintenance (O&M) Control Centre	▪ Footprint: Approximately 250 m^2 ▪ Height: Up to 10 m This will form part of the construction laydown area
Security Houses	▪ Number of guard houses: 1 ▪ Footprint of each guard house: Approximately 35 m^2
Associated Infrastructure	
Overhead power lines	
Underground low voltage cables or cable trays	
Access roads (including upgrading and widening of existing roads)	Existing roads will be upgraded wherever possible, although new roads will be constructed where necessary.
Internal roads	Internal roads to be widened to approximately including outer road 6m wide, minor inner road 5m wide, and major inner road 6m wide.
Length of internal access roads	To be determined based on final layout
Fencing around the PV Facility Perimeter	Type: Palisade or mesh Height: Up to 3 m
Work area during the construction phase (i.e. laydown area)	Temporary Laydown area: Approximately: 4.5 ha. The need for a permanent laydown area will be confirmed during the EIA Phase.

3.4.2 Description of Project components and facilities

3.4.2.1 Description of the PV panels/arrays and module mountings

The Solar project will consist of approximately 23 modules each at 400 Wp for the entire facility and building infrastructure. The total approximate area of the PV Array (i.e. area occupied by the PV Modules) for the project is 160 acres. The exact number of solar panels arrays, confirmation of the foundation type and detailed design will follow as the development progresses, but a preliminary site layout can be found in Annex 3-2.

The smallest unit of a PV installation is a cell. A number of cells form a module, and several modules cumulatively form the arrays (Figure 3-3).

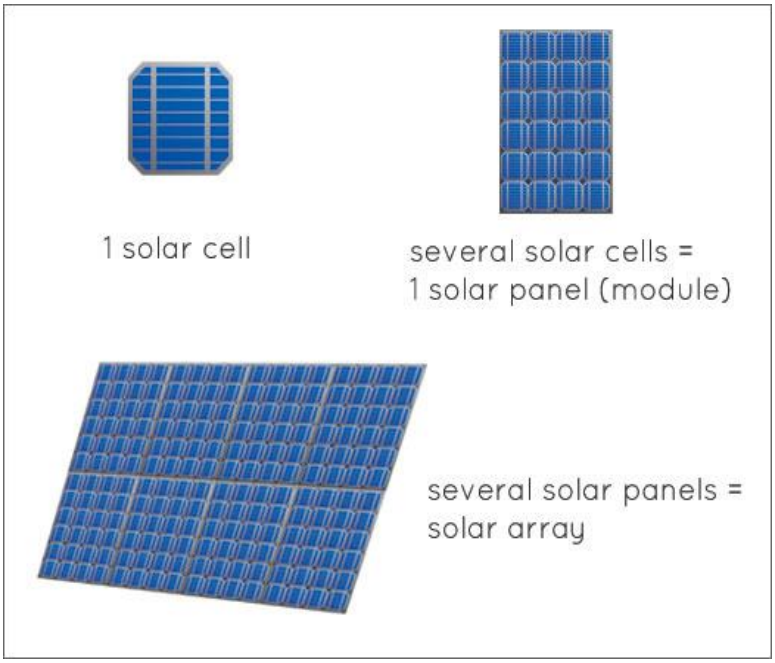


Figure 3-3: Components of the Proposed PV Installation

Modules are arranged into strings that form the solar field and are installed on racks which are made of aluminium or galvanised steel. Foundations will likely be drilled and concreted into the ground. The entire structure is not expected to exceed 3.5 m in height (measured from the ground). This system may be fixed, or may track the movement of the sun, either by adopting Fixed Axis Tracking (aligned east-west); Single Axis Tracking (can be aligned east west or seasonal north-south. The east west is the more popular one); Dual Axis Tracking (aligned east-west and north-south); Fixed Tilt Mounting Structures or Bifacial Solar Modules as explained above. This project will utilise Fixed East -West Arrays.

3.4.2.2 Description of inverters

As mentioned above, the solar arrays are typically connected to each other in strings, which are in turn connected to inverters that convert Direct Current (DC) to Alternate Current (AC). Each inverter is expected to extend approximately 3 m in height. It is estimated that there will be approximately 630 inverters.

The strings will be connected to the inverters by low voltage underground (internal) DC cables (to a maximum depth of 1.5 m) or cable trays. Power from the inverters will be collected in medium voltage transformers through underground (internal) AC cables, cable trays or AC cables which will be below ground or pole-mounted depending on voltage level and site conditions.

The output from the inverters would be around 600 to 800 V and these would be sent to a medium voltage transformer station to be stepped up to 34.5 KV before being sent to the onsite substation.

3.4.2.3 Onsite substation

The on-site Substation will extend approximately up to 10 ha in area and will have a height of up to 10 m. It is estimated that the on-site substation complex will have a 95 MVA transformation capacity and it will be stepped up to 161 kV or 330 kV for connection to the national grid.

3.4.2.4 Panel Maintenance and Cleaning

During the operational phase, the accumulation of dust on solar panels generally negatively influences the productivity of solar facility. As such the panels require regular cleaning with water. Water from the cleaning process will be free from harmful detergents.

3.4.2.5 Storm water

It is proposed that the area where the solar panels will be installed will not be totally cleared of vegetation. It is planned for the vegetation to be trimmed and the panels will be installed on steel supporting structures above the height of the vegetation. The solar panels will not replace the vegetated area and thus storm water runoff is not expected to increase specifically due to the proposed PV panel placement.

Stormwater infrastructure, such as channels, will be constructed on site to ensure that stormwater run-off from site is appropriately managed. Water from these channels is not likely to contain any chemicals or hazardous substances and will be released into the surrounding environment based

on the natural drainage contours. It is important to verify that the on-site substation and other building infrastructure are not located in an area of stormwater accumulation.

Details of storm water management are to be confirmed once the Engineering, Procurement and Construction (EPC) contractor has been selected and the design is finalised. It is proposed that a detailed storm water management plan be developed during the detailed design phase and to be implemented during all phases of the project. The plan will ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan will also include the installation of appropriate design measures that allow surface movement of water along drainage lines so as not to impede natural surface flows.

3.4.2.6 On-Site Structures/ buildings

There will be a warehouse/workshop, office, O&M control centre, and security house at the proposed site as indicted below:

- Warehouse/workshop for storage of equipment (maximum height of 10 m);
- Site Office (maximum height of 10 m and footprint of 250 m^2);
- Operational and maintenance (O&M) control centre (maximum height of 10 m and footprint 250 m^2);
- Security enclosures (height of 10 m, footprint 35 m^2);
- String inverters to be installed under the panels,
- a transformer station and this would be a little shy of a 20-footer container; and
- On-site substation building (height of up to 10 m, with an overall footprint 4 ha).

A temporary construction laydown area with a maximum footprint of approximately 4.5 ha will also be constructed. Note that the details provided above in terms of heights and footprint are estimates and will be confirmed during the detailed design.

3.4.2.7 Access roads

Internal Roads

Internal roads will also be constructed within the footprint of the proposed site. The internal roads are expected to be composed of gravel and will extend up to 6 m wide, during the construction phase. These roads will provide access to the solar panels and will accommodate cable trenches and stormwater channels, as required. Existing roads will be upgraded wherever possible, although new roads will be constructed where necessary. The total internal road length will be determined

by the EPC contractor. The total internal road length may vary slightly, depending on the final design.

The geometric design and layout for the internal roads from the access points needs to be established at detailed design stage. Existing structures and services, such as drainage structures, signage, street lighting and pipelines will need to be evaluated if impacting on the roads. It needs to be ensured that gravel sections remain in good condition and will need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed.

External Access Roads

There will be road network surrounding the site with convenient access points. The final site access points will be based on the access investigation findings, geometric considerations and site layout restrictions.

3.4.2.8 Security fencing

For various reasons such as security, public protection and lawful requirements, the proposed built infrastructure on site, will be secured via the installation of appropriate fencing. The PV facility fencing type could be palisade or mesh, with an estimated height of up to 3 m. Inner fencing will be required around the on-site substation. Access points will be managed and monitored by an appointed security service provider. The type and height of fencing to be installed will be confirmed during detailed design as the development progresses.

3.4.3 Provision of services

The VRA will consult with the appropriate authorities within the West Mamprusi Municipality during the EIA Phase to confirm the supply of services (in terms of water usage, sewage removal, solid waste removal, and electricity requirements) for the proposed project. Should the local municipality not have adequate capacity available for the handling of waste, provision of water and sewage handling; then VRA will make use of private contractors to ensure that these services are provided. An outline of the services that will be required are discussed below.

3.4.3.1 Water Usage

During the construction phase, approximately 10,000 m^3 of water will be required over an estimated 12-month construction period. This equates to approximately 833 m^3 of water per month

during the construction phase. Water will be required for human consumption and construction activities.

During the operational phase, it is estimated that the panel washing process, and human consumption as well as other operational phase activities will require approximately 1,153,425 liters of water per year for a minimum 20-year operational lifespan. The water for panel washing does not need to meet the same quality standards as that required for potable water, however the water will be tested to ensure that it does not negatively impact on the mechanical equipment.

Water required for the construction, operational and decommissioning phases will either be sourced from the following sources:

- An existing borehole or a new borehole will be drilled on site.
- The Municipality - specific arrangements will be agreed with the local municipal assembly a Service Level Agreement (SLA).
- water tankers from local suppliers in the Loagri Township.

3.4.3.2 Sewage or Liquid Effluent

The proposed project will require sewage services during the construction, operational and decommissioning phases. Low volumes of sewage or liquid effluent are estimated. More specifically, it is estimated that a peak approximately 28,000 litres per month of sewage will be generated during the construction phase. During the operational phase, it is estimated that 10,000 litres of sewerage per month will be generated.

Portable sanitation facilities (i.e. mobile toilets) will be used during the construction phase, which will be regularly serviced and emptied by a suitable and registered contractor on a regular basis. Washrooms/toilet facilities with septic tanks will be provided during the operational phase. Sewage from septic tanks will be disposed of at designated/approved locations within the municipality.

3.4.3.3 Solid Waste Generation

The quantity of waste generated will depend on the construction phase, which is estimated to be 12 months. It is estimated that approximately 2,000-5,000 kg of general waste will be generated every month during the construction phase. During the construction phase, the following waste materials are anticipated:

- Packaging material, such as the cardboard, plastic and wooden packaging and off-cuts;
- Hazardous waste from empty tins, oils, soil containing oil and diesel (in the event of spills), and chemicals;
- Building rubble, discarded bricks, wood and concrete;
- Domestic waste generated by personnel; and
- Vegetation waste generated from the clearing of vegetation.

Solid waste will be managed via the EMP during all project phases. The EMP will be provided in the Draft EIA Report, which will incorporate waste management principles. During the construction phase, general solid waste will be collected and temporarily stockpiled in skips in a designated area on site and thereafter removed, emptied into trucks, and disposed at a registered waste disposal facility on a monthly basis by an approved waste disposal contractor or the municipal assembly. A skip will be placed on site and any damaged or broken PV panels (i.e. those not returned to the supplier) will be temporarily stored in this skip.

Any hazardous waste (such as contaminated soil as a result of spillages) will be temporarily stockpiled in a designated area on site (i.e. placed in leak-proof storage skips), and thereafter removed off site by a suitable service provider for safe disposal at a registered hazardous waste disposal facility.

Waste disposal slips and waybills will be obtained for the collection and disposal of the general and hazardous waste. These disposal slips (i.e. safe disposal certificates) will be kept on file for auditing purposes as proof of disposal. The waste disposal facility selected will be suitable and able to receive the specified waste stream (i.e. hazardous waste will only be disposed of at a registered/licenced waste disposal facility). The details of the disposal facility will be finalised during the contracting process, prior to the commencement of construction. Where possible, recycling and re-use of material will be encouraged.

3.4.3.4 Electricity Requirements

In terms of electricity supply for the construction and operational phase, the VRA will make use of existing municipal infrastructure supply services in the area. Should this not be available, VRA will make use of generators during construction.

3.4.4 Manpower Requirements

Construction Phase

During the construction phase, about 400 to 650 workers will be engaged. These will comprise of skilled labour and unskilled labour. The skilled labour will include professionals such as civil, mechanical, geodetic and electrical engineers, HSE officers; and artisans such as masons, painters, carpenters, electricians and welders.

Operation and Maintenance Phase

The VRA will constitute an Operation and Maintenance (O&M) team to take over the operations of the solar plant at Loagri. The team to operate the solar power plant will consist of between 25 and 35 members as the operating and maintenance crew. All the operators will be supervised by one Operations Engineer. VRA normally outsources the cleaning of the panels to trained community members that would be made to form a group of between 10 and 15 members. Security would also be outsourced and may require about 5 people per shift so about a minimum 10 personnel per day.

3.4.5 List of inputs/raw materials required

List of inputs/raw materials required during Construction Phase

Stage of Development	**Raw Material/Inputs**
Site Clearance	Construction equipment/machinery
Civil Works	Steel bars for reinforcement
	Sand
	Gravels
	Water
	Cement
	Concrete additives
	Wood/steel plates for formwork
	Asphalt/pavement blocks
	Roofing materials such as wood trusses and Aluzinc roofing sheets

List of inputs/raw materials required during operational phase

Raw Materials / Chemicals	**Source**	**Type of packaging**	**Stage Utilized**
Water	Borehole	Storage Tank	1. Washing of panels. 2. Domestic use by workers

3.5 Power Evacuation and Grid Connection

The site is located to the West of the Tamale-Bolgatanga highway between the 330kV pylon number 289 and pylon number 294. The site shares a boarder with the Western boundary of the 330kV right of way. The 161kV line is near the South of the 330kV line and on the side of the Bolga – Tamale highway. A substation will be constructed at the site as part of the project to break into the 161kV line to connect the solar plant to the grid.

3.6 Project Schedule

VRA is responsible for the implementation of the project. Preparation of project specifications and final design documentations are on-going. A Contractor will be procured when all permitting requirements have been met.

The project implementation schedule is provided in **Table 3-3**. Land acquisition and permitting would take about a year and would be done partially in parallel with closing financing and procuring an EPC. Procurement may take about a year if ITC is used and construction will take about a year to complete. The project construction would start in the first quart (Q1) of 2026.

Table 3-3: Project Implementation Schedule

		Time Schedule in Months																					
Activities	**Duration/ months**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Survey	1																						
Land acquisition	2																						
Geotechnical investigations	2																						
Permit/license acquisition	6																						
EPC procurement and financial close	12																						
Water supply/ borehole construction	1																						
Construction preparation, plant and equipment purchase and delivery	6																						
Civil works/ construction of site buildings	4																						
PV plant construction and installation	6																						
Power evacuation infrastructure including substation and sub-transmission line construction and installation	6																						
Testing and commissioning	1																						
Performance test and taking over certificate	2																						

4.0 ALTERNATIVE CONSIDERATIONS

The alternatives considered for the proposed project included:

- Energy/Power Source Options;
- Site Selection Options;
- Solar Power Technology Options;
- PV Technology Options;
- Solar PV Module Technology Options;
- Inverter Configuration Options; and
- No Action Option.

4.1 Alternative Energy/Power Sources

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

Table 4-1: Alternative Energy/Power Sources

Options	Potential Environmental Implications	Potential Socioeconomic Implication	Conclusion /Preferred Option
ENERGY/POWER SOURCES			
Thermal	**Advantages** 1. Environmentally, natural gas thermal plant in this case has the lowest air emissions compared to petroleum or coal. It is considered a very clean and safe fossil fuel. 2. Natural gas can easily be preserved. It can be stored and transported through pipelines, small storage units, cylinders or tankers on land and sea. **Disadvantages** 1. It pollutes the atmosphere due to production of greenhouse gases though low. 2. Leaks of natural gas and oil spills are tremendously dangerous. Such leaks may cause explosions, fire or serious pollution. 3. Thermal plants add to the thermal burden of the earth.	**Advantages** 1. Less initial cost as compared to other generating plants. 2. It requires less space as compared to Hydro and solar power plants. 3. Thermal power plant construction and operation creates employment opportunities for both skilled and unskilled people particularly for those from the local communities. **Disadvantages** 1. The global price of natural gas could be very unstable. 2. Though the initial cost is less, the running cost for a thermal plant is comparatively high due to fuel, maintenance etc.	Thermal plant is not the preferred option at this moment and in this case because of cost/high capital outlay, pollution due to GHG emissions, and climate change issues. Moreover, it will not assist the Ghanaian government in addressing climate change, in reaching the targets for renewable energy, nor will it assist in supplying the increasing electricity demand within the country in the short to medium term.

Options	Potential Environmental Implications	Potential Socioeconomic Implication	Conclusion /Preferred Option
Solar Power	**Advantages** 1. PV panels provide clean– green energy. During electricity generation with PV panels, there are no harmful greenhouse gas emissions thus solar PV is environmentally friendly. 2. Solar power is a renewable source of energy. 3. Produces no health-damaging air pollution or acid rain. 4. The power plants, once in place, do not create any waste by-products in their conversion. **Disadvantages** 1. Electricity generation depends entirely on a countries exposure to sunlight; this could be limited by the availability of regular sunshine. 2. Large areas of land are required to capture the suns energy. Collectors are usually arranged together especially when electricity is to be produced and used in the same location.	**Advantages** 1. Solar jobs come in many forms, from manufacturing, installation, monitoring and maintaining solar panels, to research and design, development, cultural integration, and policy jobs. 2. Solar energy has the ability to avoid the politics and price volatility that is increasingly characterizing fossil fuel markets. 3. Solar energy is energy supplied by nature – it is thus free and abundant. 4. Solar energy can be used in remote areas where it is too expensive to extend the electricity power grid. **Disadvantages** 1. Solar panels are bulky, less efficient and expensive. 2. Solar electricity storage technology has not reached its potential yet as solar energy supply is constant. 3. The cost involved in installing solar panels and storing of energy generated is very high.	It is the preferred option in the project area in the short to medium term because (i) solar resource is readily available, (ii) land to accommodate the solar panels is readily available, (iii) is of relatively lower capital cost as compared to thermal power plants, (iv) is environmentally friendly as it does not emit GHG, (v) it will help in reaching the set targets for renewable energy.
Wind Power	**Advantages** 1. Wind energy is friendly to the surrounding environment, as no fossil fuels are burnt to generate electricity from wind energy. 2. Wind turbines can also share space with other interests such as the farming of crops or cattle. 3. Wind power is a renewable energy source. 4. Produces no health-damaging air pollution or acid rain. 5. The power plants, once in place, do not create any waste by-products in their conversion. **Disadvantages** 1. Wind turbines generally produce a lot less electricity than the average fossil	**Advantages** 1. Wind turbines are a great resource to generate energy in remote locations, such as mountain communities and remote countryside. 2. Wind energy has the ability to avoid politics and price volatility that is increasingly characterizing fossil fuel markets 3. Wind power construction and operation creates jobs and provides income for both skilled and unskilled people, particularly, those from the local communities. 4. Wind energy is energy supplied by nature – It is thus free and abundant	Although, it is not the preferred option in the project area in this case, it is however under consideration as an option for the country to help in reaching the set targets for renewable energy.

Options	Potential Environmental Implications	Potential Socioeconomic Implication	Conclusion /Preferred Option
	fuelled power station, requiring multiple wind turbines to be built in order to make an impact. This may disrupt land cover 2. Wind turbine construction can be very costly to surrounding wildlife during the building process.	**Disadvantages** 1. The wind velocities in the area can be sporadic and doesn't blow well at all locations. Research and maps are needed to identify the optimal locations, these may be costly. 2. Transmission of electricity from remote wind farms can be a major hurdle for utilities since many wind turbines are not located around urban centers. 3. The storage of excess energy from wind turbines in the form of batteries, hydrogen or other forms still needs research and development to become commercially viable	
Nuclear Power	**Advantages** 1. Production of electric energy is continuous. 2. The plant itself does not give off greenhouse gasses **Disadvantages** 1. Special precautions must be taken during the mining, transporting and storing of the uranium, as well as the storing of any waste product to prevent it from giving off harmful levels of radiation. 2. Accidental release of harmful radiation is one of the biggest drawbacks of nuclear energy. 3. There is generation of nuclear waste and managing it is difficult as it takes many years to lose its radioactivity and danger.	**Advantages** 1. With little fuel, large amounts of energy are obtained. 2. Nuclear power plant construction and operation creates employment opportunities and income for both skilled and unskilled people particularly for those from the local communities. **Disadvantages** 1. Plant construction is highly politicized. 2. Nuclear Power Plant Accidents can cause health problems and radiation. 3. It requires large capital cost and the repay of the construction of the nuclear plant is significantly more expensive.	Development of power from nuclear and hydropower sources are highly capital intensive and long term in nature. Nuclear power is not the preferred option in this case because of high capital cost outlay, and requires adequate health and safety preparations towards its realization, which the country may not yet be ready. Hydro power is not the preferred option in the project area at the moment because it is long term, and moreover, the creation of a dam on the White Volta at Pwalugu is already ongoing and not yet completed.
Hydro power	**Advantages** 1. When in use, electricity produced by dam systems do not produce greenhouse gases. They do not pollute the atmosphere. 2. The power plants, once in place, do not create any waste by-products in their conversion.	**Advantages** 1. The lake's water can be used for irrigation purposes. 2. The lake that forms behind the dam can be used for water sports and leisure/pleasure activities.	

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

4.2 Solar Power Technology Options Considered

Currently, the two types of solar power generation technologies are offered by the solar industry and these technologies were considered under this project, and they are

(i) Concentrated Solar Power (CSP) Plant; and

(ii) Solar Photovoltaic Plant.

(i) Concentrated Solar Power (CSP) Plant

Concentrated Solar Power (CSP) produce electric power by converting the sun's energy into high-temperature heat using various mirror configurations. The way this particular technology works is that the sun's energy is concentrated by various reflectors onto a small area known as a receiver. The receiver would have a working fluid, molten salt, water, or air which is heated by the concentrated sun's rays and then used to drive a heat engine, usually a steam engine, and drive an electric generator.

The plants that utilize this system consists of two parts: one that collects solar energy and converts it to heat, and the other that converts the heat energy to electricity. CSP is an indirect method that generates alternating current (AC), which is easy to distribute on the power network.

(ii) Solar Photovoltaic (PV) Plant

Though both CSP and PV use sunlight, the PV converts the sunlight directly into electricity, whereas CSP converts sunlight first to heat before using the heat for electricity. In other words, photovoltaics is the direct conversion of sunlight into electricity. The way this works is that the solar PV cells absorb light, which will then knock electrons loose. Then once the loose electrons flow, a current is created, and this current is then captured and transferred into wires, thus generating a direct electric current (DC). After the direct electric current is generated, it is then converted into AC, usually using inverters, so that it will be distributed on the power network.

The comparisons of the two solar power technologies are summarized in the table below.

Table 4-2: Advantages and Disadvantages of Concentrated Solar Power and Solar Photovoltaic Technologies

Advantages	**Disadvantages**
Concentrated Solar Power (CSP) Plant	
Clean and renewable energy source	More expensive than solar PV and wind power
Can double as a short-term energy storage system. Can store sun's heat which can be used later. This storage technology is a major selling point for CSPs.	Only feasible at the utility scale. This is in marked contrast to solar photovoltaics - which are easy to apply as well as cost effective even at the level of individual homes.
CSP can compensate for the intermittency of other renewables through time-shifting. CSP can serve as a dispatchable energy source - providing power when it is most needed, such as during evening peaks - or even as a baseload power which offers stable power continuously. This is an	Concerns over environmental impacts. CSP projects require (i) large amounts of water for cooling, which can be problematic. (ii) Land requirements are also substantial, and the land used for CSP can't be used for any other purposes. (iii) has high visual profile. (iv) The impact on local wildlife

Advantages	Disadvantages
Concentrated Solar Power (CSP) Plant	
extremely valuable attribute given the intermittency of solar PV (solar panels) and wind energy, which are reliant on the sun shining and wind blowing to produce their energy.	must also be considered, particularly birds which can be burned as they pass through the highly concentrated light.
Can generate heat for industrial applications. An emerging field is the utilization of CSP energy in heat-intensive industrial processes.	One main disadvantage of CSP is that it uses mainly the direct component of sunlight because of the mirrors and lenses. That means a CSP system typically requires region with a lot of Direct Normal Irradiance (DNI) and not just Global Horizontal Irradiance (GHI).
Clean and renewable energy source	PV requires ample electricity to perform at a higher output. Unfortunately, most power sources cannot handle conducting high levels of electricity.
Less expensive than CSP. Since PV is a lot cheaper than CSP, more and more energy investors choose it, and there are more PV suppliers than CSP suppliers.	Storing electricity in a PV system is not feasible. CSP's energy storage is superior to that of PV.
Aside from the cost, PV systems are a lot easier to build. Building them doesn't cost much, and it also doesn't take too much time.	
Although PV panels do not store thermal energy or need thermal energy to thrive, they generate high bouts of electricity directly through sunlight.	Environmental impacts as a result of large surface area required results in the removal of vegetation
More environmentally friendly than CSP. Requires less water for power generation, less land required as compared to CSP and has lower visual profile.	

Preferred Solar Power Technology

From the analysis, Solar Photovoltaic Plant is the most environmentally sensitive technology for the preferred site than CSP, as large volumes of water are not needed for power generation purposes compared to the CSP option. CSP requires large volumes of water for cooling purposes. PV is also preferred when compared to CSP technology because of the lower visual profile, lower cost and easier to build.

4.3 PV Technology Options Considered

The two main types of PV technologies were evaluated, and these were

(i) the Fixed mounted PV plant; and

(ii) Tracking PV plant.

Solar tracking systems are designed to rotate and tilt the solar panel to follow the sun's movement across the sky throughout the day, ensuring that the solar panel is always receiving maximum sunlight, while a fixed-panel system uses a single angle which remains constant.

Advantages and Disadvantages

Solar trackers are more efficient than fixed panels since they can capture more sunlight during peak hours when the sun is higher in the sky. Moreover, this increased efficiency makes them ideal for locations with long or harsh weather, typical example is winter conditions where solar radiation may be limited, so they can still capture as much energy as possible, but such harsh weather conditions are not applicable to the proposed project area. It must be noted that, the increased efficiency of solar trackers comes with certain drawbacks – namely cost and complexity. Since solar trackers need additional components such as motors, controllers and sensors to operate correctly, they tend to be significantly more expensive than fixed panels which only require a few basic components.

The advantages which are gained from the fixed mounted systems are indicated below:

- The maintenance and installation costs of a fixed mounted PV system are lower than that of a 'tracking' system which is mechanically more complex given that these PV mountings include moving parts.
- Fixed mounted PV systems are an established technology with a proven track record in terms of reliable functioning. In addition, replacement parts are able to be sourced more economically and with greater ease than with alternative systems.
- Fixed mounted systems are robustly designed and able to withstand greater exposure to winds than tracking systems.
- Tracking PV systems require regular calibration and maintenance in order to ensure their optimal performance throughout all seasons.

Preferred PV Technology

The preferred technology was selected based primarily on the operating environment and technology advantages. The proposed solar PV power facility will install fixed mounted PV system instead of a Tracking PV system.

4.4 Solar PV Module Technology Options Considered

Photovoltaic modules, commonly known as solar panels, are a web that captures solar power to transform it into sustainable energy. A solar PV module is a collection of photovoltaic (PV) cells that use the photoelectric effect to generate electricity when they are exposed to sunlight. Modules are categorized primarily based on the materials used in the construction of the photovoltaic cells.

The design of a PV plant involves a series of compromises aimed at achieving the lowest possible cost of electricity. Selecting a module requires assessment of a complex range of variables including cost, power output, benefits / drawbacks of technology type, quality, spectral response, performance in low light, nominal power tolerance levels, degradation rate and warranty terms.

Three main types of solar PV module technologies were assessed for this project, and these include: (i) Mono crystalline; (ii) Poly crystalline; and (iii) Thin film.

Table 4-3 provides a summary of the advantages and disadvantages of the three main types of solar PV module technologies considered.

Table 4-3: A comparison of PV module technologies

PV Module Technology	Advantages	Disadvantages
Mono crystalline	● High efficiency ● High availability on the market ● At price parity with poly crystalline	● High cost per kWp installed ● Poor temperature coefficient
Poly crystalline	● Cheaper than mono crystalline modules ● High availability on the market ● Take better advantage of sunlight throughout the entire day.	● Medium efficiency as compared to the mono crystalline modules ● Poor temperature coefficient

PV Module Technology	Advantages	Disadvantages
Thin film	● Good temperature coefficient ● Takes advantage of diffuse Irradiation ● Less expensive as compared to the crystalline modules	● Must be used with an inverter with a transformer ● Less availability on the market as compared to the crystalline modules ● Low efficiency as compared to the crystalline modules

Preferred PV Module Technology

Both mono and poly crystalline modules would all be suitable, however, the choice may be more down to economics and efficiency. With mono prices now almost the same as poly, having the slightly more efficient mono makes more sense economically. Monocrystalline panels have been selected as the preferred option.

4.5 Inverter Configuration Options Considered

Inverters are devices that convert the DC power from the photovoltaic modules into AC power that can be fed, at the LV level or MV level (by using step up transformers), into the grid to be utilized by customers.

The following are the three main inverter configurations that are used in utility-scale solar PV plants and they were assessed for the proposed solar power project:

- Central inverters
- String inverters
- Modular inverters

4.5.1 Central Inverter Configuration

In the central inverter concept, several modules are connected in series to form a string and numerous strings are connected in parallel, through the use of a DC combiner box, to form a PV array. Several of these PV arrays are connected to inputs of a central inverter. Central inverters usually do not have multiple power point tracking function. These central inverters usually have integrated fans that improve air ventilation and avoid overheating in hot areas. They can also be

purchased together with medium voltage transformers which are factory-built and pre-wired to meet site specific requirements.

Advantages and Disadvantages

Central inverters offer high reliability, efficiency and simplicity in installation. They however, have disadvantages of increased mismatch losses and absence of Maximum Power Point Tracking (MPPT) for each string. As a result, their deployment in areas that have multiple tilt and orientation angles (due to land topology), shading from nearby objects and usage of modules with different specifications can be a challenge.

Another challenge with central inverters is the inability to get monitoring information on the individual strings. These inverters can only provide information on the arrays that are connected to their inputs. To provide monitoring on a string level, equipment has to be installed in the DC combiner boxes to provide monitoring information and this increases the cost of the project.

Central inverters are also usually more expensive to maintain because they usually require servicing by specialist personnel. In the case of an inverter failure, a long lead time to repair can lead to a significant loss of energy before the inverter can finally be repaired or replaced. Spare inverters can be purchased but the additional cost of central inverters would increase the project cost.

4.5.2 String Inverter Configuration

In the string inverter concept, several modules are connected in series to form a string and this string is connected to an input of an inverter.

Advantages and Disadvantages

String inverters have efficiencies that are comparable to central inverters. String inverters have the advantage of providing MPPT on a string level. As such, string inverters can be deployed on sites that have multiple tilt angles and orientations due to the topology of the land or where nearby objects could shade the panels or even provide the flexibility of using panels of different specifications.

String inverters provide monitoring of energy production at a string level and this greatly decreases time spent troubleshooting losses due to shading or damaged modules. The monitoring feature is a functionality built into these inverters and so reduces the cost of providing equipment for monitoring of energy production. In addition, string inverters are comparably small in size and can easily be replaced by nonspecialist personnel in case of a fault. This leads to short lead time for replacement and hence leads to low energy loss. The cost of spare inverters does not significantly increase the cost of the project.

4.5.3 Modular Inverters

These inverters combine the robustness of central inverters and the flexibility offered by string inverters. These inverters are made up of several modules with several MPPT inputs. The inverter modules work independently with each having its own power board, control board and other essential components. They are usually built like central inverters with factory-integrated transformers, DC disconnects and other protection.

Advantages and Disadvantages

The availability of several MPPT inputs means that they can be deployed on sites where systems with different tilt angles and orientations have to be installed due to the topology of the land or where different specifications of panels have to be used or where shading by objects could be an issue.

Due to the modular nature of these inverters, faulty inverter modules could be taken out and this results in a de-rated production from that modular inverter. The energy lost is equal to what would have been produced by the faulty inverter module. These modular inverters are very robust and offer a lot of design flexibility and reliability. They are currently produced by just a few manufacturers. This thus increases the risk of the unavailability of replacement modules or trained professionals to work on faulty inverter modules.

Preferred Inverter Configuration

Considering the advantages and disadvantages of all the inverter configuration options, string inverter configuration has been selected as the preferred option.

4.6 No Action Option

The 'No Action Option' is the option of not implementing the project or do-nothing option. If the solar power plant is not developed, the site would remain in its current state. There will be no need for land acquisition and development, and the agricultural potential of the site would not be lost. However, under the "***No Action Option***", it does not guarantee that the existing environmental quality will continue to be maintained.

However, without the development, the project benefits summarised below will be lost:

- No increase in electricity generation,
- No CO2 savings associated with the power generations from the proposed development,
- No economic benefit to the landowners associated with the potential income generated through the operation of the facility,
- No employment generated, and
- No contribution to meeting Ghana's targets for renewable energy generation.

At the same time, the large society of people in the local area, e.g. West Mamprusi Municipal and North East Region in general would not derive the associated socio-economic, and political benefits but rather they are going to lose in terms of development, employment, good health and improved quality of life. The country at large will also lose out on the numerous benefits to be derived therefrom, such as increased business investment in the project area, thus promoting socioeconomic activities as a result of reliable power supply among others. The *"No Action Option or Alternative"* does therefore not represent an option that meets the best interests of the national development agenda and is proposed that the project proceeds.

5.0 BRIEF DESCRIPTION OF THE EXISTING ENVIRONMENT

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

The key literature reviewed include the:

- Feasibility Study Report for the Loagri Solar Project;
- 2022-2025 Medium-Term Development Plan (MTDP) of the West Mamprusi Municipal Assembly;
- West Mamprusi Municipal Assembly Composite Budget for 2023-2026 Programme Based Budget Estimates for 2023.
- The Ghana Statistical Service 2010 Population and Housing Census District Analytical Report for West Mamprusi.

The chapter is subdivided into three major sections as follows:

☒ Physical Environment

☒ Biological Environment

☒ Social Environment

5.1 Physical Environment

5.1.1 Climate

The Municipality is situated in the Tropical Continental Climatic Zone with mean-annual temperature ranging between 28 and 31 degrees Celsius. It experiences a single maximum rainy season, which starts in late April with little rainfall characterized by severe winds and storms. The second and third quarters of the year generally record the heaviest rainfall rising to its peak in July-August and also the greatest number of rainy days declining sharply to a complete halt in October-November. Annual rainfall ranges between 950mm -1,200mm.

The dry season is characterized by Hamattan winds. These winds, which blow across the Sahara Desert, are warm and dry causing significantly daily temperatures and causing the soil to lose moisture rapidly. Maximum day temperatures are recorded between March-April of about 45°C while minimum night temperatures of about 12°C have been recorded in December-January. The area experiences occasional storms, which have implications for base soil erosion depending on its frequency and intensity especially when they occur at the end of the dry season. The humidity level between April and October is generally high in the night and falls low during the day.

5.1.2 Solar Resource in the Project Area

The energy yield of a Solar Power plant is greatly influenced by the amount of solar irradiation available in the location of interest. A solar irradiation level of about 1600kWh/m2/year or greater is usually preferred and it can be noted from the Ghana irradiation map below (**Figure 5-1**) that Loagri has about 2100kWh/m2. This value of irradiation is above the preferred minimum of 1600kWh/m2/year and thus makes Loagri a very suitable site.

5.1.3 Topography/Relief

The Municipal has a generally undulating topography characterized by gentle slopes from north-east to south-west, with some isolated visible outcrops and uplands of not more than 10% slope. Isolated hills, which break the monotony of the landscape, can be found around Karimenga, Shelinvoya and the outskirts of Wulugu. The project site is generally flat, with no visible outcrops or isolated hills. The elevation of the project site is about 450 feet/137.2m above mean sea level.

5.1.4 Drainage

The municipal is drained by the White Volta and its tributaries the Sissili and the Kulpawn rivers. The White Volta passes through the Municipality at Nasia, Misio and Shelinvoya. Flooding by the White Volta is an annual problem caused mainly by the numerous small rivers, which flow into it especially below Pwalugu. Occasional flash floods have also been caused by spilling of waters from streams further up-stream in Burkina Faso.

The prevailing rainfall and the nature of the underlying rock formations determines to a large extent the ground and surface water potential for the district. The present combination of heavy run-off, high evaporation and transpiration and low infiltration rates to recharge aquifers in some areas in the district, contribute to water deficiencies especially to the west of the White Volta, the south around Fio area and eastern parts around Shelinvoya.

Project Site: The nearest stream or surface water body is a seasonal stream, called Naani Stream, which is located more than 500m west of the project site. The stream is used for drinking, washing, irrigation, and animal watering. Culturally, the stream serves as a shrine/god or for ritual or rites performance.

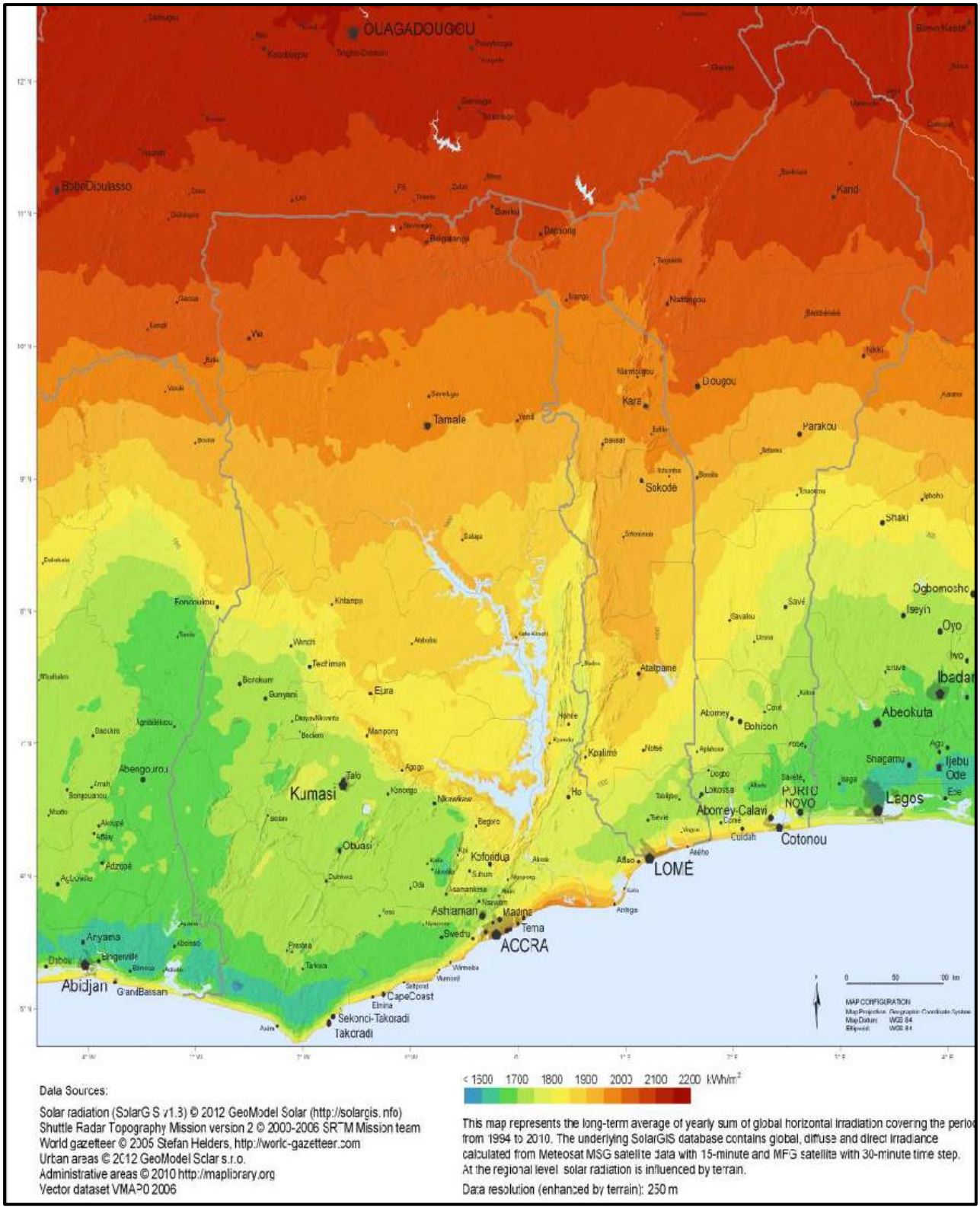


Figure 5-1: Solar Irradiation Map of Ghana

(Source: VRA Feasibility Study Report for Loagri Solar Power Project, March 2023)

5.1.5 Geology and Hydrogeology

Geology

The Geological formation in the West Mamprusi Municipal is underlain mainly by the Middle Lower Voltaian, which comprises of sandstone, arkose, mudstone and shale. The western part of the municipal is underlain by the lower Voltaian formation consisting of sandstones and grit. The northern tip is underlain by the Birimian rock formations. Birimian rocks are metamorphosed lavas, which ply Units, schists, tufts and greywacke. Regarding the middle Voltaian, the depth and degree of weathering depends on the litho logy.

Hydrogeology

In West Mamprusi, most of the successful boreholes are not deeper than 60m. This would indicate that the favourable fractured zones are within the first 60m of drilling. If no water is encountered when the first 40 to 60m is excavated then the chances of finding water inflows in deeper layer are not great. The water level in this district is usually very low. The geological formation is very important in determining the amount of underground water. Success rate of boreholes in the district is about 50%. The yield is low but sufficient for hand-pump installation. Hand-dug wells have been found to be the most preferred option. The average depth of hand-dug wells is 15 metres. There is a 90% success rate for hand-dug wells in the district.

5.1.6 Soil

The predominant soil types in the Municipality are sandy, loam, sandy-loams, and clayey soils. Naturally this provides the municipality an opportunity for the cultivation of a diversity of crop types be it upland crops such as maize, groundnuts or valley crops such as rice.

Soils of alluvial origin (savannah glycols) can be found in the major river valleys and drainage courses; these are predominantly in the west of the district along the basins of the White Volta and its tributaries. These soils are deep, fine textured and are well suited for the cultivation of a wide range of crops. The depth of these soils also allows for the use of bullocks and other forms of mechanised farming. Soils in this category remain under-utilized due to drainage and flood control problems.

On the flat to gentle upland slopes of the eastern parts of the district are found the moderately well drained upland soils developed mainly from Voltaian sandstones. These soils are characterized by

deep loamy soils of sand with good water retention capabilities described as moderately well drained. These soils are well suited for a wide range of crops; although good farming practices especially soil conservation is imperative. These soils are prone to sheet and gully erosion especially under cultivation. If organic materials are not applied regularly to these soils, heavy nutrient leaching will occur.

5.1.7 Seismicity and Earthquake Hazard

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

The Global Seismic Hazard Assessment Map of Ghana, as provided in **Figure 5-2** shows the project area including the northern sector of the country to be located within a low seismic hazard zone, with expected peak ground accelerations for events of less than 0.01g.

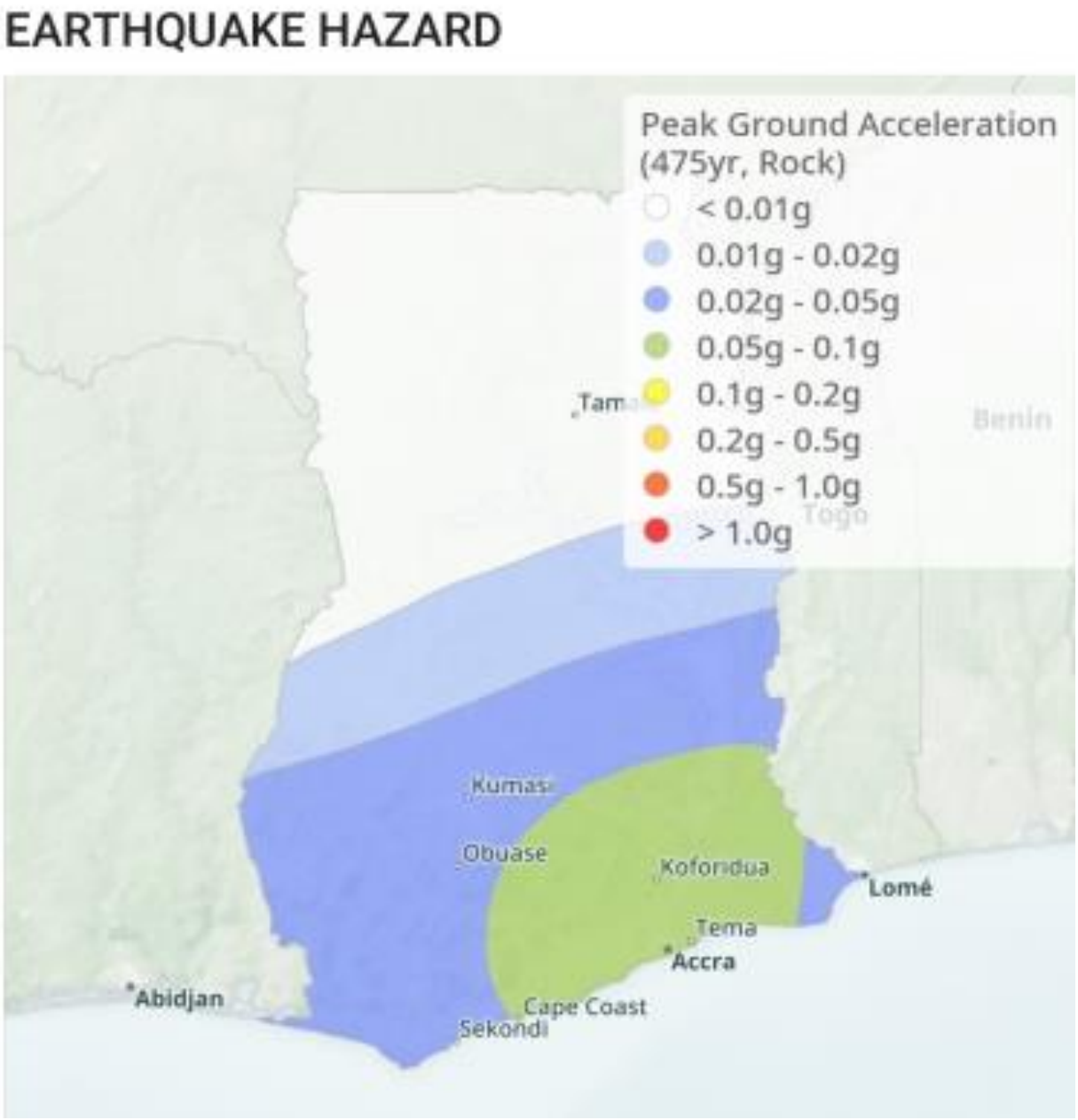


Figure 5-2: Earthquake Hazard Map of Ghana

(Source: risk-profiles/Africa/Ghana/seismic_risk_profile_Ghana.png at v2023.0.0 ·gem/risk-profiles GitHub)

5.1.8 Ambient Air Quality and Noise Nuisance

The project area depicts typical rural environment with no major industrial or major construction activities. The dust-laden harmattan winds and smoke from bushfires are major sources of air pollution during the dry season. Communities along the untarred roads also suffer from dust pollution from the roads either by vehicular movement or by wind action during the dry season.

Noise was not a major nuisance during the field visit. Sources of noise were generally from human voices or birds, insects and vehicular movement.

5.2 Biological Environment

5.2.1 Vegetation and Wildlife

The Municipality lies within the Guinea Savannah woodland vegetation with light undergrowth and scattered trees. Trees such as Shea, Dawadawa, Mango and Baobab abound in the Municipality. These trees are of economic importance as most people depend on them for their livelihood. However, notwithstanding the importance of these trees, indiscriminate felling of trees especially for firewood, charcoal and other related activities have put excessive pressure on the trees, making them stand the risk of extinction. This implies that, there should be a mass campaign to encourage the populace to embark on tree planting rather than indiscriminate felling of the tree species.

The Municipality can boast of some wildlife reserves though human activities have led to the depletion of wild life. There are Hippo traces in the Zanwara area, crocodiles in Walewale and other communities, antelopes and several families of monkeys across the Municipality. West Mamprusi has part of it falling within the Mole Game reserves. As such large land has been protected by the game reserve for the purposes of ensuring good management and sustainability of the wildlife population.

Project site

The project site is of grassland with few shrubs and economic trees and during the rainy season, farmers grow mainly groundnut, soyabean and maize on the land as shown in **Plate 5-1.**

Plate 5-1: Photo of Loagri Site showing vegetation in the dry season

Plate 5-2: Photo of Loagri Site showing vegetation in the rainy season

a. Maize farm b. groundnut farm

Plate 5-3: Some food crops grown on the project land by farmers

5.3 Social Environment

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

5.3.1 Location and Size

West Mamprusi was created in 1988 under Legislative Instrument (LI) 1448 as a District Assembly. In 2012 it was replaced with LI 2061 following the creation of the Mamprugu Moagduri District. It was upgraded to West Mamprusi Municipal under Legislative Instrument (LI) 2276 in 2018. West Mamprusi Municipal Assembly is one of the six (6) administrative MMDAs in the newly created North East Region of Ghana with Walewale as its administrative capital. The administrative capital can be located along the Tamale-Bolgatanga Road, 109 Kilometers (68mi) away from Tamale.

The municipality is located in the western part of North East Region and is located within longitudes 0°35'W and 1°45'W and Latitude 9°55'N and 10°35'N. It has a total land size of 2,596km^2. It shares boundaries with East Mamprusi Municipal and Gushegu Municipal to the east; North Gonja District, Savelugu Municipal and Kumbungu District to the south; Builsa North District, Kassena-Nankana Municipal and Bolgatanga Municipal (Upper East Region) to the north and to the west, Mamprusi Moagduri District. **Figure 5-3** is a map of the Municipality in the regional context, and **Figure 5-4** is the political/administrative map of the Municipality.

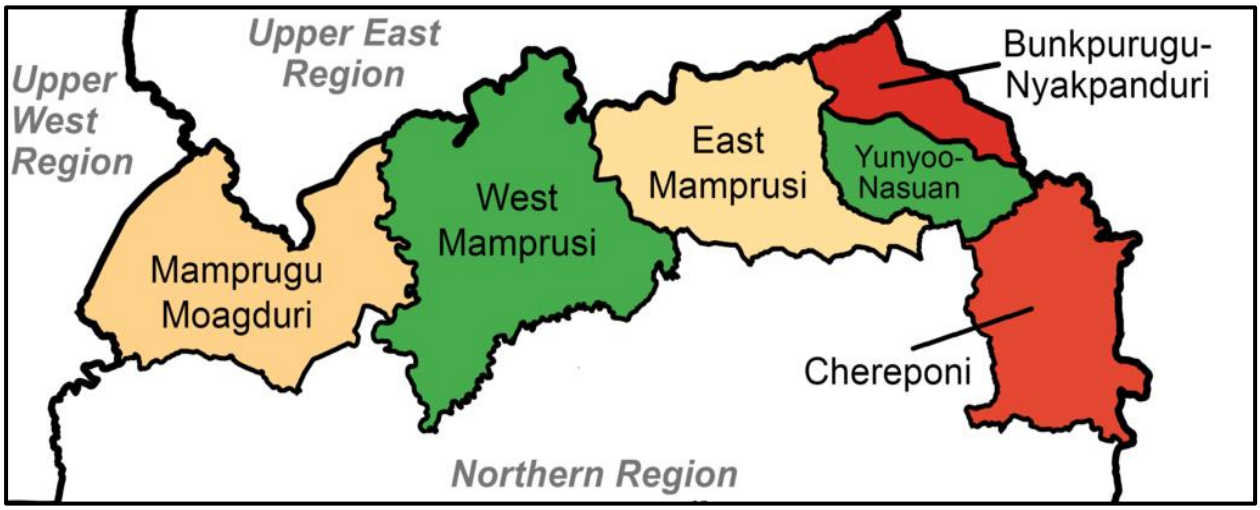
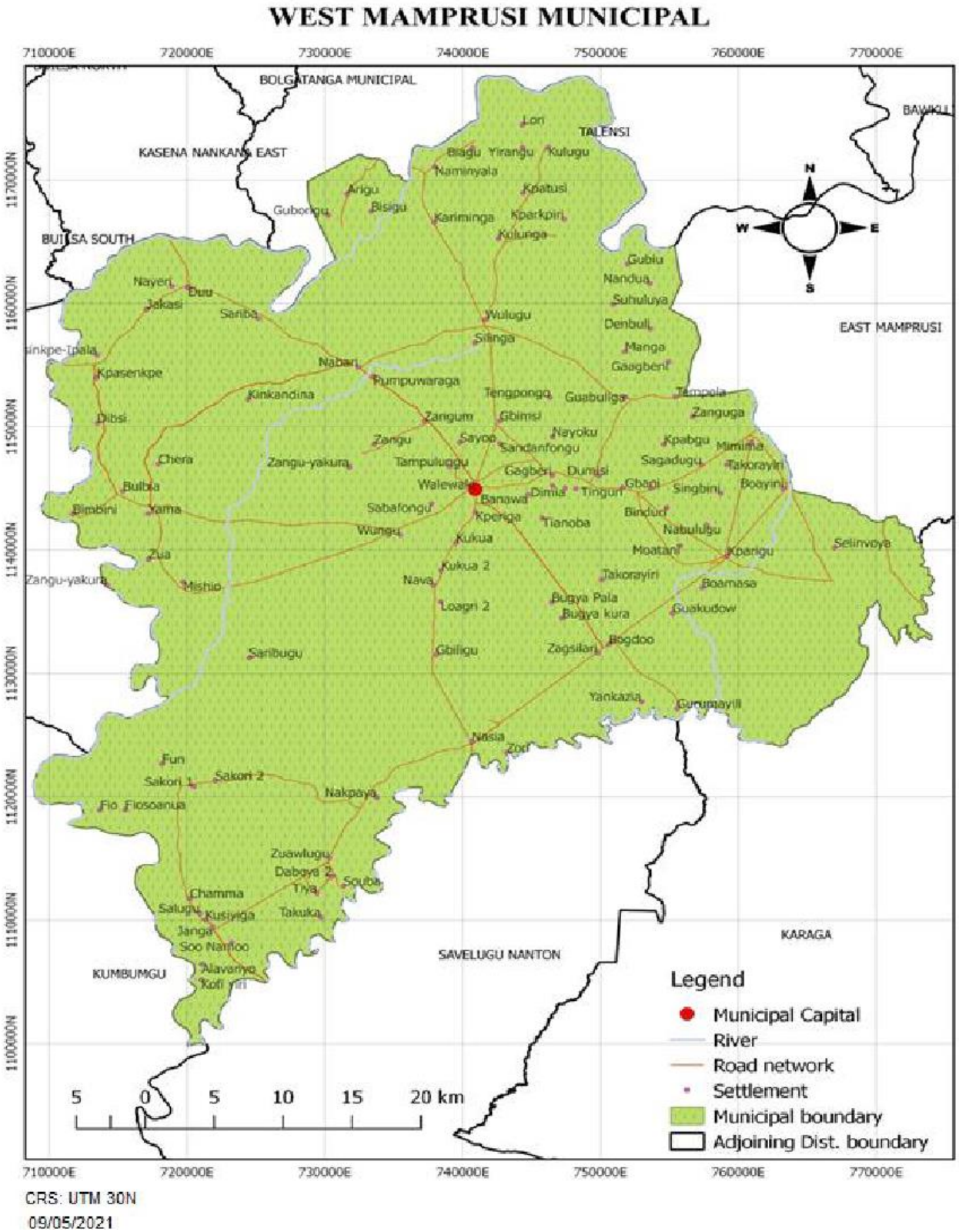


Figure 5-3: Location map of West Mamprusi Municipality in the Regional Context

(Source: Districts of the North East Region (2018) - West Mamprusi Municipal Assembly - Wikipedia)



(Source: WMMA-MTDP 2022-2025)

Figure 5-4: Map of West Mamprusi Municipality

5.3.2 Population Structure

The population of West Mamprusi Municipal, according to the 2021 Population and Housing Census is 175,755 with 90,043 females (51.2 percent) and 85,712 males (48.8 percent). More than five in every ten (52.2%) of the population lives in rural areas, while the remaining 47.8 percent lives in urban areas. With a land size of 2,596km2, the Municipality has a population density of 67.7. The population of the Municipality is youthful with about 46.2 percent below 15 years depicting a broad-based population pyramid with only 6.5 percent elderly persons of at least 60 years. The total age dependency ratio for the Municipality is 102.6. The current household population of the Municipality is 173,515 with a total of 30,450 households while average household size is 5.7.

5.3.3 Culture

The Mamprusi make up around 75% of the district's overall population and are the majority of those who live there. This dominant ethnic group coexists harmoniously with minor groups such as the Builsa (4.7%), Frafra (2.7%), Kasena (2.2%), the Dagomba (1.8%), and some other ethnic groups in Ghana such as the ewes (GSS, 2010 PHC). The ewes are mainly settler fishermen who have settled along the major rivers especially the White Volta – to engage in fishing. The Fulanis are also settled in the area and are herdsmen for the indigenous people.

The "Bugun" (fire festival) and "Damba" festivals are the two most significant traditional festivals observed in the district. The dominant religious groups are Islam (79.4%), Christianity (15.6%) and the Traditionalists (3.7%), (GSS, 2010 PHC). Being a predominant Moslem area, the people also celibrate the two festivals of Eid-ul Fitir and Eid-ul Adha.

A typical social hierarchy in a Mamprusi community is consists of the CHIEF, the WUDANA who is the linguist in the village and leader of the elders; the KPANDANA (the elders of the community and advisors to the chief), the TINDANA (in charge of the Gods in the community/ Fetish), the KANBONABA (the Chief Warrior), the NACHINAA (the Youth Leader), the MAGAZIA (the Women’s Leader), the FONGU KPAMMA the Sectional Heads. The female heads respond directly to BIISI (the Magazia) whiles the male respond to the Nachinaa.

There are four main paramouncies in the Municipality all answerable to the King of Mamprugu – the Nayiri. These include the Wulugu Traditional Area (headquarters at Kpasenkpe), Soo

Traditional Area (headquarters at Janga), Wungu Traditional Area (headquarters at Wungu) and Kurugu Traditional Area (headquarters at Kurugu). There are also a number of divisional chief under these major chiefs.

5.3.4 Gender Issues

In the Municipality, it can be realised that both males and females are engaged in economic activities. Gender issues in the Municipal over a period include equal opportunities to both male and female in development activities. The Implementation of Community Led Total Sanitation in the Municipality use both male and female to contribute to the attainment of Open Defecation Free communities. Main Economic activities in the area are concentrated in shea and groundnut processing. These industries are predominantly female. Their male counterparts tend to be in bicycle repair and blacksmithing. There is a rising manufacturing of farm implements in the area by the male counterparts.

5.3.5 Security

There have been reported cases of armed robbery attacks in the Municipality especially at Wulugu after Walewale, along the Walewale-Bolgatanga highway. The Municipal security professional intervention always rescues the high impact of robbery in the reported area. The occurrence of crime and attacks in the Municipal call for effective security management measures with adequate logistics in terms of police posts, patrol vehicle and personnel. Limited compliance to spatial land use guidelines causes land disputes especially in the Municipal capital, Walewale. A private unqualified land agent facilitates land allocation encroaching public spaces including school lands. Lack of spatial plan for the Municipal retards development as unplanned development continues in the Municipality.

5.3.6 Economic Activities

The major economic activities in the West Mamprusi Municipal area are basically primary activities and these include; Agriculture, trading in foodstuff such as maize, beans, rice and other grains, sand winning mostly for construction work, quarrying, fishing along the White Volta, Shea processing and petty trading such as provision stores. Small and Medium Enterprises operating in the Municipal to boost the local economy include hairdressing, canteen and restaurant services, tailoring and dressmaking, metal-based-blacksmithing, welding, Art-based such as pottery, basketry, weaving, painting & sign writing, drawing etc. are carried out but these enterprises lack managerial skills to enable them improve upon their businesses. They require capacity building

and financial facilities at moderate conditions to enable them exert the desired impact on the local economy.

Agriculture

The Municipality is largely an agrarian economy with about 85.5 percent of its household population involving in one form of agriculture or the other. Crop production is on a subsistence basis where small holder farmers produce for family upkeep and occasional sale. However, over the past few years, commercial farming has been intensified in the Municipality with large parcels of land being cleared for rice, maize and soya bean.

The major crops grown in the Municipal are maize, millet, rice, groundnuts, beans, sorghum, bambara beans, yam and watermelon. These crops are grown during the rainy season. Dry season farming is done along the banks of the White Volta during which crops such as tomatoes, onions, soybeans, pepper and tobacco are cultivated. Livestock such as cattle, goats, sheep, pigs and poultry are the most reared.

Estimated arable land size in the municipality is 125,456 ha with average area cropped per annum of 40,986ha. About 60% of arable land is suitable for rice production. Meanwhile, the estimated farmer population is only 40,800 (26,520M, 14,280F). This means that there is still vast land available for potential farmers in the Municipality. Investment in this sector therefore has good returns and potentials of transforming the local economy.

To address the challenge of post-harvest losses, a number of warehouses have been constructed in the Municipality. Under the government policy of 'One District One Ware house' initiative, a warehouse has been constructed at Walewale. MiDA has also constructed a 10,000mt capacity warehouse at Walewale. Other warehouses in the Municipality include the 100mt capacity warehouses constructed by SADAMVP at Nabari, Duu, Kpasenkpe and Kinkandina respectively.

Market Centres

The Municipality has a couple of local markets distributed across the communities. These include the Walewale Market, Bulbia Market, Janga Market, Kparigu Market, Duu Market, Kpasenkpe Market, Wulugu Market and Tinguri Market among others. However, only Walewale market has

some infrastructure including market stalls, sheds and water. The rest of the markets have very poor and deplorable market infrastructure.

5.3.7 Energy

The current electricity coverage in the Municipality is about 89%. Major communities such as Walewale, Gbimsi, Janga, Nasia, Wulugu, Sayoo, Tinguri are hooked to the national grid. However, there are still a number of communities that either under-served and requires extension or not connected at all. Given the important role energy plays in the development process on modern societies, a lot still needs to be done to get many communities powered to promote economic activities. The Assembly is working closely with the Ministry of Energy and NEDCO not only to connect more communities to the national grid but also to upgrade the services in the Municipality to make it economically productive. The Municipal has the potential for both large scale commercial solar energy generation due to the intensity of the sunshine and the availability of land.

Unfortunately, both households in Communities and Commercial bar/restaurant operators in the Municipal largely depend on firewood for domestic and commercial food production. This greatly depletes the vegetative cover as more trees are cut for both charcoal and fire wood.

5.3.8 Education

The Municipality is endowed with a number of educational facilities especially from Pre School to Junior High levels. It has a total of 85 pre-schools and 89 primary Schools, 57 Junior High Schools, 4 Senior High Schools and 1 Vocational/Technical school (Municipal Directorate of GES, 2023).

The Municipality is zoned into ten (10) educational circuits for administrative purposes namely: Walewale East, Walewale West, Walewale central, Wungu, Kpasenkpe East, Kpasenkpe West, Janga, Tinguri, Kparigu and Guabulga. The Municipality has a Teacher-Pupil Ratio of 35:1 and a retention rate of Eighty percent (80%).

5.3.9 Health

The Municipal health infrastructure is made up of Two Hospitals at Walewale and Janga, one Polyclinic at Kpasenkpe. Six Health centers at Wulugu, Wungu, Our Lady of Rocio-Walewale, St. Joseph the worker, Guabuliga and Walewale Health Centre. Sixteen functional CHPS

compounds at Gbeo, Nasia, Yama, Tinguri, Daboya, Duu, Nabari, Arigu, Guabuliga, Bugya, Mimima, Shelinvoya, Zangumvuga, Fungu, Kurugu and Gbimsi. There are two private clinics, one at Loagri and the other at Kparigu. The table below is the illustration on the health facilities in the municipality.

Table 5-1: List of Health Facilities

Hospital	Polyclinic	Health Center	Clinic (private clinics	CHPS Compound	Reproductive & Child Health (RCH)	TOTAL
2	1	6	2	16	1	**28**

(Source: September 2024 Scoping consultations and Composite Budget for 2024, West Mamprusi Municipal Assembly)

Top 10 Diseases

The Top Ten (10) Diseases in the Municipality are:

- Uncomplicated Malaria
- Upper Respiratory Tract Infections
- Diarrhea
- Anemia
- Typhoid Fever
- Ulcer
- Rheumatism/ other joint Pains/ Arthritis
- Skin Diseases
- Acute Urinary Tract Infections
- Intestinal Worms

5.3.10 HIV/AIDS Prevalence in the Project Area

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

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

The West Mamprusi Municipal is not within the top 10 districts/municipalities with high HIV infection in the country. With regard to the prevalence rate in the adult population, the West Mamprusi Municipal has 0.23% prevalence rate. The North East Region has 0.24% prevalence rate with estimated 774 living with the virus.

5.3.11 Road Network

The total road network of the Municipal is made up of primary, secondary and feeder roads. The Municipal is served by about a total of 476.3Km of roads made up of 116km of trunk roads and 360km of feeder roads.

The Ghana Highways Authority manages 116.3km of roads of which 19km is paved and the remaining 97.3km graveled. The total length of feeder roads in the Municipal is about 360km, made up of 211km of which needs re-gravelling whilst others need major construction to ensure all year-round use.

The Municipal has a road density of about 0.0950 /km2 and is relatively one of the lowest in the country. Road accessibility in the Municipal is very poor and this has had a ripple effect on the provision of other social and economic services.

The busiest route in the Municipal is the Tamale-Bolgatanga trunk road. The road that is asphalted passes through Walewale, the Municipal capital and other communities including Nasia, Gbimsi and Wulugu. The Nasia-Janga Road has been rehabilitated and the Wulugu-Kpasenkpe route reconstructed.

Feeder roads leading to major food-producing areas including Kparigu are in various stages of disrepair. The roads are in very bad condition and are virtually inaccessible during the rainy season. During this period, a number of settlements in the ‘Overseas” area is cut off from the rest of the Municipal including the Municipal capital due to the over flooding of the rivers in the area

west of the White Volta. This area is moderately accessible for more than half of the year through Bolgatanga (Bolgatanga Municipal, Navrongo (Kassena-Nankana Municipal) and Sandema and Fumbisi in the Builsa Municipal. The journey covers about 155km and this could be shortened considerably to about 45km through a direct link with Walewale.

The major means of transportation in the Municipal are the use of tricycles and motor bikes. Other means include the donkey with cart. The major problem facing the road sector in the Municipality is the difficulty in accessing the overseas communities in the Mamprugu Moaduri District. To resolve this challenge, there is the need to construct a bridge linking up the Municipal capital Walewale to the overseas area.

5.3.12 Information and Communication Technology

ICT plays a vital role in the socio-economic development of any environment, particularly in the ordering of daily activities. It is one of the several means of sharing information either by voice or data. There are two established Community Information Centers at Janga and Walewale that was constructed under the Ghana Investment Fund for Electronic Communication. These centers are however challenged with inadequate computers and accessories, poor network facilities and other relevant accessories.

Mobile phone has predominantly become a part of the daily communications gear. Owing a mobile phone has become a practical necessity and a symbol for social status. A total population of 73,016 constitutes the population 12 years and older in the Municipal. Out of this population, only 20.5 percent own a mobile phone. Of the male population, 27.5 percent own mobile phone while 14 percent of the female population owns the device, (WMMA 2018-2021 MTDP).

The use of the internet is an integral part of ICT. In modern economies, life is organized around the internet through communication to transacting businesses. The 2010 Population and Housing Census of the GSS indicate that a total population of 646 persons 12 years and older use the internet facility. It is evident that internet usage in the Municipal is less than one percent (0.9%) of the total population 12 years and older. Out of the male population, 1.3 percent use the internet facility while less than one percent (0.5%) of the total female population 12 years and older also use the internet. The pattern is in line with the ITU‟s report which also suggests that globally, 37% of all women are online, compared with 41% of all men.

5.3.13 Water and Sanitation

Water

With a Population of 175,755, as per the 2021 population and Housing Census, access to potable water is about 72.5%. The rest of the population still rely on unwholesome sources of water such as open wells, rivers, dams etc. for household consumption. It is refreshing to note that the Municipality benefited from the Government policy of one-village-one dam with the rehabilitation of six small earth dams at different locations. However, this intervention is not without challenges as some of the dams were either destroyed before the end of the season or dried up during the dry season. It is therefore recommended that the government re-look at the designs of the dams to improve on their water holding capacities and the provision of irrigation facilities to ensure maximum benefit from the policy. The Municipal has proposed a comprehensive strategy in its Water and Sanitation Plan (2022-2025) in its MTDP to address the challenges.

The prevailing rainfall and the nature of the underlying rock formations determines to a large extent the ground and surface water potential for the Municipal area. The present combination of heavy run-off, high evaporation and transpiration and low infiltration rates to recharge aquifers in some areas in the Municipal, contribute to water deficiencies especially to the west of the White Volta, the south around Fio area and eastern parts around Shelinvoya.

The Municipality is endowed with rivers especially at Nasia and Pwalugu. Others are at Gbimsi, Diani, Nayorku, Zangu-Vuga, Gbani, Wulugu, Wungu, Zangum and Nabari.

Sanitation

On the part of sanitation, though significant progress has been made in the area of liquid waste management, especially the construction of household latrines, the Municipality still has challenges in both solid and liquid waste management. In the area of solid waste management, indiscriminate dumping of refuse as disposal method of solid waste is commonly practiced in the Municipality. Only about 3.5% of houses access the public refuse containers in the Municipal whose refuse are properly stored.

The Municipal Assembly in collaboration with CRS and UNICEF have worked tirelessly over the last years and has improved on the open defecation free status using the concept of CLTS. Whiles continues efforts are being made to declare the rest of the communities, Seventy-two (72)

communities are ODF and three (3) ODF communities have attained sanitized level. Sanitation coverage for liquid waste is 72% while solid waste is 5%

5.3.14 Tourism

West Mamprusi is endowed with unique tourist sites like the local architecture especially a traditional mosque at Wulugu, and the mysterious light on Wungu road. The traditional mosque was built by an Islamic scholar in Wulugu during the 1980s. Although a mud wall built with simple local materials such as gravel and stone without cement, the mosque has withstood natural disasters such floods and storms and remain very strong as though it was built with modern materials such as concrete. The mysterious light on the Wungu road also dates back into history. From a distance, the light appears bright and broad but gets narrow and narrow as you move near it. Although inhabitants speculate how the light comes to be, no one seems to know as a matter of fact when and how the light came there.

There are other sites like the Kpabgu cave which is believed to be housing a lion and python. Moachira at Bimbinni where the White and Black Volta meet but run parallel no matter the disturbances for it to mix, The White Volta can serve as a good source for fishing and water transport. The Mysterious Golinga (Soglinga) springs at Duu that runs in the dry season. Kugyinni (a big stone sitting on a very small stone where a lion periodically rest under) about 2km off Walewale-Wungu Road.

The Hills in the Municipality can be used for sites of communication towers. All these are potential tourist sites which when explored and developed could bring economic gain to the West Mamprusi Municipal. The Municipal has important tourism related socio-cultural resources. These include:

- Traditional Bone Specialist at Loagri on the Tamale - Walewale High Way
- Annual cultural festivals, Damba (celebrated on the 11th – 17th of Damba of the Lunar calendar)
- Annual bugum festivals (celebrated on the 9th Day of Bugum. of the Lunar calendar)
- Largely unadulterated cultural heritage, particularly in the rural areas.

5.3.15 Land-use

Municipal

The municipal is predominantly rural with more than 70% of the population living in rural settlements with populations less than 2000. Towns with populations between 500 and 300 number about 136 settlements. Urbanisation is not a pressing problem in the district except possibly in Walewale, which is the dominant urban, centre-enjoying most of the facilities. The principal land uses reflect the almost total rural base of the district economy. About 80% of the people depend on agriculture for their livelihood. Large amounts of land are therefore put to the cultivation of major crops like maize, millet, guinea corn, and groundnuts. Important minor crops cultivated include legumes, cassava and yams.

Project Site and Adjacent land uses

There are no farming activities on the land during the dry season. During the rainy season, the site is largely cultivated by farmers and crops commonly grown include maize, soyabean and groundnut. Animal grazing at the site is also carried out during the rainy season. There is no settlement at the site. The nearest town is Loagri, about 500m from the project site. The adjacent land uses are mostly for farming and animal grazing.

5.4 Key Environmental/Social Challenges and Vulnerabilities

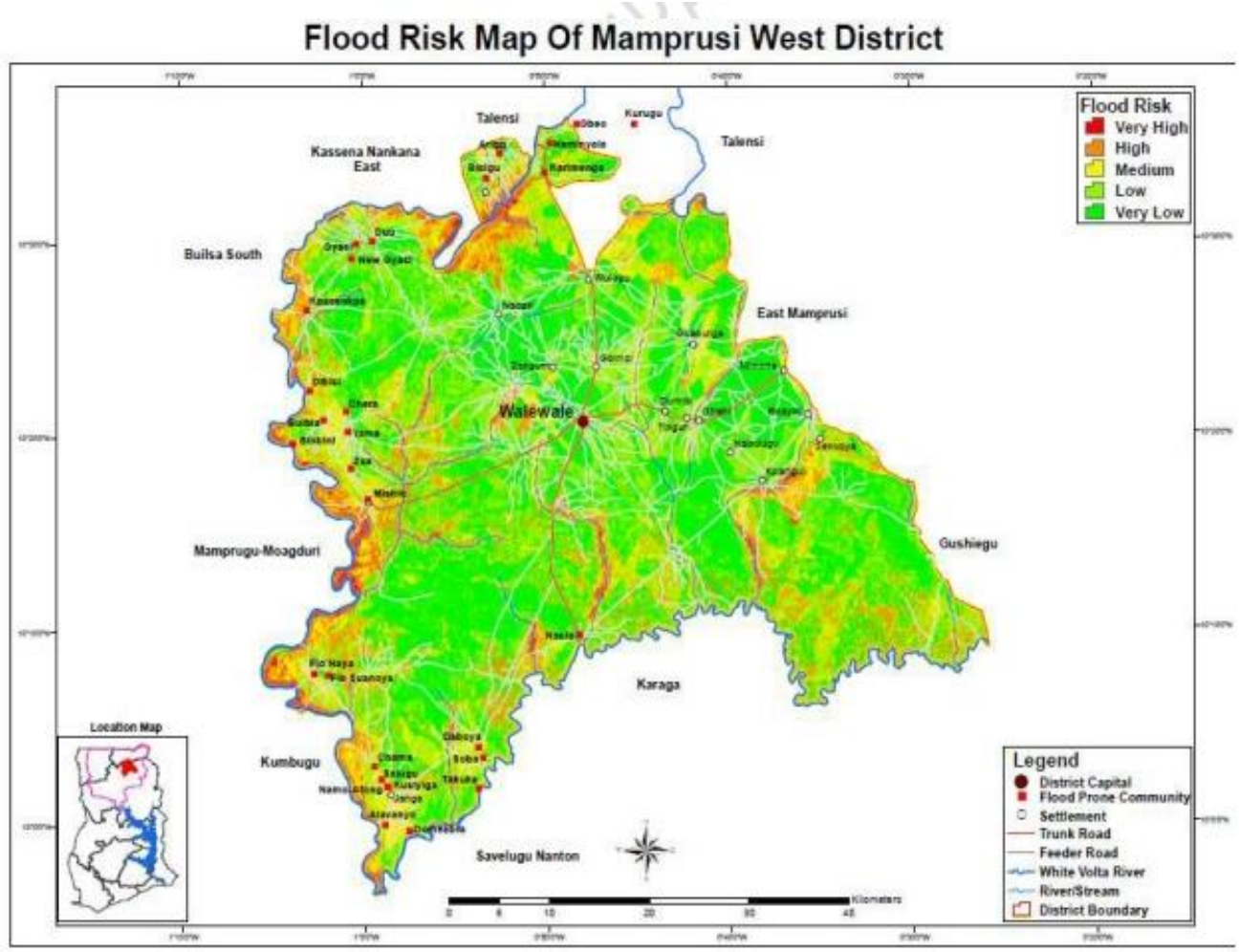
The Municipality is located in an area of the country with some level of unfavourable natural environmental conditions especially in the harsh harmattan seasons, which leads to many bush fires. The rate at which the tree vegetation is being cut down for fuel wood, charcoal and farming is alarming. The greatest threat however is the flooding in parts of the municipality due to heavy rainfall and the spillage of the Bagre Dam annually leaving many homeless and destruction of farm lands that threatens food security.

Over the past decade, there has been a dramatic change in the climatic conditions in terms of climate variability and change increase due to the general global warming as observed world over. The situation has resulted into some climate change stressors in the Municipality. The Municipality has the White Volta and its tributaries passing through. Flooding by the White Volta is an annual problem caused mainly by the numerous small rivers, which overflows into it. Annual flash floods have also been caused by spilling of water from streams further upstream in Burkina Faso (Bagre Dam). About 28 communities are prone to flood risks.

Summary of Key Issues/Challenges in the Municipality

- Armed Robbery and Break-ins in homes
- Inadequate basic health infrastructure
- Prevalence of Open defecation especially in small towns
- Inadequate Spatial Plans for Land Use Planning and Management
- Poor road network in the municipality and Inadequate potable water supply
- Inadequate Agricultural Mechanization Machinery
- Post-Harvest Losses
- Perennial Floods in the Municipality
- Deforestation (Rampant felling of trees for fuel wood/large scale farming)

The flood risk map of West Mamprusi Municipal is provided in **Figure 5-5**. The flood risk for the project site is low.



(Source: WMMA-MTDP 2018-2021)

Figure 5-5: Flood risk map of West Mamprusi Municipal

6.0 STAKEHOLDER CONSULTATIONS AND PUBLIC INVOLVEMENT

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

6.1 Key Objectives of Stakeholder Consultations

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

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

6.2 Stakeholder Identification Criteria

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

- Funding agencies;
- Project proponents;
- Regulatory bodies/institutions;

- Utility Agencies/Service providers;
- Relevant government institutions;
- Local government and administrative authorities;
- Traditional authorities/local communities;
- Project affected persons including land owners;
- NGOs/CBOs/CSOs;
- The Media; and
- The General Public/Citizenry.

6.3 Identified Stakeholder Groups and their Key Roles for the Proposed Project

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

Table 6-1: Stakeholders and their Roles

No.	Stakeholder Group	Identified Stakeholder(s)	Key Role of Stakeholder and Remarks
1	Funding agencies	Government of Ghana (GoG) / Ministry of Finance	● To provide funds for project implementation. ● In case international funding agencies come up along the line, these agencies may have their own environmental/ social safeguard policies and requirements that will have to be complied with during project implementation.
2	Project Proponents	● Ministry of Energy ● Volta River Authority (VRA)	● Accountable entities responsible for successful implementation of proposed solar power projects including planning, design, construction, operation and maintenance of the solar power plants. ● Project proponents must take into consideration requirements of any international funding agencies that may be involved in due course.
3	Regulatory Agencies/ Bodies	Environmental Protection Agency (EPA)	● Responsible for regulating the environment. ● The Agency will issue an environmental permit for construction and operation of the proposed solar power projects, and will monitor project construction to ensure compliance to the permit conditions and adherence to the Environmental Assessment Regulations, 1999.

No.	Stakeholder Group	Identified Stakeholder(s)	Key Role of Stakeholder and Remarks
		Energy Commission	● Regulator of the energy sector in general, which includes proposed project. ● To issue various permits/ licences for project implementation including: 1. Project Registration Certificate 2. Siting Permit 3. Construction Permit 4. Commissioning Permit 5. Operations Approval or Permit
		Ghana National Fire Service (GNFS)	● National institution responsible for the prevention and management of undesired fires. ● To provide fire permit /certificate for project facilities during construction and operation
		Department of Factories Inspectorate	● Regulator for health and safety of workers and workplaces in general. ● To issue facility/project registration certificate or approval ● Factories Inspectorate will monitor safety of workers at project sites.
		Water Resources Commission	● Regulates water resource abstraction and provides permit for groundwater exploitation
4	Utility Agencies/ companies	GRIDCo,	● Uptake of the power produced by VRA. ● Interested in the power infrastructure aspect of project. ● GRIDCo responsible for power transmission.
		NEDCo	● Responsible for power distribution in the Northern Sector ● NEDCo is responsible for taking power from GRIDCo to distribute to project beneficiary communities. ● Interested in the low voltage power infrastructure aspect of project.
		Community Water and Sanitation Agency (CWSA)	● Responsible for rural water supply and sanitation provision, and likely to provide water to the project areas ● To provide information on water supply situation in its operational areas
		Ghana Water Limited	● Responsible for urban water supply, and likely to provide water to some project areas ● To provide information on water supply situation in its operational areas

No.	Stakeholder Group	Identified Stakeholder(s)	Key Role of Stakeholder and Remarks
5	Other Government Institutions	Lands Commission	● To be involved with approval of site plan for project site, and transfer of project land from land owners/Traditional Authorities to Ministry of Energy/VRA. ● The Lands Valuation Division of the Commission may be involved with the valuation of affected properties or approval of valued properties for compensation purposes at the various project sites.
		Ghana Police Service	● To be involved with the provision of security and maintenance of law and order in project areas during implementation.
		Ghana Health Service	● To provide baseline health data in the project areas for the assignment and the project as a whole.
		Road Agencies - Ghana Highway Authority, Department of Urban Roads; and Department of Feeder Roads	● To provide information on the road network and road traffic and accident situation in the project areas ● To provide information on the road improvement plans in the project areas and to the project facilities
		Labour Department	● To enforce labour laws and regulations including the Workmen Compensation law that applies to project implementation issues associated with workers.
		Labour Commission	● The Commission exists to develop and sustain a peaceful and harmonious industrial relations environment through the use of effective dispute resolution practices within the context of the law, promotion of cooperation among the labour market players and mutual respect for their rights and responsibilities.
		Ghana Standards Authority	-Responsible for the management of the nation's quality infrastructure embracing the three (3) pillars of metrology, standardisation and conformity assessment (i.e. Testing, Inspection and certification). -Responsible for Calibration, Verification and Inspection of Weights, Measures and Weighing and Measuring Instruments -Promoting Quality Management Systems in Ghana. -Develops Environmental Standards for ambient air quality, noise control and effluent discharges, and makes available hardcopies of these Standards to the general public at a fee.
		Wildlife Division of the Forestry Commission	Identification of protected areas/ reserves and compatibility with the solar project within the project precincts.

No.	Stakeholder Group	Identified Stakeholder(s)	Key Role of Stakeholder and Remarks
6	Local Government and Administrative Authorities	West Mamprusi Municipal Assembly	● Responsible for the political administration and development of the project area and local communities within the Municipality. ● To provide business registration/operating license for firms and companies working within their jurisdiction. ● Land Use and Spatial Planning Department to provide development approvals and building permits for project facilities, structures and buildings.
7	Traditional Authorities and opinion leaders of the project communities	Chief & Elders, Assembly members, Unit Committee members, Opinion leaders as well as Religious leaders in the Loagri community	● To provide traditional, socio-cultural and economic information on the project communities including Taboos, Dos and Don'ts. ● Traditional Authorities have traditional/ cultural oversight of local communities in the project area and will facilitate development and resolution of conflicts/ disputes among community members associated with project implementation
9	Project affected Persons (PAPs)	-Land owners; -Farmers/ or crop owners at the sites	These are individuals or persons that will lose their properties including land, crops because the site will be acquired and affected crops will be destroyed or damaged due to project implementation
12	NGOs/ CBOs/ CSOs	1. Sheanut pickers and processors association 2. Herdsmen association 3. Farmers association	● May have interest in the Project or in the environment or community where the project will be undertaken or other aspects of project production and operational activities. ● May have interest in the proposed project and affected resource users/ persons in the project area.
13	Electronic media	Electronic media in the project areas e.g. local/ Community FM Stations; Community Information Centers, etc.	● Responsible for information dissemination, communication and education of the local communities and the general public as a whole through electronic medium
14	General Public/ Citizenry	Every citizen or person in the project areas or in the country	● Public interest role

6.4 Stakeholders to be engaged for the Scoping/EIA Assignment

The following stakeholders will be engaged as part of the preparation of the Scoping/EIA reports under this assignment:

Project Proponents

- Ministry of Energy
- VRA

Regulatory Agencies/Bodies

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

Utility Agencies

- GRIDCo
- NEDCo
- Community Water and Sanitation Agency (CWSA)
- Ghana Water Limited (GWL)

Other Government Agencies or Institutions

- Ghana Police Service
- Ghana Health Service
- Road Agencies - Ghana Highway Authority, Department of Urban Roads; and Department of Feeder Roads
- Lands Commission
- Wildlife Division of the Forestry Commission

Local Government and Administrative Authorities

- West Mamprusi Municipal Assembly in the North East Region

Traditional Authority/Opinion Leaders Local Communities

- Chief/Elders of Loagri
- Elected Assembly Members/Unit Committee representatives at Loagri community

Project Affected Persons

- Land owners; and
- Affected farmers or users of the project lands and adjacent areas that are likely to be affected

NGOs/ CBOs/ CSOs

1. Sheanut pickers and processors association
2. Herdsmen association
3. Farmers association

6.5 Stakeholder Engagement Strategy

6.5.1 Methods of Engagement

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

- Letters/Emails
- Meetings
    - Face-to-face meetings
    - Virtual meetings
- Phone calls
- WhatsApps/SMS
- Courtesy visits
- Public forum
- Focus group discussions

- Socioeconomic surveys
- Community Information Centers/ Local FM Stations

Notice of any public forum will be by community information centers, radio/FM stations and invitation letters. The EIA team will support the presentation and answer questions related to the EIA studies and is to be supported by the VRA Team where necessary. The methods of engagement for the identified stakeholders to be consulted during the Scoping/EIA preparations are provided in the table below.

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

Identified stakeholders to be engaged	Methods of engagement
<u>Project Proponents</u> ● Ministry of Energy ● VRA <u>Regulatory Agencies/Bodies</u> ● Energy Commission ● EPA ● Ghana National Fire Service ● Department of Factories Inspectorate ● Water Resources Commission <u>Utility Agencies</u> ● GRIDCo ● NEDCo ● CWSA/GWL <u>Other Government Agencies or Institutions</u> ● Ghana Police Service ● Ghana Health Service ● Road Agencies - Ghana Highway Authority, Department of Urban Roads; and Department of Feeder Roads ● Lands Commission ● Wildlife Division of the Forestry Commission	● Letters/Emails ● Meetings o Face-to-face meetings o Virtual meetings ● Phone calls ● WhatsApp/SMS

Local Government and Administrative Authorities ● West Mamprusi Municipal Assembly	
Traditional Authorities/Local Community Opinion leaders ● Chief and Elders of Loagri community ● Elected Assembly member ● Unit Committee Representatives	● Letters ● Meetings o Face-to-face meetings ● Courtesy visits ● Public forum ● Focus group discussions ● Local FM Stations/ Community Information Centers
Project Affected Persons ● Land owners ● Farmers on the project land and adjacent areas that are likely to be affected	● Meetings o Face-to-face meetings ● Phone calls ● Focus group discussions ● Socioeconomic surveys

6.5.2 Language

The English Language will be used during engagement with institutions or organisations and Traditional Authorities. Both English and Local languages will be used mainly during engagement with local community members such as herdsmen, farmers, landowners.

6.5.3 Project Information to be Shared with Stakeholders

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

6.5.4 Evidence of Engagement and Use of a Stakeholder Engagement Form

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

6.6 Outcome of Consultations carried out during the Scoping Exercise

The EIA Consultant and VRA have engaged some stakeholders including Chief/Elders of Loagri, land owners, state agencies among others as part of the scoping exercise. A summary of the key issues/concerns are provided in **Table 6-3.** The outcome of the consultations is provided in **Table 6-4. Plates 6-1 to 6-7** show some pictures from the engagement meetings**. Annex 6-3** provides contact details of stakeholders consulted.

Table 6-3: Summary of Key Issues and Concerns from the stakeholder consultations

S/N	Main Concerns presented by Stakeholders
1	● Employment for the locals during construction ● Employment opportunities during operation
2	● Loss of farmlands and livelihoods ● Communication on when access to farmlands will be restricted ● Destruction of crops ● Compensation issues
3	● Security and safety of project site ● Fencing of the project land
4	● Completion of project and not abandon it midstream
5	● Replanting of indigenous trees to be destroyed at the site in other places
6	● Land documentation: Documentation of land acquisition to prevent any future disputes and objections to any agreement reached on the acquired project land
7	● Fire safety: Provision of adequate fire cover for the project

Table 6-4: Outcome of initial consultations with stakeholders

Date	Stakeholder	Location	Main Issues and Concerns	Response
September 12, 2024	Chief and Elders of Loagri	Chief's Palace, Loagri	1. The joint team from SCL and VRA briefed the Chief and his Elders about the project.	No Response needed.
			2. The Chief, through his interpreter, expressed his gratitude to VRA for considering his community for such a significant project and for providing employment opportunities for his people.	VRA also thanked the Chief for releasing his land for the project and assured that community members, especially the youth, would be involved in the project's establishment processes.
			3. The Chief mentioned that the farmers on the land are his people and should be adequately compensated. He looks forward to the project implementation as soon as possible.	VRA is committed to adequately compensating every farmer, and this will be completed before physical construction begins.
September 12, 2024	Meeting with a farmer (Adisa) on her farm	Project Site	1. She was informed about the proposed project and indicated that she is aware of the development.	No response needed.
			2. She expressed concern that they will not be able to grow food crops for subsistence on the land originally cultivated by her grandfather, which was passed down to her mother and then to her.	The development of the project will mean they can no longer access the land for farming. However, VRA will provide adequate compensation, allowing them to either purchase land elsewhere for farming or engage in other lucrative economic activities to support their families.
September 12, 2024	West Mamprusi Municipal Assembly &	West Mamprusi Municipal Assembly Hall	1. Joint team of SCL and VRA briefed the stakeholders on the Solar PV Power project with PowerPoint presentation and project BID was distributed to every participant.	No response needed.

Date	Stakeholder	Location	Main Issues and Concerns	Response
	State Agencies (Forestry commission, NCCE, LUSPA, Lands Commission, Department of Social Welfare & Community Development)		2. The Forestry Commission inquired whether the project site would be fenced to prevent unauthorized entry and ensure the safety of the panels.	VRA responded that the site will be fenced and well-lit at night to ensure safety and security.
			3. The Assemblyman inquired about any potential health implications associated with the project and how they could be mitigated if present.	There are no health implications associated with the project, as the panels capture sunlight without emitting radiation or any harmful substances. However, provisions will be made to address workplace accidents before the project begins.
			4. The Municipal Assistant Coordinating Director expressed his hope that this project will not end up like others that never came to fruition.	This is not a government or political project. It has been proposed by the VRA, ensuring that the VRA will see it through to completion.
			5. The Lands Commission advised that the acquired land should be properly registered and that all negotiations between the Chief and VRA must be thoroughly documented to prevent any future disputes over the agreements reached.	The advice has been duly noted and will be taken into consideration during the decision-making process.
September 12, 2024	Ag. Regional Director, EPA North East Region	EPA Office, Walewale	1. The Director was briefed on the project and received the BID. He indicated that he was aware of the project and that the EPA had conducted a screening of the project site.	No response needed.
			2. The Director recommended that indigenous plants affected by the project should be replanted elsewhere and that the ground should be properly levelled. Additionally, part of the site has been excavated for borrowed	The trees will be replanted, and these recommendations will be included in the EIA report.

Date	Stakeholder	Location	Main Issues and Concerns	Response
			materials.	
			3. Food crops are cultivated on the land so there has to be compensation for the farmer.	VRA gave assurance that all affected farmers will be adequately compensated and this will be incorporated EIA report.
September 12, 2024	NEDCo staff, Walewale	NEDCo Office, Walewale	1. The workers were briefed on the project and the need for the engagement.	No response needed.
			2. The workers were pleased with the development and stated that as power distributors, they will distribute energy regardless of its source. This also implies that a substation will be constructed, bringing the energy source closer to them for distribution. Consequently, more people will be employed, and security conditions will improve.	The VRA will construct an attached substation at Loagri, creating employment opportunities for various tasks. These considerations have been noted and will be included in the report.
September 12, 2024	Municipal Fire Commander	Walewale Fire Station	1. He was informed about the project and acknowledged that he had heard of it, noting that such a development promises a bright future for the district. However, he mentioned that he would need to read more about it in the BID before sharing his thoughts appropriately with SCL.	No response needed.
			2. He recommended that, given the inclusion of a substation, the project should have its own well equipped fire station and ensure that service personnel are on-site at all times.	The concern has been noted and will be incorporated into the report for consideration during the design phase.

Date	Stakeholder	Location	Main Issues and Concerns	Response
September 17, 2024	Farmers farming on Project Site	Project Site	1. The farmers were briefed on the project and they indicated their awareness.	No response needed.
			2. Farmers expressed concerns about the project development timelines and inquired whether they would be informed before construction begins. Additionally, they want to know the specific times when their access to the land for farming will be restricted so that they can avoid planting food crops that may not be harvestable due to these restrictions.	Farmers will be properly notified, and those impacted will receive compensation, with a cut-off date established before construction starts. Compensation will not be provided for any crops planted after the specified cut-off date. Farmers may continue to grow food crops on their land but are advised against planting cash crops or tree crops that take years to mature from this point forward.
			3. Farmers are concerned about what will happen to their livelihood once their primary source of income is taken away.	Compensation will be estimated on the value of crops and size of land. The compensation will be enough to empower farmers to find land elsewhere for farming or venture into other lucrative economic activity since the project will bring development which will also help the local economy to grow. For example, workers will be engaged and women can venture into catering and be cooking food for the workers.

6.7 Pictures from the Stakeholder Engagement


MEETING WITH CHIEF AND ELDERS AT CHIEF'S PALACE




STAKEHOLDER ENGAGEMENT AT WEST MAMPRUSI MUNICIPAL ASSEMBLY

6.8 Publication of Scoping Notice in the National Dailies

VRA will publish a scoping notice in the national dailies, Daily Graphic and Ghanaian Times to inform the public about the project and to solicit public concerns and suggestions concerning the conduct of the EIA and the implementation of the project in general as required by the EPA.

A copy of the scoping notice to be published in the national dailies is provided in **Annex 6-4.**

7.0 POTENTIAL ENVIRONMENTAL ISSUES AND IMPACTS

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

7.1 Project Area of Influence

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

☒ The area likely to be affected by:

(i) the project (e.g. project sites, immediate airshed and water shed or transport corridors) and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project;

(ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or

(iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.

☒ Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable (e.g. railways, roads, transmission lines, pipelines, warehouses, logistics terminals).

☒ Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted (e.g. incremental contribution of gaseous emissions to an airshed, reduction of water flows in a watershed due to multiple withdrawals, increases in sediment loads to a water shed, interference with migratory routes or wildlife movement, or more traffic congestion and accidents due to increase in vehicular traffic on community roadways).

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

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

7.1.1 Geographical Area of Influence

The immediate geographical area of concern covers the 81.15 hectares/200.52 acres project land and its immediate environs, where the neighbouring local communities are located. The larger geographical area of influence is the West Mamprusi Municipality of the North East Region of Ghana as well as all communities likely to be impacted or benefited from the solar plant operations.

7.1.2 Environmental Media Influence

The main environmental media to be influenced are:

- The land/landscape of the Project site;
- The flora/fauna of the Project site;
- The soil resources at the Project site;
- The topography of the project site;
- The groundwater resources at the Project site; and
- The ambient air environment around the project site.

7.1.3 Socio-economic Influence

The proposed project has a bearing on the economic and socio-cultural conditions of the West Mamprusi Municipality and the North East Region as a whole. The immediate community and people to be affected by the proposed project is Loagri community, land owners and the land users.

7.1.4 Institutional Influence

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

- Ministry of Energy;

- Ministry of Local Government, Decentralisation and Rural Development;
- Energy Commission;
- VRA;
- Environmental Protection Agency;
- GRIDCo and NEDCo;
- Lands Commission;
- CWSA/GWCL;
- Department of Factories Inspectorate;
- Ghana National Fire Service;
- Water Resources Commission;
- West Mamprusi Municipal Assembly;
- Ghana Health Service; and
- Loagri Traditional Authority.

7.2 Project Activities of Environmental/Social Concern

7.2.1 Preparatory/Pre-construction Phase Activities

Preparatory or pre-construction phase activities include among others:

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

7.2.2 Constructional Phase Activities

Constructional phase activities include among others:

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

7.2.3 Operational and Maintenance Phase Activities

Operational phase activities include:

- Procurement of labour, equipment/spare parts and materials;
- Operation and maintenance of solar panels;
- Maintenance of powerhouse/switchyard station, office and warehouse;
- Materials handling and storage;
- Site protection and security services;
- Storm water and runoff management; and
- Waste management including solid and liquid waste.

7.2.4 Decommissioning Phase Activities

The major activities will include:

<u>Post-construction phase activities</u>

- Demobilization of equipment after construction;

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

Post-operational phase activities

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

7.3 Identification of Potential Environmental/Social Impacts

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

7.3.1 Potential Positive or Beneficial Impacts

The potential positive or beneficial impacts include:

7.3.1.1 Pre-construction and Construction Phases

- **Employment and job creation opportunities**
    - Engagement of skilled and unskilled labour during construction phase.

VRA staff undertook some pre-construction phase activities including project designing and feasibility studies, land surveying, land acquisition and some stakeholder consultations. Environmental consultant engaged for the EIA studies will also engage other experts as part of the team for the EIA studies, and this will create job or employment opportunities for the experts and their field assistants during the pre-construction phase. The proposed project has the potential to create jobs in the local area, national and even international both directly and indirectly during the construction phase.

Direct job opportunities will be available for high calibre professionals including engineers, mechanics and consultants, and these will be available or open to all Ghanaians including locals who are qualified. Unskilled jobs such as labourers will be offered to the local people. About 400 to 650 people are expected to be employed during the construction phase.

- **Creation of business opportunities for locals/Ghanaians and improvement of local economy**
    - Ghanaians may take up the business of supplying some needed construction materials, equipment/machinery, mechanical and electrical fittings etc
    - The contractor may procurement of some construction materials such as sand, water, chippings, cement, food etc locally
    - Taxes of workers and construction firm will accrue to the State.
    - Indirect tax/VAT on goods and services will also accrue to the State

The proposed project will also offer potential economic benefits through the procurement of goods and services, both at the regional and national level. Other business and indirect employment opportunities in the project area will spring from spin-off activities including trade, accommodation, and supply of goods and services to both the skilled and unskilled. The State will benefit from both direct and indirect taxes.

7.3.1.2 Operational and Maintenance Phase

- **Employment generation**
    - Engagement of skilled and unskilled labour during the operational phase

Engineers and technicians with experience in the power sector will be engaged during the operational phase. Employment for skilled labour during operational phase will be open to all Ghanaians via advertisement of such experienced manpower requirement. Community members will be trained for the cleaning of the solar panels. Increased income generating opportunities will be experienced at the local level to varying scales, causing different degrees of economic growth. About 25 to 35 people may be directly engaged by VRA for the plant operation and maintenance. About 10 to 15 people will be engaged for security and, also 10 to 15 people will be responsible for the periodic cleaning of the panels.

- **Stabilisation of electricity through provision of 95 MW of electric power for the project catchment area and the North East Region**

Developing the solar power facility to feed the national grid with approximately 95 MW of power will contribute to creating a stable and reliable power supply base and help meet the increasing electricity demand, thus reducing impact on power rationing. It will also improve the voltage stability of the NITS as well as the quality of electricity supply to end-users. It will contribute significantly to addressing potential power demand associated with increasing population and supply growth in-balance and deficit in the project area and region during the operational phase.

- **Reduction in VRA's total GHG emissions from its power plants**

Ghana is a signatory of the 2015 Paris Climate Agreement. The State is thus committed at the level of the Nationally Determined Contribution (NDC) to reduce its greenhouse gas emissions by 15% to 45% below business-as-usual scenario by 2030 compared to the 2019 base year. Under Ghana's Updated Nationally Determined Contribution under the Paris Agreement (2020 - 2030) prepared in September 2021, Ghana intends to achieve absolute greenhouse gas emission reductions of 64 MtCO2e by 2030.

The reduction in GHG emissions can be achieved through the use of renewable energy projects, which is framed by the country's renewable energy policy with the objective of providing ten (10) percent of Ghana's electricity demand from renewable energy sources by 2030. The operation of a solar power plant in Loagri with an installed capacity of 95 MW will have a positive impact on air quality in general and is a means of combating global warming, as it is a clean energy production system that does not generate greenhouse gases during its operation, as well as other pollutant emissions (e.g. SO2, NO2, CO2, etc.).

- **Reliable power supply to support socioeconomic activities and businesses in the West Mamprusi Municipality and economic growth in general**

The 95 MW solar project which will be fed into the national grid will play a significant role in stimulating economic growth, especially in the North East Region and neighbouring Upper East, Northern and Savannah Regions. The power input will contribute significantly to the ongoing national electrification programme, which has potential to promote spin-off effects on rural

economy and businesses. The project has the potential of reducing the cost of the power because the power generated from the project will in the long-term cost less than any other existing sources as its production cost will not increase thereafter. This has not only a positive effect on the cost of the energy production but will also lead to economic gains and growth in general.

- **Improvement in the local community infrastructure/facilities from corporate social responsibility interventions.**

VRA will carry out corporate social responsibility in the project area and this will enhance local community development and infrastructure/facilities. VRA corporate social responsibility interventions will provide support for

  - community educational and health related projects
  - livelihood interventions in the communities
  - cultural related projects including festivals, community centers, chief palaces

7.3.2 Potential Adverse/Negative Impacts

7.3.2.1 Preparatory/Pre-construction Phase Potential Adverse Impacts

Physical Environment

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

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

Biological Environment

- Disturbance of fauna during survey and field investigation activities at the project site

Social Environment

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

7.3.2.2 Construction Phase Adverse Impacts

Physical Environment

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

- Air pollution from movement of vehicles/ trucks on unpaved roads through local communities, operation of construction equipment, light vehicles, and diesel-powered electrical generators;
- Noise and vibration from movement of vehicles/trucks and operations of electrical generators and maintenance activities;
  - Impact on water resources: No direct pollution of stream expected. However, improper disposal of waste and storm runoffs may carry fuel spills and waste into the Naani stream
- Water use for construction activities and potable/domestic usage expected;
- Impact on topography and drainage – site is generally flat but limited trees at the site to be removed and will be replaced with solar panel mountings and other infrastructure. Storm

drains will be constructed around the solar plant and will collect storm-runoffs direct such runoff water into the environment.

- Impact on soil resources from site clearance, topsoil removal due to earthworks/excavations; exposure of soil leading to erosion during rainfalls and wind action; soil contamination from fuel handling, improper disposal of used lubricants/dirty oil and accidental fuel spills from construction equipment/machinery and vehicles, and painting of solar panels;
- Waste generation and disposal;
    - Generation of various streams of waste including biomass, garbage, scraps, sewage/human waste, spent lubricating oil, rubber seals, concrete debris, food wastes, disused packaging materials etc
    - Improper disposal of hazardous and non-hazardous waste concerns

Biological Environment

- Impact on terrestrial flora and fauna:
    - Destruction and loss of vegetation/habitat and trees from site clearing. Faunal habitat for rodents, insects, birds and general wildlife may be impacted.

Social Environment

- Disruption in land use
    - Current land use largely for crop farming and animal grazing will change and be converted into a solar power plant
- Labour influx/job seekers and illicit behaviours
    - Job seekers will throng the area to look for some construction jobs or be taken as labourers
    - These job seekers and those employed may put pressure on the community facilities and resources, and the non-locals may not abide by sociocultural norms in the area creating conflict or tension.
    - Labour influx can also result in gender-based violence issues especially when married women and people's girl/boy friends are taken over by construction workers
- Visual intrusion/ attraction

- Site clearance and construction activities that are in public view attract local people and commuters alike.
- Poor housekeeping practices at the site may also reduce the aesthetic value of the proposed site.

- Non-compliance with socio-cultural norms of local communities
  - The tendency for non-local employees not to conform or abide by the socio-cultural norms of local communities is high, unless they are sensitized appropriately
- Labour agitations/issues
  - Construction workers can lay down their tools if their condition of service is not good and this can affect project implementation timelines; can result in prolong and costly grievance redress cases; can pose a security threat as well etc
- Worker health/safety concerns
  - Worker injuries, bites from insects/animals, STI transmissions; accidents could result in fatalities, dust/fumes inhalation can cause respiratory problems, noise nuisance can cause hearing challenges etc
- Public/community health and safety, and security concerns
  - Increased potential for spread of infectious diseases, including HIV/AIDS. Short term migration increases the chances of sexual relationship with multiple partners, thus becoming a critical factor in the propagation of HIV/AIDS and other STDs. The movement of workers from one village, town or city to another during the construction stage makes them susceptible to irresponsible sexual behaviour and thus encourage prostitution in the community.
  - Domestic violence, sexual violence or divorces may result in the local communities when migrant workers on the project go in for married women in the local community.
  - Improper disposal of sanitary waste is a community health threat.
  - Dust inhalation can cause respiratory diseases; dust nuisance can dirty washed clothes on drying lines in the community and also dirty windows of residences and offices nearby;
  - Noise nuisance can affect the peaceful resting and relaxation of people; cause hearing challenges etc

- Potential traffic incidents/accidents on the public/community roads from transportation of material, equipment/machinery and plant components to site can cause loss of life/death, damage to vehicles and properties, cause traffic congestions, which bring about delays, stress etc. Any unattended breakdown of project vehicles/trucks on the roads can induce traffic incidents.
- Security/threats and human right abuses – theft of project property by both workers and job seekers; project site security personnel can abuse the human rights of trespassers and residents alike; workers coming to work and going out after close of work can be attacked or robbed on the way.

7.3.2.3 Operational Phase Potential Adverse Impacts

Physical Environment

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

- Air Pollution from vehicular movement on unpaved roads through local communities, and diesel-powered electrical generators. No plant GHG emissions;
- Noise from movement of vehicles/trucks, operation of standby generators, vocal noise from workers, and from routine maintenance activities;
- Impact on water resources: No direct pollution of stream expected. Water contamination may occur from improper disposal of waste and storm runoffs carrying fuel spills into nearby stream. Ground water will be abstracted to support operational activities.
- Impact on soil resources due to erosion from storm runoffs on exposed areas which were not properly stabilized after construction work, and soil contamination from vehicular fuel spills and improper disposal of spent oil/lubricants from project vehicles;
- Impact on landscape and visual intrusion: -the site which is currently mainly for crop farming and animal grazing will change into solar power infrastructure of panels, substation and buildings. This solar power infrastructure will be visible and may create some intrusion concerns.
- Waste generation and disposal;
    - Generation of various streams of waste including garbage, scraps, sewage/human waste, etc
    - Disposal of hazardous wastes concerns

Biological Environment

- Impact on fauna- there is a particular risk to birds mainly from operation of the high voltage overhead lines from the substation onsite to the High Voltage National Grid. Birds utilize transmission towers for nesting by placing the nests across wires or using holes in the tower itself.
- Impact on flora- trees that can reach the high-tension lines will be periodically removed or destroyed.

Social Environment

- Worker health and safety concerns
  - Worker injuries from handling of equipment/machinery, electrical installations, slips and falls etc
  - Worker health issues associated with exposure to electro-magnetic radiation, and noise
  - Major accidents from electrocution/electrical shock, fire hazards, and traffic incidents
- Labour agitation issues- Poor working conditions of workers can result in poor moral at workplaces and can affect effective plant operations and maintenance and result in poor plant performance.
- Impact on gender and the vulnerable:- workers with good economic power may go in for married women and peoples girl/boyfriends and this may lead to gender-based violence, divorces or separations
- Public/community health and safety and security concerns
  - Increased potential for spread of infectious diseases, including HIV/AIDS.
  - Increased potential for traffic incidents/accidents on the public/community roads
  - Security/threats and human right abuses
- Sustainability risk
  - Poor working conditions
  - Lack of maintenance affecting efficient and effective operation of the Plant
  - Emergency situations and equipment/plant failure

7.3.2.4 Decommissioning Phase Potential Adverse Impacts

Post-construction activities

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

Post-operational phase

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

7.4 Potential Impact Characterization and Evaluation Approach for the EIA

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

7.4.1 Impact Identification and Characterization

The impacts will be described in terms of their characteristics, including the impact's type and the impact's spatial and temporal features (namely extent, duration, scale, frequency and likelihood). The definitions of the terms to be used are described in **Table 7-1.**

Table 7-1: Impact Characteristics

Characteristic	Definition	Terms
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	**Beneficial / Positive -** An impact that is considered to represent an improvement on the baseline or introduces a positive change. **Adverse / Negative -** An impact that is considered to represent an adverse change from the baseline or introduces a new undesirable factor. **Direct** - Impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected). **Indirect** - Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land). **Induced or Secondary** - Impacts that result from other activities (which are not part of the Project) that happen because of the Project. **Cumulative** - Impacts that arise because of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. That is, impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
Duration	The time period over which a resource / receptor is affected.	**Temporary** - (period within 1 year -negligible/associated with the notion of reversibility) **Short term** - (period of up to 2 years i.e. construction period or production ramp up period) **Medium term** -(period of more than 2 years to 5 years) **Long term** - (period of more than 5 years and less than 20 years i.e. life of facility/plant) **Permanent** - (a period that exceeds the life of facility – i.e. irreversible. Or may last for a very long time)
Extent	The reach of the impact (i.e. physical distance an impact will extend to). How much area will adversely or positively be affected by the project.	**On-site** - impacts that are limited to the Project site. **Local** - impacts that are limited to the Project site and adjacent properties. **Regional** - impacts that are experienced at a regional scale, i.e. beyond adjacent properties, covering the Metropolis/Municipalities/ Districts and beyond

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

7.4.2 Determining Impact Magnitude

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

- extent;
- duration;
- scale;
- frequency; and
- likelihood of occurrence

Magnitude is in practice a continuum, and evaluation along the spectrum requires the exercise of professional judgement and experience. Each impact is evaluated on a case-by-case basis, and the rationale for each determination is noted. The universal magnitude designations, for both positive and negative impacts/effects, are: negligible, small, medium and large. The magnitude

designations themselves are universally consistent, but the definition for the designations varies by issue.

7.4.3 Determining Receptor Sensitivity

The other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, and socio-economic. As in the case of magnitude, the sensitivity designations themselves are universally consistent, but the definitions for these designations will vary on a resource/receptor basis. The sensitivity is also influenced by the specific local economic, social and ecological setting besides the national and international recognitions. The sensitivity of receptor used is low, medium and high as shown in the table below.

Table 7-2: Sensitivity Criteria

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

7.4.4 Assessing Significance or Severity of the Impact

Significance connotes/implies what value in terms of costs and benefits does society place on the resources and the different impacts affecting the resource (s). Once magnitude and sensitivity of

a receptor have been characterized, the significance or severity can be determined for each impact. The impact significance or severity rating will be determined, using the matrix provided in **Table 7-3.** The definitions or explanations of the impact significance assessment rating is provided in **Table 7-4.**

Table 7-3: Impact Significance Rating Matrix

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

Table 7-4: Definition of the Impact Significance/Severity Assessment Rating

Rating	Impacts
Negligible	• No discernible improvement of or deterioration to the existing environment. • Impacts that are hardly distinguishable from background conditions and expected development in a no-project situation • Impacts very unlikely to happen
Minor	• Where the Project would cause a barely perceptible improvement of or deterioration to the existing environment • Impacts of low intensity, limited in scale (site-specific) and low/medium duration (temporary) • Impacts unlikely to happen and/or the sensitivity of receiving environment is very low and/ or project designs have installed sufficient control mechanisms • Impacts can be mitigated and minimized to a negligible level through adoption of best practice, continuous improvement and optimization measures
Moderate	• Where the Project would cause a noticeable improvement of or deterioration to the existing environment • Adverse impacts on people and/or environment of medium intensity, which may have a regional spatial scale of influence or a long-term duration

	• Impacts that are measurable and able to change some characteristics of the receptor/ resource, but not to generate irreversible, unprecedented or multiple adverse effects or damage • Impacts can be avoided, managed and/or mitigated with relatively uncomplicated accepted measures
Major	• Where the Project would cause a significant improvement of or deterioration to the existing environment • Significant adverse impacts on human populations and/or environment, high in intensity and/or spatial extent (e.g. large geographic area, large number of people, transboundary impacts, cumulative impacts) • Permanent and/or irreversible impact • Areas impacted include areas of high value and sensitivity (e.g. valuable ecosystems, critical habitats) • Impacts may give rise to significant social conflict • Impact may not always be reduced by implementing mitigation measures. In this case, further options have to be considered in order to avoid any critical significance driven by project (analysis of alternative strategy). Therefore, significant resources or fundamental changes in the activities and systems are required where necessary.

8.0 DRAFT TERMS OF REFERENCE (TOR) FOR THE EIA ASSIGNMENT

This section provides the draft terms of reference for the EIA study to be carried out for the proposed solar power project.

8.1 Sources of Issues to be addressed in the EIS

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

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

8.2 Purpose and Aim of the EIA

The purpose of the EIA is to address the identified significant potential adverse physical, biological and socio-cultural impacts and risks during the pre-construction, construction, operation and decommissioning phases of project implementation, and to consolidate and enhance the identified positive impacts of the project. The aim of the EIA is to comply with all the legal obligations as contained in the Environmental Assessment Regulations 1999, Legislative Instrument 1652 and to obtain an environmental permit from the EPA for project implementation.

8.3 Objectives of the EIA

The general objective of the EIA is to identify potential adverse and beneficial environmental, safety and social impacts, likely to arise as a result of undertaking the Project and design mitigation measures to address these identified potential adverse impacts and develop measures to enhance the positive impacts for project sustainability.

Specific objectives of the EIA include:

- Provide adequate description of the Project;
- Identify activities of environmental/safety and social concerns;
- Establish the baseline physical, biological and social conditions of the Project area;

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

8.4 Scope of Work and Methodology

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

8.4.1 Detailed Description of the Proposed Project

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

Methodology to be used

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

- Project feasibility study report.
- Project Site Plan and Layout Plan.
- EIA reports on solar power projects undertaken by VRA.

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

8.4.2 Analysis of the Need for the Project and Alternative Considerations

The importance and need of the Project on the socio-economic fortunes of the local communities, the Municipal Assembly, North East Region and the country as a whole shall be discussed and justified. The various alternatives and their viability to the Project, especially, with regard to energy sources, site selection options, technology choices will be examined. The environmental criteria for the preferred option shall also be examined. The no action or no development option scenario where the Project does not come off and its effects on the biophysical and socio-economic conditions of the project area, the region and the nation as a whole will also be examined.

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

8.4.3 Description of the Policies, Legal and Institutional Framework

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

(i) extensive literature search and reviews of previous EIA reports on solar and thermal power plants;

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

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

8.4.4 Baseline Studies and Analysis

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

Secondary data will be obtained through literature reviews and consultations for the following baseline information:

- Climatic conditions
- Soil/Geology
- Solar resources in the project area
- Topography/Relief of the project area
- Water resources/hydrology
- Cultural heritage resources at the project area
- Socio-economic conditions of the West Mamprusi Municipality
- Community/public health and safety information of the project area
- Traffic and road infrastructure or network in the project area

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

- Terrestrial ecology
- Ambient air quality
- Ambient noise levels
- Water quality
- Land use in the project area

8.4.4.1 Terrestrial Ecological Study

The biodiversity baseline data collection will be carried out following internationally accepted protocols and specifications to ensure the assessment output meets IFC, World Bank and other relevant international requirements. A series of site surveys of the project enclave and surrounding area will be undertaken, to identify and map the extent of the habitats, and the potential of the site to support protected and/or notable species (including invasive alien species). This activity would be carried out by the Ecologist.

General Vegetation

A literature review on the vegetation of the area will be carried out to ascertain the broad vegetation types of the study area. The spatial distribution of native vegetation patches across the site will be determined. Features that will impact negatively on the project would be noted. Sample point positions, reference points and elevations will be recorded with the aid of Global Positioning System (GPS).

Consultation will be held with the communities that border the project enclave in order to understand:

- The biodiversity values present near the project;
- Social and economic implications of valuable biodiversity and other agricultural produce in the area and wildlife;
- The existing conservation practices and indigenous technical knowledge.

Flora Inventory

A 20 m x 20 m quadrat will be used to randomly sample species in the study area, which is generally a level ground. Species cumulative curve would be used to determine the minimum number of quadrats to sample in each vegetation stratum. Species in a quadrat will be identified and tallied for frequency and abundance. Specimens of species that cannot be readily identified in the field will be identified in a Herbarium. Nomenclature of species will follow Hutchinson and Dalziel. The conservation status of all the species identified will be verified in the IUCN red list.

Fauna Inventory

Four main methods will be used in the faunal survey both for land and freshwater: direct/opportunistic observation, identification of animal spoors, interviews, and desk surveys of available literature (Hughes & Barry, 1969; Serle et al., 1992; Delany & Happold, 1979; Kingdon, 1987; Hughes, 1988; Haltenorth & Diller, 1988; Larsen, 1994). Direct/opportunistic observation will involve recording any animal sightings or animal trails while driving or walking within the project area. Transect walks to spot animal spoors (any sign left by a living animal, such as feeding sites, regular pathways, tracks, footprints, faecal pellets, nests, etc.) will also be undertaken. Some individuals in the communities in the project area will be interviewed for information about the fauna of the area. The interviews will focus mainly on the various animals that commonly occurred in the area, and their relative abundance, and importance or value to the residents.

8.4.4.2 Ambient Air Quality

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

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

Results obtained are to be compared to the Ghana Standards and or the World Health Organization Standards, which have been discussed under Chapter 2 of this report. The monitoring will be done using a highly flexible state-of-the-art air quality monitor (SIRA Certified OSIRIS TURNKEY INSTRUMENT/ various gas meters using models of CROWCON. The ambient concentrations are recorded at 1-minute interval for the period of monitoring, from which hourly concentrations will be calculated and daily average concentration determined.

8.4.4.3 Baseline Noise Level Monitoring

A CASTLE- SONUS Sound level meter will be used for the noise monitoring. Baseline /background noise levels at the proposed site and its environs or nearest community will be measured. The noise level parameters to be measured are as follows:

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

8.4.4.4 Water Resources and Quality

No surface water bodies have been identified near the project site during the scoping study. The nearest surface water is about 500m from the project site. Further investigations will be carried out in the project area during the EIA, and any stream or water body likely to be impact by the project will be sampled for water quality analysis. The EIA will provide information on the nearest surface water bodies, and confirm potential site flooding issues from field investigations and consultations. Ground water resources in the project area will be confirmed through consultations and literature reviews.

8.4.4.5 Soils and Geology Baseline Information

Soil and geology baseline data in the project area will be obtained from literature. Information on any geotechnical studies in the project areas will also be used as part of the soil/geology baseline information.

8.4.4.6 Land use in the project area

Previous and current land use at the project site shall be studied and a summary of the expected disturbance and land take requirements provided. Restrictions on any future land use and access requirements arising from the project shall also be discussed.

8.4.4.7 Socio-Economic Baseline Data Collection

Socioeconomic baseline data will be collected on (i) land owners and land users on the project site; (ii) Loagri community; (iii) West Mamprusi Municipality, which is the municipality/district

in which the project is located. The socioeconomic baseline data relating to: demographics, community facilities and services, economic environment; employment, labour and livelihood issues; land use and natural resources; governance structures, health, education, culture, lifestyle and recreation will be collected.

This assignment will be led by the social expert and assisted by the EIA Specialist, and the consultants shall carry out a gender responsive socio-economic / livelihood assessment of the communities in and around the project site and identify livelihood needs and opportunities.

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

The methodology to be adopted shall include focus group discussions, in-depth interviews, and a survey. The focus group will be made up of male and female groups. Additionally, key informants such as queen mothers and opinion leaders will be interviewed. Also, a survey which will be based on a simple random sampling would be adopted for the study.

The study will involve the processes of analysing and identifying measures for monitoring and managing the intended and unintended social consequences, both positive and negative, of the proposed project interventions and any social change processes invoked by those interventions as well as provide accompanying recommendations to enhance and strengthen livelihood opportunities, developed through a community and stakeholder engagement. Community needs and associated capacity opportunities also will require identification. If found necessary based upon the EIA findings, a Vulnerable Community Development Plan (VCDM) will be prepared as part of the provisional EMP.

Gender Responsive Socio-economic Characteristics

Fieldwork using participatory appraisal methods and quantitative surveys will assemble information on the characteristics of the affected environment to include the following:

- Identification of directly and indirectly affected communities.
- Political and Institutional Environment (Local Government and Administration, government policies, local NGOs and Community Based Organizations-CBOs, social organization and leadership, social network structures).
- Present Land Use Patterns and management within the project area and directly affected neighbouring villages (land tenure, settlement patterns, cropping and livestock production, grazing areas, woodlots, utilization of indigenous flora and flora, entrepreneurial/ business activities, etc).
- Local Infrastructure (water and energy supply systems, roads and communication systems, waste disposal facilities, etc). Present Land Use Patterns and Infrastructure shall be mapped.
- Social and other Community Services and Facilities (education, health, retail /business, transport, police and security, entertainment, religious, etc.). This shall include an assessment of the role of local and national government, NGOs, CBOs in providing these services and facilities.
- Population and Demographic Characteristics of Affected Communities (population distribution, demographic profile of settlements and households, migrancy).
- Livelihood, Health and Welfare Characteristics of Affected Communities (community livelihood profiles, household economies, employment status, farming systems, income streams, village and household assets profile, education and skills profile, welfare profile, health profile, cultural profile, etc.).

Economic Development Opportunities

We shall also identify various economic developmental opportunities that will be associated with the project development. This shall be done by:

- Identifying effective local grassroots institutional arrangements for land tenure and long-term management of land use, the local natural resource base and development projects.
- Identifying potential income generating opportunities and projects (such as initiatives to raise income for small farmers, women, youth and disadvantaged groups, micro-credit

programs, small and medium enterprise development [SMEs], agricultural and agro-industrial co-operatives, etc).

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

- Population and Demographics
- Ethnic, Religious and Cultural Heritage
- Historical resources
- Aesthetics and Tourism
- Infrastructure
- Education
- Land tenure and Land Ownership
- Land Use
- Employment/Manufacturing
- Agriculture/ Animal farming
- Primary and secondary occupation and livelihood issues
- Public Health (including HIV/AIDS)
- Public/Community Safety and Security and Traffic Safety Issues

8.4.5 Stakeholder Consultations

Consultations form an integral part of the environmental assessment process. Stakeholders will be engaged to elicit their views/ concerns/ suggestions on the project and also solicit information related to baseline data and challenges, training and capacity building needs for the implementation of the EIA report and EPA permit schedules. A Stakeholder Engagement Plan (SEP) shall be developed, and this shall include planning of future stakeholder engagement activities, including the implementation phase. The SEP shall be a living document and will be updated on an on-going basis.

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

The consultations shall be conducted in the custom and language appropriate to stakeholders. They shall also be free of external manipulation and interference and be documented and recorded. All engagement activities will follow the strategy provided in Chapter 6 and will include a semi-structured approach covering specific focused areas relevant either to the stakeholders/communities as a whole and or to the particular group or individual participating in an engagement activity.

In addition, the Consultant in collaboration with the client will organize "Stakeholder Hearing Forum" or "Stakeholder Workshop" if appropriate or convenient. This hearing forum or workshop will involve a larger gathering of representatives of the identified stakeholders at one gathering to provide a larger platform for dialogue on the critical issues regarding project impact and implementation

The "Stakeholder Hearing Forum" will be held at an appropriate venue within the municipality. Notice of the forum will be by radio, banners, invitation letters, etc. The key objectives for the forum shall be to:

- Inform stakeholders about the project and opportunities to comment;
- Gather local knowledge to improve the understanding of the environmental and social context;
- To ensure that stakeholders can comment on the technical and public consultation processes and findings of the EIA process;
- Consider the views of stakeholders in the development of effective mitigation measures and management plans;
- Evaluate alternatives and seek solutions;
- Establish areas of co-operation and development; and

- Lay the foundation for future stakeholder engagement.

All stakeholder comments/concerns and suggestions raised throughout the EIA process will be captured and presented in the EIA report, as a comment and response matrix. The stakeholders to be consulted and outcome of the stakeholder engagement process will be compiled into a Stakeholder Consultation Report (SCR) to guide stakeholder engagement for the lifecycle of the project. The SCR will form an annex to the EIA report. List of attendees at meetings, and meeting minutes will all form part of the stakeholder consultation report.

8.4.6 Identification & Analysis of Potential Environmental & Social Impacts

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

As far as predictable, all the identified impacts and risks will be assessed for significance based on magnitude, extent, duration, sensitivity of the receptor, reversibility, compliance with relevant laws, regulations and standards, concerns and views of stakeholders, overall worker comfort, and likelihood of an occurrence. The impact evaluation approach for the EIA is provided in Chapter 7 of this Scoping report.

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

The impact ratings will be categorized as follows:

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

<u>Minor Significance</u>

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

Moderate Significance

An impact of moderate significance or referred to as a 'moderate impact', will be within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor, up to a level that might be just short of breaching an established legal limit.

Major Significance

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

8.4.7 Development of Mitigation Measures

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

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

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

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

☒ Preventive measures
- Measures to be incorporated into the design and project implementation in order to avoid an identified impact/risk

☒ Control measures
- Measures to abate or remedy the impacts

☒ Compensatory measures
- Measures to be proposed for loss or damage to an affected property or resource

8.4.8 Development of a Monitoring Programme

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

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

8.4.9 Development of a Provisional Environmental Management Plan (EMP)

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

a) Environmental, Health/Safety Policies of VRA and the Contractor
b) Roles and Responsibilities of project implementors, especially VRA and the Contractor.
c) Structure of reporting for environmental officers, to be linked to operational and administrative activities;
d) Environmental monitoring programme;
e) Project monitoring programme;
f) Capacity building and training requirements;
g) Grievance redress mechanism;
h) Documentation and record keeping;

i) Emergency preparedness and response framework;
j) Statutory reporting arrangements;
k) Environmental audit and review arrangements
l) Environmental management cost estimates

8.5 Outline and Brief Content of the Environmental Impact Statement

The process and outputs of the Environmental Assessment will be compiled into an Environmental Impact Statement (EIS) to meet the formal requirements of Ghana's EPA. The EIA report will provide maps, figures and process diagrams to facilitate understanding of the descriptive elements of the report. In accordance with the LI 1652, the EIA will be structured in line with the format for EIA Reports required by the Ghana EPA as follows:

1. Cover Page
2. Signature Page
3. Core EIA Team of Experts
4. Table of Content
5. List of Figures, List of Tables and List of Plates
6. Abbreviations and Acronyms
7. Non-Technical Executive Summary
8. Introduction
9. Policy, Legal and Regulatory Framework
10. Description of Proposed Project
11. Alternative Considerations
12. Environmental Baseline Conditions
13. Stakeholder Consultations and Public Participation
14. Potential Impact identification and Evaluation
15. Impact Mitigation and Enhancement Measures
16. Provisional Environmental Management and Monitoring Plan
17. Decommissioning
18. Conclusion
19. Bibliography or References
20. Annexes

The key issues to be addressed under the various headings provided above are as follows below:

COVER PAGE

- Name of Company/Proponent
- Title of Report
- Name of Consultant (s)
- Month and year of submission

SIGNATURE PAGE

- Project Name
- Client Name
- Report Type
- Name, Designation, Signature, and Date - of the following
    - Leader of the Consultant's Team
    - VRA Project Manager
    - VRA Director of Environment & Sustainability Department
    - VRA Chief Executive
- Disclaimer Notice

CORE EIA TEAM OF EXPERTS

- Names of all key experts, and their phone contacts/emails
- Key Experts qualification/experience and position
- Key Experts Contribution to the preparation of the EIA Report

TABLE OF CONTENTS

- Will capture the title of each heading (or subheading to the third level) with their commencing page numbers.

LIST OF FIGURES, LIST OF TABLES AND LIST OF PLATES

- List of figures will capture the title of all labelled diagrams/drawings/maps/graphs and the corresponding page number in the main EIS document excluding those presented in the annexes.
- List of tables will capture the title of all labelled tabulated information and the corresponding page number in the main EIS document excluding those presented in the annexes.
- List of plates will capture the title of all labelled pictures or photos and the corresponding page number in the main EIS document excluding those presented in the annexes.

ABBREVIATIONS AND ACRONYMS

- Under abbreviations and acronyms, all shortened forms of words or phrases used in the main EIS document will be listed and written in full.

NON-TECHNICAL EXECUTIVE SUMMARY

The executive summary will contain

- a non-technical description of the proposed project,
- key policies and laws, alternatives/ options considered,
- summary of baseline information,
- potential environmental impacts management and monitoring programmes including budget.
- The main conclusions from the study and the benefits to be created by the project to the national economy will be outlined here.

CHAPTER 1: INTRODUCTION

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

CHAPTER 2: POLICY, LEGISLATIONS AND INSTITUTIONAL FRAMEWORK

This section will capture various national and international policies, laws and regulations as well as guidelines and environmental/safety permits/licenses applicable or relevant to the project and the key institutions to be involved with project implementation. International protocols and conventions and best practices applicable to the project as well as VRA Health Safety and Environment and Social policies and guidelines will be provided under this chapter.

CHAPTER 3: DESCRIPTION OF THE PROPOSED PROJECT

This section will give detailed description of the proposed project including project location, land-take, project scope, components, energy production processes, resource requirements (labour/manpower, raw materials, equipment/machinery, water usage, fuel/energy usage), waste management, project management and implementation schedule, brief project financial requirement, and any other project information that may be relevant to or required by stakeholders.

CHAPTER 4: ALTERNATIVE CONSIDERATIONS

All alternatives to the proposed project will be considered in detail in this section, and will cover choice of energy sources; site selection options; and various technology selection options as well as the no action or development option.

CHAPTER 5: ENVIRONMENTAL BASELINE CONDITIONS

The baseline chapter will present a comprehensive description of the existing environment with regard to the project catchment area covering the physical, biological and socio-economic and cultural environments.

CHAPTER 6: STAKEHOLDER CONSULTATIONS AND PUBLIC PARTICIPATION

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

CHAPTER 7: POTENTIAL IMPACT IDENTIFICATION AND EVALUATION

The potential environmental/social impacts and risks identified will be presented and assessed or evaluated under this chapter of the EIA report.

CHAPTER 8: MITIGATION AND ENHANCEMENT MEASURES

This chapter will present the proposed mitigation measures for the significant adverse environmental impacts and risks that would occur from preconstruction, construction, operational/maintenance and decommissioning phases of project implementation. Enhancement measures for identified positive impacts will also be presented in this chapter.

CHAPTER 9: PROVISIONAL ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

This chapter will contain appropriate management and monitoring measures with roles/responsibilities, cost, timelines and reporting requirements to ensure that the mitigation measures proposed for the identified impacts are properly implemented to achieve the desired outcome. Emergency response, health/safety management and any relevant vulnerability management issues will also be included in this chapter.

CHAPTER 10: DECOMMISSIONING

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

CHAPTER 11: CONCLUSION

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

BIBLIOGRAPHY

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

ANNEXES

This section will contain the relevant correspondences, maps, consultation report, project drawings and any other relevant information or data not included in the main EIS document.

8.6 Work Plan and Core Specialist for the EIA

8.6.1 Work Plan

The work plan for the EIA execution is provided in **Table 8-1**. The EIA assignment will be executed in 11 weeks. This period excludes review periods by the EPA.

8.6.2 Core Specialists for the EIA

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

- Social Expert/Socio-economic Specialist
- EIA Expert
- Ecologist
- Health/Safety Expert

Table 8-1: EIA Work Plan

		Weeks										
No.	Activity (Work)	1	2	3	4	5	6	7	8	9	10	11
1.0	**Detailed EIA Study**											
1.1	Stakeholder/Public Consultations											
1.2	***Specialist Studies and Literature Reviews***											
1.2.1	*Health and Safety Impact Study and Assessment*											
1.2.2	*Socio-economic Impact Study and Assessment*											
1.2.3	*Water Resources, ambient air quality and noise level study and traffic assessment*											
1.2.4	*Ecological and land use study*											
1.2.5	*Climate, Soil, Geology, Topography/Relief, Solar Resources, Seismicity, Drainage networks etc*											
1.3	***EIA Data analysis***											
1.3.1	*Impact identification, analysis and evaluation*											
1.3.2	*Analysis of Impact mitigation, management and monitoring data and measures*											
1.4	***EIA Report Preparations and Submissions***											
1.4.1	*Initial draft EIA Report preparation*											
1.4.2	*Submission of initial draft EIA Report to VRA for review comments*											
1.4.3	*Revision of initial draft EIA Report with VRA comments*											
1.4.4	*Submission of final draft EIA Report to EPA*											

9.0 CONCLUSION

This Environmental Scoping Report for the EIA of the proposed 95 MW Loagri Solar Power Project at Loagri in the West Mamprusi Municipality of the North East Region has been carried out in line with the Environmental Assessment Regulations, 1999, Legislative Instrument (LI) 1652, and best international impact assessment practice.

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

The Scoping Report has identified key biophysical, socio-economic and health/safety risks and impacts that may arise from the construction and operation of the proposed solar power project. These identified impacts and risks will be subjected to in-depth analysis and evaluation during the EIA for the development of comprehensive mitigation, monitoring and management measures to address the likely adverse impacts on local communities and the environment in general. The Scoping Report has also defined the draft Terms of Reference (ToR) for the EIA studies and has provided the Work Plan, which will guide the successful execution of the EIA and ensure approval or permit is obtained from the EPA.

The implementation of the solar power project will enhance socioeconomic development in the local communities through production and supply of quality and reliable electrical power. It will also enable VRA to diversity its power generation portfolio by increasing the renewable energy generation capacity and contribute in meeting Government of Ghana policy objectives on GHG emission reduction.

There were no objections to the implementation of the proposed project from the initial stakeholder consultations carried out. The VRA and the Ministry of Energy will ensure that the

Project is implemented in line with all relevant national policies, laws and standards to enhance the intended benefits of the Project and reduce potential negative impacts to local communities.

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K. Johnson, M. Villani, K. Bayliss, C. Brooks, S. Chandrasekhar, T. Chartier, Y. Chen, J. Garcia-Pelaez, R. Gee, R. Styron, A. Rood, M. Simionato, M. Pagani (2023). Global Earthquake Model (GEM) Seismic Hazard Map (version 2023.1 - June 2023), DOI: https://doi.org/10.5281/zenodo.8409647

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Internet sources

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ANNEXES

Annex 1-1 EPA Response to Project Registration

Tel: (0302) 664697 / 664698 / 662465
667524 / 0289673960 / 1 / 2
Fax: 233 (0302) 662690
E-mail: info@epa.gov.gh
Ghana Post (GPS): GA-107-1998

Our Ref: CE: 8497/01/02

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

VOLTA RIVER AUTHORITY
EXECUTIVE REGISTRY
RECEIVED
21 APR 2023
HEAD OFFICE

March 09, 2023

The Chief Executive
Volta River Authority Limited
P. O. Box MB 77
Accra, Ghana

Dear Sir,

ENVIRONMENTAL IMPACT ASSESSEMENT (EIA)
PROPOSED 70MWP SOLAR PHOTOVOLTAIC POWER PLANT LOCATED AT LOAGRI IN THE WEST MAMPRUSI DISTRICT OF THE NORTH EAST REGION OF GHANA

We acknowledge receipt of your letter dated February 20, 2023, on the above proposal submitted to the Agency for the purpose of obtaining environmental approval for change of scope from emulsion fabrication to emulsion manufacturing in accordance with the Environmental Assessment Regulations 1999 (LI 1652).

The proposal falls in the category of undertakings (Regulation 3) for which Environmental Impact Assessment (EIA) is required to help understand the likely implications of the proposal, the relevant alternatives and mitigations to consider in order to ensure, sound decision-making and sustainable development of the project.

In line with Regulation 11 of LI 1652, you are advised to carry out a scoping exercise to generate the relevant terms of reference (TOR) to guide satisfactory EIA study of the proposal.

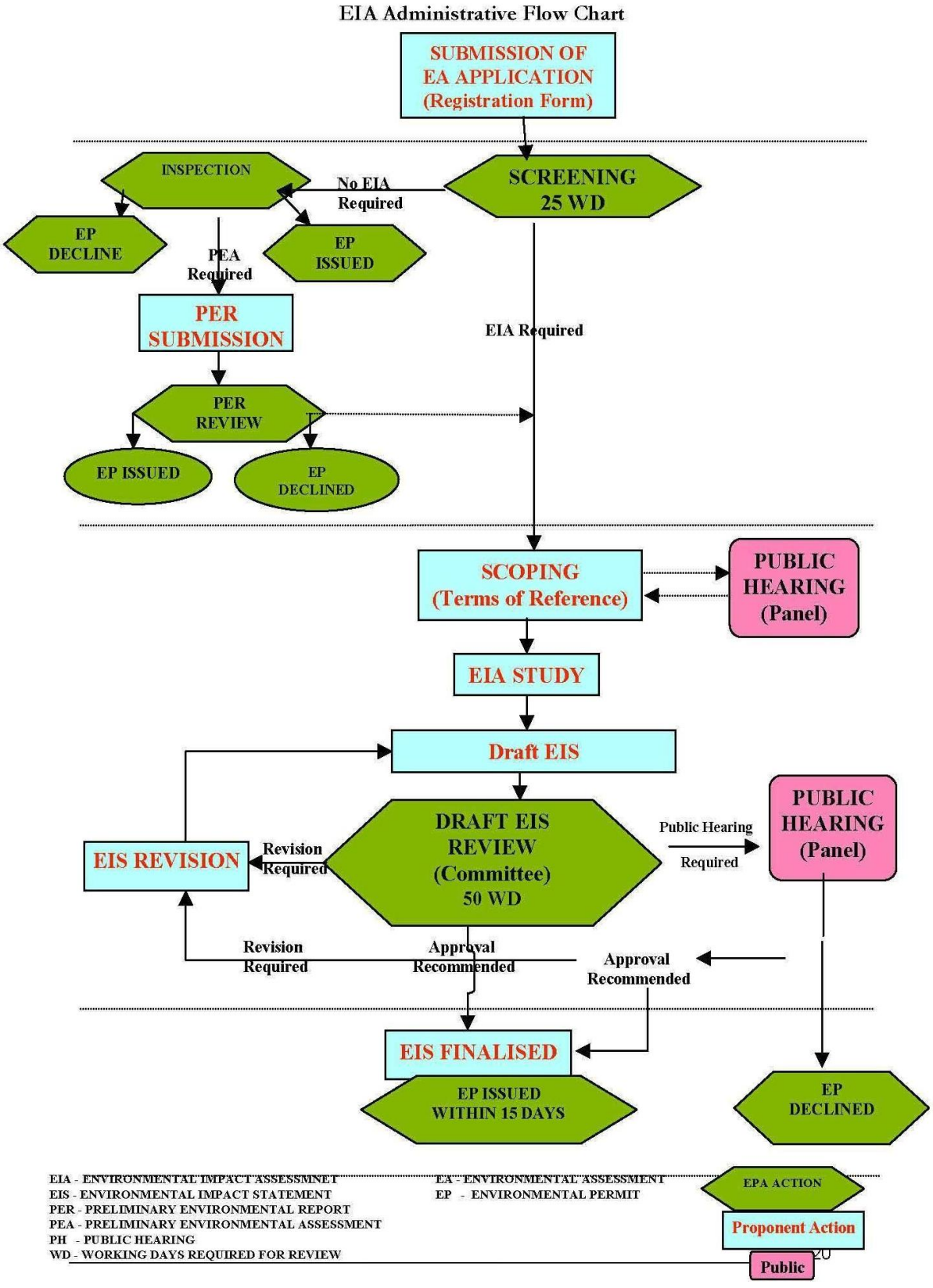
Please note that scoping is meant to focus the EIA on the key issues, concerns and decision areas and solicit input and guidance of all relevant stakeholders on the TOR. Scoping notices must be served as appropriate to facilitate stakeholder involvement (see attached sample). Ten (10) hard copies of the scoping report must be submitted to the Agency for study and agreement on the TOR, prior to the EIA studies.

It is important to note that both the Scoping Report and Environmental Impact Statement contains information on the consultants who prepared the reports. This should include the names, address, email, telephone experience and their specific contribution to the study. Failure to provide this information would render the submission incomplete.

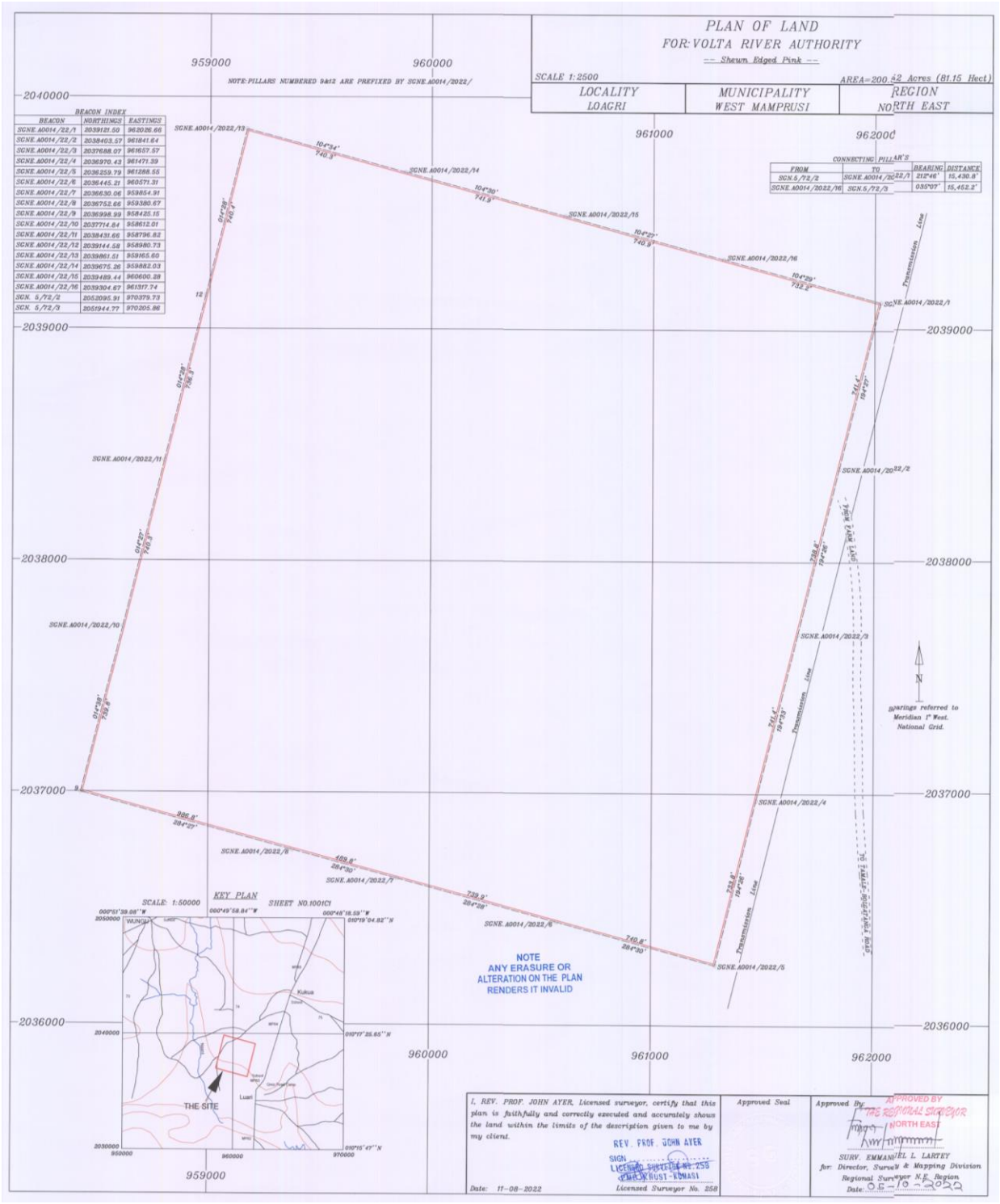
Do not hesitate to contact the EPA Head Office (Room 305) or the undersigned on 0501301447 or via E-mail; eaa.dept@epa.gov.gh for any assistance you may require in this regard.
Yours faithfully,

ANDRIANA N.K. NELSON
AG. DIRECTOR/EAA UNIT
FOR: EXECUTIVE DIRECTOR
cc: The Director, EPA, North East Region, Walewale

Annex 1-2 Administrative Flow Chart of the Ghana EIA Procedures


EIA Administrative Flow Chart
SUBMISSION OF EA APPLICATION (Registration Form)
INSPECTION
No EIA Required
SCREENING 25 WD
EP DECLINE
PEA Required
EP ISSUED
PER SUBMISSION
EIA Required
PER REVIEW
EP ISSUED
EP DECLINED
SCOPING (Terms of Reference)
PUBLIC HEARING (Panel)
EIA STUDY
Draft EIS
DRAFT EIS REVIEW (Committee) 50 WD
Public Hearing Required
PUBLIC HEARING (Panel)
EIS REVISION
Revision Required
Revision Required
Approval Recommended
Approval Recommended
EIS FINALISED
EP ISSUED WITHIN 15 DAYS
EP DECLINED
EIA - ENVIRONMENTAL IMPACT ASSESSMNET
EIS - ENVIRONMENTAL IMPACT STATEMENT
PER - PRELIMINARY ENVIRONMENTAL REPORT
PEA - PRELIMINARY ENVIRONMENTAL ASSESSMENT
PH - PUBLIC HEARING
WD - WORKING DAYS REQUIRED FOR REVIEW
EA - ENVIRONMENTAL ASSESSMENT
EP - ENVIRONMENTAL PERMIT
EPA ACTION
Proponent Action
Public

Annex 3-1 Copy of Site Plan



Annex 3-2 Copy of Layout Plan

Annex 6-1 Copy of Background Information Document (BID)

Environmental Impact Assessment for the Proposed Solar Photovoltaic Power Projects Under Phase 2 of VRA'S Renewed Energy Development Programme

BACKGROUND INFORMATION DOCUMENT

SELJEN CONSULT
P. O. Box MD 100,
Madina-Accra.
Ghana-West Africa
Tel: +233 208 434 557
Contact person: Kofi Gatu
Email: seljencon@gmail.com

VOLTA RIVER AUTHORITY

BACKGROUND

The Government of Ghana (GoG) formulated a Renewable Energy (RE) policy with the objective of providing ten (10) percent of Ghana's electricity demand from renewable energy sources by 2030. Subsequently, in November 2011, the Renewable Energy Act (Act 832) was passed to provide the necessary legal and regulatory framework for promoting the provision of energy, including electricity, from renewable sources. In line with the GOG's policy on renewable energy, the Volta River Authority (VRA) formulated a Renewable Energy policy with the following objectives:

1. Promote renewable energy as a means of reducing VRA's exposure to fuel price volatility and fuel supply risks.

2. Promote the use of renewable energy in VRA's Corporate Residential and Non-residential facilities and those of the Authority's Subsidiaries to reduce the cost of energy utilized in those facilities.

3. Diversify VRA's generation portfolio in a sustainable manner whiles maintaining a low carbon footprint.

The capacity target of Phase 2 of the Renewable Energy Development Programme (REDP) is to construct about 425MW of solar PV capacity. Part of the strategies to attain the target for the solar PV capacity in the Phase 2 comprises the proposed construction of **68 MW Sawla Solar Power Project** in the Savanna Region, **20 MW Sherigu Solar Power Project** and **20 MW Zebilla Solar Power Project** in the Upper East Region, and **95 MW Loagri Solar Power Project** in the North East Region.

WHAT DOES THE BACKGROUND INFORMATION DOCUMENT TELL YOU?

This Background Information Document (BID) provides you, as an Interested and or Affected Party (I&AP), with the background information on the proposed "**68 MW Sawla Solar Power Project, 20 MW Sherigu Solar Power Project, 20 MW Zebilla Solar Power Project,** and **95 MW Loagri Solar Power Project**" as follows.

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

What Does the Project Entail?

The Project

The main components of the **Solar Power Projects**, as shown in Figure 1 below include:

1. PV modules, that convert sunlight to electricity
2. Inverters, that convert DC power to AC grid compatible power
3. A connection to the grid through transformers, switchgear and distribution lines.

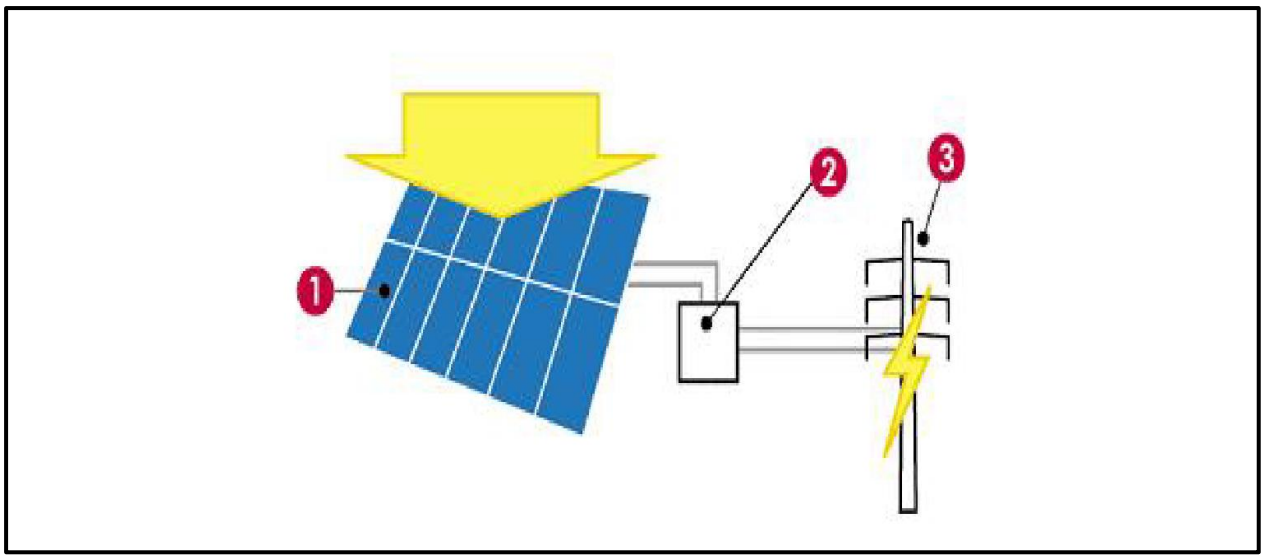


Figure 1: Components of a grid-connected power plant

Other equipment that might be needed include:

a. DC junction or combiner boxes
b. DC breakers and switches
c. Mounting structure
d. Energy production monitoring system

Project Benefits

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

- To spur development in the locality
- To produce quality electrical power
- To provide continuous supply of reliable power to end users
- To diversify VRA generation portfolio and its Geographical spread
- Reduction of Losses in the National Interconnected Transmission System (NITS) due to proximity of GRIDCo substation to the solar plant
- To increase VRA Renewable Energy (RE) generation capacity and contribute to meeting Government of Ghana policy objectives, and also allows VRA to meet consumers renewable energy requirements

Site Locations and Access

1. 68 MW Sawla Solar Power Project

The VRA is acquiring 61.38 hectares/151.67 acres of land in Sawla for the development of **68MW solar Power project**. Sawla is a town situated in the Savannah Region of Ghana between Bole and Wa, about 37.7km from Bole on the Bole-Wa Road (i.e. N12 road). The proposed site has coordinates 9°

14' 41.72"N/ 2° 27' 03.73"W; 9° 14' 55.38"N/ 2° 26' 47.72"W; 9° 15' 18.84"N/ 2° 27' 08.16"W; and 9° 15' 05.19"N/2° 27' 24.14"W. The Sawla site is on the west site of the N12 road from Wa to Bole, and there is adequate access to the site.

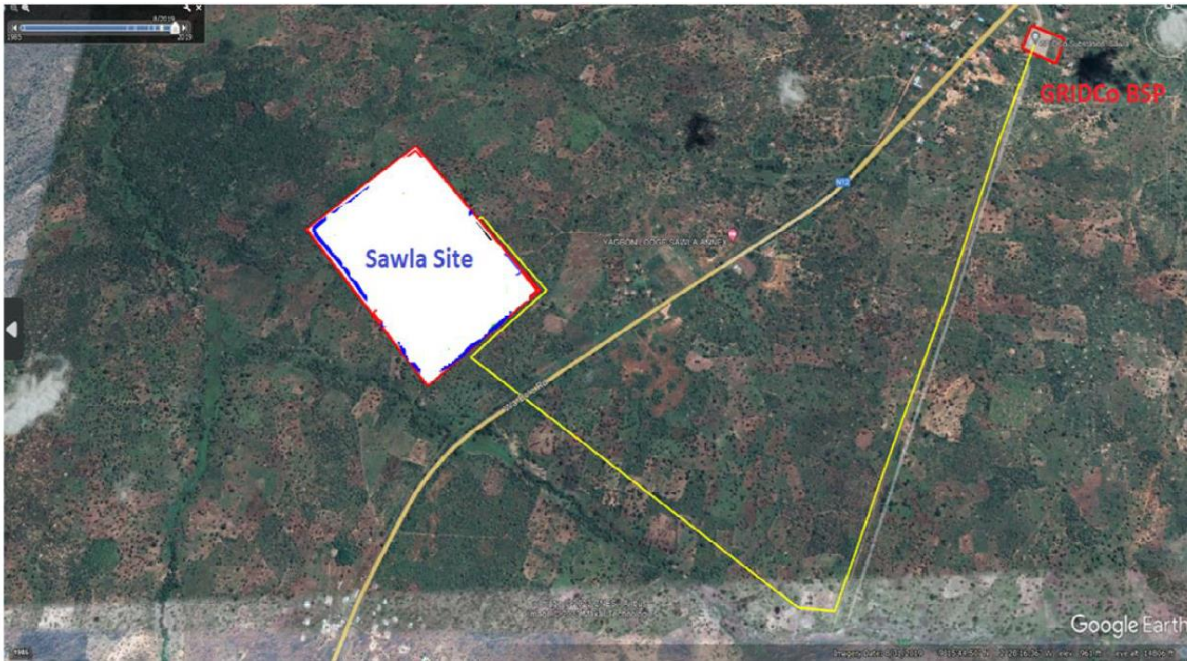


Figure 2: Aerial Photo of the Proposed Sawla Site

Key Features/characteristics of the proposed Site

The site is flat, grassland with few shrubs and economic trees as shown in Figure 3 above. Currently, there are no farming activities on the land, but the site was used for farming before acquired for the project. There is no settlement on the land.

Water Availability & Supply

There are no visible sources surface water in or close to the site. A borehole will have to be dug for water for construction and for Operation & Maintenance including cleaning of the solar panels during operation of the plant.

Power Evacuation and Grid Connection

The Sawla site is located on the west side of the N12 road from Wa to Bole. The site shares a border with the Wa-Bole Road and the 161kV right of way which is less than 2km away from the site. It is proposed that the Sawla Solar Power Plant (Sawla SPP) is expected to be constructed in two phases. Currently, GRIDCo's substation capacity can accommodate 20MW of Solar Power to be generated from the Sawla SPP under phase 1. The phase 1 involves the construction of the Sawla SPP with the power evacuation lines to be terminated on the 161kV lattice tower line which is 2km away from the site. The construction of phase 2 of the Sawla SPP which will generate the remaining 48MW will involve substation works and 6km sub-transmission power lines to evacuate the remaining power from the site to the GRIDCo BSP at Sawla.

2. 20MW Sherigu Solar Power Project

The proposed site for the Sherigu Solar Power Project is at Sherigu, about 9.42km west of the Regional Capital Bolgatanga town close to the Tamale-Bolgatanga Road. The available land is 30Hectares/76Acres. The proposed site has coordinates 10°46'22.281" N/0°56'29.226" W.

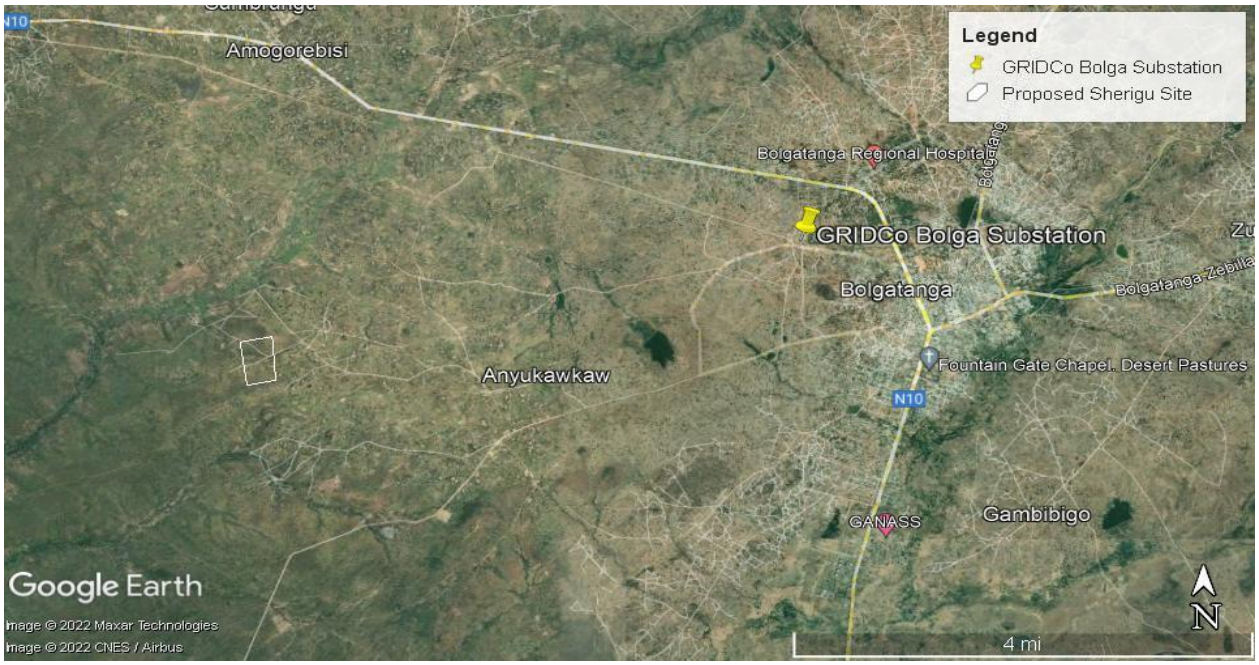


Figure 3: Proposed site for the Sherigu Solar Power Project

Key Features/characteristics of the proposed Site

The site is flat, savanna grassland with scattered shrubs and shows no farming activities. The site which is generally sandy has a flat topography. The soil type in some areas are however lateritic gravel and fused laterite in other areas. The soil types within the site is free draining.

Water Availability & Supply

The site is close to the GRIDCo Bolgatanga Substation. There is no water body to the site therefore, for operating and maintenance purposes, a borehole will be constructed on the site.

Power Evacuation and Grid Connection

The average annual solar irradiation level at Sherigu is between 2,100kWh/m^2 to 2,200kWh/m^2, which is above the preferred average of 1600kWh/m^2. This value of irradiation makes Sherigu a suitable site for the development of the solar PV plant.

3. 20MW Zebilla Solar Power Project

The proposed site for the Zebilla Solar Power Project is at Ankpaliga, about 2.22km east of Zebilla town along the main Zebilla to Bawku Road. The site is 600m from the Zebilla-Bawku Road. The available land is 22.60Hectares/55.84Acres. The proposed site has coordinates 10°56'38.30" N/0°27'23.90" W and 10°56'33.00" N/ 0°27'47.40" W on the south side and 10°56'45.50" N/ 0°27'45.60" W and 10°56'50.60" N/ 0°27'32.20" W on the north side. The proposed site is next to the

road from Zebilla to Bawku, and the road is tarred to the GRIDCo substation which shares a boundary with the site.

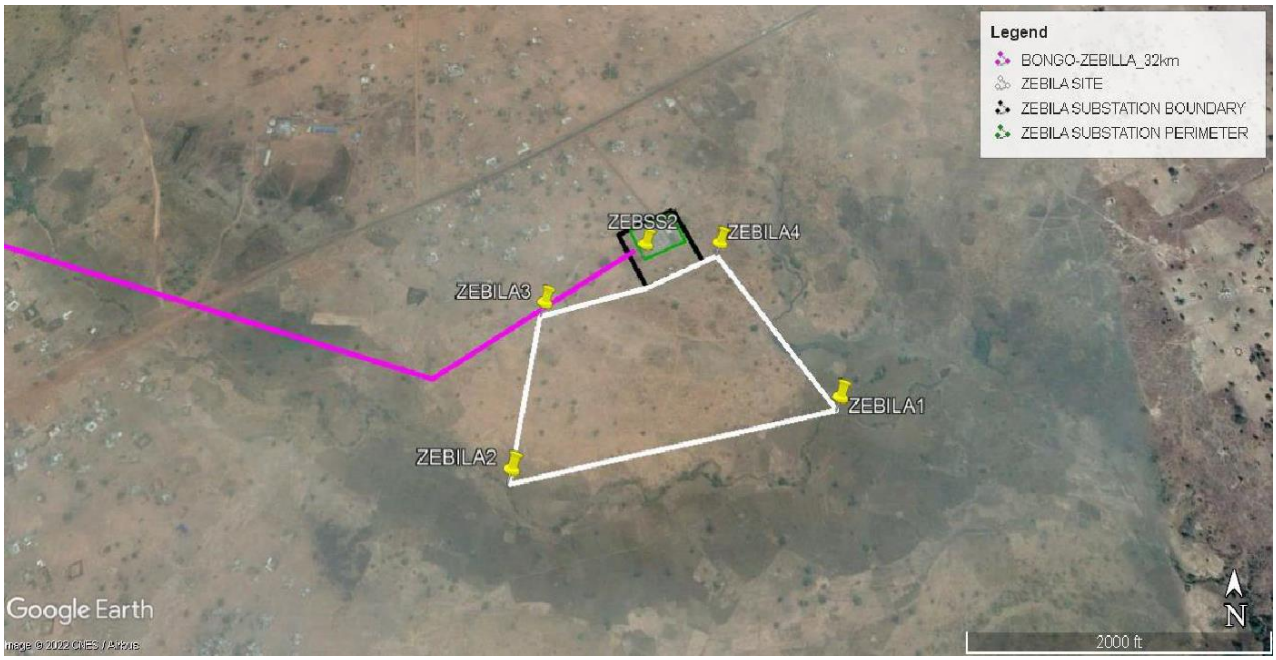


Figure 4: Proposed site for the Zebilla Solar Power Project

Key Features/characteristics of the proposed Site

The site is flat, grassland with shrubs and there are no farming activities or settlements. The closest settlements are about 150m from the north boundary of this site.

Water Availability & Supply

There are no indications of surface water in or close to the site. A borehole will have to be dug for water for Construction and for Operation & Maintenance.

Power Evacuation and Grid Connection

Evacuation of the electricity that would be produced at the proposed solar PV plant would be done via a 34.5kV sub-transmission underground cable to the adjacent GRIDCo substation.

4. 95MW Loagri Solar Power Project

The VRA is acquiring 81.15 hectares/200.52 acres of land in Loagri for the development of about **95 MW solar Power project**. Loagri is a town situated in the North East region of Ghana. The proposed site has coordinates 10° 17' 31.27"N/ 0° 50' 6.38"W; 10° 17' 24.06"N/ 0° 49' 38.68"W; 10° 16' 56.79"N/ 0° 49' 45.68"W; and 10° 17' 3.88"N/0° 50' 13.68"W. The Loagri site is on the west site of the N10 road from Tamale to Bolgatanga as shown in Figure 5.

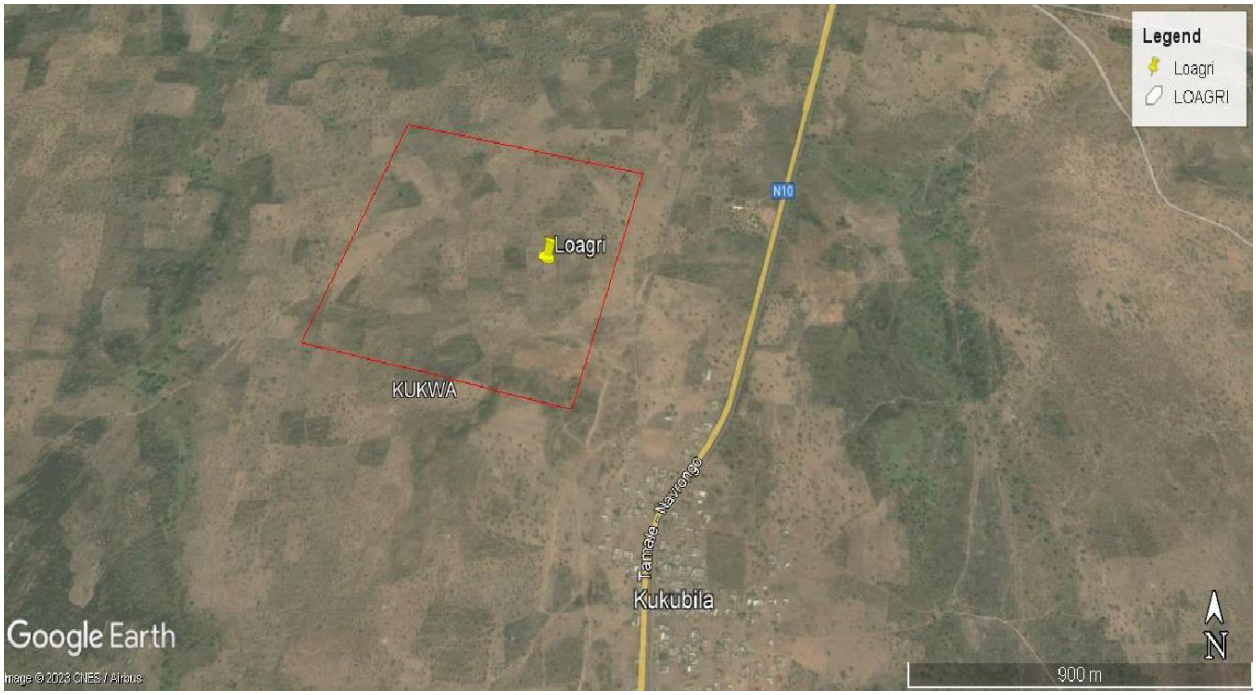


Figure 5: Aerial Photo of the Proposed Site for the Loagri Solar PV project

Key Features/characteristics of the proposed Site

The site is flat, grassland with few shrubs and economic trees as shown in Figure 3 above. There are no farming activities on the land currently. However, the site was used for farming before acquired or purchased for the project. There is no settlement at the site. The nearby towns include Kukwa, Loagri, and Wungu.

Water Availability & Supply

There are no visible sources surface water in or close to the site. A borehole will have to be dug for water for construction and for Operation & Maintenance including cleaning of the solar panels during operation of the plant.

Power Evacuation and Grid Connection

The site is located to West of the Tamale-Bolgatanga highway between the 330kV pylon number 289 and pylon number 294. The site shares a boarder with the Western boundary of the 330kV right of way. The 161kV line is near the South of the 330kV line and on the side of the Bolga – Tamale highway. It is proposed to construct a substation at the site to break into the 161kV line to connect the solar plant to the grid.

The Environmental Impact Assessment Study

Section 2.2 of the Environmental Impact Assessment (EIA) Guidelines for the Energy Sector, Volume 1, dated September 2011, indicates that ground-mounted PV power plant/system, either stand-alone, hybrid, or grid-tied with a total surface area of array exceeding twenty (20) hectares requires the undertaking of a full-blown environmental impact assessment and the preparation of an Environmental Impact Statement (EIS), and this shall apply to the **"68 MW Sawla Solar Power Project, 20 MW Sherigu Solar Power Project, 20 MW Zebilla Solar Power Project,** and **95 MW Loagri Solar**

Power Project". Volume 2 of the Energy Sector EIA Guidelines outlines the systematic procedures to be followed in the preparation of EIA Reports for the energy sector as well as guidelines on potential impacts and mitigation measures. In line with this legal requirement, a full EIA report for the project is required to enable the Ghana EPA issue an Environmental Permit to allow for physical construction to commence.

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

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

2. Phase 2 will involve full detailed environmental impact assessment study and the preparation of **"Environmental Impact Assessment Report for the Solar Power Projects"**.

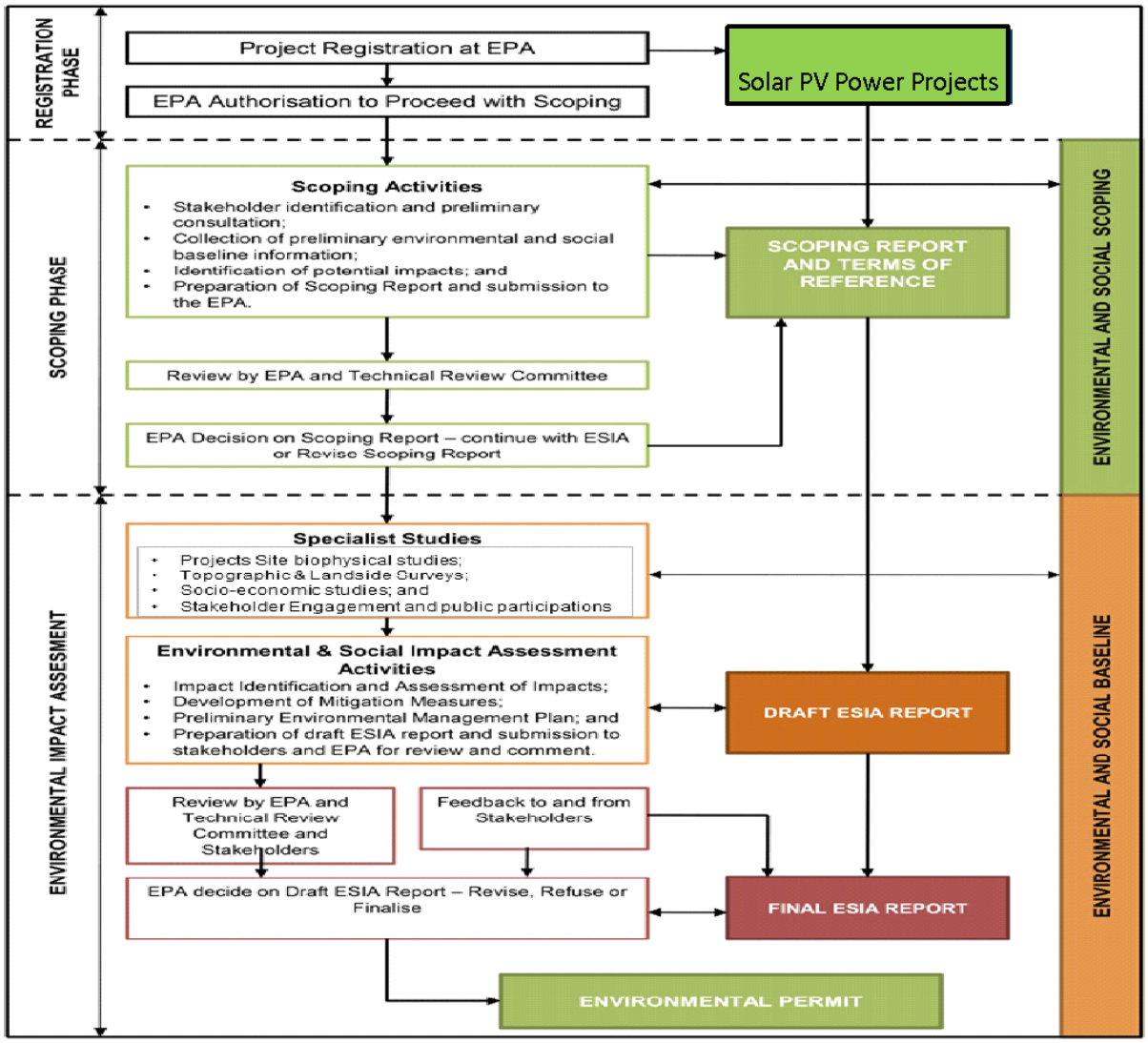
The main applicable regulations that would be triggered in the context of the proposed project are the Environmental Protection Agency Act, 1994 (Act 490), Environmental Assessment Regulations 1999, LI 1652, Renewable Energy Act, 2011 (Act 832), and Health, Safety and Environmental Policy for the Energy Sector, 2016. The list of relevant regulations will be refined during the Scoping and EIA Processes, and other regulations triggered may be added as applicable.

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

- Land acquisition and impacts on land owners and land users
- Socio-economic and local communities
- Landscape & Visual intrusion
- Terrestrial Ecology
- Geology & Soils
- Noise and vibration
- Air Quality
- Resource Use
- Impact on water resources
- Waste/hazardous material generation and disposal
- Impact on cultural heritage resources and social norms

- Community/Worker health and safety and fire hazard concerns
- Traffic & Transport
- Global Climate Change & Greenhouse Gas Emission Reductions

The steps in the Scoping and EIA Process are shown as below.



How can you get involved in the EIA Study?

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

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

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

Name: Kofi Gatu
Address: Seljen Consult Limited,
P. O. Box MD 100,
Madina -Accra
Email: seljencon@gmail.com
Mobile/WhatsApp: +233-20-843-4557

REGISTRATION AND COMMENT SHEET:

Should you have any queries, comments or suggestions regarding the proposed **Sawla Solar Power Project, Sherigu Solar Power Project, Zebilla Solar Power Project, Loagri Solar Power Project** being developed by the Volta River Authority at **Sawla, Sherigu, Zebilla, and Loagri** respectively, please note them below and return this sheet to the contact detail above:

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

Comments:

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

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

Annex 6-2 Stakeholder Engagement Form

VOLTA RIVER AUTHORITY

SELJEN CONSULT

CONSULTANCY SERVICES FOR THE PREPARATION OF ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED 95 MW LOAGRI SOLAR POWER PROJECT UNDER PHASE 2 OF VRA'S REDP

STAKEHOLDER ENGAGEMENT FORM

Identified Stakeholder: ……

Venue: ……..

Interviewer(s):
…….

Stakeholders Consulted		
Name	**Contact Number**	**Position**

Summary of Stakeholder discussions/Comments/Concerns

Issue	Comments/Concerns/Recommendations

Name:…….

Signature:……..

Date: ……..

Annex 6-3 Contact details of stakeholders consulted

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CONSULTANCY SERVICES FOR THE PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS FOR PROPOSED SOLAR POWER PROJECTS UNDER PHASE 2 OF VRA'S REDP

STAKEHOLDER ENGAGEMENT MEETING (ATTENDANCE)

DATE 12-09-2024

VENUE WEST MAMPRUSI MUNICIPAL ASS.

TIME 1:00 PM

NO.	NAME	DEPT/ORG.	PHONE NUMBER	EMAIL	SIGNATURE
1	KOFI OKISIN	VRA	0244234332	kofi.okisin@vra.com	[signature]
2	Kofi Atta Kakra Boakye	VRA	0550061768	kofi.boakye@vra.com	[signature]
3	Lukman Hudu	ARW & CD	0244944573	lukmanhudu@gmail.com	[signature]
4	Kukubor Edward	VRA	0552644985	edward.kukubor@vra.com	[signature]
5	Boateng Susuana	VRA	0247446264	susuanaoforiwah@gmail.com	[signature]
6	Ogere Brahy E	VRA	0203748157	Emmanuel.obrety@vra.com	[signature]
7	DALMEIDA ISHMAEL	VRA	0245490921	Ishmael.dalmeida@vra.com	[signature]
8	Richard Woamah	VRA	0243856196	Richard.Woam@vra.com	[signature]

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CONSULTANCY SERVICES FOR THE PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS FOR PROPOSED SOLAR POWER PROJECTS UNDER PHASE 2 OF VRA'S REDP

STAKEHOLDER ENGAGEMENT MEETING (ATTENDANCE)

DATE 12-09-2024

VENUE WEST MAMPRUSI MUNICIPAL ASS.

TIME 1:10 PM.

NO.	NAME	DEPT/ORG.	PHONE NUMBER	EMAIL	SIGNATURE
9	Jonas K. Agbeko	VRA	0248891433	Jonasagbeko@VRA.com	[signature]
* 10	Gs, RN. Shaibu Sulemana	WMMA/PPD	0548302685	Sulemanashaibu@gmail.com	[signature]
11	Abdul-Aziz Ruhaina	WMMA/PPD	0541811687	ruhainaaziz@gmail.com	[signature]
12	Millicent Luni	WMMA/DPD	0540408120	millicent.pare@gmail.com	[signature]
13	Issahaku Asinbo	Chief palace	0240449632		[signature]
14	Awudu Issaka	chiefs place	0245365646		[signature]
15	Orlando Dasha	Seljen	0245662743		[signature]
16	Hayibor Christabel	Seljen	0240028796	kristihayibor@gmail	[signature]

VOLTA RIVER AUTHORITY

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CONSULTANCY SERVICES FOR THE PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS FOR PROPOSED SOLAR POWER PROJECTS UNDER PHASE 2 OF VRA'S REDP

STAKEHOLDER ENGAGEMENT MEETING (ATTENDANCE)

DATE 12-09-2024

VENUE WEST MAMPRUSI MUNICIPAL ASS.

TIME 1:00 Pm.

NO.	NAME	DEPT/ORG.	PHONE NUMBER	EMAIL	SIGNATURE
17	[illegible]	SELJEN	0246437114	Sorbah2203 @gmail.com	[signature]
18	Alhaji Ibrahim	Kukua	0245633086		[signature]
19	Kazeare Francis	Forestry	0243233079	fkazare@gmail.com	[signature]
20	Rt. Shale Sulemana	Rep for MCE	0548302695	sulemanashale @gmail.com	[signature]
21	Abdul-Wahab Solifu	Assist. Director	0244568423	abdulwahab Sulifu23 @gmail.com	[signature]
22	Yaw Danso Boateng	Lands Comm	0246386559	[illegible]@yahoo.com	[signature]
23	Rasheed Wemah	LUSPA	0244461587	rasheedwema @yahoo.com	[signature]
24	Mohammed Alhassan	NCCE	0547060771	alhassm42@gmail.com	[signature]

VOLTA RIVER AUTHORITY

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CONSULTANCY SERVICES FOR THE PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS FOR PROPOSED SOLAR POWER PROJECTS UNDER PHASE 2 OF VRA'S REDP

STAKEHOLDER ENGAGEMENT FORM

Identified Stakeholder: EPA - WEST MAMPRUSI / NORTH EAST REGION OFFICE Venue: EPA OFFICE

Interviewer (s): SELJEN CONSULT

Stakeholders Consulted		
Name	Contact Number	Position
JAFARU ADAM MUSAH	0244445831/0501301601	AG. REGIONAL DIRECTOR
KIZITO DOGHLE	0542825026	ASS. PROGRAMME OFFICER

Page 1 of 2

VOLTA RIVER AUTHORITY

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CONSULTANCY SERVICES FOR THE PREPARATION OF
ENVIRONMENTAL IMPACT STATEMENTS FOR
PROPOSED SOLAR POWER PROJECTS UNDER PHASE 2 OF VRA'S REDP

STAKEHOLDER ENGAGEMENT FORM

Identified Stakeholder: NEDCo – WALEWALE Venue: NEDCO OFFICE

Interviewer (s): SELJEN CONSULT

Stakeholders Consulted		
Name	Contact Number	Position
Ebenezer Korsah	0201203349	Estate Assistant
Aaron Oppong	0240283239	Contracter
Roger Akapewc	0546272233	Station Supervisor
Ali Wakal Kufia	0545181130	M.M

Page 1 of 2

VOLTA RIVER AUTHORITY

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CONSULTANCY SERVICES FOR THE PREPARATION OF
ENVIRONMENTAL IMPACT STATEMENTS FOR
PROPOSED SOLAR POWER PROJECTS UNDER PHASE 2 OF VRA'S REDP

STAKEHOLDER ENGAGEMENT FORM

Identified Stakeholder: WEST MAMPRUSI FIRE OFFICER Venue:

Interviewer (s): SELJEN CONSULT

Stakeholders Consulted		
Name YAKUBU HARUNA (DOII)	Contact Number	Position
	0245296348	MUNICIPAL FIRE COMMANDER

Page 1 of 2

VOLTA RIVER AUTHORITY

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CONSULTANCY SERVICES FOR THE PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS FOR PROPOSED SOLAR POWER PROJECTS UNDER PHASE 2 OF VRA'S REDP

STAKEHOLDER ENGAGEMENT FORM

Identified Stakeholder: Farmers - LOAGRI - KUKUA Venue: PROJECT SITE

Interviewer (s): SELJEN CONSULT

Stakeholders Consulted			
	Name	Contact Number	Position
1	Issahaku Aminiyaw	0240449632	Maiz - 15 acres
2	Ibrahim Bukari	0503203855	Millet - 4 acres
3	Ahamadu Issahaku	0208493459	bean - 7 acres
4	Gatari Issahaku	0547074778	Maiz - 6 acres
5	Mahamadu Bukari	0535727965	Maiz - 10 acres
6	Musah Amidu		Granut - 20 acres
7	Adam ~~Ibra~~ Isha	0544255041	Maiz - 7 acres
8	Azizi Imoro	0538581222	Soyabean - 8 acres
9	ABukari Issahaku	0554010589	Maiz - 5 acres
10	Idelisu Braimah	0558742673	Granut - 5 acres
11	Issahaku Mohamadu	0599534760	Maiz - 5 acres
12	Amidu Issahaku	0242596296	millet - 6 acres

Page 1 of 2

VOLTA RIVER AUTHORITY

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CONSULTANCY SERVICES FOR THE PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS FOR PROPOSED SOLAR POWER PROJECTS UNDER PHASE 2 OF VRA'S REDP

STAKEHOLDER ENGAGEMENT FORM

Identified Stakeholder: FARMERS - LOAGRI x KUKUA Venue: PROJECT SITE

Interviewer (s): SELJEN CONSULT

Stakeholders Consulted			
	Name	Contact Number	Position
13	~~Abubakari~~ Baba	0535687510	Granut - 1 acre
14	Braimah Issifu	0556314354	Maiz - 4 acres
15	Adam Issaka	0541055588	Maiz - 3 acres
16	Abu Tanko	0541476658	Maiz - 2 acres
17	Sayuti Barrah	0257507795	
18	Sumani Abdul Rauf	0245048463	Granut - 2 acre
19	Salifu Latif	0246785471	bean - 1 acre
20	yakuby Ibrahim	0559315813	bean - 3 acre
21	Adisa Issah	0596677839	Granut - 3 acre
22	Sumani Abibu	0537847296	Granut 3 acre
23	Saida Sumani	0530605546	Granut 6 acre
24	Lamisu Mahami	0547571747	bean 2 acre

Page 1 of 2

VOLTA RIVER AUTHORITY

SELJEN CONSULT

CONSULTANCY SERVICES FOR THE PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS FOR PROPOSED SOLAR POWER PROJECTS UNDER PHASE 2 OF VRA'S REDP

STAKEHOLDER ENGAGEMENT FORM

Identified Stakeholder: FARMERS - LOAGRI - KUKUA Venue: PROJECT SITE

Interviewer (s): SELJEN CONSULT

	Stakeholders Consulted		
	Name	**Contact Number**	**Position**
25	Sadat Ibrahim	0557912467	Maiz - 8 acres
26	Ahamadu Dokurugu	0246748027	Soyabean - 9 acres
27	Sumani Yidana	0559442531	Maiz - 3 acres
28	Rukaya Alhassan	0549707115	Beans - 2 acres
29	Mariam Bunto	0532380836	Maize - 2 acres
30	Aminu Issahaku	0554158063	Bean - 15 acres
31	Sulemana Bukari	0556868195	Bean - 3 acres
32	Zanba Zaanbaa	0243633286	Maiz - 8 acres
33	Hudu Amidu	0248134512	Granut - 6 acres
34	Buley Osman	0597044977	Maiz - 7 acres
35	Baba Musah	0554719882	Maiz - 5 acres
36	Abdulkarim Bukari	0550052673	Maize - 3 acres

Page 1 of 2

Annex 6-4 Copy of Scoping Notice to be published in the national dailies.

SCOPING NOTICE

Volta River Authority (VRA) Propose to establish a 95 MW Loagri Solar Photovoltaic Power Project at Loagri in the West Mamprusi District of the North East Region.

Notice of the proposed 95 MW Loagri Solar Photovoltaic Power Project is hereby served for public information as required under the procedure for the conduct of EIA in accordance with Regulation 15 (1) of (LI 1652).

Any person(s) who has an interest, concern, or special knowledge relating to potential environmental effects of the undertaking, may contact or send such concerns, etc to

The Chief Executive	and	The Executive Director
Volta River Authority		Environmental Protection Agency
Post Office Box MB77		P. O. Box MB326
Accra.		Accra
Tel: +233-30-2664941-9		0302-664697/8 0302-667524/662465
Fax: +233-30-2662610		0302-662690
Email: ben.sackey@vra.com		info@epa.gov.gh