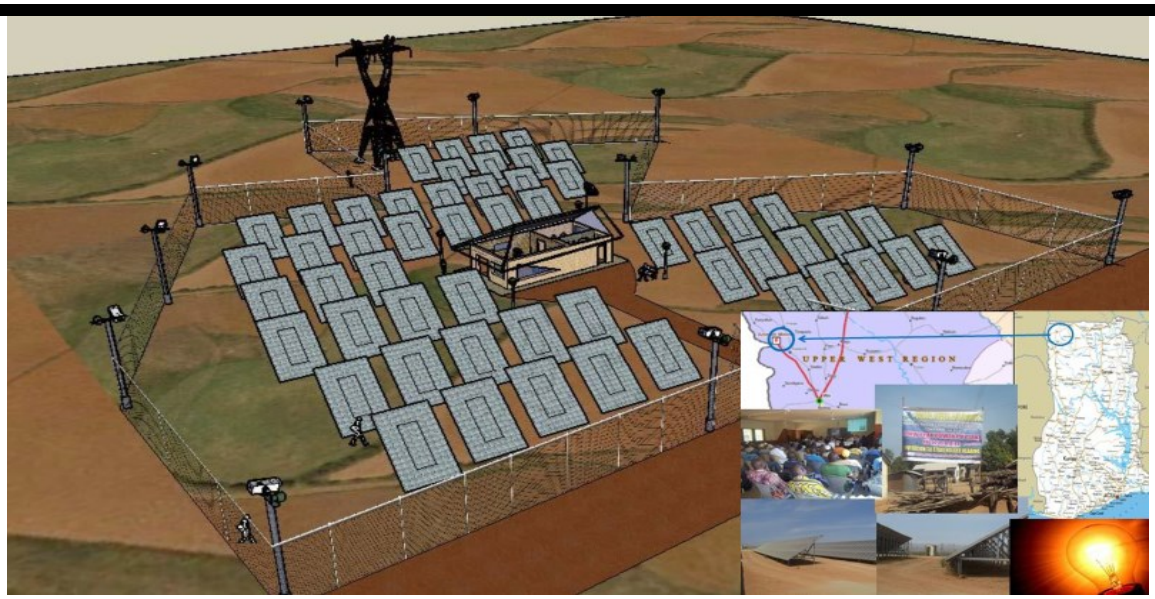
35MW Solar Power Project (SPP): Upper West Regional Project Sites



Environmental Impact Assessment Report: Non-Technical Summary

A STAND - ALONE REPORT

VOLTA RIVER AUTHORITY

UPDATED JANUARY 2020

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

REPORT DETAILS

Title:	Environmental & Social Impact Assessment for the proposed 35MW Solar Power Project: Upper West Regional Project Sites – Non-Technical Summary Report
Project Description:	This NTS Report forms part of a series of reports and information sources that are being provided under the Environmental Impact Assessment (EIA) process for the proposed 35MW Solar Power Project: Upper West Regional Project Sites. The EIA is a process designed to ensure that new developments, and extensions to existing developments, are located and designed in such a way as to minimise environmental impact. and that all concerns are addressed as a project gains momentum through to implementation. Specifically, the NTS Report is intended to provide a briefing for decision makers and to allow the general reader an appreciation of the key environmental issues of the project and the way they have been addressed in the EIA Report to satisfy the requirements of the Ghana EPA and project financiers.
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35MW Solar Power Project: Upper West Regional Project Sites – Non-Technical Summary of EIA Report

DATE: **UPDATED JANUARY 2020**
REPORT STATUS: **FINAL**
PROPONENT: **VOLTA RIVER AUTHORITY**

INTERNAL DOCUMENT DISTRIBUTION

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5	VRA Head Office Library	Volta River Authority	Accra

NOTE:

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LIST OF ABBREVIATIONS

Abbreviation		Meaning
CDM	-	Clean Development Mechanism
CDP	-	Community Development Programme
EIA	-	Environmental Impact Assessment
EMMP	-	Environmental Management & Monitoring Plan
EPA	-	Environmental Protection Agency
FSD	-	Forest Services Division
GHG	-	Greenhouse Gas
GoG	-	Government of Ghana
IPPs	-	Independent Power Producers
kfW	-	Kreditanstalt Für Wiederaufbau
LI	-	Lahmeyer International
MOU	-	Memorandum of Understanding
MW	-	Megawatts
NEDCo	-	Northern Electricity Distribution Company
NTS	-	Non-Technical Summary
PEA	-	Preliminary Environmental Assessment
PER	-	Preliminary Environmental Report
PV	-	Photovoltaic
RE	-	Renewable Energy
REDP	-	Renewable Energy Development Programme Phase
SPP-UWR	-	Solar Power Project: Upper West Regional Project Sites
VRA	-	Volta River Authority

SUMMARY

1. In line with the Environmental Assessment Regulations, LI 1652 (1999), the Volta River Authority (VRA) in September 2014 obtained an Environmental Permit to construct a 12MW solar power plant, comprising of 8MW plant at Kaleo and a 4MW plant at Lawra, all in the Upper West Region of Ghana. Currently, the VRA intends to expand the scope of the development from 12MW to 35MW, and this is to be achieved through the acquisition of additional lands at the Kaleo and Lawra sites to accommodate the extra 23MW capacity.

2. The project which is titled the ***"35MW Solar Power Project: Upper West Regional Project Sites"*** (hereinafter referred to either as the "Project") is to be developed in two phases by utilizing four (4) separate sites with a total land area of 49.79Ha. The breakdown of the developmental phases and land sizes to be utilized under the project is as shown below:

Name	Size (Ha)	Phase 1	Phase 2	Total	Latitude	Longitude
Kaleo Site 1	10.22	8 MW	-	8 MW	10°10'22.89"N	2°32'1.07"W
Kaleo Site 2	18.39	-	13 MW	13 MW	10°10'49.91"N	2°32'4.98"W
Kaleo Site 3	10.18	5 MW	2 MW	7 MW	10°10'49.91"N	2°32'4.98"W
Lawra	11.00	4 MW	3 MW	7 MW	10°66'24.01 N	2°89'92.18W
Total	**49.79**	**17** MW	**18** MW	**35** MW		

***Source:* "Requirements for modifications of Phase 1 to accommodate Phase 2 (2018)**

3. An associated 34.5kV sub transmission and water supply systems are to be constructed under both phases. Developments activities under Phase 1 will allow for relevant modifications and ease of installations for those under Phase 2. Constructional activities for Phase 1 are expected to commence latest by November 2019, and depending on financial closure, that of Phase 2 is targeted by June 2020. Thus, based on the timing of financial closure for Phase 2, construction may run concurrently resulting in both phases being linked as a singular project.

4. An Environmental Permit for the 12MW component (i.e. 8MW Kaleo Site 1 and the 4MW Lawra Site under Phase 1) has been obtained. There is therefore the need to undertake an environmental assessment for the acquisition of an Environmental Permit to cover the entire 35MW PV power plants, hence the preparation of this EIA Report, which is a requirement under the Environmental Assessment Regulations, LI 1652 (1999). Based on the submission of a Draft EIA Report, dated March 2019, EPA per letter dated July 29, 2019 submitted their review comments and requested that the issues raised be addressed and incorporated in the Final EIA Report.

5. A Final EIA Report, dated Septemder 2019, has been prepared to address any predicted environmental and social issue associated with the construction and operation of the "***35MW Solar Power Project: Upper West Regional Project Sites"***, takin into consideration the EPA review comments. The Final EIA Report records the results and conclusions of the environmental assessment carried out to determine the potential impacts (both adverse and beneficial) of the solar power project. The Report provides information of all relevant national and international environmental, social, health, safety and labour laws, policies, regulations, guidelines and standards that apply to the development of the project and how they are comaplied with. It further provides details of the bio-physical and socio-economic environment of the project area. An Environmental permit, dated December 18, 2019 has been issued for the project.

6. There is no involuntary resettlement associated under this project, for both the PV Plant and sub-transmission line. VRA acquired the lands for the PV sites through voluntary means and private treaties, and the required leases executed and registered with the Lands Commision. The Water Resource Commission has assessed that the project would not negatively impact on community water needs as a result of the use of groundwater for panel cleaning during the operational phase. All the PV sites enumerated are degraded and characterized by annual bush fires, continuous farming, and animal grazing etc. Due to closeness of the sites to human settlement coupled with continuous farming activities and annual bushfire, few wildlife resources are identified at the project sites.

7. Key stakeholders consulted during the period included all landowning Families, general populations within the Lawra and Kaleo communities, elected representatives of Lawra and Kaleo communities as well as the state agencies within the Nadowli-Kaleo District and Lawra Municipal. Public stakeholder engagements held in January 2012, November 2017 and August 2019 has provided key socio-cultural information that needs to be addressed during project execution. The stakeholder engagements in August 2019 was aimed at addressing EPA review comments on the Draft EIA Report. An Environmental & Social Managment Plan as well as an Environmental Monitoring Plan has been prepared to provide measures in addressing associated project impacts.

8. This Non-Technical Summary (NTS) Report is intended to provide a briefing for decision makers and to allow the general reader an appreciation of the key environmental issues of the "***35MW Solar Power Project: Upper West Regional Project Sites"*** and the way they have been addressed in the ESIA Report to satisfy the requirements of the Ghana EPA and project financiers. The NTS Report is a stand-alone document and information provided should be linked to the suite of documents for the environmental assessment study, of which the following are also part:

    a. 35MW Solar Power Project: Upper West Regional Project Sites – Final Environmental Impact Assessment Report, September 2019

b. 35MW Solar Power Project Phase 1: Upper West Regional Project Sites - Baseline Flora and Faunal Report, August 2018

c. 35MW Solar Power Project: Upper West Regional Project Sites - Stakeholder Engagement Plan, January 2020

d. 35MW Solar Power Project Phase 1: Upper West Regional Project Sites - Land Acquisition & Resettlement Plan, January 2020

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1 BACKGROUND

As part of its generation expansion projects, the Volta River Authority (VRA) [1] proposes to construct and operate a total installed capacity of 35MW of solar power plants and associated electrical infrastructure within Kaleo and Lawra communities, in the Nadowli-Kaleo District and Lawra Municipal respectively, all in the Upper West Region of Ghana. The project is to be developed in two (2) phases by utilizing four (4) separate sites with a total land area of 49.79a. Phase 1 and Phase 2 will involve the installation of 17MW and 18MW, respectively. Developments activities under Phase 1 will allow for relevant modifications and ease of installations for those under Phase 2. An associated 34.5kV sub transmission and water supply systems are to be constructed under both phases. In the case of Lawra and Kaleo Site 3, modifications in network connections needed to allow easy installation of the solar capacity under Phase II would be provided under the Phase I Project. The development will proceed on a turnkey engineering, procurement and construction basis. Design specifications to be followed during construction are to be in line with both the Ghana Building Code, 2018 as well as international standards such as the British Standards.

VRA submitted a Draft EIA Report for the 35MW Solar Power Project, dated March 2019 to the EPA for review. The EPA per letter dated July 29, 2019 submitted their review comments and requested that the issues raised be addressed and incorporated in the Final EIA Report for the issuance of the constructional Environmental Permit. The Final EIA Report (September 2019), records the results and conclusions of the environmental assessment carried out to determine the potential impacts (both adverse and beneficial) of the "***35MW Solar Power Project: Upper West Regional Project Sites",*** taking into consideration the EPA review comments. This Non-Technical Summary Report is a stand-alone document and is intended to provide a briefing for decision makers and to allow the general reader an appreciation of the key environmental issues of the project and the way they have been addressed in the EIA Report to satisfy the requirements of the Ghana EPA and project financiers.

[1] *Details of VRA can be accessed on its website www.vra.com.*

2 THE NEED FOR PROJECT DEVELOPMENT

In line with the National Renewable Energy Act, 2011 (Act 832), VRA in February 2010 adopted a Renewable Energy (RE) Policy in order to develop and operate RE plants in an efficient, cost effective and environmentally sustainable manner. To achieve the purpose set out in the Corporate RE Policy, VRA formulated the Renewable Energy Development Programme (REDP). The VRA REDP sets a 5-10 years' Renewable generation capacity target, taking cognisance of the local and export demand and the system constraints and is being rolled out in two (2) phases as shown in Table 2-1.

Table 2-1: VRA Renewable Energy Development Programme

REDP	Solar Power Project	Wind Power Project
Phase 1	a. 2.5 MW Navrongo Solar Power Plant in the Kassena Nankana East District of the Upper East Region and the plant has been operational since May 2013. b. 17MW (8MW and 5MW in Kaleo, 4MW Lawra) in the Upper West Region. Feasibility Study, including this EIA and procurement of EPC Contract is ongoing.	a. 76 MW Wind Power Project -1 (Anloga, Srogbe, Anyanui in Volta Region) b. 76.5MW Wind Power Project -2 (Wokumagbe and Goi in Greater Accra Region) Feasibility Study, including EIA, for WPP1 and WPP2 are ongoing and are expected to be completed by close of June 2018.
Phase 2	200MW Solar Power project to be built in different phases, including the following: a. 18MW (13MW and 2MW in Kaleo, 3MW Lawra) in the Upper West Region. Feasibility Study, including this EIA is ongoing. b. 40MW Bongo Solar Power Project: Feasibility Study, including EIA, is ongoing.	200MW Wind Power Project, and wind measurements completed at four (4) sites.

Source: "Scoping Report for 40MW Bongo Solar Power Project, 2018

VRA in May 2013 commenced the operation of a 2.5MW Solar PV plant in Navrongo, in the Upper East Region of Ghana. The development of the 17MW and 18MW Solar PV capacity in the Upper West Region of Ghana, known as the "***35MW Solar Power Project: Upper West Regional Project Sites"*** is part of the strategy to attain the set targets for Phase 1 and Phase 2 of the REDP.

3 POLICY, LEGISLATIVE & ADMINISTRATIVE REQUIREMENTS

It is a requirement to provide an overview of all national legislation and international conventions/guidelines that may inform the environmental assessment process to ensure that the proposed project meets the highest possible standards of ESIA and the subsequent management policies. Subsequently, the relevant policies, legislative and administrative framework, including VRA's Corporate Policies, that must be considered for the successful implementation of this project have been gathered and how they apply discussed as part of this environmental assessment report. Key national legislation, regulations and guidelines of relevance to the envisaged project and this ESIA report relates to that of Environmental Protection, Occupational Health & Safety, Road Traffic Safety, Labour & Other Social Responsibility, Property Acquisition & Compensation, Land & Water Resource Protection, Biodiversity & Resource Protection and Climate Change & Vulnerabilities.

The governmental bodies in Ghana that will be directly responsible for overseeing the project at all stages are the Ministry of Energy, the Energy Commission, the Public Utilities and Regulatory Commission, the Volta River Authority, the Northern Electricity Distribution Company and the Ghana Grid Company. The legal framework within which these institutions exist and their roles in the administration of the proposed solar project are explained in the ESIA Report.

The project is partly financed by the KfW Group through an on-lending Agreement between VRA and the Government of Ghana. Thus, in addition to the national laws, the proposed solar power project has also committed to align as far as possible with the requirements of international financiers. Generally, KfW bases project assessments on the regulations that apply in the country in which the project is to be implemented. These regulations must be consistent with international environmental, social, health, safety and labour standards. Thus, international safeguards such as those of the World Bank Group, including International Finance Company, Organisation for Economic Corporation & Development (OECD), European Development Finance Institutions (EDFI) as well as the Equator Principles that dictate 'best-practice' from an environmental and social impact perspective are outlined briefly along with guidelines developed by the international community.

All relevant national and international environmental, social, health, safety and labour laws, policies, regulations, guidelines and standards that apply to the development of the project will be applied as required.

4 KEY PROJECT FEATURES

4.1 Project Overview

The "35MW Solar Power Project Phase: Upper West Regional Project Sites", is to be developed in two phases and utilising four (4) sites, within Kaleo and Lawra communities. The breakdown of the developmental phases and land sizes with geographic coordinates to be utilized under the 35MW solar power project is shown in *Table 4-1*.

Table 4-1: Breakdown of 35MW Solar Power Project in the Upper West Region

Name	Size (Ha)	Phase 1 (MW)	Phase 2 (MW)	Total (MW)	Latitude	Longitude
Kaleo Site 1	10.22	8	0	8	10°10'22.89"N	2°32'1.07"W
Kaleo Site 2	18.39	0	13	13	10°10'49.91"N	2°32'4.98"W
Kaleo Site 3	10.18	5	2	7	10°10'49.91"N	2°32'4.98"W
Lawra	11.00	4	3	7	10°66'24.01 N	2°89'92.18W
Total	**49.79**	**17**	**18**	**35**		

The location of project districts within the Upper West Region in the context of Ghana, the Site Plans as well as Google Maps of the Kaleo and Lawra PV Sites are provided in Appendix 2. An associated 34.5kV sub transmission and water supply systems are to be constructed under both phases. In the case of Lawra and Kaleo Site 3, modifications in network connections needed to allow easy installation of the Phase II Solar Capacity would be provided under the Phase I Project. Feasibility studies for the planned 17MW component for the Phase 1 Development has been completed, whilst that for the additional 18MW under Phase 2 is still underway.

Tractebel Engineering (formerly Lahmeyer International GmbH) as the Owner's Engineer for the project is responsible for site verifications, design, specification and all technical aspects of the tender and contracting as well as working as specialist environmental advisors. The services also cover the supervision of the whole construction process and commissioning. The procurement of an EPC Contractor, Elecnor SA of Spain was completed in June 2019 and constructional activities commenced in November 2019. The Lawra Site is expected to take 7 months to complete whilst that of Kaleo will take 15 months. Design specifications to be followed during construction are to be in line with both the Ghana Building Code, 2018 as well as international standards such as the British Standards.

Depending on the timing of financial closure, project construction for both phases at the various sites may run concurrently to achieve the total of the 35MW PV power plants. The construction schedule has been created according to FIDIC contract standards and is deemed suitable for both projects. It must be noted however, that the construction time of this type of projects is largely based on the logistics and the manpower of the EPC contractor. During operations and maintenance, the responsibility is going to be taken over by a dedicated VRA Team.

4.2 Kaleo Solar Power Project

The project site is located on the eastern side of the Kaleo township within the Nadowli-Kaleo District, formerly known as the Nadowli District. The terrain of the three (3) project sites are mostly flat with a slight slope towards south. They are rectangular shaped which is regarded as suitable for PV installation. However, it needs to be adequately prepared for some part. Kaleo is an attractive site for PV development due to its direct access to the distribution grid and the flat terrain surface. Parts of the area were previously used as farmland but has now been turn into fallow land. Specifically, some tall trees, comprising mostly of Dadawa, Sheanut, Red Flowered Silk cotton, Nim Trees as well as shrub vegetation and rocks at few spot-like locations will have to be removed. This indicates that ramming the foundations of the support structure will be possible. The only significant constraint which needs to be considered for the future operation is the anticipation of the growing of the town and farms towards the PV area. Consequently, safety margins close to property borders are essential not only for safety reasons but also to avoid any energy production losses from shadows (small houses, pylons etc.). There is a footpath at the North of the site used by dwellers from the town to arrive at their farms. It is recommended to re-establish this existing footpath as keeping them would certainly prevent any conflicts.

Within the project vicinity across the main road of Kaleo Site 1 are the Kaleo DA Nursery and Primary schools, and the Church of Pentecost. One key historical resource in Kaleo is the burial ground of the Late Hon. Jatoe Kaleo, who died on June 6, 1998. This site is about 500 m to the Kaleo Site 1. The Late Hon. Jatoe Kaleo was one of the leading Ghanaian politicians who led Ghana into independence. The Kaleo Police Station and the Ahmadiya Mission Hospital are both located close to the western side of the Kaleo Site 2. There are 2 Fulani nomadic settlements, one just outside the Kaleo Site 2 and the other located within the site, made up of 2 hamlets. Discussions with the landowner indicate these Fulanis was contracted by him to look after his cattle and the landowner himself (upon request by VRA) will oversee and provide for the adequate resettlement to another equivalent plot on his property for them.

The neighbouring features around the immediate impact of the project area and their coordinates as well as distances from the project sites are shown in Table 4-2 Table 4-2 and a satellite view shown in ***Figure 4-1***. See Appendix 3 for site pictures of the Kaleo Solar Power Project.

Table 4-2: Sensitive Infrastructure Close to Kaleo PV Site

Name of Infrastructure/facilities	Latitude	Longitude	Distances (km)		
			Site 1	Site 2	Site 3
Kaleo Police Station	10° 9'56.28"N	2°32'24.91"W	1.1	0.48	1.76
Ahmadiyah Mission Hospital	10°10'10.81"N	2°32'30.27"W	0.96	0.72	1.42
Kaleo R/C Primary	10°10'19.27"N	2°32'32.54"W	0.96	0.93	1.26
Kaleo DA Nursery	10°10'27.62"N	2°32'20.89"W	0.62	0.93	0.84
Kaleo DA Primary School	10°10'35.84"N	2°32'5.12"W	0.42	1.12	0.43

Name of Infrastructure/facilities	Latitude	Longitude	Distances (km)		
			Site 1	Site 2	Site 3
Burial Site of Late Hon. Jatoe Kaleo	10°10'27.10"N	2°32'21.66"W	0.64	0.92	0.87
Church of Pentecost	10°10'34.12"N	2°32'15.65"W	0.56	1.1	0.59
Fulani Settlement 1	10° 9'54.26"N	2°32'10.14"W	0.92	0.17	1.72
Fulani Settlement 2	10° 9'58.61"N	2°32'18.41"W	0.92	0.28	1.63
Emmanuel Worldwide Synagogue	10°10'46.92"N	2°32'8.53"W	0.77	1.46	0.14
Kaleo Community Dam	10°10'53.74"N	2°32'32.19"W	1.35	1.8	0.83
Kaleo Site 1	10°10'22.89"N	2°32'1.07"W	-	0.76	0.84
Kaleo Site 2 (for future expansion project)	10° 9'59.70"N	2°32'9.38"W	0.76	-	1.55
Kaleo Site 3	10°10'49.91"N	2°32'4.98"W	0.84	1.55	-

4.3 Lawra Solar Power Plant

The project site is located on the north of the Lawra township within the Lawra Municipal. The Lawra PV Site has an area for installation of 6.13 hectares. There are no settlements on this site, and the land is largely fallow with shrubs and Acacia and Sheanut being the most dominant trees. The land is also used for farming of annual crops and legumes as well as animal grazing. The terrain is not completely flat showing small bumps and slight slope descending towards North with 2.5-3% in average. The slope needs to be considered in the design by adjustment of the row to row spacing. The neighbouring features close to the Lawra PV sites and their coordinates and distances are shown in Table 4-3 and a satellite view shown in *Figure 4-2*. See Appendix 3 for site pictures of the Lawra Solar Power Project.

Table 4-3: Neighbouring Infrastructure Within the Immediate Impact Area of the Lawra PV Site

Name	Latitude	Longitude	Distance from Solar Site
Black Volta	10°40'9.79"N	2°54'41.68"W	1.50 km
Forestry Commission Lawra Office	10°39'13.27"N	2°53'22.55"W	1.80 km
Forest Reserve	10°39'16.02"N	2°53'27.82"W	1.64 km

There is an untarred road located on the southern end of the site that leads to the Black Volta. The Black Volta serves as the demarcation between Ghana and Burkina Faso. The water body also serves as a recreational facility during public holidays for the youth of Lawra. Just by the side of this road, but outside the project area, is a tree shrine, comprising of Ebony / Nim Tree, known as the Kulbonuo Shrine belonging to the Nuo-ire (*wrongly spelt as Bayoyire in the previous EIA Report*) Family in Lawra. The site was acquired in such a way to avoid the shrine, however, its nearness to the project site is a recipe for future conflict with the shrine owners and will be advisable to relocate them as part of project implementation. The relative location of the tree shrine with respect to the Lawra Solar Power project site is shown in Figure 4-3.

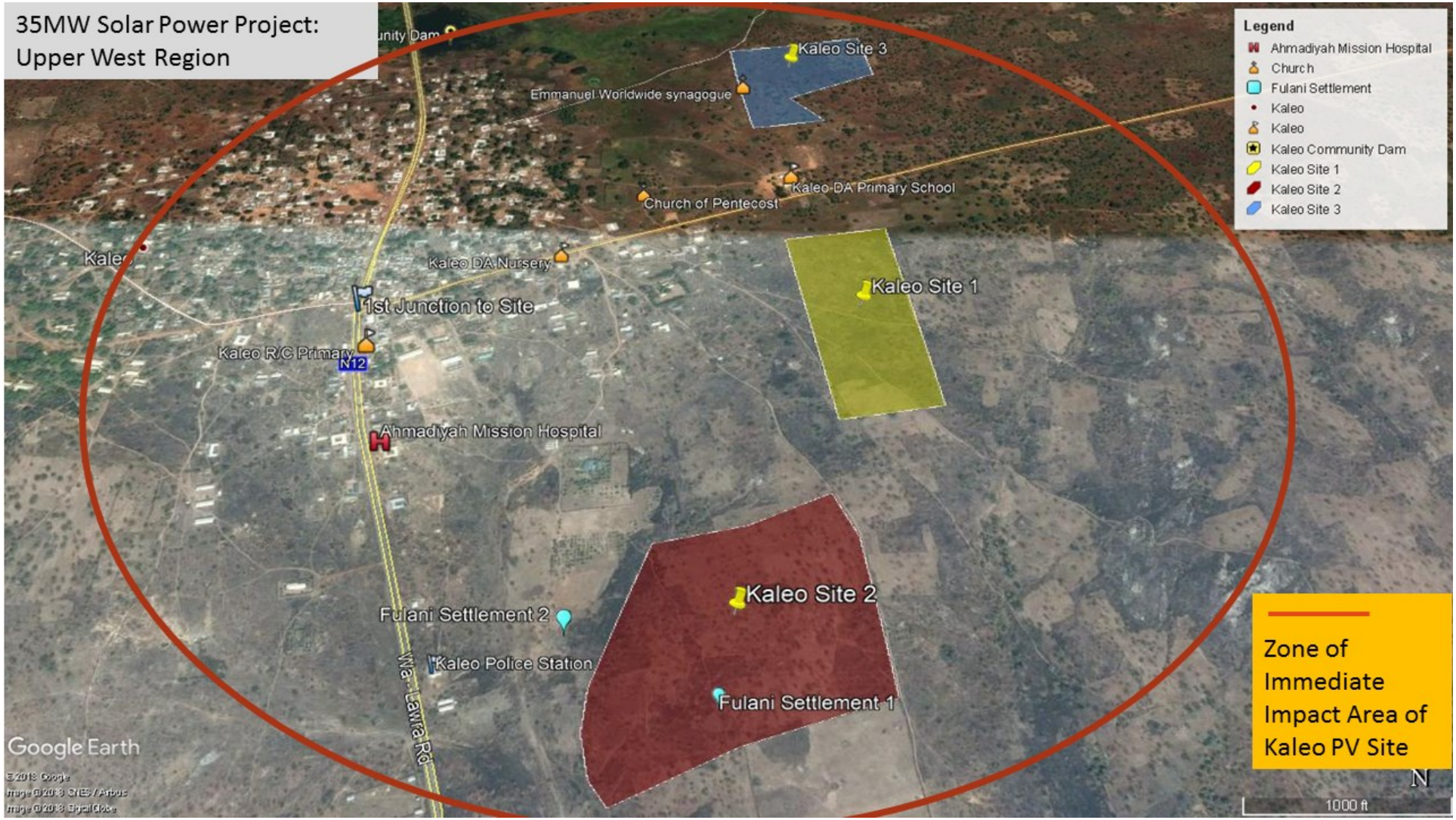


Figure 4-1: Location Map showing relation between Kaleo PV Plants and neighbouring Features

Figure 4-2: Location Map showing relation between Lawra PV Plant and neighbouring Features

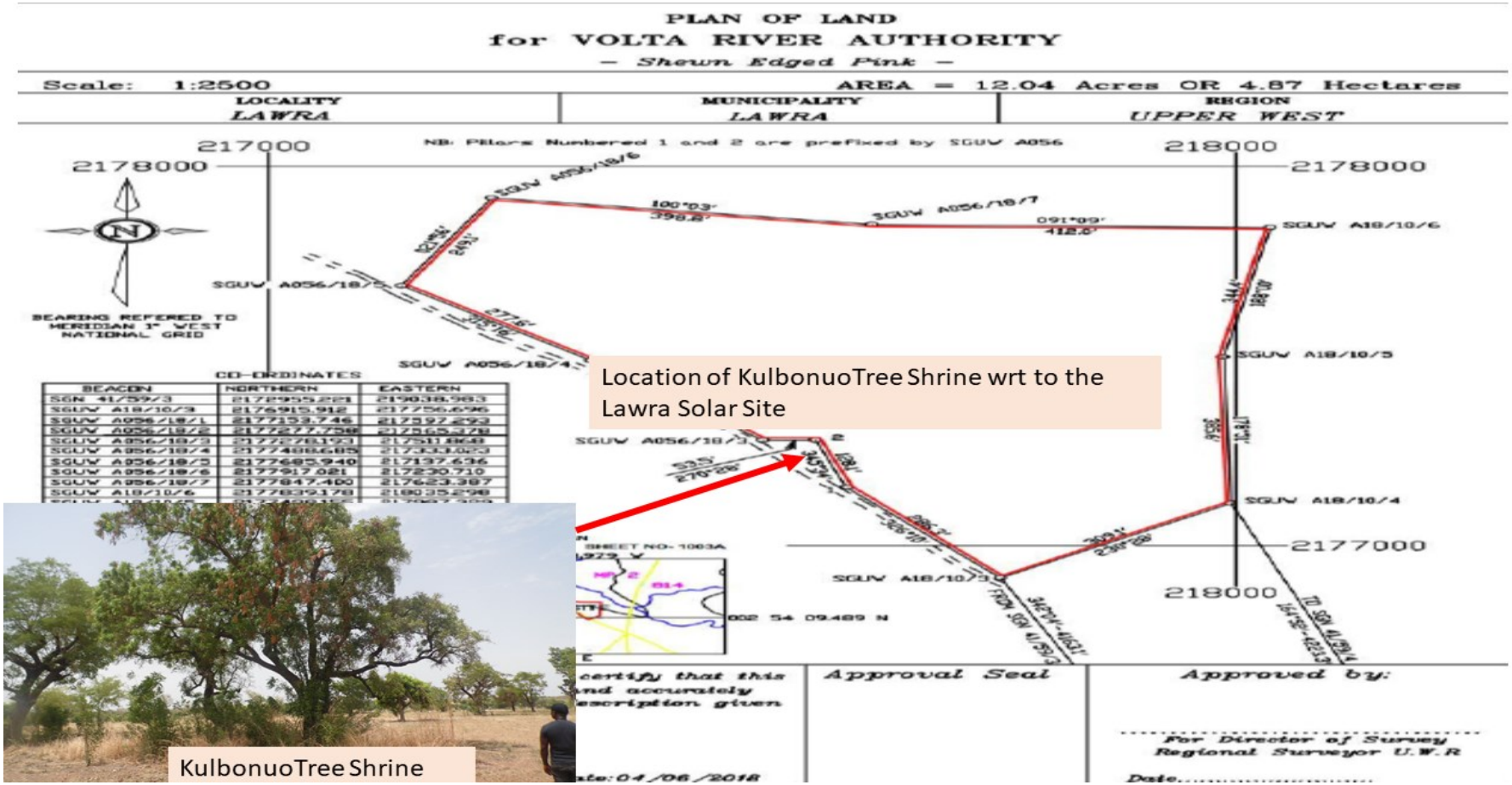


Figure 4-3: Relative location of Kulbonuo Tree Shrine on the Lawra PV Site

Discussions with the shrine owners however revealed the need for the shrine to co-exist with the solar power project and this is to be achieved by the installation of a chain linked fenced with access gate, to be kept under lock, to avoid encroachment by pedestrians. The shrine owners will therefore have direct access to the shrine as and when required for the necessary rituals and this will not have any impact on the project. A Consent Sheet was formally executed between the shrine owners and the VRA Team on August 29, 2018.

Approximately 0.5Km of the associated 34.5KV transmission line for the Lawra PV project will traverse through the Lawra Forest Reserve, which is located about 1.5 km at the south eastern side of the project, on the east of the Lawra-Hamile N12 Highway. The reserve is a tropical savannah woodland covering 127 ha with 40 ha converted into plantations and the remaining 87 ha protected. Thus approximately 0.004% of the reserve will be affected by the project. Within the reserve are the offices of the Lawra Forestry Commission, strategically located to ensure a 24/7 surveillance.

4.4 Facilities at PV Sites

Facilities at the PV Sites shall include the module invertor set ups, spare parts store, main house, water supply system, main distribution room, meteorological station, fire-fighting system, wastewater collection, internal roads and parking space, and fencing. Project facilities shall largely be obtained from German or Canadian manufacturers, thus reducing the number of manufacturers and assuring best quality and after service support. A summary of the configurations for the Kaleo and Lawra PV Plants is provided in Table 4-4.

Table 4-4: Module Inverter Set-up for Kaleo and Lawra PV Plants

Parameter	Unit	Kaleo			Lawra
		Site 1	Site 2	Site 3	
Orientation	Degree	12°, perfect South			12°, perfect South
Module power	Wp	330	330	330	330
Type of module	-	Poly	Poly	Poly	Poly
Modules in String	-	20	20	20	20
Total Modules	-	24,320	39,520	21,280	21,280
Nominal AC inverter power	kW	25	25	25	25
Number of inverters per array	-	38	38	38	38
No. of total inverters	-	304	494	266	266
No. of arrays with 1 transformer each	-	8	13	7	7
Total Peak Power (DC)	kWp	8,026	13,042	7,022	7,022
PDC/AC ratio	-	1.056	1.056	1.056	1.056

The basic civil designs for the Lawra and Kaleo PV Sites and a write up of the necessary facilities to be provided for execution of operation and maintenance of the PV Plants are discussed in detail in the EIA Report. The civil layouts for the two sites are shown in Appendix 2.

4.5 Network Connection

The envisaged connection of these utility scale PV power plants based on decentralised inverter configuration concept is stated to be at the 34.5 kV level. Relevant aspects for the grid connection at 34.5 kV level of the PV Power Plants with a nominal power feed capacity of the PV power plants have been analysed. The general layouts of the medium voltage interconnection transmission lines are shown in Figure 4-4 and Figure 4-5. In the case of the Lawra PV plant, the network connection will comprise of the development of a 4.5 km overhead line system integrated into the existing 34.5 kV main corridors' line at Lawra as a Tee-off connection. The envisaged point of connection is located close to the Lawra – Nadowli road, south east of Lawra town at Pole No. XLN 0255. The substation to be built at Lawra as part of the first phase would have some minor modifications to accept an additional 3 MWp capacity. This includes fencing of the additional land and upgrading the evacuation and communication/control facilities for a total station capacity of 7MWp.

For the Kaleo PV Plants, based on preliminary analysis about alternative points of connection (T-Off Connection), the most favourable option based on technical as well as monitoring issues is the direct connection to the Wa GRIDCo Substation. This is based on the understanding that a way leave carrying two lines requires less ground area than two-way leaves each carrying one line. Thus, for the Kaleo Sites, and as stated in the responsive technical proposal, an approximately 12.5km overhead line system outgoing from Kaleo PV substation to the 34.5 kV busbar of the Wa GRIDCo Substation will be developed. In order to allow ease of the expansion of Phase I from 12 to 17MW and Phase 2, the general interconnection concept is to extend the Kaleo-Wa MW line to Kaleo Site 3 and for each site to aggregate the PV arrays through a 34.5 kV bus to the MV line. The transmission line is also intended to be upgraded from 23MVA to 30MVA. The Kaleo Site 2 Capacity of 13MW would have a complete Control Room and Substation for evacuation via the Kaleo -Wa MV line. There is an already an existing trench under WA Air Strip and the project intends to use that tunnel to lay down the underground cable. There shall be no civil works, such as the use of pipe ramming machine regarding to this part of the interconnection line, however, VRA shall engage the Ghana Civil Aviation Authority prior to the commencement of works.

Depending on the type of lines and their electrical characteristics to be applied for the grid connection of the PV Plants, the expected peak values for electrical losses range between 1.8% (AAAC 100 mm²) and 1.4% (AAAC 150 mm²). In comparison with the line Type AAAC 100 mm², the implementation of the network's connection with the overhead line type AAAC 150 mm² can reduce the electrical losses for the transmission of power from the PV plants by approx. 20% (peak value of losses), therefore the interconnection lines of the envisaged PV Plants, are recommended to be realized with the overhead line Type AAAC-150 mm².

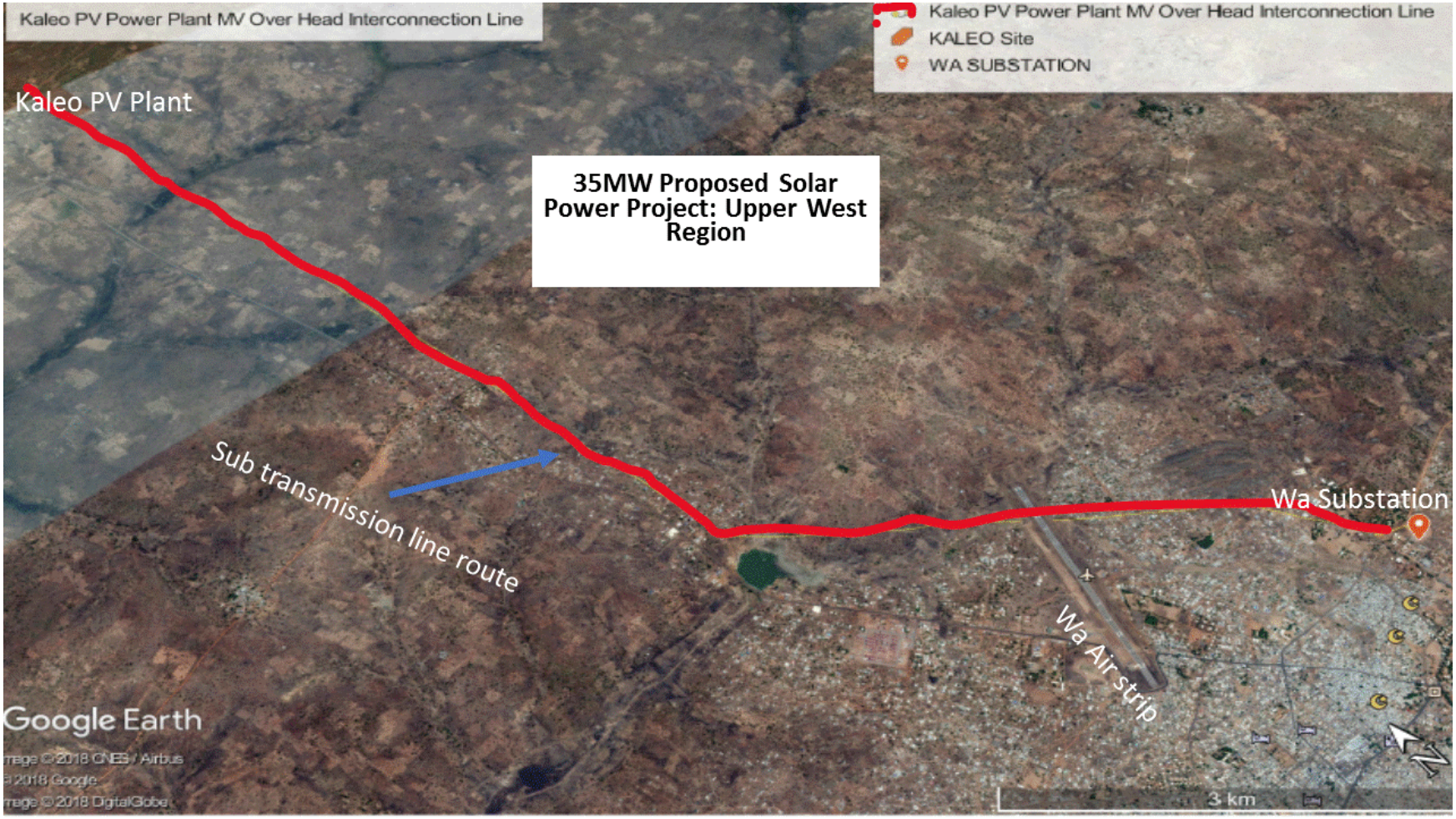


Figure 4-4: General layout of Kaleo PV Medium Voltage Overhead Transmission Line

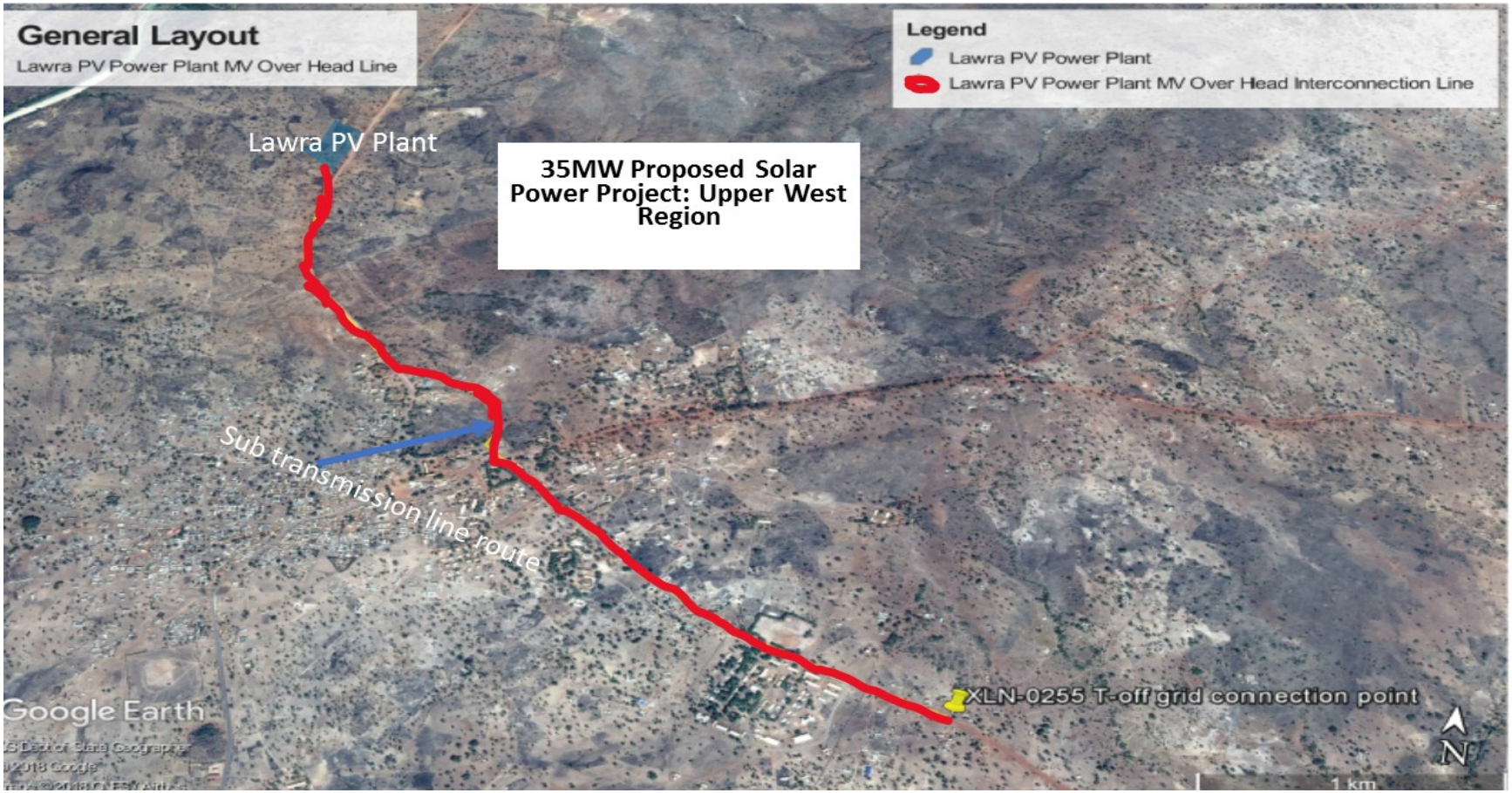


Figure 4-5: General layout of Lawra PV Medium Voltage Overhead Transmission Line

4.6 Land Acquisition & Compensation

The project is to be achieved by utilizing a total land area of 44.92 Ha at three closely sited areas at Kaleo (10.22Ha, 18.39 Ha, and 10.18 Ha) as well as 6.13 Ha at Lawra. VRA has used in-house expertise for the land surveying and pillaring of the identified sites. The proposed PV sites are used for agricultural purposes and there are no residential facilities on it, apart from the Kaleo Site 2, where 2 Fulani nomadic settlements are settled in 2 hamlets. Discussions with the landowners indicate that the settlers have been contracted by the landowner to look after his cattle and the landowner himself (upon request by VRA) will oversee and provide for the adequate resettlement to another equivalent plot on his property for them. Strategies for acquisition was in line with the requirements of the VRA Land & Resettlement Policy Framework and involved extensive consultations with the land-owning families that gave VRA opportunity to be conversant with the land tenure systems and arrangements within the areas as well as to identify right persons to deal with. The first consultation took place in 2010. Within the context of the community engagements, the nature of the project, its impact, the process of land acquisition and consequential compensation matters were explained in detail. Further consultations were also held with the state land agencies both at the national level and at the Regional Level (Upper West Region). These include Land Valuation Division, Survey and Mapping Division and Public and Vested Lands Management Division of Lands Commission.

VRA acquired the lands for the PV sites through voluntary means and private treaties and therefore there is no involuntary acquisition associated under this project. Compensation was assessed based on an arm's length discussions on current market values within the neighbourhood. In actual sense the final value of amount payable for the land is a negotiated sum. In line with established procedures, compensation have been paid in full to the landowners for both the lands and economic crops. VRA negotiated with the Land-owning families and obtained Leases from them. A term of fifty (50) years each was granted. In order to establish a cordial and continuous relationship between the Landowners (Lessors) and VRA (Acquiring Agency - Lessee), parties also negotiated on the annual ground rent payable by VRA, aside the cost of the land consideration. This arrangement is to accord the landowners some level of rights within the 50-year term. The ground rent is subject to review every 5 years till the lease expires in 31st December 2069. Payment receipts for the lands are available and for the purposes of anonymity, the names of the landowners have been coded as shown in *Table 4-5*. Following payment of all customary and statutory rites, access has been given to enable VRA carry out its activities.

Table 4-5: Compensation Payments

Landowner	PV Site	Amount Paid GH¢		
		Land	Economic Trees	Total
Landowner 1	Lawra	32,160.00	1,436.94	33,596.94
Landowner 2	Lawra	112,320,00	4,300.00	116,620.00
Landowner 3	Kaleo	221,408.00	10,250.69	231,658.69
Landowner 4	Kaleo	399,872.00	36,551.21	436,423.21
GRAND TOTAL				**818,298.84**

Currently there is no law or legislation governing the length of Right of Way (RoW) for 34.5 kV transmission line. The 34.5 kV sub-transmission lines will, in principle, be constructed in the wayleave zones of the existing roads and transmission routes. Thus, for the sub-transmission line route, there would not be the need for any RoW acquisition with the associated resettlement and or compensation. It is noted that about 0.5Km section of this new line shall traverse through the Lawra Station Forest Reserve. Common tree species in the reserve include Khaya senegalensis, Tectona grandis and Anogeissus leiocarpus. Impacted trees to be affected and compensated for in the Lawra Forest Reserve have so far been accessed and details outlined in the relevant section of the Report.

A Land Acquisition & Resettlement Plan for the "35MW Solar Power Project: Upper West Regional Project Sites", January 2020, has been prepared as part of the project suite of documents to guide compensation issues.

4.7 Acquisition of Permits & Licensing

The necessary statutory permits and licenses that must be acquired for the construction and operational/maintenance phases of the solar power project are as follows:

a. Environmental Construction/Operational Permits from the EPA
b. Siting Permit from Energy Commission
c. Construction Permit from Energy Commission
d. Building Permits from Lawra Municipal & Nadowli-Kaleo District Assemblies
e. Water Use Permit from the Water Resources Commission
f. Fire Permit from the Ghana National Fire Service
g. Generation & Electricity Wholesale Supply Licence from Energy Commission

VRA has consequently embarked on relevant activities to ensure all required permits have been obtained and has engaged all the state agencies involved to discuss modalities. Currently, legal approvals and permits such as the Siting and Constructional Permits from the Energy Commission as well as the Environmental Permit from the Environmental Protection Agency have been

acquired[2]. VRA acquired the Building Permits for the Lawra and Kaleo Solar Power Sites from Lawra Municipal and Nadowli-Kaleo District Assemblies respectively in October 2017 and these are available in the Final ESIA Report. It must be noted that except for the Building Permit, all the above-mentioned permits are to be continuously renewed during the lifetime of the project.

4.8 General Development Activities

VRA is the responsible organization of the project's implementation. Preparations of project concept design, project specification and final design documentations have been completed by Lahmeyer International (now Tractabel Engineering). Procurement of EPC Contractor was completed in June 2019, and in August 2019, the contractor, Elecnor SA of Spain was formally introduced to the Local Government and Traditional Heads as well as the landowners in Lawra and Kaleo. All preconstruction activities will be completed before the actual construction works begin. This includes, but not limited to the acquisition of the Environmental Constructional Permit from the EPA to cover the entire 35MW development as well as the Constructional permit from the Energy Commission for the 17MW Phase 1 development facility. The Constructional permit from the Energy Commission for the 18MW Phase 2 facility will be requested for when financial close is achieved.

Initial site works will comprise site clearance. The main works would follow a straightforward sequence beginning with excavation for structural foundations and structural development. Key activities under the project are as follows:

a) Design, installation and site testing of PV array, support structure, connection boxes, DC & AC disconnects, fuses, inverters, grounding, surge protection, etc. and a control structure / building to house inverters, meters and control & communication devices.
b) Installation, erection, site testing and commissioning of more than one set up transformer with capacity between 0.7 to 1.25 MVA.
c) Supply, installation, site testing and commissioning of outdoor 34.5kV circuit breakers, 34.5kV disconnect switches, 34.5kV busworks, 34.5kV feeder equipment complete, grounding, control panel, metering, etc.
d) Bringing into service PV power plants and organizing the works to minimize the power supply interruptions to the 34.5 kV network in the area.
e) Fencing and gravelling of the PV plant enclaves.
f) Supply and installation of 34.5 kV tubular steel pole sub-transmission line to interconnect with the nearest point on the existing distribution network.

[2] See Appendix 1 for the Constructional and Environmental Permits

g) Civil works associated with the above works including equipment plinths and foundations, etc.

The final stages would be the installation of the PV equipment followed by landscaping, commissioning activities and the handover period. VRA is the responsible organization of the project's implementation. Preparations of project concept design, project specification and final design documentations have been completed by Owner's Engineer, Lahmeyer International (now Tractebel Engineering). Procurement of EPC Contractor has also been completed. All preconstruction activities will be completed before the actual construction works begin. This includes, but not limited to the acquisition of the Environmental Permit to cover the 35MW development.

Depending on the timing of financial closure, project construction for both phases at the various sites may run concurrently to achieve the total of the 35MW PV power plants. Constructional activities for Phase 1 are expected to commence tentatively in November 2019, and depending on financial closure, that of Phase 2 is targeted by June 2020. As at now, the Commercial Operation Date (COD) is yet to be fixed, however, the total period from the notice to proceed / advance payment to the commissioning phase for each PV site is estimated to be about 15 months for Kaleo and 7 months for Lawra for Phase 1, further, the issuances of Provisional Acceptance of Certificate for the PV Plants are also expected to be completed by close of the fifteenth (15) month. The construction schedule has been created according to FIDIC contract standards and is deemed suitable for both projects. It must be noted however, that the construction time of this type of projects is largely based on the logistics and the manpower of the EPC contractor.

The programme for the sub-transmission line works is critical to the optimum timing for the project and it will be essential to have this infrastructure in place prior to completion and commissioning of the substation. The project schedules supplied by the Contractor shall be used by VRA to monitor the overall progress of the Work. The project schedules shall fully integrate design, procurement, manufacture, erection and commissioning activities. Key events shall be clearly identified on all project schedules and be integrated into the program logic.

4.9 Financing Details

The VRA, as Project Executing Agency, is expected to provide funding for the project. A loan facility from KfW Group is to be used to partly finance the Phase 1 of the project (17MW), through an on-lending Agreement between VRA and the Government of Ghana, which has since been executed. Discussions are ongoing for the financing details for remaining 18MW under the Phase 2 component.

4.10 Conceptual Decommissioning & Dismantling Plan

Each of the solar power projects shall typically have a life expectancy of 20 to 25 years. The current trend in the solar energy industry has been to replace or "re-power" older solar energy projects by upgrading older equipment with more efficient PV plants and ancillary equipment. However, if not upgraded the PV plants will be decommissioned. The solar power facility decommissioning process shall be initiated upon the termination of the leases with the landowners. VRA or the project owners at the time agree to meet with the landowner prior to the lease expiration date to ensure that the owners perform its obligations to remove its property and restore the premises. Removal of machinery, equipment, PV Modules/Inverters and all other materials related to the project is to be completed within one year of decommissioning. Thus, within twelve (12) months of initiating the decommissioning, the relevant project components will have been removed from the leased land.

The decommissioning processes would be undertaken in accordance with environmental laws and standards in place at the time of decommissioning. Prior to any decommissioning of the PV Project, the Ghana EPA will be notified, and an assessment will be carried out to identify any potential environmental impacts that need to be addressed and mitigated in the decommissioning process. At the end of the decommissioning exercise, the EPA will be invited to carry out a post-decommissioning assessment to establish compliance with all regulatory requirements and issue a certificate to that effect.

4.11 Consideration of Alternatives

Feasibility studies regarding the project basic design, network connection assessment and field surveys were done which has helped the Environmental Assessment to present alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative and some based upon the environmental, social, and economic effects of implementing each alternative.

Alternatives considered in the EIA Report were as follows:

- “No Development Scenario”
- Alternative fuel, considering thermal and hydropower generation options inclduing the ongoing 48MW Pwalugu Multipurpose Dam
- Site Selection, using the geographical situation and meteorological conditions which formed the basis for selecting the sites in Northern Ghana
- PV Module Technology Options, including module technology, inverter concept and mounting system and selected components suitable for the project conditions.
- Selection of Optimal Line Route

A description of the alternative analysis for the transmission line routing to verify the routing through the Lawra Forest Reserve is provided below.

4.11.1 Selection of Optimal Line Route in the Lawra Forest Reserve

Figure 4-6 provides a diagrammatic impression of the two (2) line routes considered and shows the route that has been proposed, indicated as a red line. As shown, the most obvious route, shown as the blue line, will have been a straight route of about 3.94 km from the Lawra Solar Power Project (A1) to tie into a transformer near the Lawra Secondary School at P10. However, due to socio-economic impact because of the presence of the Lawra community, farmlands, the Lawra Forest Reserve and football field within the course of this line route which would have also added additional cost during the construction, there was the need to divert the line and to utilise the right of way of the existing Lawra-Hamile N12 Highway. Thus, the proposed line route which is a total of 4.22km, commences from the Solar Power Site at A1 through P1 to P3 using the right of way of the western side of Lawra-Hamile N12 Highway.

The proposed line crosses the road to the eastern side at P4 to P4A, with about 0.5Km passing through part of the Lawra Forest Reserve but near the existing road. It again crosses the existing road at the Health Assistance Training School and Lawra English and Arabic School using the right of way corridor of the road to P5 and P6. Even though it passes through the Lawra Forest Reserve, the transmission line route will still be within the right of way of the road corridor. Furthermore, the Line Route had to be diverted to the eastern side, where the Forest reserve is because the western side of the road is encroached on by the presence of existing structures (Buildings). At P6, the Line Route passes through the western side of the existing tarred road through the township and crosses to the western side at P7 and P8 to P10 using the right of way corridor of the road, avoiding the Lawra Secondary School, to tie into the transformer

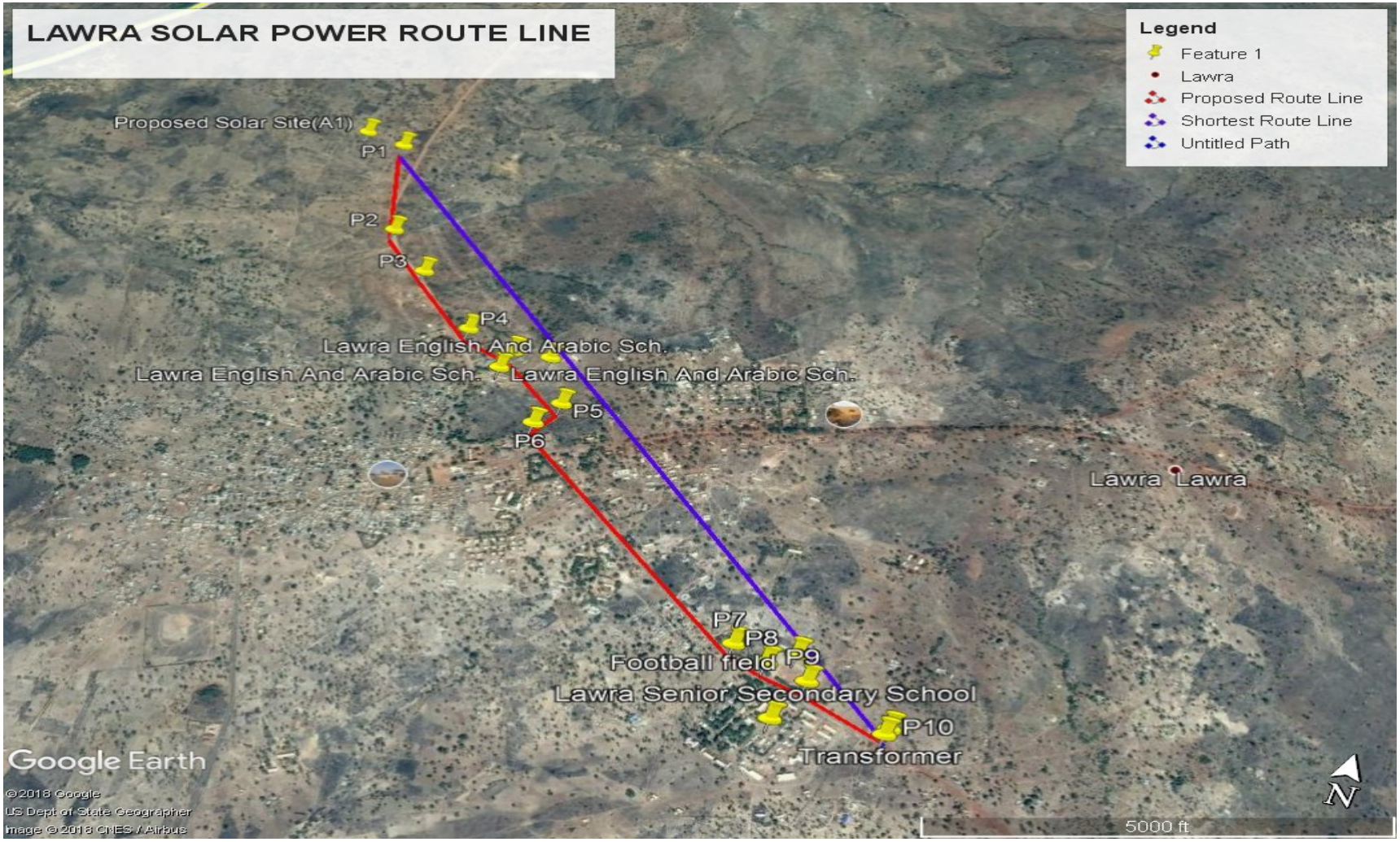


Figure 4-6: Alternatives for the Sub-transmission line Routes for Lawra PV Plant

5 THE EXISTING ENVIRONMENT

The Solar Power Projects in the Upper West Region are to be located within Kaleo and Lawra communities, located within the Nadowli-Kaleo and Lawra District Assemblies respectively. In line with the environmental assessment requirements, a baseline survey was undertaken to establish the existing ecological and socio-economic situation in the project area. In this regard, research work on the existing biophysical and social environment was done by the environmental and social research team from June 2011 – March 2012 and updated in December 2013. The compilation of project area data was done through site visits, use of survey instruments, extensive literature review and consultations with community elders. A field visit in May 2018 has also helped in providing additional information.[3] A detailed report covering all aspects of the existing bio-physical and socio-economic environment has been included in the EIA Report. A brief of this is outlined here.

5.1 Physical Environment

5.1.1 Greenhouse Gases

According to Ghana's Second Biennial Update Report (August 2018), Greenhouse gas (GHG) and Short-lived Climate Pollutant inventory was conducted for the period 1990-2016 using the latest 2006 IPCC guidelines. The total national greenhouse gas emissions are estimated at 31.5 million tonnes carbon dioxide equivalent (MtCO2e) in 2016 representing 65% increase compared to 2000 emissions. The increasing trends in the overall emissions is attributed to the rising population and the economic diversification measures. The Energy sector contributes 50.2% of the total 2016 GHG emissions. Within the Energy sector, road transport and electricity generation are the two dominant sources of GHG emissions. GHG emissions from Agriculture, Forestry and Other Land Uses (AFOLU) is the second dominant source (36.4%) of the total GHG emissions in the same year. Emissions from the Waste and Industrial Process and Product Use (IPPU) sectors contributed respectively to 10.1% and 3.3% of the total emissions.

5.1.2 Atmospheric & Climatic Conditions

The climate in the project affected districts of Nadowli-Kaleo and Lawra, all in the Upper West Region are similar and is classified by Gmet Classification as having a Tropical Savannah Climate (Aw). Factors considered in site selection included direct solar radiation, sky scattering radiation, and ground reflection radiation. The sunshine in the Upper West Region is enough as the average annual total radiation can reach 7384.3MJ/ m^2. The proposed selected PV sites areas are therefore rich in sunlight; the total amount of annual solar energy radiation is abundant, and thus very suitable to build PV power

[3] See Appendix 3 for pictures of the various project sites

plants. Monthly Radiation and temperature profile for the two (2) PV plant based on Solar GIS Information as well as the atmospheric conditions are provided in the EIA Report.

5.1.3 Ambient Noise

A limited survey of daytime noise levels for duration of five (5) days were carried out in December 2011 and updated in May 2018. Recorded noise levels during the survey are 33.5 - 69.3 Db (A) and the levels were largely within the permissible values of 55 dB(A) per the Ghana Standard for Health Protection – Requirements for Ambient Noise Control (GS 1222:2018).

5.1.4 Air Quality

Measurement of suspended particulate matter concentrations within the selected communities for air quality monitoring was established over a four (4) day period in December 2011 and updated in May 2018 at various times of the day for monitoring purposes. In December 2011, high PM levels were observed basically due to the dusty nature of the access roads at the time near the sampling points. This informed that the upgrade of access roads, especially those leading to the project sites, is critical for the maintenance of the PV Modules. Currently, the main access road, which is N12 Wa - Hamile road, is tarred and asphalted and can be classified as a first-class road and data obtained in May 2018 shows levels of particulate matter within Ghana Standard for Environment and Health Protection-Requirements for Ambient Air Quality and Point Source/Stack Emissions (GS 1236: 2019).

5.1.5 Topography & Drainage

For the designated site for the Kaleo Solar Power plant, the terrain is generally flat and has a rectangular shape which is regarded as suitable for PV application. The area is mainly low lying and undulating at altitudes ranging between 150m-300m above sea level though some parts average 600m. For the designated site for the Lawra Solar Power Plant, the terrain is not completely flat showing small bumps and slight slope descending towards the North with 2.5-3% in average. The slope shall be considered in the design by adjustment of the row to row spacing. The site has trapezoid shape with its longer side long the road and a triangular edge to the South. The Lawra District is gently rolling with a few hills ranging between 180 and 300M above sea level.

5.1.6 Geology & Soils

Elecnor S.A., project contractors engaged the Building and Road Research Institute (BRRI) of the Council for Scientific and Industrial Research (CSIR) to conduct geotechnical investigations to facilitate the foundation design of the Plants. According to the report, geologically, the proposed project sites are part of the Birimian Subgroup which is contained within the extensional tectonics, horst-graben formation. The main rock types associated with this formation include the sedimentary basins which have been metamorphosed into the undifferentiated sediment/volcaniclastic sediment. The Volcanic Belts had also been metamorphosed into undifferentiated volcaniclastics, spatially associated and interbedded with flow rock, and the Birimian Protoliths.

5.1.7 Water Resources

There is no water body close to the designated site at Kaleo. The designated Solar Power Plant site at Lawra is about 3km from the main river in the district, the Black Volta, to the west which forms the boundary between the District and the Republic of Burkina Faso. With respect to groundwater availability, data provided by the Water Resources Commission indicate that the average borehole yield in the project area is about 53.3 L/min (3.2 m3/hour).

5.1.8 Transport & Access

The Kaleo and Lawra Solar project sites are both located in the Upper West Region, and therefore the major route to the site will be the Wa – Lawra section of the N12 Highway, and the relative locations are shown in Figure 5-1. The N12 Highway is part of the trunk roads between major urban centers and forms part of the backbone of the road system in Ghana. It is expected that the solar power materials will be brought by sea to the Tema Port. From there, it will be offloaded and likely brought to Accra on the N1 Highway in the southern sector, where it will be transported up north to site through to Kumasi on the N6 Highway, Techiman on the N10 Highway, and then on to the N12 Highway through Wa, the regional capital, and finally to Lawra, covering a total distance of about 860 km. The distance between Wa and Lawra is approximately 80Km and the major communities along the route are Kaleo, Sambo, Sariperi, Nadowli, Yiziiri, Nadawii, Yagha and finally Kwonyonkwon. See Figure A7-A9 in Appendix 2 for the transportation route to the PV Sites.

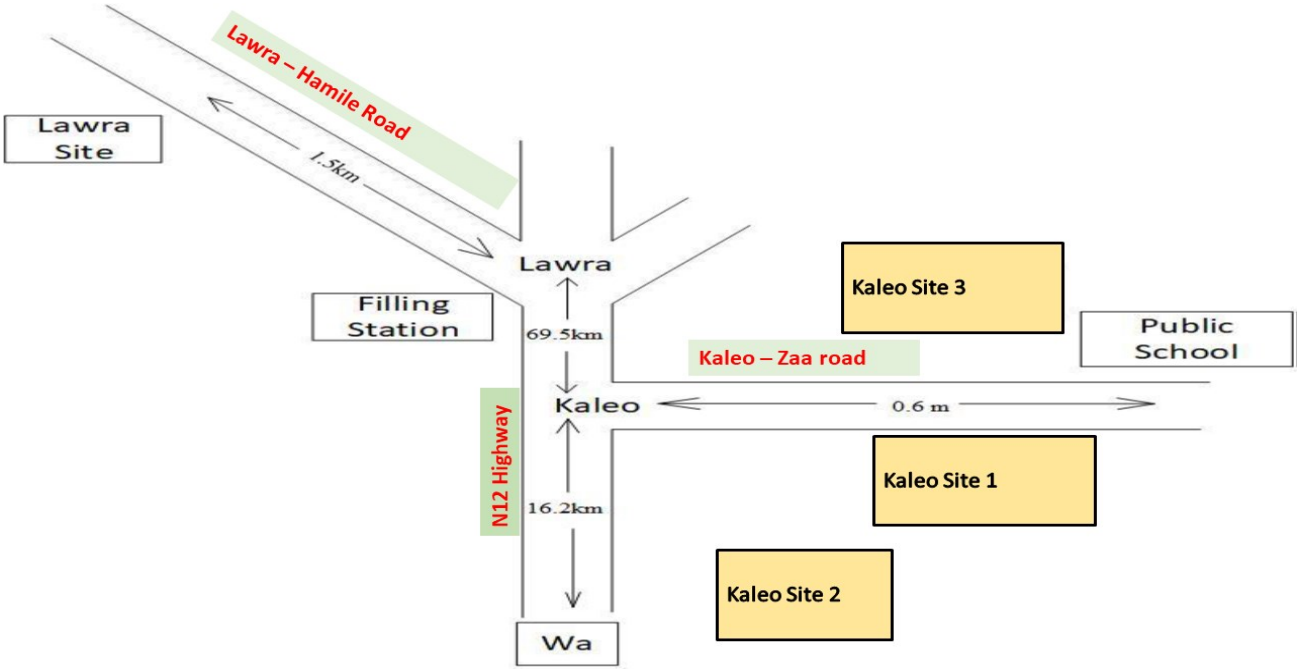


Figure 5-1: Relative locations of Solar Power Project Sites at Kaleo and Lawra

With regards to site access, the Lawra PV site is located 3.96 km Northwest of Lawra village on the Lawra-Hamile section of the N12 Highway, near Bikpe community. The site for the Kaleo PV development is located off the Wa - Lawra section of the N12 Highway, about 0.85 km to the east of the Kaleo – Zaa Road, which is untarred and a feeder road. The Kaleo – Zaa road runs approximately 125 m parallel to the Northern site boundary of Kaleo Site 1. From that road, the site access could be built adjutant or even within the line route corridor of 10 m (at each side of the MV lines) where NEDCo owns the right of way. This would reduce the need for additional road construction and further easement rights significantly.

It must be noted that illegal road ramps have been mounted by community members at various areas along the entire route from Tema, especially on the N12 Highway section with the Upper West Region heading towards Lawra and this must be assessed critically prior to actual transportation as some might have to be removed entirely. The removal of any of such ramps must be done in collaboration with the relevant District Assembly and the Security agencies as it could be a source of conflict with the community members, if not handled appropriately.

5.2 Biological Environment

The EA Report provides details of the biological environment of the project area. The Forest Services Division, Lawra Office, was engaged in May 2018 to undertake a quantification and listing of identified flora and fauna within the PV project sites as well as the Lawra Forest Reserve. FSD has since submitted ***"Solar Power Project Phase 1: Upper West Regional Project Sites" - Baseline Flora and Faunal Report, August 2018.*** Report on the quantification is available as part of the suite of documents for the EA Study and a brief provided in this report. Details of the individual trees enumerated, including their environmental relevance and level of endangerment, are provided as part of the Appendix 4.

All the five (5) sites enumerated are degraded and characterized by annual bush fires, continuous farming, and animal grazing etc. A total of 1,442 trees were enumerated at all the sites. At the Lawra Station Forest Reserve, 105 trees comprising 8 species were identified, with the dominant species being Leocarpus and Teak which are not endangered species. Again, total of 1,337 trees of 29 species were enumerated at the four (4) off reserve areas, with the dominant species being Dawadawa and Sheanut trees. The major trees which are also economic ones are Sheabutter (42.65%) and Dawadawa (13.87%). The neem tree (10.26%) is basically used for fuel wood and is also medicinal. Fire is a common feature here, and the more successful tree species have adapted to the annual fires by having thick barks. It is also characterized by several species of grasses which survive the fires by way of their rhizomes and fibrous roots that remain buried in the soil during the sweeping fires.

Due to closeness of the sites to human settlement coupled with continuous farming activities and annual bushfire, few wildlife resources are identified at the project sites and those identified are listed in Table 5-1. The fauna of the project area has been extensively affected by over-exploitation, alteration and

fragmentation of habitat resulting from especially bushfire, human settlements, and agricultural activities. Livestock were common. Some birds were found perching on the trees and in an interview, community members confirmed that the identified birds are occasionally seen in this area.

Table 5-1: Faunal species on Project Sites

Name of Animal/Bird	Local name	Scientific name
Domestic Animals		
Cattle	Naboo	Bos Taurus
Donkey	Bonya	Eqnus asinus
Goat	Buo	Capra aegagrus hircus
Sheep	Piroo	Ovis aries
Guinea fowls	Kpeiroo	Numida meleagris
Pigs	Dobaa	Sus
Rabbits	sounyaa	Oryctolagus curiculus
Wild Animals		
Flying squirrel	Kye	Ammalierus spp
Ground squirrel	Kye	Eimaceus spp
Royal python	Zip	Python sebae
Hedgehog		Atelerix albiventris
Giant rat	Dauuo	Cricetomy gambianus
Patas monkey	Aglre	Cercopithecus patas
Birds		
Red wood pecker	Saakonkoliraa	Melanerpes carolins
Hooded crow	Galingaa	Cervus cormix
Rock dove	Janee	Columba livia
Condor	Dakyeraa	Vulture gryphus
Albatross	Zuiel	Phoebitria
Sparrow	Sylaa	Passer domesticus
Black vulture	Zugire	Coragyps attratus

5.2.1 Environmental Sensitive Areas

All areas declared by law as national parks, watershed reserves, wildlife reserves and sanctuaries including sacred groves are categorized as environmentally sensitive areas. Within the context of the definitions outlined, the Lawra Station Forest Reserve can be categorized as an environmental sensitive area in the project area of influence. A 4.5km of a new sub-transmission line is to be constructed to interconnect the PV Site at Lawra to the existing 34.5 kV Domwini – Lawra Line. About 0.5Km section of this new transmission line will pass through the reserve between BP 5- BP 6. Out of this, the transmission line will cover 0.25ha (150m) in the reserve and the remaining 350m falls within Off-reserve areas. The general condition of the reserve is poor and the trees to be affected will be mainly used for firewood. A total of 105 trees comprising 8 species were identified in the reserve. The dominant

species include Leocarpus and Teak which are not endangered species. Details of flora existing in the reserve as well as the benefits to the local people are provided in the EA Report.

This Reserve was established in 1950. The Lawra Station Forest Reserve has only been harvested once and that was in the early 1980s. The natural reserve scores a condition class of 2, i.e. "Good" and the plantation is on the average considered to be 3, i.e. "Fairly Good". There is considerable potential for regeneration. Except some few ha of the lower ground where the trees naturally thin out and bare ground appears, the rest is developed through natural regeneration.

5.3 Socio-economic and Cultural Environment

5.3.1 Kaleo Community in the Nadowli-Kaleo District

Traditionally, the Kaleo Community is under the Kaleo-Naah in the person of Sandu Banauwimi II, who is also the Paramount Chief of the area. The 2010 estimated population of Nadowli-Kaleo District is comprise of 39,375 males and 43,341 females giving a male / female ratio of 80:100 as compared with the national male / female ratio of 97.9:100. The Kaleo community is made up of over 99% Dagaabas. With respect to religion, about 80% of the community members in Kaleo community are Christians, with 18% being Moslems and 2% Traditional religion. There is a total of 1 pre-school establishment, 2 primaries/Junior High Schools, and 2 Technical/Vocational institutions and 1 Senior High School in the Kaleo community.

There are 2 health centres in Kaleo community, and these are the Kaleo Catholic Clinic and the Ahmadiya Moslem Hospital. The major illness includes; malaria, hypertension, pneumonia, anaemia and acute respiration infection. Malaria continued to top the list of the ten (10) top diseases at all levels. HIV/AIDS remains a disease of concern in the district. Majority cases fell within the age group of 15-39 who form the potential labour force in the district. The Kaleo Community just like other parts of the Nadowli-Kaleo District depicts a typical rural economy dominated by the agriculture sector with the commerce and industrial sectors least developed. About 70% of the estimated population in Kaleo are farmers whilst about 20 % are traders with the remaining being in the formal sector. In the Nadowli-Kaleo District in general, agriculture alone accounts for about 85% of the labour force while commerce/service and industry account for 14% and 1% respectively. On key historical resources in Kaleo is the burial ground of the Late Hon. Jatoe Kaleo, who died on June 6, 1998. This site is about 500 m to the Kaleo SPP site. The Late Hon. Jatoe Kaleo was one of the leading Ghanaian politicians who led Ghana into independence. He is known to be among the political gurus who stood on the same platform with the Late Dr. Kwame Nkrumah, the 1st President of Ghana, during the formal announcement of the independence of Ghana on March 6, 1957.

5.3.2 Lawra Community of the Lawra District

The Lawra Community is within the Lawra Municipal. Naa Puowelle E. Karbo II is the Paramount Chief of Lawra whilst Kori T. Kofi is the Lawra Community Chief. The 2000 National Population and Housing Census results put the Lawra Community at 5,763, made up of 2,618 males and 3,145 females. The provisional figure for the community during the 2010 PHC is 6,805, indicating an 18% increase over the 2000 figure. With respect to religious composition, Christians dominate with a figure of 57%, Muslims constitute a meagre figure of 4.19% whiles Traditional African Religion follows the Christian religion with a figure of 36.46%.

Malaria has been the main cause of OPD attendance followed by URTI, skin diseases, eye infection and pneumonia. The HIV/AIDS pandemic has now become a developmental issue due to the alarming trend of spread in the district. In the Lawra Municipal it has been reported that since 1995 to 2013, a total of 642 cases were recorded. This is attributed to many entry points to the district from Burkina Faso. Out of the 642 cases, 507 cases are between 15-44 years (106 male and 401 female). It is estimated that 83% of the population are engaged in subsistence agriculture. Food production is low due to the poor nature of the soil and unfavourable weather condition. It has become prudent for the introduction of new sources of livelihood such as irrigation, commerce etc., with the deterioration nature of soils and whether. An estimated percentage of households with access to electricity currently stand at 24.3% for the entire Lawra Municipal.

6 STAKEHOLDER CONSULTATIONS

6.1 Overview

A program of stakeholder engagements was developed as part of the environmental assessment to avoid any risk of apprehension associated with this project. A stakeholder mapping was subsequently done to identify those critical to be consulted during the process. It largely involved identifying stakeholders located within the project's proximity as they are the most likely persons to be impacted upon, like those whose properties will be affected by the project, or those who reside in the communities. Based on this mapping assessment, the following categories of key stakeholders were identified and have been consulted and information provided as part of the Final EIA Report:

- Property Affected Persons (PAPs), including landowners within the Lawra and Kaleo as well as crop owners.
- Farmers and women whose farmlands have been affected.
- Community members within Lawra and Kaleo, including Traditional Authorities and elected representatives.
- State Agencies within the Nadowli-Kaleo District and Lawra Municipal
- Forestry Services Division, Lawra Office
- Water Resources Commission, Accra
- Ghana Airports Company, Accra
- Energy Commission
- Irrigation Development Authority
- Owners of facilities/activities identified closed to the project site, including the Church of Pentecost and the Ahmadiyah Mission Hospital
- "Nuo-Ire" Family, owners of the Kulbonuo Tree Shrine.
- The Fulani settlements

There is the need to ensure that enough water is available and that there is no negative impact on the drinking water supply situation of the nearby communities which may create substantial social conflicts. In view of the this, VRA formally requested the Water Resources Commission to provide detailed information on the actual water supply situation, the risk of depletion of ground water resources and possible (negative) impacts on village water supply. In their response letter, dated March 4, 2019, WRC indicated that the average borehole yield is about **53.3 L/min (3.2 m^3/hour).** Therefore, this yield can satisfy or meet the estimated volume of water demand of the company for wet cleaning of solar panels **(19.5 m^3/year to 84.5 m^3/year)**. Moreover, since the abstraction rates will not have any negative stress on the aquifer, the drinking water supply of the communities involved will not be affected negatively. A copy of WRC letter is attached as part of Appendix 6.

A local stakeholder hearing and public consultation for the project sites was held in January 2012. In addition, VRA organised pre-construction public hearing in Kaleo and Lawra in November 2017. These hearings were open to the public and advertisements were carried by the national dailies, radio, public banners and posters. Various actions have been recommended for consideration for implementation during project development.

A "***Report of the Stakeholder Engagements*** (December 2017) as well as a Stakeholder Engagement Plan (January 2020) for ***"35MW Solar Power Project Phase 1: Upper West Regional Project Sites***" are available as part of the suite of documents for the EIA Study.

One of the key issues that came out during the pre-construction stakeholder engagement was the need for VRA to formally introduce the contractors to the traditional authorities prior to commencement of work. This was to enable them to collaborate effectively in project implementation, especially regarding employment. Subsequently, following the execution of contract with Elecnor SA of Spain, and the planned commencement of physical construction in November 2019, VRA in August 2019 also introduced the project contractors to the heads of the local government administration in the project areas. These were the Upper West Regional Minister, Honourable Hafiz Bin Salih, the Nadowli-Kaleo District Chief Executive, Honourable Katherine T. Lankono and that of Lawra Municipal Assembly, Honourable Martin Bomba-Ire. The Lawra Municipal Chief Executive was represented by the Municipal Coordinating Director, Mohmmed A. Majeed. The rational was to introduce the contractors to them and to update them on project progress as well as solicit cooperation during project information, as has been agreed upon during the stakeholders meeting in November 2017. A presentation on the status of the project was made to the Upper West Regional Minister.

6.2 Public Disclosure Programme

As part of the consultation processes, the VRA is to disclose at various times to the public, relevant documentation and activities for their attention and relevant action. Thus, with respect to public disclosure under the EIA Study, the Draft PEA Report (June 2012) covering the initial 8MW PV Plant was publicly disclosed in the national dailies in July 2012 for comments, and a copy of this publication was provided in the Updated PEA Report. VRA in October 2017, again publicly disclosed the Final Updated PEA Report (June 2014) and the NTS (October 2014) covering the 12MW PV Plant in the Daily Graphic and the Ghanaian Times, the two (2) most widely circulating newspapers in the country to enable the public make inputs or provide review comments.

The Draft EIA Report and updated NTS Report, covering the 35MW have also been publicly disclosed and made available at the under-listed locations for the public to assess and provide any review comments[4]:

a. E-copy on the VRA Corporate website at www.vra.com.
b. EPA Head office in Accra
c. EPA Upper West Regional Office in Wa
d. Lawra Municipal Assembly
e. Nadowli-Kaleo District Assembly
f. Paramountcy of Lawra Naa

Comments were to be provided to the EIA team at the address, tel./fax numbers or e-mail address provided below. It must be noted that no comments had been received from the public by the close of the deadline of July 31, 2019.

The Chief Executive
Volta River Authority
P. O. Box MB 77, Accra
Tel No: +233-302-664941-9; Fax: +233-30-2662610
Email: corpcomm@vra.com

The Final EIA Report is to be used to replace the Draft EIA Document on the corporate website. All comments received following the release of the EIA/NTS Report, through meetings and written correspondence will be reviewed and addressed as necessary. Going forward and as part of the disclosure processes, VRA will also give approval for KfW Group or any potential funding agency to publicly disclose the EIA Report / NTS on their online portal.

6.3 Grievance Redress Mechanism

The establishment of Grievance mechanism to receive and facilitate resolution of Affected Communities' concerns and grievances about the client's environmental and social performance is emphasized under Section 35 of the IFC Performance Standard 1 (2012). Consultations with the elected representatives of the communities, specifically the District Chief Executives of the Lawra District and Nadowli/Kaleo District Assemblies as well as elected representatives from

[4] *See Appendix 5 for copies of the Public Disclosure Notices*

Lawra and Kaleo communities on the Local Government, known as Assembly persons / Unit committee members was undertaken with a view of collating social information as well as informing them about the project and its impacts on the community members and to request them to represent as Grievance Committee Members. Till date, VRA had identified the following persons as key in the two (2) project communities to perform the functions of Grievance Committees as shown in Table 6-1. The membership is to be updated depending on the contingencies of the time during implementation.

Table 6-1: Proposed Grievance Committee Members

Community	Name of Assemblyperson	Position	Contact number
Kaleo	• Hon. Katherine T. Lankono • Hon. Ngminnie A. Noah • Nana Oboabeng Aberi	• District Chief Executive • Kaleo East Assemblyman • CID, Ghana Police Service	• 0207444484 • 0247697937 • 0241103797
Lawra	• Naa Puowele Karbo III • Martin Domotier Bomba-Ire • Hon. David Y. Kuudegi	• Lawra Naa • Municipal Chief Executive • Yagpelle Assemblyman	• 0244805521 • 0244985706 • 0208816135

Members of the Grievance Committee are expected to assist VRA in the following ways.

- Serves as a liaison between the community members and VRA
- Address misleading issues/problems if any.
- Bear witness to any damages and compensations to be paid.
- Identify and testify rightful owners of properties.

Currently, a Grievance Redress Mechanism – Operational Manual (June 2016) has been released by the Ghana EPA. The Manual seeks to ensure an efficient and transparent execution of the GRM process and was developed to provide a standardized mode of addressing grievances across board. It is therefore planned that the strategies recommended in the Operational manual is to be adopted by the VRA in project implementation. The sample formats to record and register complaints as provided in the GRM-Operational Manual is now to be adopted for the project. All formal grievances will receive a formal written reply within seven (7) working days.

6.4 Next Steps in the Stakeholder Engagement Process

Based on the project briefings, status quo conditions of the study area and the nature of the proposed development, the key issues of concern that must be considered during project implementation are summarized as below:

- Effective Community Entry by Project Contractors
- Employment for Community Members

- Social Investment Programme
- Availability of Grievance Redress Mechanism
- Land Acquisition & Compensation for Loss Property
- Risk to Public Safety, Community Health & Security Issues
- Continued Engagement During Construction & Operational Phase
- Effective Monitoring & Evaluation Process
- Acquisition of Permits

To address this, further consultation is planned to refresh the project information and to disclose the mitigation and other management plans upon commencement of constructional activities. In addition, VRA is committed to ongoing engagement with all identified stakeholders throughout the planning, development, construction and operational phases of the project. These activities will include public notices, one-on-one meetings and responses to emails, telephone and written responses to all formal enquires. This is currently on-going, and all records of consultations are available and have been included in this Final EIA Report.

In addition, VRA shall also monitor and report on the on-going stakeholder engagement efforts to ensure that the desired outcomes are being achieved, and to maintain a comprehensive record of engagement activities and issues raised. The stakeholder engagement activities should be periodically evaluated.

7 IDENTIFICATION, ANALYSIS AND EVALUATION OF IMPACTS

As required under the Ghana EA Regulations, the ESIA process is expected to identify the potential impacts, both positive and negative, of the proposed development that occurs during the pre-construction, construction, operational and decommissioning phases of the development. The following categories/attributes: nature, duration, spatial extent reversibility, direct and indirect impacts, short term and long term, positive or negative, cumulative, have been utilized in identifying project impacts. A simple, clearly defined method has been used in order to accurately determine the significance of the predicted impact on, or benefit to, the surrounding natural and/or social environment as shown belows:

*Significance Rating = Impact Magnitude * Probability*

"Impact Magnitude" = Potential Intensity + duration + extent

Nonetheless, it must be remembered that an impact assessment will always contain a degree of subjectivity, as it is based on the value judgment of various specialists and Environmental Assessment Practitioners. The evaluation of significance is thus contingent upon the assigned values, professional judgement, and dependent upon the environmental and community context. A guide to how the various impact signifcnac e were arrived at is provided in *Table 7-1*.

Table 7-1: Guide to assessing risk/impact significance as a result of consequence and probability

Scoring	Significance Rating	Description
18 - 26	**Fatally Flawed**	The project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating.
10 - < 18	**High**	The impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making.
5 - <10	**Medium**	The impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures and will only have an influence on the decision-making if not mitigated.
2 - <5	**Low**	The impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures and will not have an influence on decision-making.
<2	**Very Low**	The impact may result in very minor alterations of the environment and can be avoided through the implementation of mitigation measures.

The impact assessment methodology employed as well as the potential environmental, social, economic, health and public safety related impacts likely to be associated with all phases of the project as required has been discussed in the ESIA Report. The issues and impacts presented have been identified via the environmental status quo of the receiving environment, a review of

environmental impacts from other similar projects and inputs from specialists that form part of the project team. Both associated positive and negative impacts have been identified and discussed. A Summary of Ratings of Project Associated Impacts is shown in Table 7-2. Assessing the various negative impacts associated with the constructional and operational phases, the overall significance rating can be defined as **LOW NEGATIVE**.

Appendix 7 provides details of the evaluation of impacts (both positive and negative) at the constructional, operational and decommission phases as well as its significance rating with and without enhancement or mitigative measures.

Within the project area and its surrounding there are no existing and/or planned developments which would result in cumulative impacts on any of the environmental or social receptors investigated as part of the ESIA. The assessment of cumulative impacts in that sense is not relevant. However, impact on water resource especially, ground water, is critical as water is required for cleaning of the PV modules on a regular basis. Estimated volume of water demand for wet cleaning of solar panels ranges from 19.5 m3/year to 84.5 m3/year for a duration of 20 years. There is the need to ensure that enough water is available and that there is no negative impact on the drinking water supply situation of the nearby communities which may create substantial social conflicts.

Table 7-2: Summary of Ratings of Project Associated Impacts

Nature of Impact	Phase	Score	Impact Significance Before Mitigation
POSITIVE IMPACTS			
Minimisation of Greenhouse Gases	Constructional		Not Applicable
	Operational	13	High Positive
Increase in Employment Opportunities	Constructional	7	Medium Positive
	Operational	6.75	Medium Positive
Stabilization of Electricity	Constructional		Not Applicable
	Operational	9	Medium Positive
Promotion of Economic Growth	Operational	6	Medium Positive
NEGATIVE IMPACTS			
Noise & Vibration	Constructional	5	Medium Negative
	Operational	1.5	Very Low Negative
Air Quality	Constructional	3.5	**Low Negative**
	Operational	0.6	Very Low Negative
Topography & Drainage	Constructional	7	Medium Negative

Nature of Impact	Phase	Score	Impact Significance Before Mitigation
	Operational	0.6	Very Low Negative
Water Resources	Constructional	4	**Low Negative**
	Operational	0.4	Very Low Negative
Geology & Soils	Constructional	0.75	Very Low Negative
	Operational	0.75	Very Low Negative
Waste	Constructional	2	**Low Negative**
	Operational	0.6	Very Low Negative
Landscape & Visual Intrusion	Constructional	4	**Low Negative**
	Operational	1.5	Very Low Negative
Ecology	Constructional	9	**High Negative**
	Operational	0.75	Very Low Negative
Historical & Cultural Heritage Resources	Constructional	3.8	Low Negative
	Operational	0.75	Very Low Negative
Occupational Health & Safety	Constructional	5	Medium Negative
	Operational	1.5	Very Low Negative
Land Acquisition	Constructional	13	**High Negative**
	Operational	3.5	**Low Negative**
Land Use	Constructional	9	Medium Negative
	Operational	6	Medium Negative
Labour & Working Conditions	Constructional	2	**Low Negative**
	Operational	1.25	Very Low Negative
Community, Health, Safety and Security	Constructional	2.5	**Low Negative**
	Operational	1.75	Very Low Negative
Traffic & Transport	Constructional	9	Medium Negative
	Operational	1.75	Very Low Negative
Average of Summary Rating of Negative Impacts		***3.42***	***Low Negative***
NEGATIVE IMPACTS - DECOMMISSIONING			
Noise & Vibration	Decommissioning	1.5	Very Low Negative
Air Quality	Decommissioning	2	**Low Negative**
Solid Waste	Decommissioning	8	Medium Negative
Community, Health, Safety and Security	Decommissioning	4	**Low Negative**
Traffic & Transport	Decommissioning	4.5	**Low Negative**

8 MITIGATION MEASURES

Various mitigation measures have been recommended in the ESIA Report based on the identified impacts outlined in *Table 7-2* through the consideration of the following:

- Enhancement measures, which outlined measures to be implemented to enhance already positive benefits of the project.
- Embedded or In-built Controls, which outlines mitigation measures which is built into the project during the design process as well legal requirements that must be adhered to in order for easy transfer into all contractual documents with the EPC Contractor, if required
- Mitigation of significant effects or key mitigation (pertinent measures that will be written into and enforced through the ESMP for implementation to ensure that the significance of the associated impact is acceptable).
- Mitigation of non-significant effects or additional mitigation (management actions to be considered by proponent and authority).

Appendix 8 outlines the recommended mitigations for the identified impacts for the constructional, operational and decommissioning phases which are summarised as part of the ESMP. The identified measures are to be implemented mostly by the EPC Contractor in collaboration or under the supervision of VRA at the constructional stage whilst the VRA is solely responsible for the operational stage.

There are no other known large development projects in the project's area of influence, the cumulative impact has been assessed to be negligible and there are no proposed mitigative measures for this impact. The water requirement for cleaning of modules is an important aspect to be kept in view. Water conservation measures is a must requirement for the project and should be practiced at the site. It is recommended that VRA consider incorporating into the facility design, the harvesting and storage of rainwater for use on the project

9 ENVIRONMENTAL MANAGEMENT & MONITORING PLAN

An Environmental and Social Management Plan (ESMP) for the Project has been prepared as part of the ESIA Report. The purpose of this ESMP is to specify the standards and controls required to manage and monitor environmental and social impacts during construction and operation phase. The ESMP identifies potential adverse impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, natural and social environment. Some residual impact will however persist after the all mitigation measures are employed, the ESMP intends to delineate monitoring and management measures to minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures during construction and operational phase. The ESMP therefore includes proposed mitigation measures, environmental monitoring and reporting requirements, training measures, implementation schedule and cost estimates.

The ESMP as developed for the project to minimize adverse impacts during different phases of project lifecycles, is provided in **Appendix 8.**

A monitoring programme has been developed to determine impacts on the physical, biological and socio-economic/cultural environments within the project's area of influence and around the proposed power plant and associated facilities. The monitoring results are expected to indicate whether the predictions of potential environmental impacts are accurate and also whether the mitigation measures proposed for the management of the impacts are appropriate and adequate. The programme will also serve as an early warning system by revealing unforeseen impacts and allowing additional corrective measures to be implemented to arrest the situation and ensure that irreversible damage is not caused. The programme is also expected to provide useful guidance for the successful planning and implementation of future solar power projects that will be undertaken by the VRA.

The environmental monitoring activities showing parameters, methodology, period for monitoring, location and responsibilities is presented in **Appendix 9.**

10 CONCLUSION

In Ghana, the industrial facilities and power generation facilities are mainly centered in a small part of the Country. Renewable power plants can be distributed around the country based on resource availability. This allows for increased physical security and distributions of wealth and income by having jobs spread all around the country. This solar power projects in general seek to foster sustainable low carbon energy provision, provision of jobs in local communities and global partnerships that ensure that the projects should have some form of local content during development and operation.

The construction, commissioning and operation of the solar power project will be carried out in environmentally sustainable manner to minimise or eliminate impact on the environment and human health, lifestyle and sustenance. VRA has put forward mitigation measures aimed at reducing, and if possible, elimination of the impacts afore-mentioned to ensure that the end use of the land after the expiry for the project's life span is not compromised. VRA acquired the lands for the PV sites through voluntary means and private treaties. This was carried out by engaging and consulting with respective landowners freely to give out lands willingly.

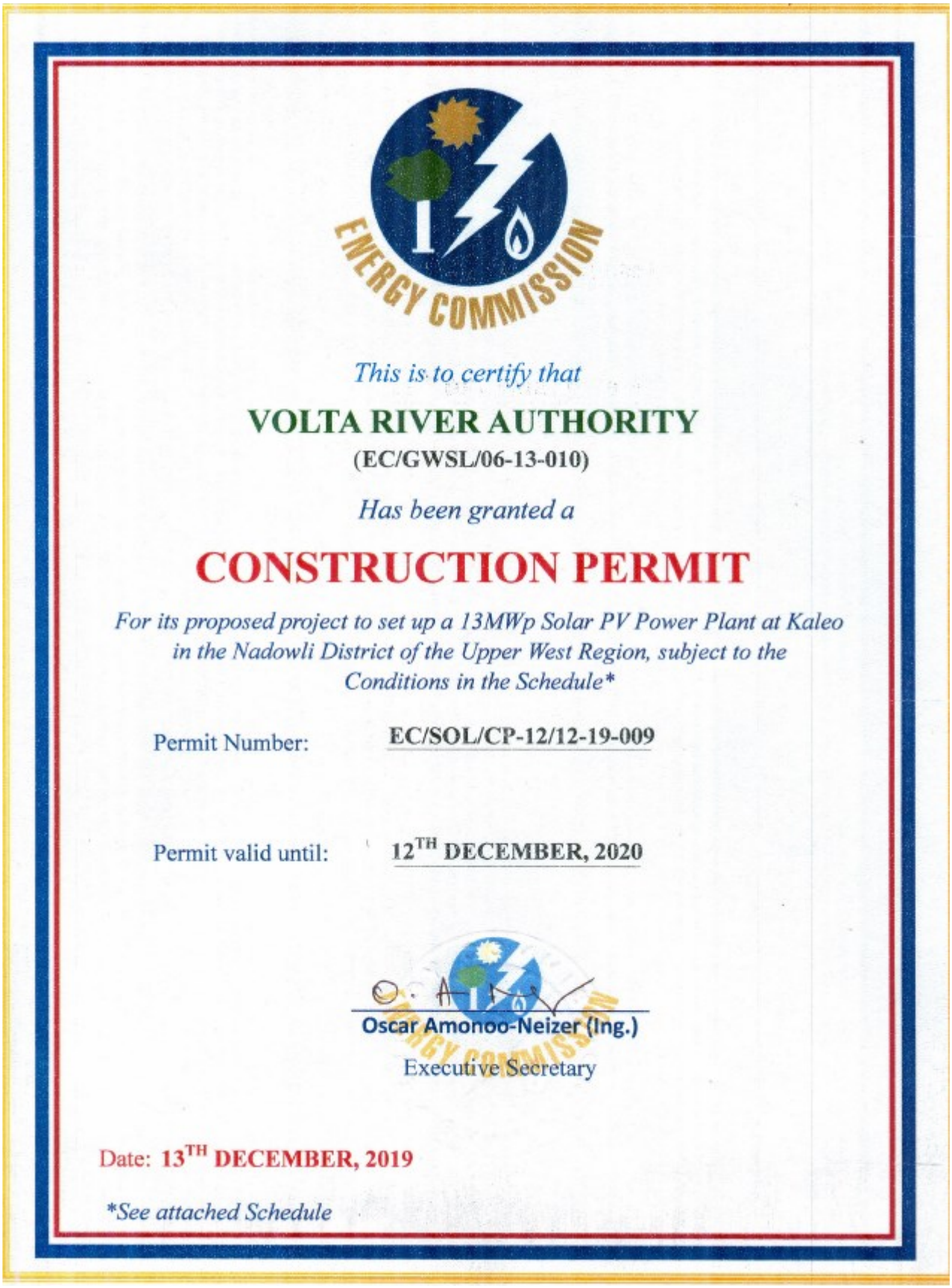
The environmental benign, economic viability, socio-cultural acceptability and institutional arrangements that the country will enjoy from implementing the solar power project has been discussed in the ESIA Report. In conclusion, it is affirmed that VRA is committed to ensuring continuous improvement of environmental performance to minimize the impacts of all its operations on the environment, in line with the principles of sustainable development, in addition to complying with national and international environmental protection regulations. This is an undertaking VRA is firmly committed to and shall adhere to it.

VRA believes that the ESIA Report has sufficiently dealt with the significant issues on the ground. It is hoped that the report will meet the expectations of the EPA and warrant the issuance of Permit to enable VRA to commence the project. VRA commits to collaborate with EPA to jointly manage the environmental and social concerns related to the solar power plant project and shall submit progress environmental reports to the EPA as required. The study therefore recommends that the ESIA Report should be approved with the provision that the suggested mitigations measures will be adopted, and the ESMP / Monitoring Plans will be followed in the letter and spirit.

APPENIDX

APPENDIX 1:
PROJECT REGULATORY PERMITS

a. Construction Permit for 13MW Kaleo Solar Power Project
b. Construction Permit for 4MW Lawra Solar Power Project
c. Environmental Permit for 35MW Solar Power Project – Upper West Region



ENERGY COMMISSION

This is to certify that

VOLTA RIVER AUTHORITY

(EC/GWSL/06-13-010)

Has been granted a

CONSTRUCTION PERMIT

*For its proposed project to set up a 13MWp Solar PV Power Plant at Kaleo in the Nadowli District of the Upper West Region, subject to the Conditions in the Schedule**

Permit Number: **EC/SOL/CP-12/12-19-009**

Permit valid until: **12TH DECEMBER, 2020**

Oscar Amonoo-Neizer (Ing.)
Executive Secretary

Date: **13TH DECEMBER, 2019**

**See attached Schedule*

ENERGY COMMISSION

This is to certify that

VOLTA RIVER AUTHORITY

(EC/GWSL/06-13-011)

Has been granted a

CONSTRUCTION PERMIT

*For its proposed project to set up a 4MWp Solar PV Power Plant at Lawra in the Lawra District of the Upper West Region, subject to the Conditions in the Schedule**

Permit Number: **EC/SOL/CP-13/12-19-010**

Permit valid until: **12TH DECEMBER, 2020**

Oscar Amonoo-Neizer (Ing.)
Executive Secretary

Date: **13TH DECEMBER, 2019**

**See attached Schedule*

Permit No: CE0030770202

ENVIRONMENTAL PROTECTION AGENCY

Environmental Permit

ENVIRONMENTAL ASSESSMENT REGULATIONS, 1999 (LI 1652)

This is to authorize

VOLTA RIVER AUTHORITY

To commence the proposed 35MW solar power project as per the attached schedule

Located in the Kaleo District and Lawra Municipality of the Upper West Region

.....

Ebenezer Appah-Sampong
Deputy Executive Director/Technical Services
For: Ag. Executive Director

Date Issued: December 18, 2019
Expiry Date: June 17, 2021

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

Appendix 2: Maps & Figures

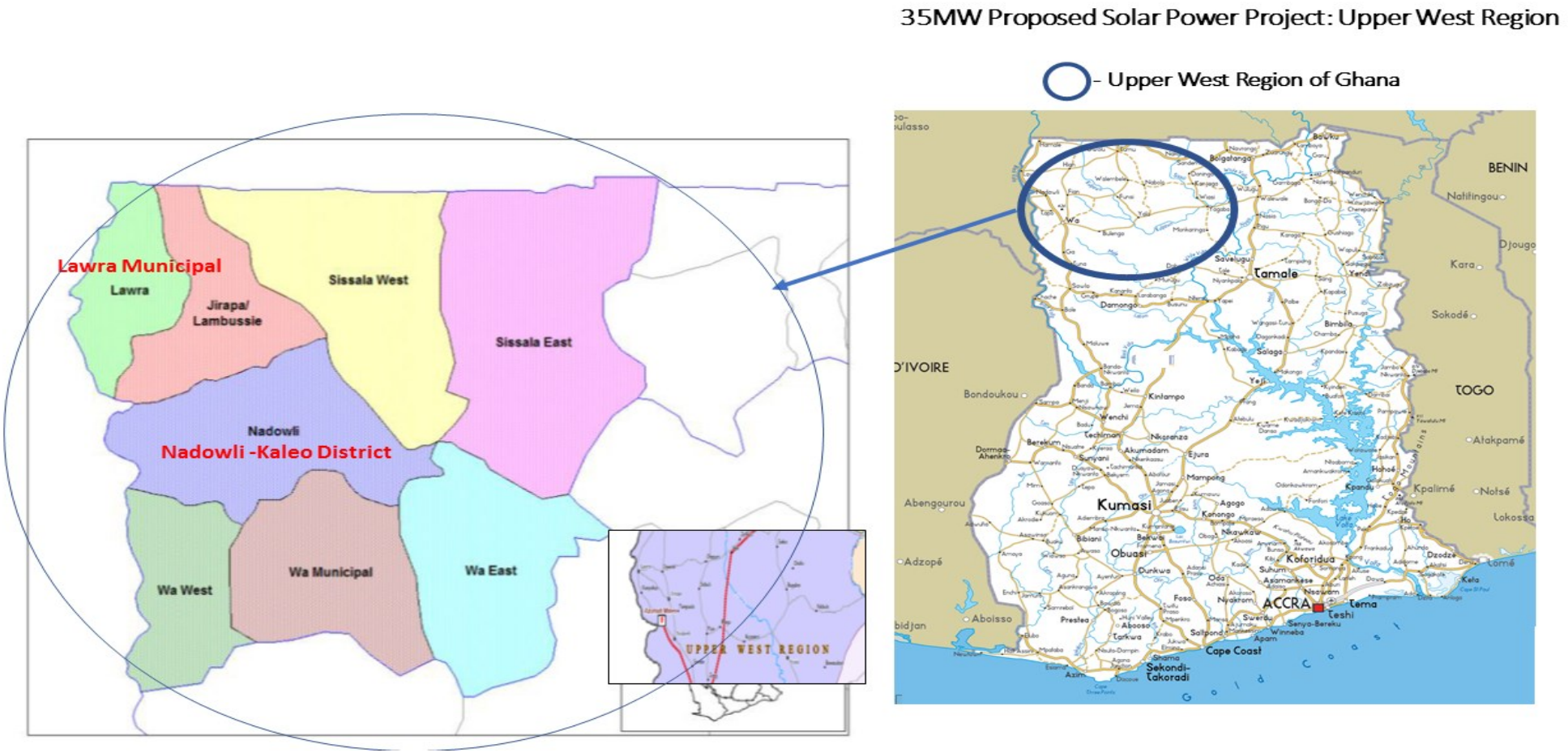


Figure A1: Location of Project Districts in the Upper West Region in the Context of Ghana

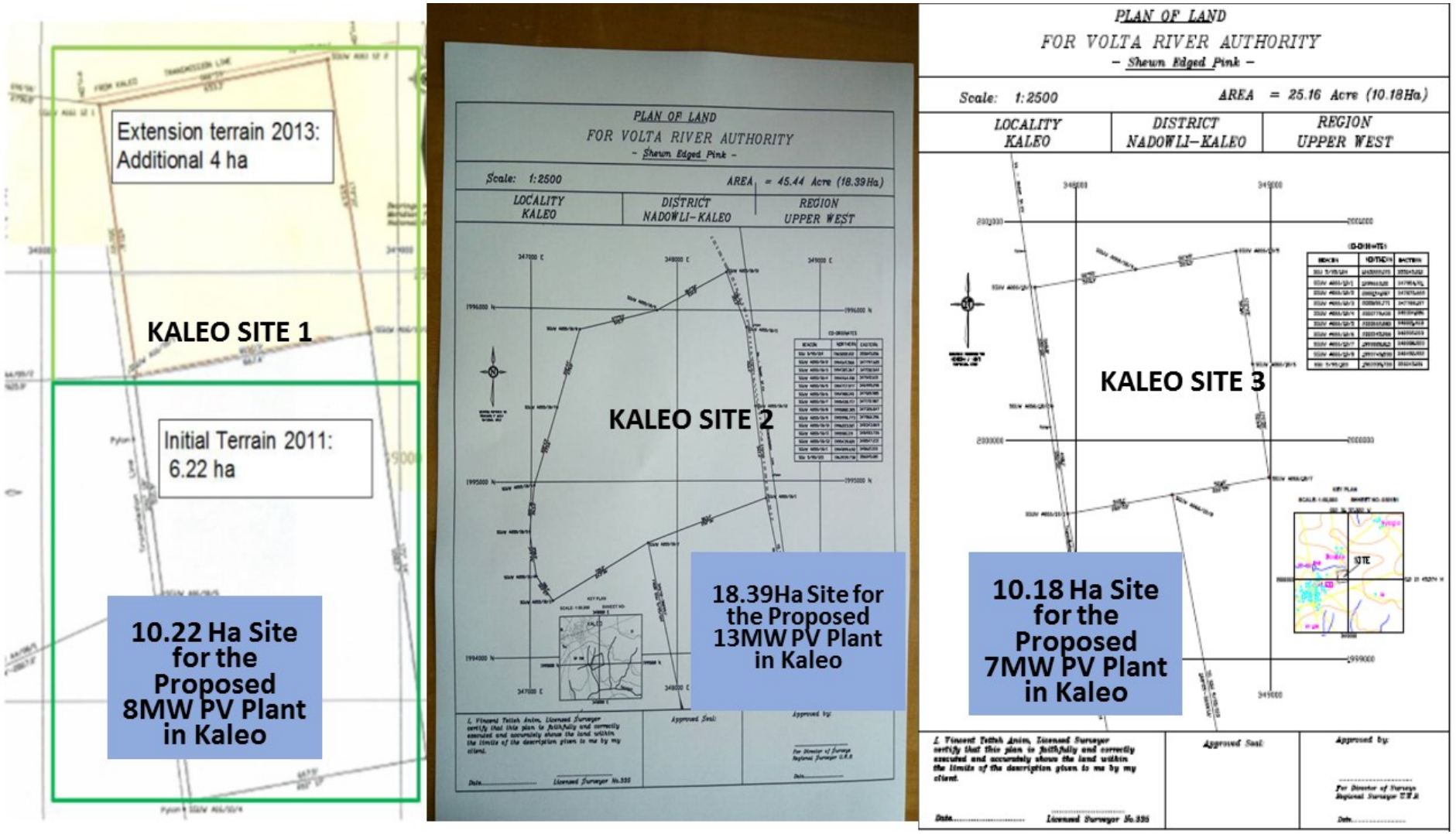


Figure A2 - Site Plans of Kaleo PV Sites

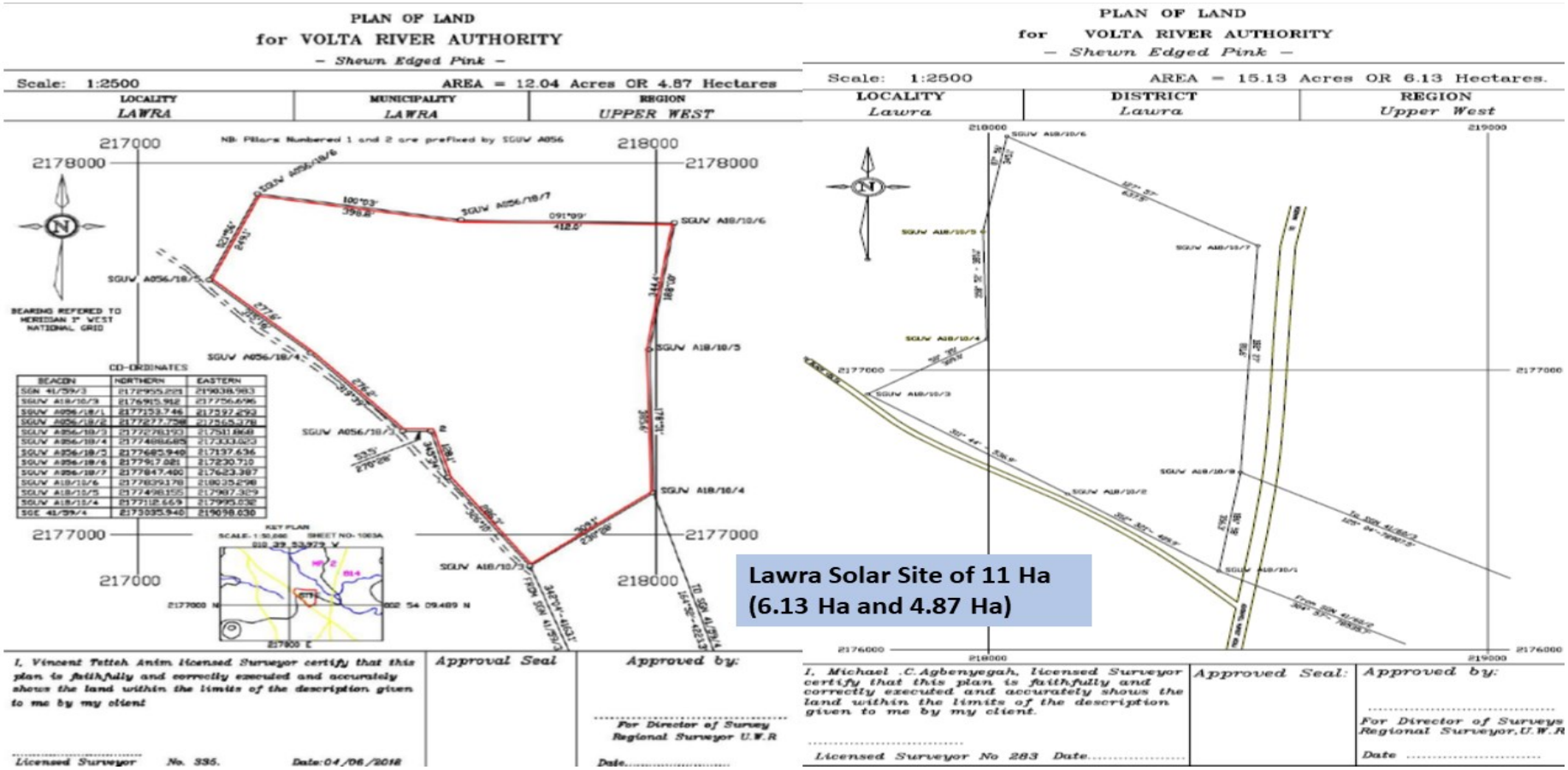


Figure A3 - Site Plan of Lawra

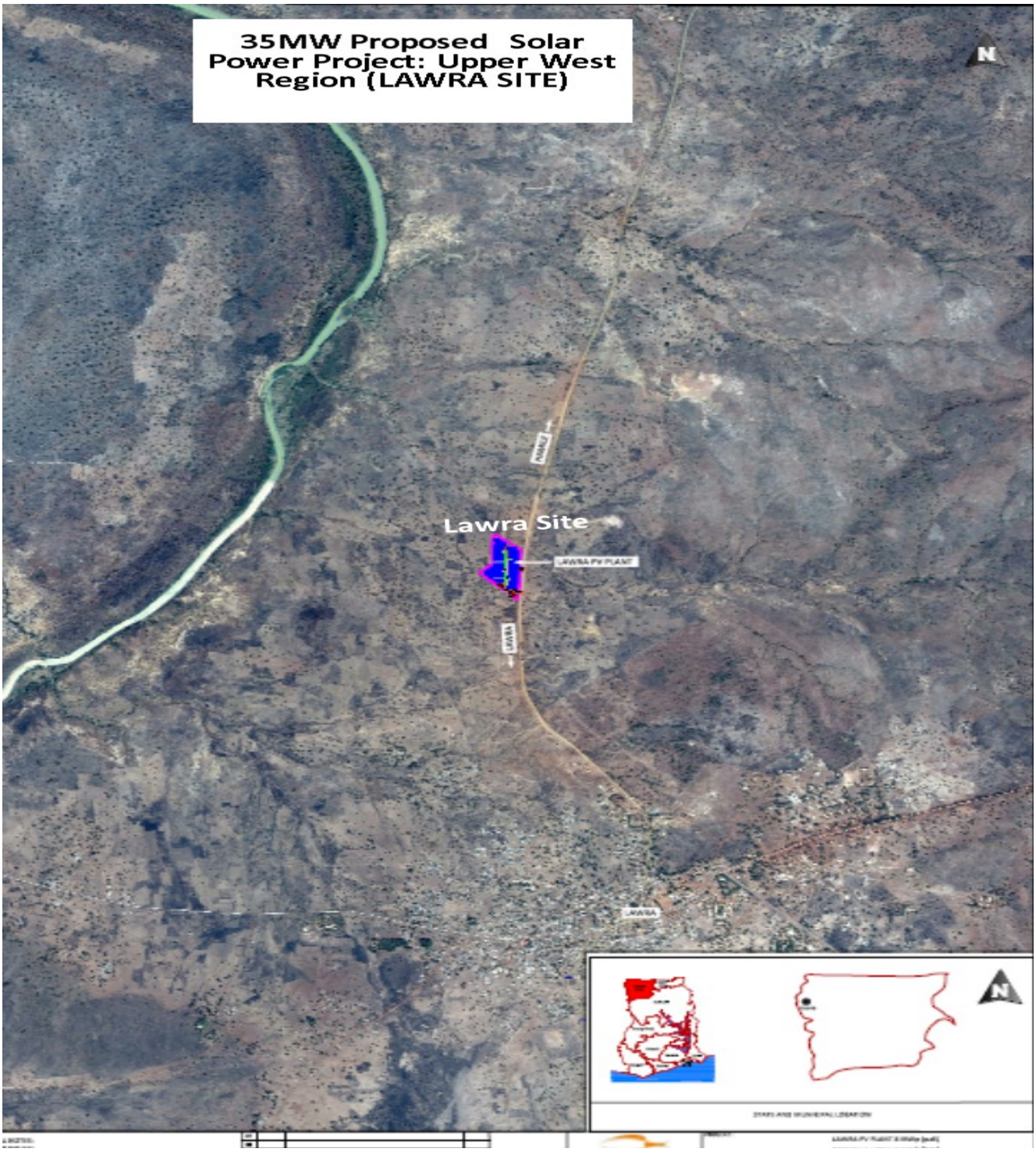


Figure A4 - PV Site at Lawra Township

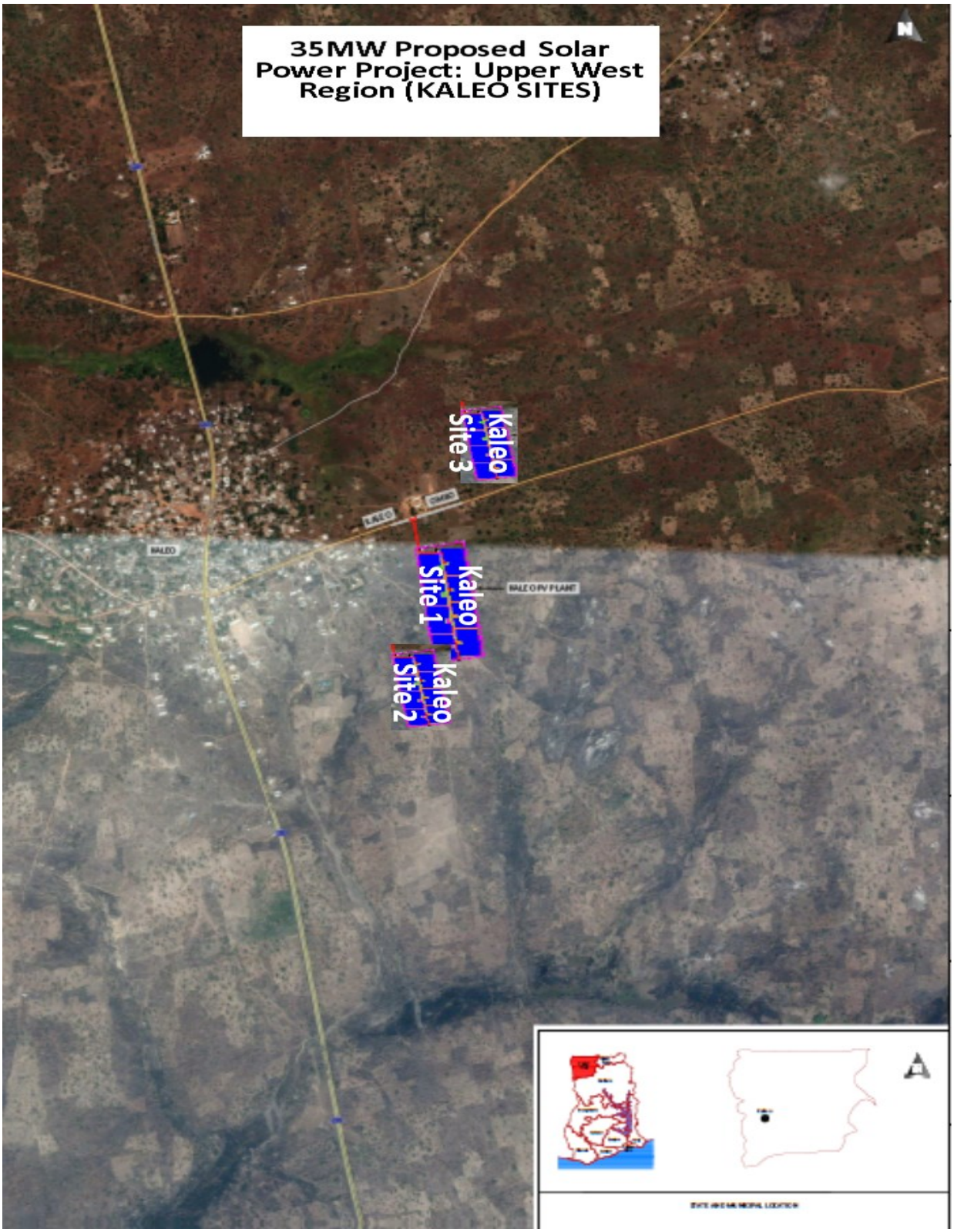


Figure A5 - Three (3) PV sites at Kaleo Township

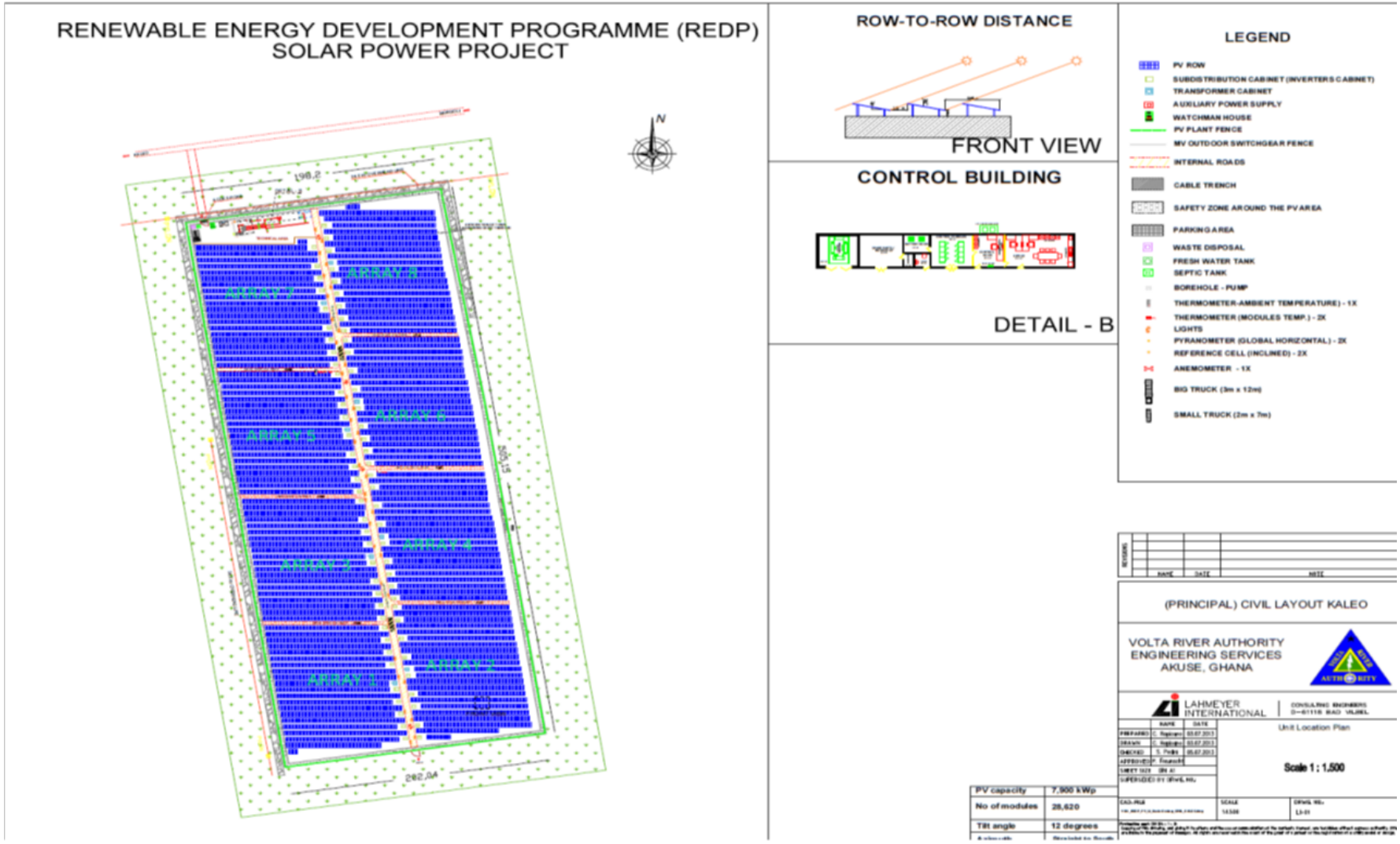


Figure A6 – Design Drawing Showing Civil Layout for Kaleo Site

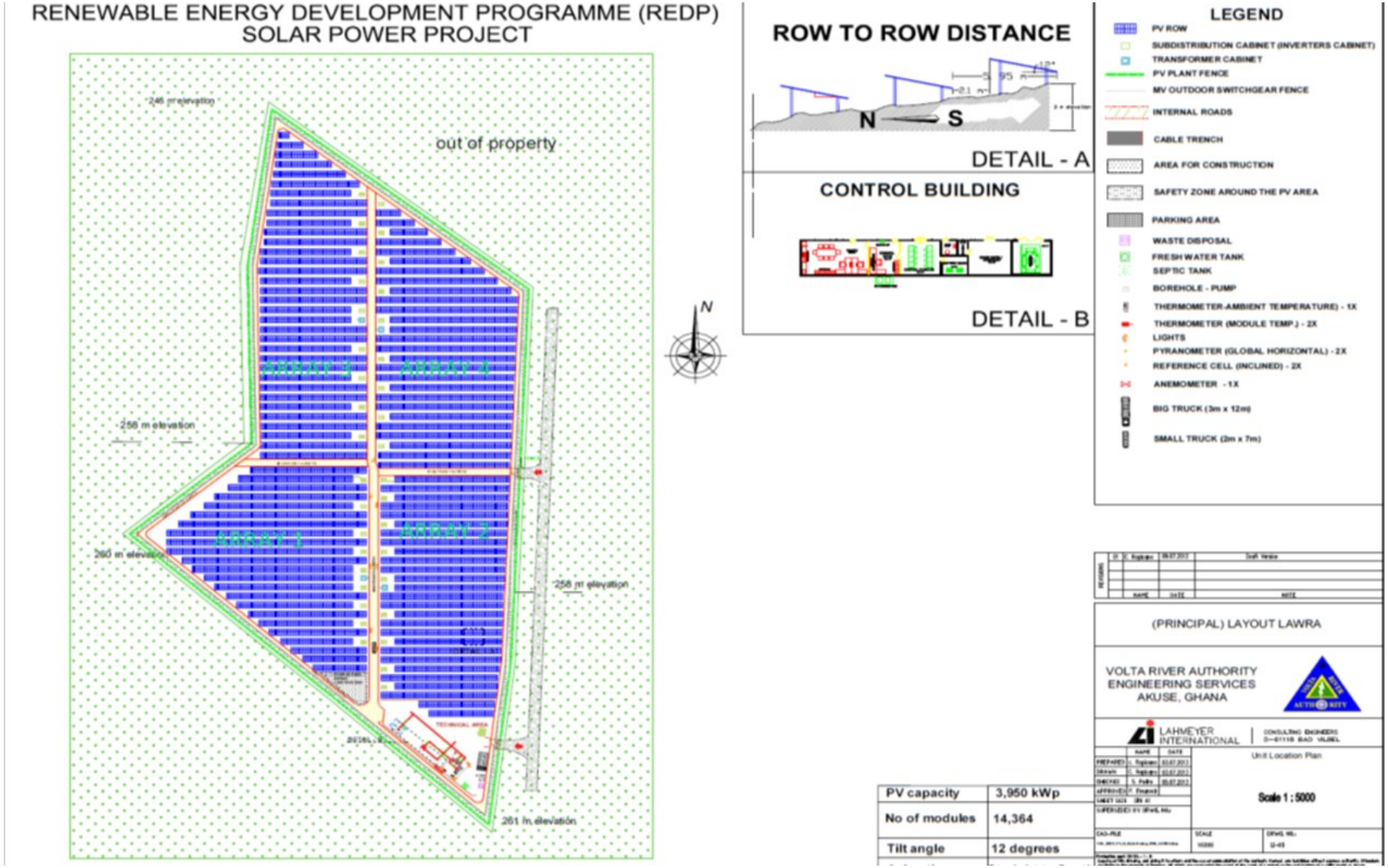


Figure A7 – Design Drawing Showing Civil Layout for Lawra Site

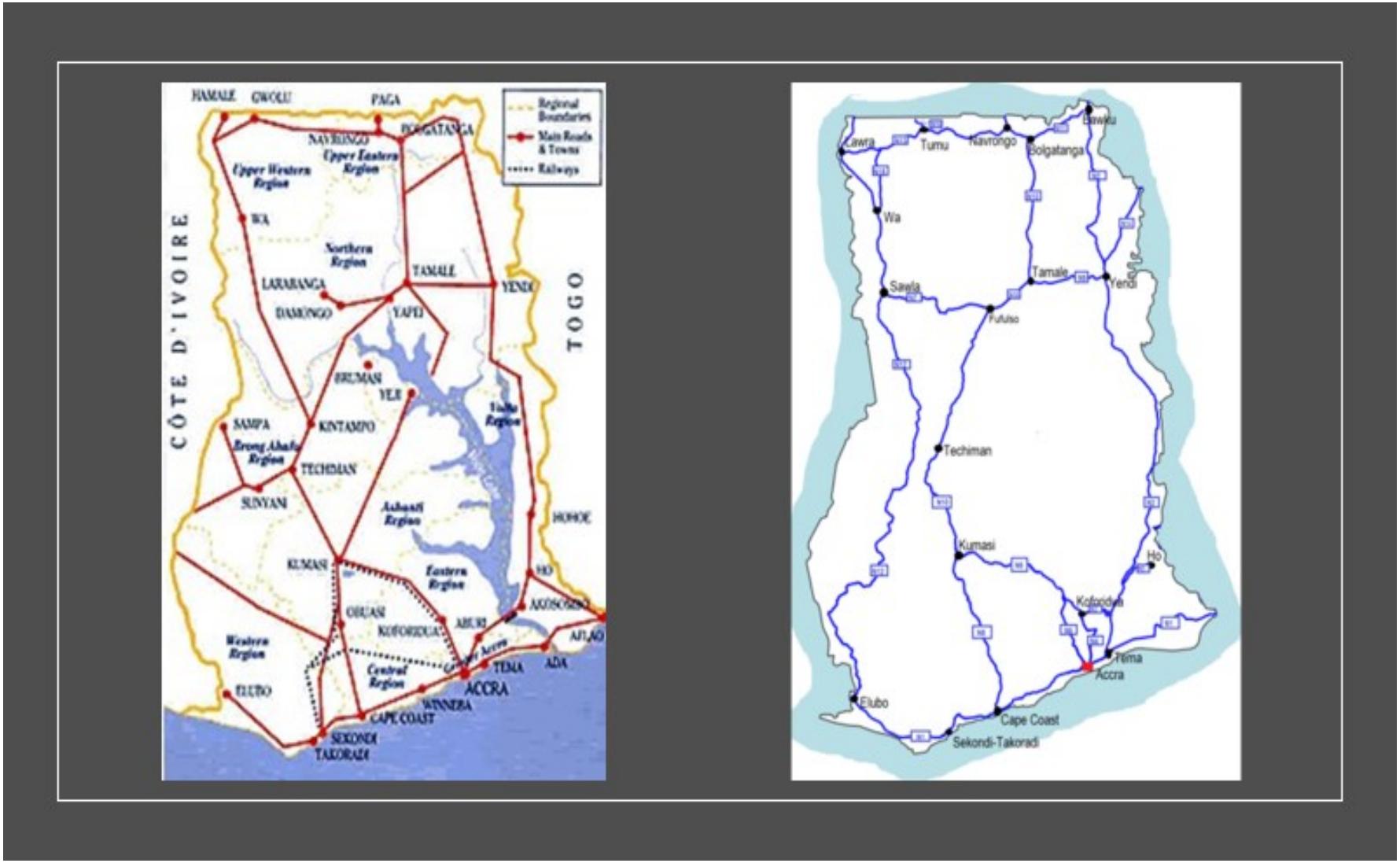


Figure A8 - Ghana Highway Transportation Route

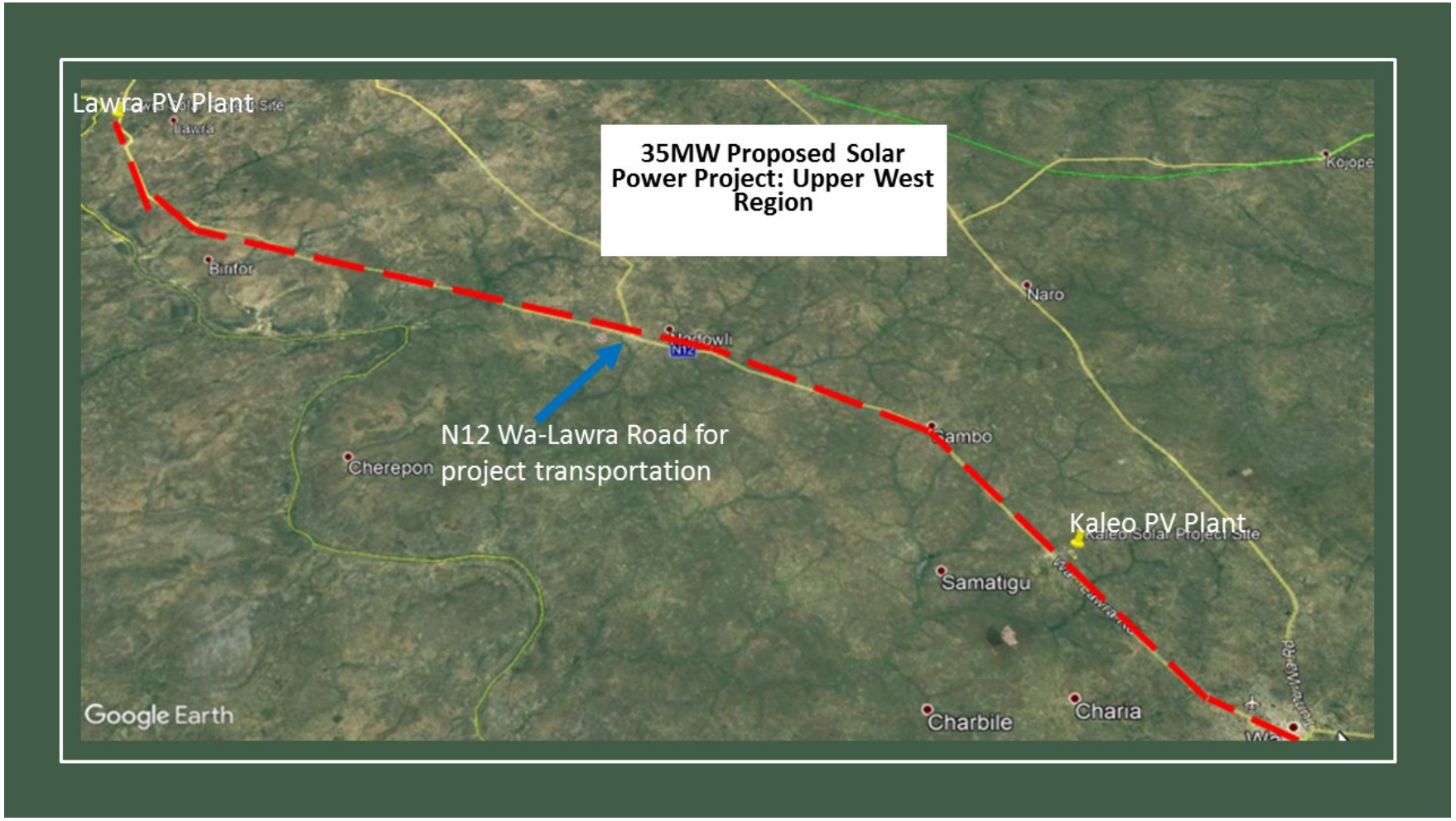


Figure A9 - Google Map of Project Transport Route from Wa

Appendix 3: Pictures of PV Sites

Plate A1- Site panorama in the centre of the terrain facing south at the Kaleo PV Site

Plate A2- 360°- Panaorama at the district road looking south along the MV line for Kaleo PV Site

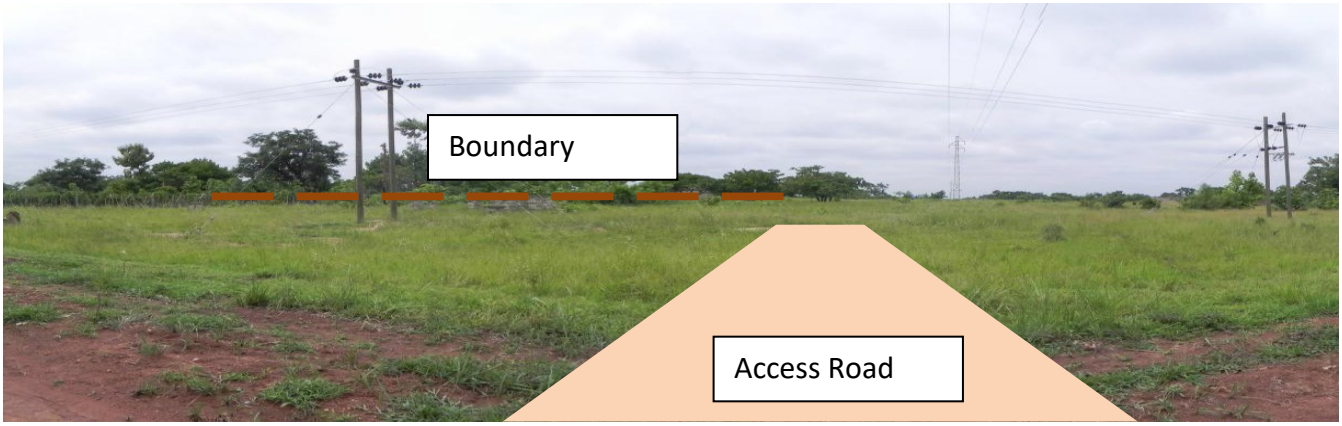


***Plate A3*- Schematic visualisation of the potential access road for Kaleo PV Site**

***Plate A4*- Pictures of Pentecost Church and Kaleo Primary near the Kaleo PV Site**

***Plate A5*- Pictures of neighbouring features of near the Kaleo PV Site**

***Plate A6*- Pictures of Fulnani Hamlets and Police Station near the Kaleo PV Site**

Plate A7- Site for the Lawra PV Plant During Dry Season

Plate A8- Status of Lawra – Hamile N12 Highway Road, near the Lawra PV Site, in 2011 and 2018

Plate A9-Site for the Lawra PV Plant During Wet Season

Appendix 4: Results of Flora assessment within VRA PV Sites at Lawra and Kaleo

No	NAME			Family	Frequency					Total		Environmental Relevance	Level of Endangered Species
	English	Local	Botanical		Kaleo Plot 3	Kaleo Plot 2	Kaleo Plot 1	Lawra	Lawra Forest Reserve	No.	%		
1	Acacia	Acacia	*Acacia mangium*	*Fabaceae*	2	0	0	0	0	2	0.14%	Its nitrogenous plant and helps to improve soil fertility. It is also good wood fuel	Green
2	African copaiba balsam tree	*Kakyele*	*Daniellia oliveri*	*Fabaceae*	2	9	0	0	1	12	0.83%	It serves as wind break and also prevent soil erosion	*Scarlet*
3	Africa jacana	kakala	*Azflia africana*	*Leguminosae*	0	8	1	0	0	9	0.62%	They reduce wind speed and cool the air as they lose moisture and reflect heat upwards from their leaves	Red
4	Baobab	Tuo	*Adansonia digitata*	*Malvaceae*	0	0	2	0	0	2	0.14%	Improves soil fertility and acts as carbon sinks thereby reducing global warming.	Pink
5	Cashew	Cashew	*Anacardium occidentale*	*Anacardiaceae*	2	1	0	0	0	3	0.21%	It serves as a means or way to stop soil erosion in coastal areas in the tropics.	Green
6	Cassia	Cassia	*Cinnamomum cassia*	*Fabaceae*	0	67	0	0	0	67	4.65%	It is designated as an environmental weed that can affect human health or can be invasive in reducing the natural bio-diversity.	Green

No	NAME			Family	Frequency					Total		Environmental Relevance	Level of Endangered Species
	English	Local	Botanical		Kaleo Plot 3	Kaleo Plot 2	Kaleo Plot 1	Lawra	Lawra Forest Reserve	No.	%		
7	Cotton	Guon	*Ceiba pentandra*	*Malvaceae*	0	5	12	0	0	17	1.18%	It help cleanse the air by intercepting airborne particles, reducing heat, and absorbing carbon monoxide and nitrogen dioxide.	Scarlet
8	Dawadawa	Duotie	*Parkia biglobosa*	*Fabaceae*	56	72	23	38	11	200	13.87%	Serves as wind break and improve soil fertility.	Scarlet
9	Ebony	Gaa	*Diospyros mespiliformis*	*Ebenaceae*	13	21	1	0	8	43	2.98%	They reduce wind speed and cool the air as they lose moisture and reflect heat upwards from their leaves.	Gold
10	Gam Arabic tree	Stum	*Acacia nilotical*	*Fabaceae*	0	0	0	46	0	46	3.19%	It serves as wind break and also prevent soil erosion	Green
11		Sinasule	*Lannea Acida*	Anacardiaceae	0	0	0	0	11	11	0.76%	It serves as a means or way to stop soil erosion in coastal areas in the tropics.	Green
12	Mahogany	Kog	*Khaya senegalensis*	*Meliaceae*	3	3	1	1	0	8	0.55%	They absorb carbon dioxide as they grow and the carbon that they store in their wood helps slow the rate of global warming.	Black
13	Neem tree	Neem	*Azadirachta indica*	*Meliaceae*	19	53	18	58	0	148	10.26%	It exhales out oxygen and keep the oxygen level in the atmosphere balanced.	Pink

No	NAME			Family	Frequency					Total		Environmental Relevance	Level of Endangered Species
	English	Local	Botanical		Kaleo Plot 3	Kaleo Plot 2	Kaleo Plot 1	Lawra	Lawra Forest Reserve	No.	%		
14	Pawpaw		*Carica papaya*	*Caricaceae*	0	1	0	0	0	1	0.07%	It's a friut tree and serve as food.	Green
15	Red berry	Sunsule	*Dichrostachya glomerata*	*Fabaceae*	16	38	2	2	0	58	4.02%	It serves as wind break and also prevent soil erosion.	Green
16	Red-flowered silk cotton tree	Vagatie	*Bombax costatum*	*Bombacaceae*	8	47	6	0	0	61	4.23%	They absorb carbon dioxide as they grow and the carbon that they store in their wood helps slow the rate of global warming.	Red
17	Rose wood	Liga	*Ptercarpus erinaceus*	*Fabaceae*	0	2	0	0	0	2	0.14%	It act as carbon sinks thereby reducing global warming. As timber, medicine and wood fuel	Red
18	Sheanut tree	Tantie	*Vitellaria paradoxa*	*Sapotaceae*	94	414	85	22	0	615	42.65%	It act as carbon sinks thereby reducing global warming.	Scarlet
19	Soapberry tree	Sansantie	*Balanites aegyptiaca*	*Balanitaceae*	0	1	0	0	0	1	0.07%	It act as carbon sinks thereby reducing global warming.	Scarlet
20	Teak	Teak	*Tectona grandis*	*Lamiaceae*	0	2	0	0	25	27	1.87%	It act as carbon sinks thereby reducing global warming.	Green
21	Yellow berry	Oraa	*Solanum virginianum*	*Vaccinium*	0	2	0	0	0	2	0.14%	It serves as wind break and also prevent soil erosion.	Green
22	Yilla		*Mitragyna inermis*	*Rubiaceae*	0	2	0	0	0	2	0.14%	It serves as wind break and also prevent soil erosion. Good for wood fuel	Green

No	NAME			Family	Frequency					Total		Environmental Relevance	Level of Endangered Species
	English	Local	Botanical		Kaleo Plot 3	Kaleo Plot 2	Kaleo Plot 1	Lawra	Lawra Forest Reserve	No.	%		
23	Ficus	Kankanpla	*Ficus capensis*	*Moraceae*	0	2	0	0	0	2	0.14%	It serves as a means or way to stop soil erosion in coastal areas in the tropics.	Green
24		Kankanga	*Ficus microcarpa*	*Moraceae*	1	2	0	0	0	3	0.21%	They absorb carbon dioxide as they grow and the carbon that they store in their wood helps slow the rate of global warming.	Green
25		Zimbrima	*Haematostaphis barteri*	*Anacardiaceae*		5	0	0	0	5	0.35%	It acts as carbon sinks thereby reducing global warming.	Green
26		Saalzie	*Unknown*	*Unknown*		1	0	0	0	1	0.07%	It act as carbon sinks thereby reducing global warming.	Green
27		Puretie	*Tamarindus indica*	*Fabaceae indigenous*	2	5	2	0	0	9	0.62%	It serves as wind break and also prevent soil erosion	Green
28		Pumpum	*Boswellia dalzielli*	*Burseraceae*	10	0	0	0	0	10	0.69%	They absorb carbon dioxide as they grow and the carbon that they store in their wood helps slow the rate of global warming.	Green
29		Sitre	*Anogeissus Leiocarpus*	*Combretaceae*	0	0	0	0	46	46	3.19%	It serves as wind break and also prevent soil erosion. Good for wood fuel	Green
30		Dazugu	*Unknown*	*Unknown*	0	0	0	0	2	2	0.14%	It serves as wind break and also prevent soil erosion. Good for wood fuel	Green

No	NAME			Family	Frequency					Total		Environmental Relevance	Level of Endangered Species
	English	Local	Botanical		Kaleo Plot 3	Kaleo Plot 2	Kaleo Plot 1	Lawra	Lawra Forest Reserve	No.	%		
31		Sansah	*Unknown*	*Unknown*	0	0	0	0	1	1	0.07%	It serves as wind break and also prevent soil erosion. Good for wood fuel	Green
32	Wattles	Goozie	*Acacia dudge*	*Mimosoideae*	0	0	0	26	0	26	1.80%	They reduce wind speed and cool the air as they lose moisture and reflect heat upwards from their leaves	Green
TOTAL					**228**	**763**	**153**	**193**	**105**	**1442**	**100%**		

Star system of genetics

Black: Rare international and uncommon in Ghana. Highly protected.
Gold: Fairly rare both international and/or Ghana. Highly protected.
Blue: Widespread internationally but rare in Ghana or vice versa
Scarlet: Common, but under high pressure from over exploitation, strict control and annual allowable cut.
Red: Common, but tend to be over exploited, restriction needed. Level of cut (100-200) % of AAC.
Pink: Utilizable, but not as popular to the trade present cut below AAC.
Green: No particular conservation concern.

Appendix 5: Public Disclosure Notices For UWR:SPP

ADVERTISER'S ANNOUNCEMENT

35MW Solar Power Project: Upper West Regional Project Sites

The Volta River Authority (VRA) has submitted to the Environmental Protection Agency for review, an Environmental Impact Assessment (EIA) Report for its **"35MW Solar Power Project Upper West Regional Sites"**, in line with the EPA Act 490, 1994 and the LI 1652, 1999.

The 35MW Solar Power facility is to be developed in two (2) phases. Phase 1 and Phase 2 will involve the installation of 17MW and 18MW respectively and will utilise four (4) separate sites with a total land area of 44.92Ha at Kaleo and Lawra, in the Nadowli-Kaleo District and Lawra municipality respectively, all in the Upper West Region. Hard copies of the EIA Reports are available at the EPA Head office in Accra. The electronic copy is available on the VRA's website at **www.vra.com.** Also available on the VRA website is the Non-Technical Summary Report of the EIA.

Any person(s) who have an interest, concern, or special knowledge relating to potential environmental effects of the proposed undertaking may contact or submit such concerns, etc., to:

The Chief Executive
Volta River Authority
P. O. Box MB 77, Accra
Tel No: +233-302-664941-9
Email: corpcomm@vra.com

AND

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

Not later than July 31, 2019

Daily Graphic, Monday, June 10, 2019; Pg 71

28 Tues. Oct. 10, 2017 www.ghanaia

GHANAIAN Times TUESDAY, OCT

12MW SOLAR PHOTOVOLTAIC POWER PROJECT AT KALEO AND LAWRA IN THE UPPER WEST REGION OF GHANA

Preliminary Environmental Assessment Report

The Volta River Authority (VRA) proposes to develop a 12MW Solar Photovoltaic Power Plants at Kaleo and Lawra in the Upper West Region of Ghana. The project which is in line with Ghana's Renewable Energy Act, 2011 (Act 832) and known as the "***Solar Power Project Phase 1: Upper West Regional Project Sites***" comprises of 8MW PV Power Plant at Kaleo and 4MW PV Power Plant at Lawra.

A Preliminary Environmental Assessment Report (PEAR) has been prepared for the 12MW Solar Photovoltaic Power Project. Copies of the PEAR as well as a Non-Technical Summary of the PEAR are available at the VRA Head Office in Accra, EPA Head office in Accra, EPA Upper West Regional Office in Wa and on the VRA's website (i.e. www.vra.com).

Notice of the proposed "***Solar Power Project Phase 1: Upper West Regional Project Sites***" is hereby served for public information, as required under the procedures for the conduct of Environmental Assessment in accordance with Regulation 16 of LI. 1652.

Any person(s) who have an interest, concern, or special knowledge relating to the potential environmental and social implications of the proposed undertaking may contact or submit such concerns, etc., to:

1. **The Chief Executive**
   Volta River Authority
   P. O. Box MB 77, Accra
   Tel No: +233-302-664941-9
   Fax: +233-30-2662610
   Email: corpcomm@vra.com
2. **The Executive Director**
   Environmental Protection Agency
   Tel No: +233-302-664697/8
   Fax No: +233-302-662690
   Email: info@epa,gov.gh

VOLTA RIVER AUTHORITY

Not later than November 30th, 2017

Appendix 6: Response Letter from the Water Resources Commission

WATER RESOURCES COMMISSION

Registered Office/Courier Address
No. E4 Leshie Crescent
Labone Estates
Accra-Ghana

Postal Address
P.O. Box CT 5630
Cantonments
Accra-Ghana

Our Ref: WRC/VRA/V1/125

Date: March 04 2019

Your Ref:

March 04, 2019

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

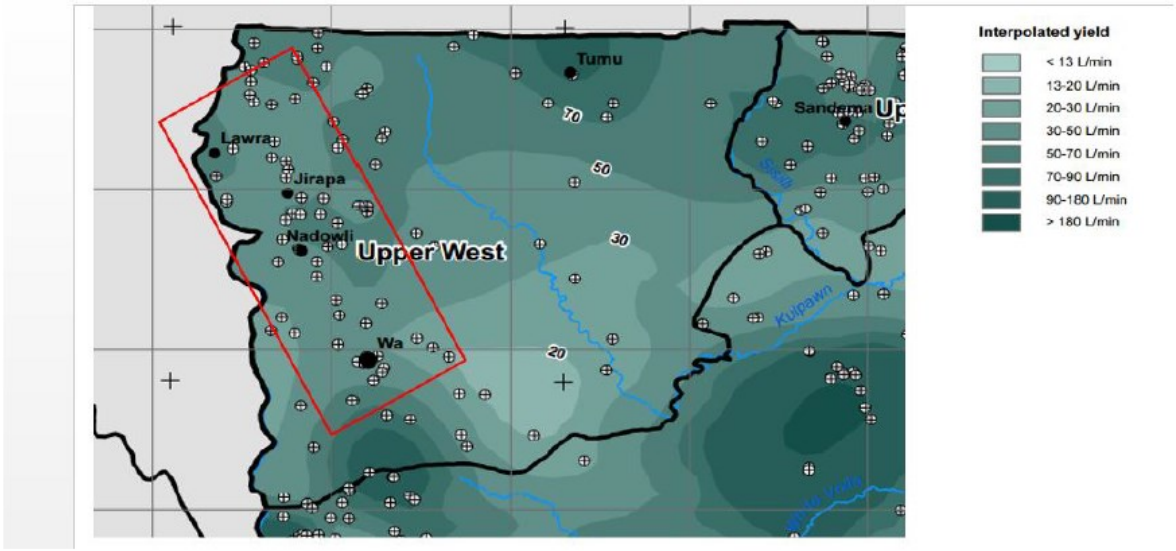
Dear Sir,

RESULTS OF THE ASSESSMENT OF THE POSSIBLE RISKS TO WATER SECURITY FOR THE CLEANING OF THE SOLAR PANELS AND THE IMPACTS ON THE DRINKING WATER SUPPLY SITUATION TO THE VILLAGES IN KALEO AND LAWRA AREAS

We write to submit the results of your institution's request to assess the possible risks to water security for the cleaning of the solar panels and the impacts on the drinking water supply situation to the villages in Kaleo and Lawra areas as follows:

1. The Lawra and Kaleo area is underlain by rocks of the Birimian and intrusive Granitoids. The predominant geology of the area is composed of various composition of granites.
2. Productive zones of groundwater in the area are located within the saprolite (weathered zones) or fracture zones of the bedrock.
3. Average borehole yield is about **53.3 L/min (3.2 m^3/hour)** (HAP, 2011). Therefore, this yield can satisfy or meet the estimated volume of water demand of the company for wet cleaning of solar panels **(19.5 m^3/year to 84.5 m^3/year)**.
4. The abstraction rates will not have any negative stress on the aquifer. However, detailed **hydrogeological and geophysical investigations** should be employed to locate extensive fracture zones to increase the chances of drilling success and higher-yielding boreholes to meet demand.
5. Moreover, the abstraction rates will have no negative impact on the drinking water supply to the community at Kaleo and Lawra.

Tel: 233-0302-763651/765860 Fax: 233-0302-763649
Email: watrecom@wrc-gh.org Website: www.wrc-gh.org
GhanaPost Digital Address: GL-013-5504



Interpolated borehole yield map with area of interest located within red margin. This map only provides an overview of the regional trends in borehole yield and is therefore not accurate at local scale (HAP, 2011).

Do not hesitate to revert to the undersigned should you require any clarification or further information on the matter,

Yours faithfully,

Ben Ampomah
Executive Secretary

cc: Director Engineering Services Department
Volta River Authority
Electro-Volta House
P.O. Box MB 77
Accra.

Tel: 233-0302-763651/765860 Fax: 233-0302-763649
Email: watrecom@wrc-gh.org Website: www.wrc-gh.org
GhanaPost Digital Address: GL-013-5504

Appendix 7: Details of Ratings of Project Associated Impacts

Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence/ Intensity	Probability	Reversibility	Irreplaceability	Significance		Confidence Level
									Without Mitigation	*With Mitigation*	
POSITIVE IMPACTS											
Climate Change	Minimisation of GHG	Positive	International	Long Term	Medium	Definite	Low	High	High	High	High
Job Creation	Increase in Employment Opportunities	Positive	International	Temporal	Low	Definite	High	Replaceable	Medium	High	High
Electricity Availability	Stabilization of Electricity	Positive	Regional	Long Term	Medium-Low	Definite	Low	Moderate	Medium	Medium	High
Economic Growth	Promotion of Economic Growth	Positive	Local	Long Term	Medium-Low	High Probable	Low	Moderate	Medium	Medium	Low
NEGATIVE IMPACTS – CONSTRUCTIONAL PHASE											
Noise & Vibrations	Disturbance to general populace	Negative	Local	Temporal	Medium-Low	Definite	High	Low	Medium	Low	Medium
Air Quality	Increase levels of fugitive dust and vehicular emissions	Negative	Local	Temporal	Medium	Medium Probable	High	High	Low	Very Low	High
Topography & Drainage	Flood risks	Negative	Site Specific	Short Term	Medium	Definite	High	Moderate	Medium	Low	High
Geology & Soils	Soil Pollution	Negative	Site Specific	Temporal	Low	Low Probable	High	Low	Very Low	Very Low	Medium
Water Resources	Water Pollution	Negative	Local	Short Term	Medium	Medium Probable	High	High	Low	Very Low	High
Waste Generation	Increase risks to environment and health	Negative	Site Specific	Temporal	Medium-Low	Medium Probable	High	Moderate	Low	Very Low	High
Landscape & Visual Intrusion	Altered sense of place and visual intrusion from construction activities	Negative	Site Specific	Temporal	Medium-Low	Definite	Low	Low	Low	Very Low	Moderate

Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence/ Intensity	Probability	Reversibility	Irreplaceability	Significance		Confidence Level
									Without Mitigation	*With Mitigation*	
Ecology	Loss of habitat and listed/rare species	Negative	Site Specific	Long Term	Medium	Definite	Moderate	Moderate	High	Low	High
Historical & Cultural Heritage Resources	Destruction / loss of Historical & Cultural Heritage Resources	Negative	Local	Temporal	Medium-Low	High Probable	High	Low	Low	Very Low	Medium
Occupational Health & Safety	Injury to workers	Negative	International	Temporal	Medium	Medium Probable	High	Low	Medium	Very Low	Medium
Land Acquisition	Loss of Properties	Negative	Site Specific	Long Term	High	Definite	Non-reversible	High	High	Low	High
Land Use	Loss of land for personal and commercial use	Negative	Site Specific	Long Term	Medium	Definite	Low	Moderate	Medium	Low	Medium
Labour & Working Conditions	Reduction in productivity	Negative	International	Temporal	Medium-Low	Low Probable	High	Low	Low	Very Low	Medium
Community Health, Safety and Security	Injury to public	Negative	Local	Temporal	Medium Low	Medium Probable	Low	High	Low	Very Low	Medium
Traffic & Transport	Increase in traffic and road accidents	Negative	Regional	Temporal	High	High Probable	High	Low	Medium	Very Low	Medium
NEGATIVE IMPACTS – OPERATIONAL PHASE											
Noise & Vibrations	Disturbance as a result of increased environmental noise levels caused by operational	Negative	Site Specific	Long Term	Low	Low Probable	High	Low	Very Low	Very Low	High

Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence/ Intensity	Probability	Reversibility	Irreplaceability	Significance		Confidence Level
									Without Mitigation	*With Mitigation*	
	equipment										
Air Quality	Poor air quality	Negative	Site Specific	Long Term	Low	Unlikely	High	Low	Very Low	Very Low	High
Topography & Drainage	Flood risks	Negative	Site Specific	Long Term	Low	Unlikely	High	Low	Very Low	Very Low	Moderate
Geology & Soils	Soil Pollution	Negative	Site Specific	Temporal	Low	Low Probable	High	Low	Very Low	Very Low	Medium
Water Resources	Water Scarcity	Negative	Site Specific	Temporal	Low	Unlikely	Moderate	Moderate	Very Low	Very Low	High
Waste Generation	Increase in health hazard	Negative	Site Specific	Long Term	Low	Unlikely	High	Moderate	Very Low	Very Low	High
Landscape & Visual Intrusion	Altered sense of place and visual intrusion from the PV panels and plant facilities	Negative	Site Specific	Long Term	Low	Low Probable	Low	Low	Very Low	Very Low	High
Ecology	Loss of connectivity and habitat fragmentation may result if fauna avoid the area or cannot move through the area on account of the presence of the facility	Negative	Site Specific	Temporal	Low	Low Probable	Moderate	Moderate	Very Low	Very Low	High
Historical & Cultural Heritage Resources	Destruction / loss of Historical & Cultural Heritage Resources	Negative	Local	Temporal	Low	Unlikely	High	Low	Very Low	Very Low	Medium
Occupational Health & Safety	Injury to workers	Negative	Site Specific	Long Term	Low	Low Probable	Low	Low	Very Low	Very Low	Medium

Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence/ Intensity	Probability	Reversibility	Irreplaceability	Significance		Confidence Level
									Without Mitigation	*With Mitigation*	
Land Acquisition	Loss of Properties	Negative	Site Specific	Long Term	Medium Low	Medium Probable	Non-reversible	High	Low Negative	Very Low	High
Land Use	Permanent loss of land for personal and commercial use	Negative	Site Specific	Long Term	Low	Definite	Low	High	Medium	Very Low	Medium
Labour & Working Conditions	Reduction in productivity	Negative	Regional	Temporal	Low	Low Probable	High	Low	Very Low	Very Low	Medium
Community, Health, Safety and Security	Injury to public	Negative	Local	Temporal	Low	Low Probable	Moderate	Low	Very Low	Very Low	Medium
Traffic & Transport	Increase in traffic and road accidents	Negative	Local	Long Term	Low	Low Probable	High	Low	Very Low	Very Low	High
NEGATIVE IMPACTS - DECOMMISSIONING PHASE											
Noise & Vibrations	Disturbance to general populace	Negative	Site Specific	Temporal	Low	Medium Probable	High	Low	Very Low	Very Low	Medium
Air Quality	Increase levels of dust	Negative	Site Specific	Temporal	Medium-Low	Medium Probable	High	High	Low	Very Low	High
Solid Waste	Increase in health hazard	Negative	International	Temporal	Medium-Low	Definite	Hugh	Low	Medium	Very Low	Hugh
Occupational Health &Safety	Injury to workers	Negative	International	Temporal	Medium-Low	Medium Probable	High	Low	Low	Very Low	Medium
Traffic & Transport	Increase in traffic and road accidents	Negative	Regional	Temporal	Medium-Low	High Probable	High	Low	Low	Very Low	Medium

Appendix 8: Environmental & Social Management Plan

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
PLANNING & CONSTRUCTIONAL PHASE							
▪ Increase in Noise Levels	▪ Use of adequate general noise suppressing measures.	▪ Restricting normal working hours from 8am to 6pm. ▪ Restriction of the use of vehicle horns and heavy engine breaking ▪ Erection of appropriate warning signages on noise making ▪ Monitoring of noise levels and apply adequate general noise suppressing measures, where relevant. ▪ Use of relevant PPEs for high noise levels ▪ Continued review of all site activities to establish and quantify noise activities. ▪ Operation of only well-maintained equipment on-site.	▪ To reduce and monitor construction noise	▪ No complaints from surrounding communities	▪ 45,000.00	▪ June 2019 – March 2020	▪ Contractor EHS Office
▪ Increase in fugitive dust and vehicular emissions levels	▪ Application of basic dust control and suppression measures	▪ Visual monitoring of the dust emissions shall be performed during earthworks and construction activities. ▪ Regular watering of all active construction areas. ▪ Prevention of idling of vehicles and equipment ▪ Limitation of speed of vehicles on site to 10-15 km/hr. ▪ Regular inspection and scheduled maintenance program for all vehicles, machinery, and equipment ▪ Appropriate signages will be erected to checking of vehicular speed on construction site ▪ Workers will be provided with appropriate PPE's e.g. masks, eye	▪ To minimise fugitive dust and vehicular emissions on ambient air quality to acceptable health and safety requirements	▪ Establish and quantify the effectiveness of planned management practises to minimise fugitive emissions production and vehicular emissions.	▪ 25,000.00	▪ June 2019 – March 2020	▪ Contractor EHS Office

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
		goggles, breathing equipment, etc. ▪ Employees shall be included in regular health check-ups and treated as appropriate ▪ Restriction of diesel generator use to emergencies and power back-up only					
▪ Flood risks due to changes in topography and drainage	▪ Develop and construct an appropriate design for surface water drainage system ▪ Avoid any unnecessary changes in the topography and any micro-watershed drainage pattern.	▪ Construction of the facility in line with approved design ▪ Site clearance, topsoil removal, compacting, cutting and filling, and foundation construction shall follow each other in order to avoid or minimize the incidence of erosion. ▪ The site when cleared shall not be left unused for a long time. ▪ Carry our restoration of the worked areas immediately by backfilling, professional landscaping/levelling and planting of low grass in open areas, flowers and suitable tree species. ▪ Provide appropriate number of cross drainage channels during access road construction to maintain flow in existing natural channels.	▪ To avoid flood risks due to constructiona l activities	▪ Minimise project associated floods	▪ Part of Project Cost	▪ June 2019 – March 2020	▪ Contractor Engineer ▪ Project Engineer
▪ Soil Pollution	▪ Ensure adherence to the requirements of the Land Planning and Soil Conservation Act, 1957	▪ Ensure construction activities are restricted to designated work areas ▪ Constructional activities shall be restricted to the dry season. ▪ Topsoil shall be stripped and stored separately from subsoil. ▪ Drivers shall be restricted to the use of existing access roads. ▪ Existing roads will be widened to have the width and turning radius to accommodate the necessary vehicles for the project. ▪ Locate temporary storage tanks on impervious bases and use drip trays during re-fuelling of equipment. ▪ Install fuel and lubricants storage	▪ To prevent soil contaminatio n due to constructiona l activities	▪ Zero contamination of soil quality ▪ Minimal erosion inside the construction areas and surrounds.	▪ Part of Project Cost	▪ June 2019 – March 2020	▪ Contractor Officer ▪ Project Engineer

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
		containers and prevent leakages. ▪ Clean up equipment shall be supplied ▪ Contaminated soil shall be treated as hazardous material and handled as such.					
▪ Water Pollution	▪ Effective arrangements for disposal of aqueous effluents. ▪ Measures to mitigate the influence from torrential rain and runoff from rainfall and flooding should be considered in the planning.	▪ Construction of borehole should be in line with LI 1827. ▪ Provide impervious storage area for Fuel & lubricant, hazardous waste. ▪ Prevent storage of hazardous materials near natural drainage channels. ▪ Provide equipment and materials for clean ups ▪ Temporary refuelling tanks should be bunded.	To prevent contamination of water resources	▪ Zero contamination of water quality	▪ Part of Project Cost	▪ June 2019 – March 2020	▪ EPC Contractor ▪ Project Engineer
▪ Increase risks to environment and health from waste generation	▪ Practice waste reduction techniques such as Reduce, Recycle, Reuse and Recover	▪ Construction debris will be utilised for levelling of the land ▪ Unused debris shall be disposed-off to nearest Municipal waste disposal site. ▪ Random stocking of raw material, storage of debris, piling of loose soil etc. to be strictly controlled ▪ Hazardous waste (like used oil, paint tins, defected panels, etc.) shall be stored at designated place and only be sold to authorized vendors. ▪ Dispose labour waste regularly in approved waste disposal sites ▪ Wastes like wood packaging material, metal, jute, etc. will be sold to scrap dealers/ buyers. ▪ Provision of proper sanitation and sewage facility	To ensure constructional waste generation does not pollute the environment	▪ Zero contamination of soil and water from solid and liquid constructional waste	▪ Part of Project Cost	▪ June 2019 – March 2020	▪ Contractor EHS Offic ▪ Project Engineer
▪ Altered sense of place and visual	▪ Undertake appropriate design to assist	▪ Appropriate colour and materials shall be used in architectural designs. ▪ Proper housekeeping shall be	▪ Reduce visual intrusion of	▪ Minimal visual intrusion of	▪ Part of Project Cost	▪ June 2019 – March 2020	▪ Contractor Engineer ▪ Project

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
intrusion from construction activities	in the respectful integration of the facades of the power facility with surrounding environment and existing buildings	undertaken, and workforce instructed accordingly ▪ Waste shall be collected and evacuated in a timely manner and the project site will be left in an orderly state after each working day. ▪ Ensure all machines, vehicles and tools used during construction should be removed on the earliest time possible	construction activities project wide.	construction activities project wide.			Engineer
▪ Loss of habitat and listed/rare species	▪ Implement proper management measures to prevent damage to the biodiversity of the site. ▪ Minimise risks to electrocution as part of project design. ▪ Unnecessary disturbance of neighbouring vegetation due to off-road vehicular movement, fuel wood procurement and destruction of floral resources should be prohibited.	▪ Conditions of MoU b/n VRA and FSD to be strictly adhered to ▪ Undertake detailed flora and faunal assessment to inform habitat management. ▪ Dangerous and potentially dangerous trees within the Lawra Forest Reserve will be enumerated and documented by VRA prior to felling. ▪ Appropriate routing of lines, use of bird deflectors, and pole design shall be undertaken to reduce electrocution risks from power lines and associated infrastructure. ▪ Undertake trainings among the staff and labourers to enhance general awareness regarding anti-poaching, hunting ▪ Hunting at any time and under any condition by construction workers onsite shall be prohibited ▪ Conduct construction activity in a phased manner ▪ Vegetation disturbance and clearance should be restricted to the project activity area location of laydown area, construction activities and storage areas.	▪ Ensure compliance with relevant legislation in respect of habitat and vegetation forms. ▪ Avoidance of unnecessary disturbance to the site and surrounds, and to establish buffers where required.	▪ Minimal disturbance to fauna in the area ▪ Avoid loss of habitat within the designated sensitive areas.	▪ GH¢200,000	▪ June 2019 – March 2020	▪ Project Engineer ▪ Project EH Officer
▪ Destruction / loss of Historical &	▪ Properly plan construction	▪ Continuous dialogue with local community and owners/caretakers to	▪ To avoid disturbance, damage to	▪ Compensation of all community	▪ GH¢150,000	▪ June 2019 – March 2020	▪ Community Liaison Officer

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
Cultural Heritage Resources	activities to consider the identified resources locations to ensure they are protected from any potential damage. ▪ Ensure adherence to requirements of the National Museums Act, Act 387 of 1969. ▪ Proper documentation and reporting of chance find	provide the support to ensure that any identified resource does not pose a problem for project development, ▪ Appropriate chance find procedures shall be implemented in collaboration with GMMB ▪ Only professional archaeologist shall be engaged to examine, document and/or remove and identified archaeological material. ▪ All works shall be executed within the authorised footprint to avoid impacts to any nearby tangible and intangible heritage resources. ▪ Strict observation of the cultural taboos shall be observed.	and destruction of heritage resources ▪ To enhance gains to the science of archaeology by recording chance finds	members for the removal of important heritage sites ▪ No damage to any significant cultural heritage features on site			▪ Project EH Officer
▪ Injury to workers	▪ Requirements of Factories, Shops and Offices Act of 1970 (Act 328) and VRA's "Safety, Health and Environment Standards for Contractors to be adhered ▪ Adopt and implement the provisions of the Occupational Health and Safety Plan	▪ Fire permit to be acquired prior to project implementation to ensure fire safety. ▪ Development Permit shall be acquired from the relevant District Assembly ▪ A Health & Safety Plan, an Environmental Protection Plan as well as a Quality Assurance Plan to be developed by and implemented ▪ Provide Personal Protective Equipment (PPEs to workers always. ▪ Health screening to be conducted for employees both before their employment and throughout the contract period on an irregular basis. ▪ Construction activities shall be	▪ To prevent injury to workers	▪ Zero injury	▪ GH¢500,000	▪ June 2019 – March 2020	▪ Project Engineer ▪ Contractor EHS Office ▪ Project EH Officer

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
	throughout the Project construction phase	undertaken during daytime hours ▪ Vigilance for any potential accidents shall be maintained ▪ Awareness training on communicable disease prevention ▪ Undertake health and safety awareness training amongst staff and workers					
▪ Loss of Properties	▪ Adhere to requirements of VRA "Land Acquisition & Resettlement Policy Framework"	▪ Survey of project-affected persons shall be undertaken for the purposes of compensation payment. ▪ Prompt, adequate and fair compensation to be paid to all project-affected persons before the start of constructional activities. ▪ Community Liaison Officer shall be appointed as a designated point of contact for the community. ▪ Institute appropriate grievance mechanisms to address concerns of the public ▪ Existing right of way for roads and sub-transmission lines shall be utilised to minimise land acquisition.	▪ Reduce land acquisition requirements where possible ▪ Effectively and transparently manage land acquisition process.	▪ Effectively and transparently manage land acquisition process. ▪ Zero grievances of non-payment from rightful land owners	▪ GH¢1.2 M	▪ June 2019 – March 2020	▪ Project Engineer ▪ Contractor EHS Offic ▪ Project EH Officer
▪ Loss of land for personal and commercial use	▪ Effective zoning of project area by the Land Use & Spatial Planning Dept. ▪ Restriction of constructional activities within the allotted land and immediate surroundings only.	▪ Appropriate consultations shall be instituted with all stakeholders to raise awareness about the project. ▪ A grievance mechanism to be implemented (i.e. complain register) and keep record of all complaints from the community ▪ Development Permit to be acquired from the relevant District Assemblies, prior to construction. ▪ After construction work, any land taken for a temporary basis for	▪ Minimise impacts on changes to land use	▪ Zero grievances complaints from land owners regarding changes in current land use	▪ Part of Project Cost	▪ June 2019 – March 2020	▪ Community Liaison Officer ▪ Contractor Engineer ▪ Project Engineer

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
		storage of material shall be restored to their original form. ▪ Utilise existing right of way to minimise land acquisition. ▪ Utilisation of existing roads for access to the project site ▪ Community Liaison Officer to be appointed as a designated point of contact for the community. ▪ Land use in and around permanent project facilities should not be disturbed. ▪ Land used for temporary facilities, if any, shall be restored to the extent possible.					
▪ Reduction in productivity	▪ Prepare and adhere to a Labour Management Plan	▪ Design and adhere to employment and workforce policies. ▪ Locals shall be engaged for unskilled manpower requirements ▪ Provision of adequate shelter, drinking water, toilet facilities for the workers. ▪ Put in place suitable measures to maintain a healthy environment for the labour force ▪ Worker grievance mechanism to be instituted including monitoring and resolving of such concerns. ▪ Community Liaison Officer to be appointed as a designated point of contact for the community	To ensure working conditions of employees are in line with national and international standards	Minimal grievance related to working conditions at the project site	▪ GH¢200,000	▪ June 2019 – March 2020	▪ Community Liaison Officer ▪ Contractor Engineer ▪ Project Engineer
▪ Injury to public	▪ Requirements of Factories, Shops and Offices Act	▪ Formal notification to be given to local government/traditional authorities on the date of project	▪ Reduce impacts associated with the	▪ Influx of people and impacts during the	▪ GH¢50,000	▪ June 2019 – March 2020	▪ Community Liaison Officer ▪ Project

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
	of 1970 (Act 328) and VRA's "Safety, Health and Environment Standards for Contractors to be adhered ▪ Adopt and implement the provisions of the Occupational Health and Safety Plan throughout the Project construction phase ▪ Minimizing potential conflicts with the communities. ▪ Appropriate solid waste management practice	commencement. ▪ Observation of all necessary traditional requirements prior to project commencement ▪ Institute public grievance mechanism including monitoring and resolving of such concerns. ▪ Create awareness amongst staff about local cultural sensitivities. ▪ Constructional activities shall be undertaken only during the day i.e. between 0700 hours to 1800 hours. ▪ Segregation of the various wastes and arrange for subsequent disposal through either efficient incineration or disposal in a sanitary landfill. ▪ Fencing of all excavated areas to avoid access to outsiders and wildlife. ▪ Provision of security and warning signages around construction site ▪ Provision of alternative access route to the nearby local resort at the Lawra site, if required. ▪ Undertake public health awareness amongst staff, especially on Sexually Transmitted Diseases and HIV/AIDS.	influx of people during the construction phase	construction phase to be appropriately managed			Engineer ▪ Contractor Engineer ▪ Project EH Officer
▪ Increase in traffic and road accidents	▪ Preparation and implementation of a Traffic Method Statement with the aim of minimizing disturbance to the nearby	▪ Traffic shall be controlled on the access road to the site, especially when heavy trucks are turning in and out of the site. ▪ Drivers shall be trained in defensive driving ▪ Speed limits shall be enforced for heavy good vehicles and workforce transportation vehicles;	▪ Reduce number of road accidents due to increased traffic during construction	▪ Zero accidents from road and traffic	▪ GH¢350,000	▪ June 2019 – March 2020	▪ Community Liaison Officer ▪ Contractor Engineer ▪ Project EH Officer

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
	residents, industrial workers and general road users.	▪ Densest areas of traffic, if possible, shall be avoided through planning and channelling of traffic. ▪ Involvement of local authorities in defining optimum project traffic routes and times for transit ▪ Traffic calming measures (speed bumps and rumble strips) shall be installed to slow traffic down where heavy vehicles cross or enter busy roads. ▪ Installation of speed control limits for the project and ensuring all vehicles comply with the site driving regulations. ▪ Conduct periodic and routine alcohol checks for all site drivers and site workers ▪ Provision of site vehicle maintenance services in order to ensure technical failures do not occur; ▪ Install traffic safety signage at vantage points along access routes with the project sites. ▪ Develop and implement a “No Drinking” “No Alcohol” policy on site during both construction and operation. ▪ Improve and enhance community sensitization on road traffic accidents within the project area. ▪ Engage communities on road risk and educate them through constant communications, road signals as well as with communications with the local authorities and community leaders.					

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
OPERATIONAL PHASE							
Disturbance as a result of increased environmental noise levels caused by equipment	▪ Adherence to relevant requirements of the Factories, Shops and Offices Act of 1970 (Act 328).	▪ Equip workers with proper Personal Protective Equipment (e.g. Earmuffs) ▪ Ensure only well-maintained equipment are operated on-site;	▪ To reduce and monitor operational noise	▪ No complaints from surrounding communities	▪ 15,000.00 annually	▪ Continuous	▪ Project EH Officer
Poor air quality	▪ Adherence to requirements of Driver & Vehicle Licensing Authority Act, 1999 (ACT 569)	▪ Limit speed of vehicles on site to 10-15 km/hr. ▪ Prevent idling of vehicles and equipment. ▪ Ensure vehicles have valid Vehicle Examination Certificate to minimise vehicular emissions.	▪ To minimise vehicular emissions on ambient air quality to acceptable health and safety requirements	▪ Establish and quantify the effectiveness of planned management practises to minimise vehicular emissions.	▪ 25,000.00 annually	▪ Continuous	▪ Project EH Officer
Flood risks	▪ Ensure maintenance of surface water drainage system designs in line with the Ghana National Building Regulations, 1996, LI 1630 and the Ghana National Building Code, 2006.	▪ Regularly maintain surface water drainage and culverts to prevent storm water (run-off) from accumulating within the site spreading to the neighbourhood.	▪ To avoid flood risks due to power operations	▪ Minimise project associated floods	▪ Part of O&M Cost	▪ Continuous	Site Enginee
Soil Pollution	▪ Adherence to the requirements of the Land Planning and	▪ Restrict operational activities to designated work areas, to avoid damage and disturbance outside of the power plant site, especially the	▪ To prevent soil contaminatio n due to operational	▪ Zero contamination of soil quality ▪ Minimal erosion inside	▪ Part of O&M Cost	▪ Continuous	Site Enginee

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
	Soil Conservation Act, 1957 within the power facilities.	sub-transmission line component. ▪ Collect contaminated soil immediately and stored as hazardous waste.	activities	the operational areas and surrounds.			
Water Scarcity	▪ Ensure valid Water Use Permit from Water Resources Commission for abstraction of ground water as required under the provision of the Water Use Regulations, 2001 (L.I. 1692).	▪ Engage with Community members continuously on issues of water security to avoid potential conflicts. ▪ Regularly monitor the ground water abstraction and report on it on regular basis to the EPA. ▪ Maintain logbook for water consumption. ▪ Progressively adopt less water consuming module cleaning methods. ▪ Installation of automatic water level sensors inside wells	To prevent contamination of water resources	▪ Zero contamination of water quality	▪ Part of O&M Cost	▪ Continuous	Site Enginee
Increase in health hazard due to waste generation	▪ Adherence to requirements of National Environmental Sanitation Policy 2010 and the Hazardous & Electronic Waste Control Management Act, 2016 (Act 917). ▪ Manage waste in line with operational site Environmental Management Plan and will be	▪ Coordinate with respective District Assemblies to hire a private contractor for the collection of waste water from the site ▪ Ensure all waste arising from the works is deposited, treated, kept, disposed of and carried in accordance with the provisions of relevant national and local environmental protection acts. ▪ Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste"; ▪ Provide waste oil tanks to hold the waste lubricating oils to be produced. ▪ Utilize EPA licensed operators for re-use of waste oil	To ensure waste generation does not pollute the environment	▪ Zero contamination of soil and water from solid and liquid waste	▪ Part of O&M Cost	▪ Continuous	Site Enginee

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
	incorporated into any contract between VRA and the licensed operator.	▪ Foul water should always go to a septic tank. ▪ Waste from the septic tank should be disposed of in an environmentally acceptable manner by a licensed operator approved by EPA. ▪ Prohibit illegal disposal of wastewater to the land. ▪ Ensure that constructed septic tanks during operation are well contained and impermeable to prevent leakage of wastewater into soil;					
Altered sense of place and visual intrusion from the PV panels and plant facilities	▪ Ensure effective repairs and maintenance of the solar power facilities in line with the Ghana National Building Regulations, 1996, LI 1630 and the Ghana National Building Code, 2006.	▪ Informative signs shall be maintained on the N12 Highway for commuters regarding potential for glare within the area. ▪ Native trees shall be planted at the frontage of the power plant facilities to act as windbreaks, noise buffer and to reduce the visual effect of having a power plant located at the site.	▪ Reduce visual intrusion of project facilities	▪ Minimal visual intrusion of construction activities project wide.	▪ Part of O&M Cost	▪ Continuous	Site Enginee
Loss of connectivity and habitat fragmentation may result if fauna avoid the area or cannot move through the area on	▪ General awareness regarding fauna should be enhanced through trainings, posters, etc. among the staff and labourers.	▪ Maintain the use of bird deflectors, and pole design which minimizes electrocution risks during project operations to reduce impacts from power lines and associated infrastructure. ▪ Anti-poaching, trapping and hunting policy among employees should be strictly enforced. ▪ Cover upright insulators on	▪ Ensure compliance with relevant legislation in respect of habitat and vegetation forms. ▪ Avoidance of unnecessary disturbance to the site	▪ Minimal disturbance to fauna in the area ▪ Avoid loss of habitat within the designated sensitive areas.	▪ Part of O&M Cost	▪ Continuous	Site Enginee

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
account of the presence of the facility	▪ Adhere to requirements of existing conditions of MoU Between VRA and FSD regarding work in the Lawra Forest Reserve.	transmission poles with plastic insulating caps or insulating tubing to prevent electrocution risk; ▪ Install bird detractors such as moving cloth or scarecrow to prevent birds from venturing close to solar modules. ▪ Regular checking of the vacuums or holes in the towers to avoid nesting by any of the birds;	and surrounds, and to establish buffers where required.				
Destruction / loss of Historical & Cultural Heritage Resources	▪ Adhere to requirements of the National Museums Act, Act 387 of 1969. ▪ Ensure that the Code of Conduct, awareness raising, and training developed for personnel involved in the operation phase of the Project to emphasizes the presence of archaeological locations in the area	▪ Activities shall be properly planned to consider the identified archaeological locations to ensure they are protected from any potential damage. ▪ All works shall be undertaken within the authorised footprint so as to avoid impacts to any nearby tangible and intangible heritage resources. ▪ Community members shall be engaged with regarding compensation and moving any identified shrine. ▪ Ensure strict observation of the cultural taboos. ▪ Documentation and reporting of chance finds and submission to GMMB in Accra.	▪ To avoid disturbance, damage to and destruction of heritage resources ▪ To enhance gains to the science of archaeology by recording chance finds	▪ Compensation of all community members for the removal of important heritage sites ▪ No damage to any significant cultural heritage features on site	▪ Part of O&M Cost	▪ Continuous	Site Enginee
Injury to workers	▪ Adherence to requirements of the "Hazardous & Electronic Waste Control	▪ Acquire valid permits from Ghana National Fire Service, Factories & Inspectorate Division, Environmental Protection Agency and the Energy Commission.	▪ To prevent injury to workers	▪ Zero injury	▪ GH¢30,000.00 annually	▪ Continuous	Site Enginee

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
	Management Act, 2016 (Act 917)" to provide for the control, management, disposal of hazardous waste, electrical and electronic waste and for related purposes. ▪ Implementation of a Health & Safety Policy in line with IFC Occupational Health and Safety (OHS) Guidelines for the solar power project.	▪ All workers (regular and contracted) shall be provided with training on Health and Safety management system on EHS policies and procedures. ▪ Warning signs shall be placed at appropriate sites where there is a risk to health and safety. ▪ Comprehensive fire detection and protection system shall be provided to cover all equipment on site that could constitute a fire risk. ▪ Health and safety performance shall be continuously monitored. ▪ An operating audit system for the facilities shall be put in place. ▪ Cranes and lifting equipment shall be operated by trained and authorized persons only. ▪ Appropriate safety harnesses and lowering/raising tools shall be provided for use for working at heights.					
Loss of Properties	▪ Institution of an appropriate grievance mechanisms to address concerns of the public	▪ Community Liaison Officer shall be appointed as a designated point of contact for the community	▪ Reduce land acquisition requirements where possible ▪ Effectively and transparently manage land acquisition process.	▪ Effectively and transparently manage land acquisition process. ▪ Zero grievances of non-payment from rightful land owners	▪ Part of O&M Cost	▪ Continuous	Site Enginee
Permanent loss of land for	▪ Implementation of CSR activities	▪ Proactive action shall be taken in case required to avoid any undue	▪ Minimise impacts on	▪ Zero grievances	▪ Part of O&M Cost	▪ Continuous	Site Enginee

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
personal and commercial use	to improve the standards of living and long-term wellbeing of the affected communities.	confrontation with affected community. ▪ Ensure the availability of wood fuel and fodder should not be affected by the project and in case if there is shortage reported due to the project then it must be supplemented by VRA. ▪	changes to land use	complaints from land owners regarding changes in current land use			
Reduction in productivity	▪ Prepare and adhere to a Labour Management Plan	▪ Design and adhere to employment and workforce policies. ▪ Locals shall be engaged for unskilled manpower requirements ▪ Provision of adequate shelter, drinking water, toilet facilities for the workers. ▪ Worker grievance mechanism to be instituted including monitoring and resolving of such concerns. ▪ Community Liaison Officer to be appointed as a designated point of contact for the community ▪ Provisions shall be made to accommodate migrant labour within the communities. ▪ Put in place suitable measures to maintain a healthy environment for the labour force	▪ To ensure working conditions of employees are in line with national and international standards	Minimal grievance related to working conditions at the project site	▪ Part of O&M Cost	▪ Continuous	Site Enginee
Injury to public	▪ Adherence to requirements of the "Hazardous & Electronic Waste Control Management Act, 2016 (Act	▪ Effective security measures shall be provided for the PV Plants and the project sites through fencing, enough security staff and other measures such as floodlights with motion control. ▪ Necessary precautions shall be taken to beef up the security of the solar	▪ Reduce impacts associated with the influx of people during the construction	▪ Influx of people and impacts during the construction phase to be appropriately managed	▪ Part of O&M Cost	▪ Continuous	Site Enginee

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
	917)" to provide for the control, management, disposal of hazardous waste, electrical and electronic waste and for related purposes. ▪ Implementation of a Health & Safety Policy in line with IFC Occupational Health and Safety (OHS) Guidelines for the solar power project.	park. ▪ Onsite guards shall be adequately trained to deal with trespassing incidents. In addition, guard must refrain from using excessive force, unless situation extremely requires so ▪ Cultivate harmonious co-existence between itself and the local communities in the project area.	phase				
Increase in traffic and road accidents	▪ Implementation of a Traffic Method Statement developed for the construction phase will continue to be used for the operational phase.	▪ Continue implementation of TMS ▪ Encourage car sharing amongst staff	▪ Reduce number of road accidents due to increased traffic during construction	▪ Zero accidents from road and traffic	▪ Part of O&M Cost	▪ Continuous	▪ Project Engineer
DECOMMISSIONING							
Noise disturbance to general	▪ Use of adequate general noise suppressing	▪ All the decommissioning activities will be done during daytime ▪ The contractor will be kept informed	▪ To reduce and monitor construction	▪ No complaints from surrounding	▪ 15,000.00	▪ Decommissioning	▪ Contractor EHS Office

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
populace	measures.	by the community of any noise or vibration complaints. ▪ Conduct demolition activities in line with the maximum permitted noise levels ▪ Inspection of activities during decommissioning by carrying out regular Noise level test. ▪ Emphasize on the use of noise reduction techniques such as silencers and ear mufflers to employees while onsite. ▪ Develop a regular inspection and scheduled maintenance program for vehicles and machineries in order to abate the noise produced	noise	communities			
Increase levels of dust	▪ Regular watering of all active construction areas.	▪ Train all workers on the management of air pollution from vehicles and machinery ▪ Strictly control the speed limit for all motor vehicles during the demolition exercise. ▪ Sprinkle water on dusty places onsite and on dust to reduce fugitive dust emissions ▪ Provide workers with dust masks	▪ To minimise fugitive dust and vehicular emissions on ambient air quality to acceptable health and safety requirements	▪ Establish and quantify the effectiveness of planned management practises to minimise fugitive emissions production and vehicular emissions.	▪ 30,000.00	▪ Decommissioning	▪ Contractor EHS Offic
Increase risks to environment and health from waste generation	▪ Practice waste reduction techniques such as Reduce, Recycle, Reuse and Recover	▪ Develop and implement a Solid Waste Management Plan (SWMP) before decommissioning commencement in line with the governing regulations ▪ The waste streams generated should be re-used, re-cycled and reduced to the extent possible ▪ Dispose all demolition waste that cannot be recycled or reused to a	To ensure constructional waste generation does not pollute the environment	▪ Zero contamination of soil and water from solid and liquid constructional waste	▪ Part of Decommissioni ng Cost	▪ Decommissioning	▪ Contractor EHS Offic

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
		licensed waste disposal site using a licensed waste handler ▪ Rehabilitate the site as appropriate using indigenous vegetation species for landscaping to restore biodiversity					
Injury to workers	▪ Adherence to requirements of the "Hazardous & Electronic Waste Control Management Act, 2016 (Act 917)" to provide for the control, management, disposal of hazardous waste, electrical and electronic waste and for related purposes. ▪ Implementation of a Health & Safety Policy in line with IFC Occupational Health and Safety (OHS) Guidelines for the solar power project.	▪ Develop and implement an Occupational Health and Safety Plan ▪ Train employees on the importance of occupational health and safety ▪ Provide workers with appropriate personal protective clothing such as helmets, safety boots, gloves, dust masks, ear mufflers and overalls. ▪ Strictly enforce the use of the Personal Protective Equipment to minimise the accidents during decommissioning ▪ Regular medical checks ▪ Provide fully equipped First Aid Kit and sanitary facilities on site, including water for drinking and bathing ▪ Put clear signage to restricted areas ▪ Prohibit unauthorized persons at the site during decommissioning ▪ Promote HIV/AIDs Awareness	▪ To prevent injury to workers	▪ Zero injury	▪ Part of Decommissioning Cost	▪ Decommissioning	▪ Contractor EHS Office
Increase in traffic and road accidents	▪ Preparation and implementation of a Traffic Method Statement with the aim of	▪ Traffic shall be controlled on the access road to the site, especially when heavy trucks are turning in and out of the site. ▪ Drivers shall be trained in defensive driving	▪ Reduce number of road accidents due to increased traffic during	▪ Zero accidents from road and traffic	▪ Part of Decommissioning Cost	▪ Decommissioning	▪ Contractor EHS Office

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
	minimizing disturbance to the nearby residents, industrial workers and general road users.	▪ Speed limits shall be enforced for heavy good vehicles and workforce transportation vehicles; ▪ Densest areas of traffic, if possible, shall be avoided through planning and channelling of traffic. ▪ Involvement of local authorities in defining optimum project traffic routes and times for transit ▪ Traffic calming measures (speed bumps and rumble strips) shall be installed to slow traffic down where heavy vehicles cross or enter busy roads. ▪ Installation of speed control limits for the project and ensuring all vehicles comply with the site driving regulations. ▪ Conduct periodic and routine alcohol checks for all site drivers and site workers ▪ Provision of site vehicle maintenance services in order to ensure technical failures do not occur; ▪ Install traffic safety signage at vantage points along access routes with the project sites. ▪ Develop and implement a “No Drinking” “No Alcohol” policy on site during both construction and operation. ▪ Improve and enhance community sensitization on road traffic accidents within the project area. ▪ Engage communities on road risk and educate them through constant communications, road signals as well	construction				

Impact	Identified mitigation action	Actual action	Objective	Target	Budget GH¢	Time frame	Responsibilit
		as with communications with the local authorities and community leaders.					

Appendix 9: Environmental Monitoring Plan

	Monitoring Parameters	Monitoring Frequency	Methodology	Responsibility	Budget GH¢
	PLANNING & CONSTRUCTIONAL PHASE				
Noise levels	▪ Limitation of constructional activities only during the day i.e. between 0700 hours to 1800 hours. ▪ Levels of noise within project designated site ▪ Application of adequate general noise suppressing measures. ▪ Use of relevant PPEs for high noise levels ▪ Restriction of the use of vehicle horns and heavy engine breaking ▪ Erection of appropriate warning signages on noise making ▪ Operation of only well-maintained equipment on-site.	▪ Daily ▪ As required ▪ As required ▪ Daily ▪ As required ▪ Monthly ▪ As required	▪ Use of work logbook ▪ Noise meter ▪ Std. Ops. Procedure ▪ Supply of PPEs ▪ Std. Ops. Procedure ▪ No. of Signages ▪ Maintenance Schedules	▪ Contractor's EHS Officer	▪ 15,000.00
	OPERATIONAL PHASE				
	▪ Use of appropriate PPEs for high noise levels ▪ Operation of only well-maintained equipment on-site.	▪ Daily ▪ As required	▪ Supply of PPEs ▪ Maintenance Schedules	▪ Project EHS Officer	▪ 20,000.00 annually
	PLANNING & CONSTRUCTIONAL PHASE				
	▪ Regular watering of all active construction areas. ▪ Regular inspection and scheduled maintenance program for all vehicles, machinery, and equipment ▪ Erection of appropriate signages to checking of vehicular speed ▪ Provision of appropriate PPE's ▪ Visual monitoring of the dust emissions ▪ Regular health check-ups and treatment of employees ▪ Limitation of speed of vehicles on site to 10-15	▪ Daily ▪ As required ▪ Monthly ▪ As required ▪ Daily ▪ As required ▪ Daily	▪ Use of Water tankers ▪ Maintenance Schedules ▪ No. of Signages ▪ Supply of PPEs ▪ Optics ▪ Medical Check Ups	▪ Contractor's EHS Officer	▪ 25,000.00

	km/hr. ▪ Prevention of idling of vehicles and equipment ▪ Restriction of diesel generator use to emergencies and power back-up only	▪ As required ▪ As required	▪ Speed rumps/Signages ▪ Std. Ops. Procedure ▪ Std. Ops. Procedure		
	OPERATIONAL PHASE				
Air Quality	▪ Limitation of speed of vehicles on site to 10-15 km/hr. ▪ Prevention of idling of vehicles and equipment ▪ Ensure vehicles have valid Vehicle Examination Certificate to minimise vehicular emissions.	▪ Daily ▪ As required ▪ Annual	▪ Speed rumps/Signages ▪ Std. Ops. Procedure ▪ VELD Certificate	▪ Project EHS Officer	▪ 15,000.00 annually
Flood Risks	**PLANNING & CONSTRUCTIONAL PHASE**				
	▪ Construction of the facility in line with approved design ▪ Immediate restoration of worked areas ▪ Provision of appropriate number of cross drainage channels	▪ As required ▪ As required ▪ As required	▪ Constructional Design ▪ Std. Ops. Procedure ▪ Drainage Channels	▪ Contractor's Engineer ▪ Project Engineer	▪ Part of Project Cost
	OPERATIONAL PHASE				
	▪ Regular maintenance of surface water drainage and culverts to prevent storm water (run-off)	▪ As required	▪ Maintenance Schedules	Site Engineer	▪ Part of O&M Cost
	PLANNING & CONSTRUCTIONAL PHASE				
	▪ Restriction of construction activities to designated work areas ▪ Restriction of constructional activities to the dry season. ▪ Avoidance of construction during raining seasons to minimize erosion and run-off ▪ Storing of stripped topsoil separately from subsoil. ▪ Restriction of drivers to the use of existing access roads. ▪ Widening of existing roads to accommodate the necessary vehicles for the project. ▪ Installation of fuel and lubricants storage containers to prevent leakages. ▪ Location of temporary storage tanks on impervious bases and use drip trays during re-fuelling of equipment. ▪ Supply of on-site clean up equipment	▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required	▪ Constructional Areas ▪ Period of work ▪ Period of work ▪ Storage areas ▪ Access roads ▪ Existing roads ▪ Storage Containers ▪ Impervious Bases/Drip Trays ▪ Clean up equipment. ▪ Std. Ops. Procedure	▪ Contractor's Officer ▪ Project Engineer	▪ Part of Project Cost

	▪ Treatment of contaminated soil as hazardous material and handled as such.				
	OPERATIONAL PHASE				
Soil Pollution	▪ Restriction of operational activities to designated work areas ▪ Treatment of contaminated soil as hazardous material and handled as such.	▪ As required ▪ As required	▪ Operational Areas ▪ Std. Ops. Procedure	Site Engineer	▪ Part of O&M Cost
	PLANNING & CONSTRUCTIONAL PHASE				
	▪ Registration of borehole construction with WRC. ▪ Construction of borehole should be in line with LI 1827. ▪ Prevention of storage of hazardous materials near natural drainage channels. ▪ Provision of clean ups equipment and materials on site ▪ Installation of temporary and permanent run-pass pipes during rainy flood and road barriers against rainwater storm where necessary. ▪ Provision of impervious storage area for Fuel & lubricant, hazardous waste. ▪ Provision of bund for temporary refuelling tanks.	▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required	▪ Registration Forms ▪ Std. Ops. Procedure ▪ Std. Ops. Procedure ▪ Clean-up equipment ▪ Std. Ops. Procedure ▪ Impervious Bases/Drip Trays ▪ Bunds	▪ EPC Contractor ▪ Project Engineer	▪ Part of Project Cost
	OPERATIONAL PHASE				
Water Resources	▪ Engaging with Community members continuously on issues of water security to avoid potential conflicts. ▪ Regular monitoring of the ground water abstraction ▪ Regular reporting on volume of ground water abstraction to the EPA. ▪ Maintenance of logbook for water consumption. ▪ Adoption of less water consuming module cleaning methods.	▪ As required ▪ Monthly ▪ Monthly ▪ Weekly ▪ As required	▪ Meeting minutes ▪ Monitoring Report ▪ EPA Monitoring report ▪ Logbook for water consumption ▪ Facility design	Site Engineer	▪ Part of O&M Cost
	PLANNING & CONSTRUCTIONAL PHASE				

Waste Generation	▪ Utilisation of construction debris for levelling of the land ▪ Disposal of unused debris to nearest Municipal waste disposal site. ▪ Regular disposal of labour waste at approved waste disposal sites ▪ Strict control of random stocking of raw material, storage of debris, piling of loose soil ▪ Storage of hazardous waste at designated place ▪ Sale of hazardous waste to authorized vendors. ▪ Sale of recyclable waste to scrap dealers/ buyers. ▪ Provision of proper sanitation and sewage facility	▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required	▪ Use of debris ▪ Volume of debris ▪ Volume of waste ▪ Std. Ops. Procedure ▪ Storage areas ▪ Waste Log sheet ▪ Waste Log sheet ▪ Sewage facility	▪ Contractor's EHS Officer ▪ Project Engineer	▪ Part of Project Cost
	OPERATIONAL PHASE				
Waste Generation	▪ Use of a private contractor for wastewater collection ▪ Presence of properly contained litter bins ▪ Provision of waste oil tanks ▪ Utilization of EPA licensed operators for re-use of waste oil ▪ Disposal of waste from the septic tank by EPA licensed operator ▪ Illegal disposal of wastewater to the land. ▪ Utilisation of well contained and impermeable septic tanks	▪ Monthly ▪ Weekly ▪ Monthly ▪ As required ▪ As required ▪ As required ▪ As required	▪ Type of Waste Contractor ▪ Labelled Bins ▪ Waste oil tanks ▪ Type of waste contractor ▪ Std. Ops. Procedure ▪ Std. Ops. Procedure ▪ Septic Tank type	Site Engineer	▪ Part of O&M Cost
Landscape & Visual Intrusion	**PLANNING & CONSTRUCTIONAL PHASE**				
	▪ Usage of appropriate colour and materials in architectural designs. ▪ Proper housekeeping practices by workforce ▪ State of workplace after day's work ▪ Early removal of machines, vehicles and tools after use	▪ As required ▪ As required ▪ Daily ▪ As required	▪ Architectural designs. ▪ Std. Ops. Procedure ▪ Std. Ops. Procedure ▪ Std. Ops. Procedure	▪ Contractor's Engineer ▪ Project Engineer	▪ Part of Project Cost
	OPERATIONAL PHASE				
	▪ Informative signs regarding potential for glare within the area. ▪ Utilisation of native trees as windbreaks	▪ As required ▪ As required	▪ Informative signages ▪ Windbreaks	Site Engineer	▪ Part of O&M Cost

Flora & Fauna	**PLANNING & CONSTRUCTIONAL PHASE**				
	▪ Assessment of Flora and faunal to inform habitat management. ▪ Appropriate routing of lines to reduce electrocution risks, ▪ Use of bird deflectors to reduce electrocution risks, ▪ Pole design to reduce electrocution risks ▪ Adherence to conditions of MoU ▪ Felling of enumerated dangerous and potentially dangerous trees within the Lawra Forest Reserve ▪ Onsite hunting and poaching ▪ Training of staff regarding anti-poaching, hunting ▪ Restriction of vegetation disturbance to the project activity area	▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ Quarterly ▪ As required	▪ Study report ▪ Constructional Design ▪ Constructional Design ▪ Constructional Design ▪ Std. Ops. Procedure ▪ No. of Trees felled ▪ Worker attitude ▪ H&S Meetings ▪ Worker attitude	▪ Project Engineer ▪ Project EHS Officer	▪ GH¢200,000
Flora & Fauna	**OPERATIONAL PHASE**				
	▪ Maintenance of the use of bird deflectors, and pole design which minimizes electrocution risks during project operations to reduce impacts from power lines and associated infrastructure. ▪ Enforcement of anti-poaching, trapping and hunting policy among employees ▪ Cover upright insulators on transmission poles with plastic insulating caps or insulating tubing to prevent electrocution risk; ▪ Regular checking of the vacuums or holes in the towers to avoid nesting by any of the birds;	▪ Quarterly ▪ Daily ▪ Quarterly ▪ Quarterly	▪ Bird deflectors ▪ Policy implementation ▪ Insulating caps ▪ Presence of holes	Site Engineer	▪ Part of O&M Cost
	PLANNING & CONSTRUCTIONAL PHASE				
	▪ Institution of platform for dialogue with local community and owners/caretakers ▪ Implementation of an appropriate chance find procedures in collaboration with GMMB ▪ Engagement of professional archaeologist to examine, document and/or remove and identified archaeological material. ▪ Execution of works within the authorised footprint ▪ Strict observation of the cultural taboos. ▪ Compensation for identified owners for the removal of any cultural heritage sites and shrines.	▪ Quarterly ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required	▪ Engagement PlatformStd. Ops. Procedure ▪ Contract Document ▪ Work Areas ▪ Mode of work ▪ Compensation paid	▪ Community Liaison Officer ▪ Project EHS Officer	▪ GH¢150,000

Historical & Cultural Heritage	**OPERATIONAL PHASE**				
	▪ Protection of identified archaeological locations to prevent potential damage. ▪ Execution of works within the authorised footprint ▪ Institution of platform for dialogue with local community and owners/caretakers ▪ Strict observation of the cultural taboos ▪ Documentation and reporting of chance find and submission to GMMB in Accra.	▪ As required ▪ As required ▪ As required ▪ As required ▪ As required	▪ State of archaeological locations ▪ Work Areas ▪ Engagement platforms ▪ Std. Ops. Procedure ▪ Chance finds procedures	Site Engineer	▪ Part of O&M Cost
	PLANNING & CONSTRUCTIONAL PHASE				
	▪ Implementation of a Health & Safety Plan, an Environmental Protection Plan as well as a Quality Assurance Plan ▪ Provision of PPEs to workers always. ▪ Construction activities during daytime hours ▪ Vigilance for any potential accidents shall be maintained ▪ Presence of valid Fire permit ▪ Presence of valid Development Permit ▪ Health screening of employees ▪ Training of disease prevention awareness ▪ Training on Health and safety awareness amongst staff and workers	▪ As required ▪ Monthly ▪ Daily ▪ As required ▪ Annual ▪ Annual ▪ Annual ▪ Quarterly ▪ Quarterly	▪ Std. Ops. Procedure ▪ PPEs ▪ Use of work logbook ▪ Routine Safety Checks ▪ Fire permit ▪ Development Permit ▪ Screening Report ▪ Training Report ▪ H&S Report	▪ Project Engineer ▪ Contractor EHS Officer ▪ Project EHS Officer	▪ GH¢500,000
	OPERATIONAL PHASE				

Occupational Health & Safety	▪ Provision of PPEs to workers always ▪ Presence of valid Fire permit ▪ Presence of valid EPA Permit ▪ Presence of valid Factories Inspectorate Certificate ▪ Training on Health and safety awareness amongst staff and workers ▪ Existing of safety warning signages ▪ Provision of Comprehensive fire detection and protection system ▪ Monitoring of Health and safety performance ▪ Existing operating safety audit system	▪ Monthly ▪ Annual ▪ Annual ▪ Annual ▪ Quarterly ▪ As required ▪ Monthly ▪ Quarterly ▪ Monthly ▪ Quarterly	▪ PPEs ▪ Fire Permit ▪ EPA Permit ▪ FI Certificate ▪ Training Report ▪ ignages ▪ Fire detection System ▪ H&S Monthly reports ▪ Audit Reports	Site Engineer	▪ GH¢30,000.00 annually
Loss of Properties	**PLANNING & CONSTRUCTIONAL PHASE**				
	▪ Implment Land Aquisition & Resettlment Plan ▪ Implmnet Stakeholder Engagaement Plan ▪ Utilisation of existing right of way to minimise land acquisition. ▪ Survey of project-affected persons for the purposes of compensation payment. ▪ Compensation payment before the start of constructional activities. ▪ Presence of Community Liaison Officer as a designated point of contact for the community. ▪ Implementation of appropriate grievance mechanisms to address concerns of the public ▪ Relocation of Fulanis by Lanowner themselves ▪ Support for alternative livelihoods for vulnerable persons	▪ As required ▪ As required ▪ As required ▪ As required ▪ Annual ▪ Monthly ▪ Quarterly ▪ As required	▪ Line route survey ▪ List of PAPs ▪ Amount of compensation paid ▪ Presence of CLO ▪ Complaint Register	▪ Project Engineer ▪ Contractor EHS Officer ▪ Project EHS Officer	▪ GH¢1.2 M
	OPERATIONAL PHASE				
	▪ Implment Land Aquisition & Resettlment Plan ▪ Implmnet Stakeholder Engagaement Plan ▪ Presence of Community Liaison Officer as a designated point of contact for the community.	▪ Annual	▪ Presence of CLO	Site Engineer	▪ GH¢15,000.00 annually
	PLANNING & CONSTRUCTIONAL PHASE				

	▪ Level of awareness amongst stakeholders on the project ▪ Institution of grievance mechanism to keep record of all complaints from the community ▪ Presence of valid Development Permit ▪ Restoration of land acquired on temporary basis for storage of material to their original form. ▪ Utilisation of existing right of way to minimise land acquisition. ▪ Utilisation of existing roads for access to the project site ▪ Presence of Community Liaison Officer as a designated point of contact for the community. ▪ Non disturbance of land use in and around permanent project facilities ▪ Use CDP to assist NCCE and FSD to educate populace on effects of bush fires	▪ Monthly ▪ Quarterly ▪ Annual ▪ As required ▪ As required ▪ As required ▪ Quarterly ▪ Daily	▪ Community engagement ▪ Complaint Register ▪ Development Permit ▪ State of temporary lands ▪ Use of Right of way ▪ Use of existing roads ▪ Presence of CLO ▪ State of land around project facilities	▪ Community Liaison Officer ▪ Contractor Engineer ▪ Project Engineer	▪ Part of Project Cost
	OPERATIONAL PHASE				
Land Use	▪ Implment Land Aquisition & Resettlment Plan ▪ Implmnet Stakeholder Engagaement Plan ▪ Implementation of CSR activities to improve the standards of living and long-term wellbeing of the affected communities. ▪ Undertake proactive action to avoid any undue confrontation with affected community. ▪ Use CDP to assist NCCE and FSD to educate populace on effects of bush fires	▪ Annual ▪ As required	▪ CSR Report ▪ Complaint Register	Site Engineer	▪ Part of O&M Cost
	PLANNING & CONSTRUCTIONAL PHASE				
	▪ Adherence to employment and workforce policies. ▪ Engagement of Locals for unskilled manpower requirements ▪ Provision of adequate shelter, drinking water, toilet facilities for the workers. ▪ Provision of accommodation of migrant labour within the communities. ▪ Presence of Community Liaison Officer as a designated point of contact for the community	▪ Monthly ▪ Monthly ▪ Monthly ▪ Monthly ▪ Quarterly	▪ Labour Policies ▪ Employment records ▪ Accommodation for staff ▪ Accommodation for migrant staff ▪ Presence of CLO ▪ Compliant Register	▪ Community Liaison Officer ▪ Contractor Engineer ▪ Project Engineer	▪ GH¢200,000

Labour & Working Conditions	▪ Implementation of worker grievance mechanism ▪ Maintenance of a healthy environment for the labour force	▪ Quarterly ▪ As required	▪ Complaint Register		
	OPERATIONAL PHASE				
	▪ Same at constructional phase	▪ See above	▪ See above	Site Engineer	▪ Part of O&M Cost
	PLANNING & CONSTRUCTIONAL PHASE				
	▪ Notification to local government/traditional authorities on the date of project commencement. ▪ Observation of all necessary traditional requirements prior to project commencement ▪ Institution of public grievance mechanism. ▪ Creation of awareness amongst staff about local cultural sensitivities. ▪ Limitation of constructional activities only during the day i.e. between 0700 hours to 1800 hours. ▪ Segregation of the various wastes and arrange for subsequent disposal through either efficient incineration or disposal in a sanitary landfill. ▪ Fencing of all excavated areas to avoid access to outsiders and wildlife. ▪ Provision of security and warning signages around construction site ▪ Provision of alternative access route to the nearby local resort at the Lawra site, if required. ▪ Briefings to create awareness on Public health amongst staff, especially on Sexually Transmitted Diseases and HIV/AIDS.	▪ As required ▪ As required ▪ As required ▪ Quarterly ▪ Daily ▪ As required ▪ As required ▪ Daily ▪ As required ▪ Quarterly	▪ Notification Letter ▪ Pacification Rites ▪ Complaint Register ▪ Training Report ▪ Use of work logbook ▪ Waste log book ▪ Std. Ops. Procedure ▪ Warning signages ▪ Access routes ▪ Briefing report	▪ Community Liaison Officer ▪ Project Engineer ▪ Contractor Engineer ▪ Project EHS Officer	▪ GH¢50,000
	OPERATIONAL PHASE				

Public Safety	▪ Provision of fencing for the PV Plants ▪ Provision of security staff ▪ Provision of floodlights within facility ▪ Provision of motion controls within facility ▪ Training of onsite guards to deal with trespassing incidents. ▪ Maintenance of harmonious co-existence between staff and the local communities in the project area.	▪ Quarterly ▪ Monthly ▪ Monthly ▪ Monthly ▪ Annual ▪ As required	▪ Fence ▪ Security Staff ▪ Floodlights ▪ Motion Controls ▪ Training Report ▪ Std. Ops. Procedure	Site Engineer	▪ Part of O&M Cost
Traffic & Transport	**PLANNING & CONSTRUCTIONAL PHASE**				
	▪ Implementation of TMS ▪ Implementation of traffic control measures ▪ Training of drivers in defensive driving ▪ Enforcement of speed limits for heavy good vehicles and workforce transportation vehicles; ▪ Avoidance of dense areas of traffic through planning and channelling of traffic. ▪ Involvement of local authorities in defining optimum project traffic routes and times for transit ▪ Implementation of a "No Drinking" "No Alcohol" policy on site ▪ Conduction of periodic and routine alcohol checks for all site drivers and site workers ▪ Provision of site vehicle maintenance services in order to ensure technical failures do not occur; ▪ Installation of traffic safety signage at vantage points along access routes with the project sites. ▪ Sensitisation programs for communities within the project area on road traffic and risks. ▪ Removal of speed ramps to be done in collaboration with DA's and Security agencies	▪ Daily ▪ Daily ▪ As required ▪ Daily ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required ▪ As required	▪ Std. Ops. Procedure ▪ Speed rumps, signages, ▪ Training Report ▪ Speed limits ▪ Level of traffic ▪ Traffic routes ▪ Policy on No Drinking and No Alcohol ▪ Report on routine checks ▪ Vehicle maintenance site ▪ Traffic safety signages ▪ Sensitisation Report	▪ Community Liaison Officer ▪ Contractor Engineer ▪ Project EHS Officer	▪ GH¢350,000
	OPERATIONAL PHASE				
	▪ Implementation of TMS ▪ Use of car sharing amongst staff	▪ As required ▪ As required	▪ Std. Ops. Procedure ▪ Car sharing strategy	▪ Project Engineer	▪ Part of O&M Cost