GOVERNMENT OF GHANA

ENVIRONMENTAL PROTECTION AGENCY

WORLD BANK GROUP

GHANA, AFRICA ENVIRONMENTAL HEALTH AND POLLUTION MANAGEMENT PROGRAM (AEHPMP)

FINAL

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) FOR THE PROPOSED DAKRUPE CLEAN MINE DEMONSTRATION CENTER (CMDC)

JUNE 2025

EXECUTIVE SUMMARY

Introduction and background

The informal, unsafe, and unregulated nature of mercury use in the Artisanal Small-scale Gold Mining (ASGM) sector creates a legacy of severe adverse and irreversible environmental and health damage in its wake. It is therefore a priority to reduce, and where feasible, eliminate mercury use in ASGM as required in Article 7 of the Minamata Convention. Current crude methods of handling mercury to process gold lead to release of mercury into the environment with limited controls, leading to occupational and community exposures. For mercury abatement, technologies to promote phasing out of mercury usage have been proposed as part of the Africa Environmental Health and Pollution Management Program (AEHPMP), whose objective is to reduce exposure to mercury and regulate mercury use in ASGM. The focus will be on promoting alternative technologies for gold extraction without the use of harmful chemicals. Possible technologies to avoid the use of mercury in ASGM include sluicing, direct smelting, improved milling, shaking table, reactivation, centrifuges etc.

The Government of Ghana (GoG), acting through the Ministry of Environment, Science, Technology and Innovation (MESTI) and the Environmental Protection Agency (EPA), is implementing the AEHPMP with funds from the World Bank. The AEHPMP is being implemented by EPA where a Project Implementation Unit (PIU) has been established. To achieve the objectives of the AEHPMP, the PIU has proposed to establish Clean Mine demonstration Centers (CMDC) in four ASGM sites in Ghana namely Dakrupe and Tinga in Bole District of Savannah Region, Apinto/ Fanti Mines in Prestea Huni Valley District of Western Region and Tweapease of Birim North District of Eastern Region.

The GoG has acquired a 0.92-acre (0.37Ha) land at Dakrupe for the establishment of one of the CMDCs (The Project). The site in reference is part of a larger parcel of land designated for the Dakrupe Community Mining Scheme. GoG acquired the land through a Voluntary Land Donation (VLD) made by the Dakrupe community, led by their Traditional Authority.
The donation has been subjected to the World Bank's VLD Protocol through which the community was duly informed about their right to refuse the donation and to be compensated for land so donated. No households were displaced as a result of the donation.

The CMDC in Dakrupe will be a masonry roofed blockwork/ concrete structure and will have the following:

- Provision of offices/washrooms/training spaces to cater for the anticipated number of people;
- Appropriate-sized washrooms have been provided to serve the anticipated population of users;
- Use of environmentally friendly materials;
- Use of energy-efficient materials and facilities; and
- Provision for water storage including harvesting of rainwater.

The CMDC at Dakrupe have been designed for air circulation and cross ventilation through the windows. Natural air circulation through the windows is allowed in order to eliminate or reduce the usage of mechanical ventilation systems. The CMDC in Dakrupe will be made of a masonry roofed blockwork office structure. The main facilities proposed for the Dakrupe CMDC includes the following:

- Demonstration Area (Processing Area and Smelting Area);
- Tailings Storage and Water Recycling Ponds Area;
- Office Rooms;
- Training Spaces (Indoor and Outdoor) and Eating Space;
- Storage Spaces;
- Visitor Amenities (Washrooms);
- Fencing; and
- Car Park

The site is greenfield with no water body close by and easily accessible although connecting roads are not engineered. The Environmental and Social (E&S) risks identified at the site includes:

- Public health and safety risks arising from closeness of the site to the community park (circa 200m);
- Potential loss of some economic trees that are communally owned especially *Afzelia africana* and *Vitellaria paradoxa* that have to be cut;

- Development of access road to the site and impact on biodiversity; and
- Lack of water supply that may lead to sanitation issues.

Alternative Considerations
The alternative analyses covered the following:
- Site Selection Option- the chosen site vis-à-vis other sites in Dakrupe;
- Choice of Building Materials for the Dakrupe CMDC- use of typical brick/block and mortar as against prefabricated containerized structures;
- Choice of Technology- use of a combination of comminution, gravimetric concentration and gold separation and to avoid mercury use through leaching and direct smelting; and
- Do nothing scenario- no CMDC is provided at Dakrupe and the status quo remains.

Construction Materials and Equipment
The materials required for the Project include building materials such as cement, cement block, sand, gravel, stone chippings, concrete, iron rods, water, PVC/HDM pipes and admixtures. Other accessories will include barbed wire, wire mesh, balustrade, etc. The construction equipment to be used includes excavators, backhoes, shovels/ pickaxes, concrete mixers, haulage trucks, dump trucks, concrete dispensing trucks, water pumps etc.

Construction Labor
It is estimated that between 30 to 50 persons will be engaged during the construction phase of the Project's construction works. This will include unskilled labor, drivers, masons, carpenters, plumbers, electricians, mechanics, plant operators, engineers, and administrators. The Dakrupe community is endowed with youth who are currently unemployed and so will be available for employment as unskilled labor.

Skilled labor will be hired from outside the Dakrupe community and risks such as social conflict, increased Sexually Transmitted Diseases (STDs) and gender-based violence may occur. In this regard, adequate measures have been provided in this ESMP including Code of Conduct to regulate the conduct of the contractor and their labor force to ensure the risks associated with labor from outside the project location are minimized. Labor camps will not be established to house workers during construction, rather the workers will go to their various homes and proceed from there to work.

In line with environmental permitting requirements as provided under the Environmental Assessment Regulations of 1999, Legislative Instrument (LI) 1652, the AEHPMP PIU commissioned the preparation of this ESMP to guide the environmental and social risk management associated with the construction and operation of the Dakrupe CMDC. This report is therefore the Final ESMP in compliance with the World Bank Environmental and Social Standards (ESSs) especially ESS 1 on Assessment and Management of Environmental and Social Risks and Impacts.

Objective and Purpose of the ESMP
The purpose of the ESMP is to provide guidance for the environmental and social risk management associated with the construction and operation (including maintenance) of the CMDC at Dakrupe

Relevant Policies, Legal and Administrative Framework
The proposed Project will strictly adhere to and follow the World Bank's Environmental and Social Framework (ESF) as well as the legal and regulatory frameworks of Ghana. The key environmental policies, legal framework and procedures considered as relevant under the proposed Project have been presented in Chapter 2 of this ESMP. The proposed construction and operation of the Dakrupe CMDC is expected to comply with the requirements of the following EPA administered Ghana Standards (GS):
1. GS 1236:2019- Environment and Health Protection – Requirements for Ambient Air Quality and Point Source/ Stack Emissions;
2. GS 1222:2018- Health Protection – Requirements for Ambient Noise Control; and
3. GS 1212:2019- Environmental Protection Requirements for Effluent Discharge (General Industry).

Ghana Environmental Assessment Regulations 1999 (LI 1652): Under the provisions of the Ghana Environmental Assessment Regulations 1999 (LI 1652), the proposed Project is classified under projects for which an EIA is required. The EPA Act 490 (1994) established the Agency and entrusted it with the

responsibility of ensuring compliance with the EIA process and procedures in the planning and execution of development projects.

World Bank Environmental and Social Framework: The construction and operation of the Dakrupe CMDC is World Bank Funded and therefore must also conform to the World Bank's ESSs which govern the funding agreement between the Bank and the Government of Ghana. The objective of the standards is to prevent or at least minimize biophysical environment and socioeconomic-cultural risks and impacts while increasing the environmental and the socio-economic benefits of projects. The applicable ESSs are as follows:

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

Stakeholder Consultations

Key stakeholders have been consulted, these include regulatory bodies, local government institutions and project affected persons and the Dakrupe community. Stakeholder consultation is a continuous process and would be conducted throughout the Project implementation.

The following are key highlights of the issues/concerns raised by stakeholders/affected persons during the consultations:

- Some community members/ miners had doubts that the Project will see the light of day.
- The miners expressed concern about whether the Dakrupe CMDC will be able to process all the ore mined in Dakrupe.
- Aside the Dakrupe CMDC to be established, miners also require implements such as water pumps, PPEs at the mine shafts to be able to increase ore production and to ensure their safety.
- The executive of the Dakrupe Community Mine requires support in extending electricity to the Sonyo Road site to ensure increased production of the gold ore.
- The miners are aware of the mercury problem and are eager to support the construction and operation of the CMDC at Dakrupe in order to eliminate mercury use in the community.

Potential Environmental and Social Risks and Impacts of the Dakrupe CMDC

The potential beneficial and adverse impacts of the proposed Project have been identified and discussed based on the nature of the activity and area of influence.

The potential positive impacts of the project include:

- Awareness creation on impacts and risks of mercury use in ASGM in Dakrupe;
- Employment creation and enhanced business opportunities in ASGM in Dakrupe;
- Deepening of construction health and safety education and awareness in Dakrupe;
- Improved institutional capacity and coordination in the ASGM sector;
- Enhanced image of Dakrupe as a model mercury free mining community;
- Improved health of miners and community members; and
- Improvement in local and national economy.

The key adverse environmental and social issues which could possibly arise from the various stages of the Project have been evaluated and presented in Chapter 5 of this document.
They include:

- Air quality deterioration and exposure of some community members to the particulates;
- Vibration and noise nuisance and exposure of some community members to the noise;
- Loss of vegetation/ habitat and impacts on flora and fauna;
- Land degradation and loss of soil resources at the Dakrupe CMDC;

- Impact of bush fires;
- Exposure of workers to noise, dust, odor and workplace accidents e.g., slips, falls etc. as an occupational health and safety issue;
- Exposure of some community members to accidents involving construction vehicles;
- Increased risk of Sexually Transmitted Diseases;
- Child labor; and
- Gender based violence including sexual harassment, child abuse and exploitation due to labor influx.

Proposed Enhancement and Mitigation Measures for Potential Environmental and Social Risks and Impacts Identified

The Proposed Environmental and Social Management and Monitoring Plan (ESMMP) which aims to ensure that the potential environmental and social risks and impacts identified are reduced to the barest minimum, or completely eliminated during pre-construction, construction, operation and decommissioning phases of the proposed Project at Dakrupe is presented in Chapter 6 of the ESMP document. To ensure effectiveness and compliance with sound environmental and social practices and ensure sustainability of the Dakrupe CMDC, a provisional environmental and social management and monitoring program to help manage and monitor the risks and impacts and which will help sustain environmental quality within acceptable guidelines/standards, including monitoring roles and responsibilities have been provided in the ESMP. The programme includes a proposed Monitoring Plan for monitoring the effectiveness of the implementation of each of the management measures.

Grievance Redress

A grievance resolution procedure consistent with the EPA's GRM has been provided in this ESMP. It aims at addressing and resolving grievances or complaints from Project Affected Persons (PAPs) promptly, fairly and in a manner to the extent possible, acceptable to all parties during the proposed Project implementation.

Capacity Building Plan

All relevant stakeholders including contractors and their workers, the Bole District Assembly, AEHPMP - PIU staff, community opinion leaders, NGOs, project affected persons etc. who will be involved in the implementation, monitoring and supervision of the Project implementation will undergo training to create understanding on the ESMP requirements, the roles and responsibilities of the stakeholders in order to ensure compliance with the ESMP.

Estimated Cost for the ESMP Implementation

The costs involve:

i. Implementation of the environmental and social impacts mitigation measures is estimated to cost GHS694,500.00 (this cost excludes some of the mitigation management costs already included in the BoQs).
ii. Monitoring of the mitigation measures implementation is estimated to cost GHS569,000.00 (this cost excludes some of the mitigation management costs already included in the BoQs)
iii. Capacity Building including Grievance Redress: GHS1,170,000.

Conclusion

The intervention, a community-focused cleaner technology seeks to address current policy challenges as well as to strengthen regulatory frameworks and facilitate their implementation, to better address environmental health risks associated with mercury use in ASGM sector.

The proposed establishment of a CMDC at Dakrupe is to assist in eliminating mercury exposure and use in ASGM and improve the health risks and effects associated with mercury in the community and Ghana as a whole. Mercury is a known neurotoxin with high exposures linked to some health challenges including kidney and autoimmune dysfunction.

The various stages in the existing Dakrupe ASGM activities have some environmental and social risks and impacts which the proposed CMDC seeks to address, which also has some impacts albeit minor. This ESMP therefore seeks to provide mitigation and management measures to realize the benefits from the intervention while eliminating any cumulative impacts.

The studies towards the preparation of this ESMP has revealed that the execution of the CMDC at Dakrupe will not impact negatively on the existing environmental, social, safety and health conditions of the community.

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LIST OF ABBREVIATIONS

ADR	Alternative Dispute Resolution
AEAs	Agriculture Extension Agents
AfDB	African Development Bank
AEHPMP	African Environment Health Pollution Management Program
AIDS	Acquired Immune Deficiency Syndrome
AoI	Area of Influence
AER	Annual Environmental Report
APHA	American Public Health Association
ASM	Artisanal Small-Scale Mining ()
ASGM	Artisanal Small-Scale Gold Mining
AWWA	American Water Works Association
BOP	Business Operating Permit
BoQs	Bill of Quantities
BP	Bank Policy
CBD	Convention on Biological Diversity
C-ESMP	Contractor's Environmental and Social Management Plan
CHPS	Community Health-Based Planning Services
CMDCs	Clean Mine Demonstration Centers
COVID-19	Corona Virus Disease of 2019
CPESDP	Coordinated Programme of Economic and Social Development Policies
CSIR	Council for Scientific and Industrial Research
EAP	Emergency Assembly Point
EHS	Environment, Health and Safety
SHS	Environment, Social, Health and Safety
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
EMP	Environmental Management Plan
ESF	Environmental and Social Framework
ESCP	Environmental and Social Commitment Plan
ESHS	Environment, Social, Health and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMMP	Environmental and Social Management Monitoring Plan
ESS	Environmental and Social Standard
FDI	Foreign Direct Investment
FGD	Focus Group Discussion
GBV	Gender Based Violence
GDP	Gross Domestic Product
GEF	Global Environment Facility
GES	Ghana Education Service
GHG	Green House Gas
GHS	Ghana Health Service
GIIP	Good International Industry Practice
GNCCP	Ghana National Climate Change Policy
GNFS	Ghana National Fire Service
GoG	Government of Ghana
GRM	Grievance Redress Mechanism
GS	Ghana Standard
GSA	Ghana Standard Authority
GSS	Ghana Statistical Service

HIV	Human Immunodeficiency Virus
I&APs	Interested and Affected Parties
ICT	Information and Communication Technology
ILO	International Labor Organization
IPF	Investment Project Financing
ITB	Inter Tropical Boundary
ITCZ	Inter Tropical Convergence Zone
JHS	Junior High School
KID	Key Informant Discussion
KII	Key Informant Interview
KPI	Key Person Interview
KVIP	Kumasi Ventilated-Improved Pit
LC	Lands Commission
LI	Legislative Instrument
LMP	Labor Management Procedures
LUSPA	Land Use and Spatial Planning Authority
LVD	Lands Valuation Division
MC	Minerals Commission
MESTI	Ministry of Environment, Science, Technology and Innovation
MID	Mines Inspectorate Division
MMDA	Metropolitan, Municipal and District Assembly
MLGDRD	Ministry of Local Government, Decentralization and Rural Development
MoFA	Ministry of Food and Agriculture
MOP	Mining Operating Plan
NDCs	Nationally Determined Contributions
NEAP	National Environment Action Plan
NEDCo	Northern Electricity Distribution Company
NEP	National Environment Policy
NEmP	National Employment Policy
NGOs	Non-Governmental Organizations
NHP	National Health Policy
NLP	National Labor Policy
NWP	National Water Policy
OASL	Office of Administrator of Stool Lands
OP	Operational Policy
OSH	Occupational Safety and Health
PAP	Project Affected Person
PIU	Project Implementation Unit
PNDC	Provisional National Defense Council
PNDCL	Provisional National Defense Council Law
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment
PWDs	Persons with Disabilities
RBZP	Riparian Buffer Zone Policy
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RMG	Royal Mining Group
SDGs	Sustainable Development Goals
SEA	Sexual Exploitation and Abuse
SEP	Stakeholder Engagement Plan
SGBV	Sexual and Gender Based Violence
SH	Sexual Harassment
SHS	Senior High School
SPSS	Statistical Package for Social Sciences
STD	Sexually Transmitted Diseases
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
UPOPs	Unintentional Persistent Organic Pollutants
UNESCO	United Nations Educational Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
VAC	Violence Against Children
VLD	Voluntary Land Donation
WB	World Bank
WBG	World Bank Group
WC	Water Closet

WEF	Water Environment Federation
WHO	World Health Organization
WRC	Water Resources Commission
WRI	Water Research Institute

1.0 INTRODUCTION

1.1 Background

The mining sector plays a vital role in the Ghanaian economy, attracting more than half of all Foreign Direct Investment (FDI), and generating more than one-third of all export revenues. The mining industry is the largest tax-paying sector in the country and makes a significant contribution to GDP and employment.

As a low-tech, labor-intensive industry with few barriers to entry, ASGM has become an alluring alternative livelihood for some Ghanaians especially the unemployed youth. Despite the financial benefits, a variety of environmental, social and public health concerns have accompanied the expansion of ASGM in Ghana and they include water contamination, inhalation of dust from pulverized ore, and exposure to mercury and other heavy metals.

The informal, unsafe, and unregulated nature of mercury use in the ASGM Sector creates a legacy of severe adverse and irreversible environmental and health damage in its wake. It is therefore a priority to reduce, and where feasible, eliminate mercury use in ASGM as required in Article 7 of the Minamata Convention. Current crude methods of handling mercury to process gold lead to release of mercury into the environment with limited controls, leading to occupational and community exposures. For mercury abatement, technologies to promote phasing out of mercury usage has been proposed as part of this project under the Africa Environmental Health and Pollution Management Program (AEHPMP), whose objective is to reduce exposure to mercury and regulate mercury use in ASGM. The focus will be on promoting alternative technologies for gold extraction without the use of harmful chemicals. Possible technologies to avoid the use of mercury in ASGM include sluicing, direct smelting, improved milling, shaking table, reactivation, centrifuges etc.

Ghana is one of five African countries participating in the Global Environment Facility (GEF) funded AEHPMP. The project in Ghana has four (4) Components as follow:

Component 1: Institutional Strengthening, Capacity Building and Knowledge Sharing
The component will strengthen the knowledge and capacity base of public institutions and private stakeholders to address environmental health risks associated with mercury use in ASGM sector and Persistent Organic Pollutants (POPs)/ Unintentional POPs (UPOPs) releases from e-waste.

Component 2: Support Policy Dialogue and Regulatory Enhancements
The component seeks to address current policy challenges as well as to strengthen regulatory frameworks and facilitate their implementation, to better address environmental health risks associated with mercury use in ASGM sector and POPs/UPOPs releases from e-waste. It complements activities under component 3, focused on operational-level approaches to incentivize practices and technologies less harmful to human health and the environment.

Component 3: Demonstrating the Application of Technological Tools and Economic Approaches
This component finances specific community-focused cleaner technology demonstration activities in contaminated areas, selected and designed based on environmental health risks and cost-effectiveness of interventions. The objective is to address technical and methodological challenges to the adoption and deployment of cleaner technologies and practices in complement to activities under component 2, which focuses on challenges and policy incentives to reduce environmental and health pressures.

Component 4: Project Management
This component covers the cost for project management, implementation and supervision of project activities, administration of procurement and financial management, monitoring and evaluation, and monitoring of safeguards compliance. The component covers in particular the cost of the Project Implementation Units (PIU) within the EPA.

The project's geographical scope covers all of Ghana however the establishment of the CDMCs at the four small scale mining locations are in three districts and three regions of Ghana as shown in **Table 1-1** and further illustrated in **Figure 1-1**.

Table 1-1: Selected Regions and Districts for AEHPMP Project

No.	Name of Site	District	Region
1.	Dakrupe	Bole	Savannah
2.	Tinga	Bole	Savannah
3.	Tweapease near New Abirem	Birim North	Eastern
4.	Fanti Mines at Abosso	Prestea Huni Valley	Western

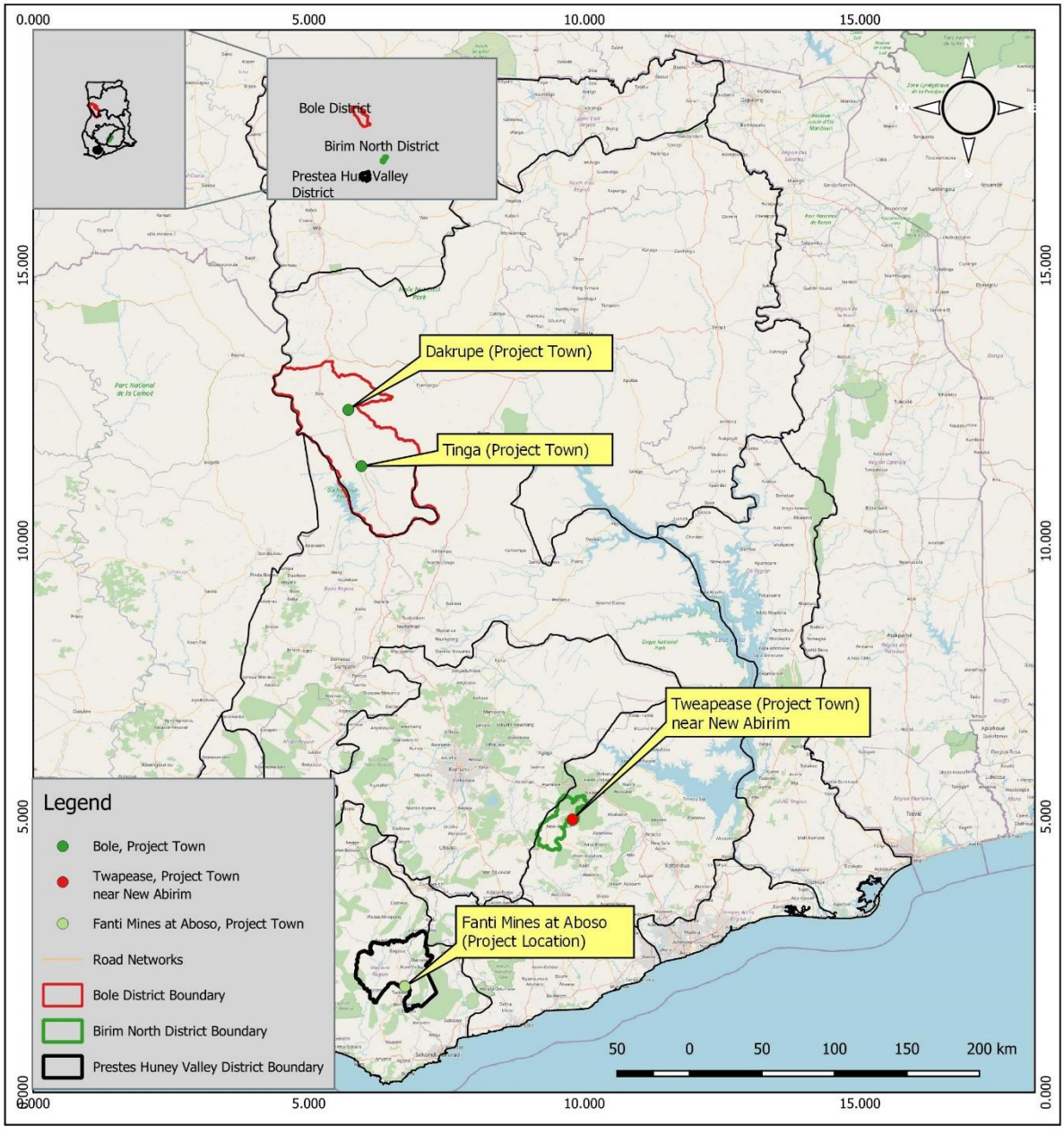


Figure 1-1: Map of Ghana Showing Proposed Project Locations

1.2 Description of the Proposed CMDC at Dakrupe

1.2.1 The Dakrupe CMDC

The land for the construction of the Dakrupe CMDC is a 0.92 acre land. This land, along with access roads to the site, is part of a larger parcel of land designated for the Dakrupe Community Mining

Scheme. The designation of a place for Community Mining Schemes (CMS) is done by the Minerals Commission of Ghana, in close consultation and involvement of relevant Traditional Authorities, District Assembly representatives and community people. In practice, such designated areas are free from any other uses and encumbrances, including farming activities. The land has been acquired by the GoG through a Voluntary Land Donation (VLD) arrangement with the Dakrupe community through the Traditional Authority. The donation process followed the World Bank's VLD Protocol through which it was confirmed that the donation was not coerced and that the owners (Dakrupe community) finalize the donation after they were duly informed about their right to refuse the donation and to be compensated for land so donated. No households were displaced by the donation..
The infrastructure required for the CMDC is made up of the following:

- Built- up spaces;
- parking area;
- landscaping area; and
- circulation- internal and external and services distribution.

The design of the CMDC at Dakrupe will have the following:

- Provision of offices/washrooms/training spaces to cater for the anticipated number of people;
- Appropriate-sized washrooms have been provided to serve the anticipated population of users;
- Use of environmentally friendly materials;
- Use of energy-efficient materials and facilities; and
- Provision for water storage including harvesting of rainwater.

The CMDC at Dakrupe have been designed for air circulation and cross ventilation through the windows. Natural air circulation through the windows is allowed in order to eliminate or reduce the usage of mechanical ventilation systems. The CMDC in Dakrupe will be made of a masonry roofed blockwork office structure.

The design of the CMDC at Dakrupe embodies a play of light, patterns and shades. The overall internal color scheme is proposed to be one which will reflect good lighting system. Consideration for the finishes has been based on functionality of space, durability and maintenance. Acrylic emulsion paint which allows good lighting system has been adopted.

The washroom areas will be tiled and the immediate environs of the buildings will be enhanced by the introduction of aprons and drains around the facilities.

The main facilities proposed for the Dakrupe CMDC includes the following:

- Demonstration Area (Processing Area and Smelting Area);
- Tailings Storage and Water Recycling Ponds Area;
- Office Rooms;
- Training Spaces (Indoor and Outdoor) and Eating Space;
- Storage Spaces;
- Visitor Amenities (Washrooms);
- Fencing; and
- Car Park.

<u>Demonstration Area (Processing Area and Smelting Area)</u>
The section demarcated as demonstration area will be for both processing of the ores and for smelting of the gold. The demonstration area is designed to process the daily tonnage of materials according to the technology assessment at the mine. The average tonnage of materials to be processed is estimated at 1.5 - 5t/da . The processing area will house the mercury-free technology equipment. It will serve for both practical demonstrations of the clean gold processing techniques and provide support services to miners especially women involved in ore processing. The smelting area will house the smelter, where the final processing is done to obtain the gold ore through direct smelting (semi refined gold). The demonstration area will

basically have sheds without enclosed walls to provide sun and rain shades for the equipment and workers during the processing, and also to allow for proper ventilation and to minimize dust pollution.

Figure 1-2 shows the environmentally based process flow diagram of the gold production processes of winnowing, cyanidation and direct smelting.

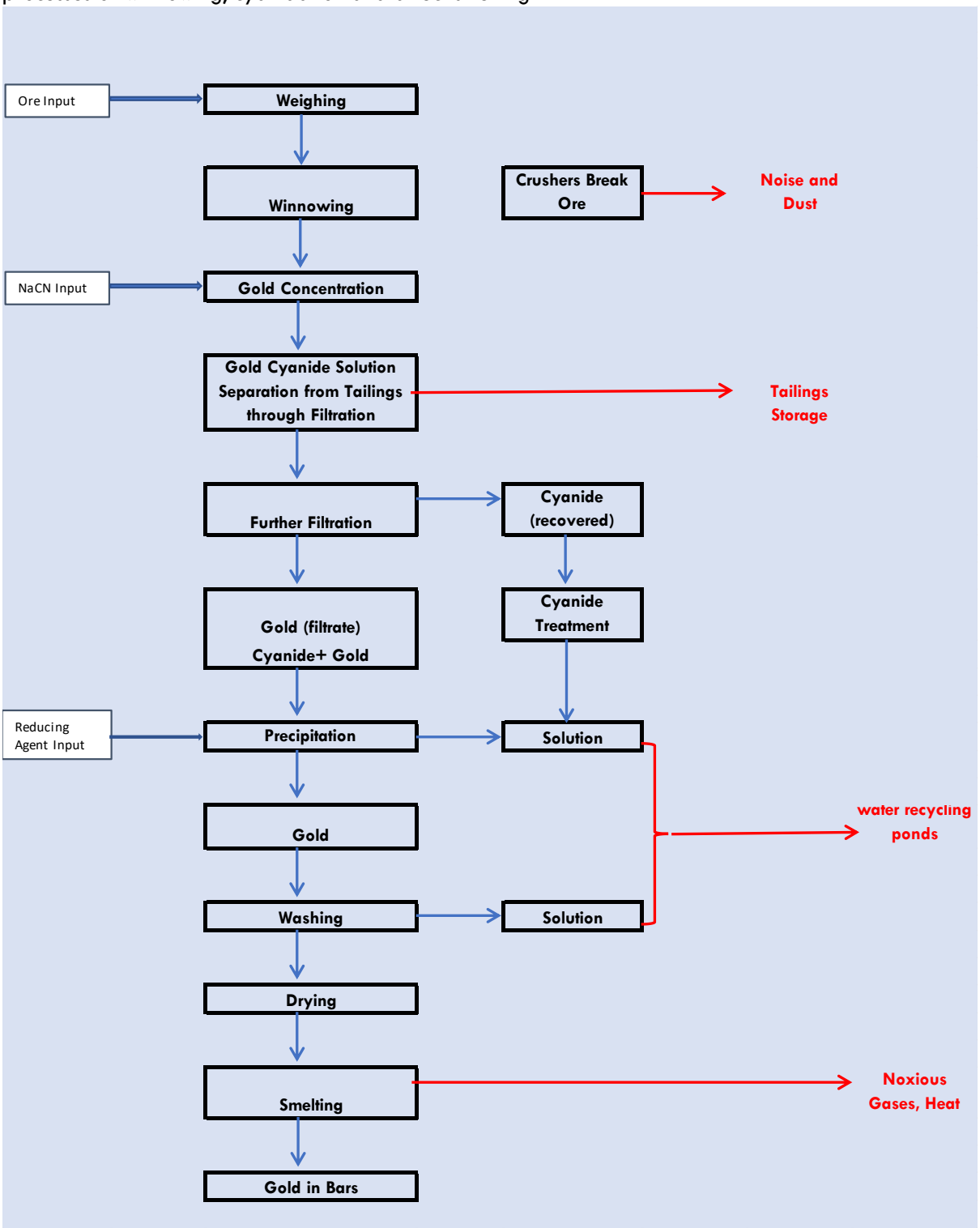


Figure 1-2: Environmentally Based Process Flow Diagram of the Gold Production Processes

Tailings Storage Facility (TSF) and Water Recycling Ponds Area

Practical demonstration of the mercury-free gold processing techniques would need water and lead to production of tailings. An effective impoundment/TSF will serve the purpose of recycling the processed water and to contain the tailings produced during the demonstration.

An area is allotted for tailings storage and the construction of water recycling ponds. It is proposed to provide the Dakrupe site with a borehole for process water supply purposes.

Office Rooms

The Dakrupe CMDC will be of a masonry roofed blockwork office.

The masonry roofed blockwork office will consist of a concrete strip foundation, rendered masonry block walls as external and internal envelope, concrete columns and beams, roofing sheeting, ceiling, painting, wooden doors, aluminum glazed windows, electrical and air-conditioning installations. This is proposed because of the ready availability of the above materials.

The office spaces will be required for administering training and for the daily operation of the center. An office space of dimension 5m (length) by 2m (width) by 2.2m (height) will be provided. Office staff of four (4) persons have been considered for the operation of the center although the space allotted for the office can contain approximately eight (8) office staff. The office will have standard desks, high back chairs, stackable chairs, filing cabinets, exhibit boards and white boards.

Training Facility

Training spaces will also be required to do workshops for miners, the public, students etc. The proposed dimension of the space that will be adequate is 12m (length) x 2.2m (width) x 2.2m (height) to be able to house a maximum number of forty (40) people at a time for training. The training spaces will also typically have folding chairs, tables where required, whiteboards, exhibit boards, and an image projector.

An outdoor training area for demonstration will be constructed. It will be in a tent form with timber posts as the main structural supports bolted on concrete slab and roofed with aluminum roofing sheets of 50mm x 100mm timber rafters and purlins. It will have an external envelope made of 25mm x 50mm wooden battens spaced 100mm apart to enhance ventilation. The overall dimension proposed is 10m (length) x 5m (width) x 4m (height). The outdoor training area will also serve as a resting and eating area for the non-office staff and shall have benches and tables.

Storage Spaces, Kitchenette and Visitors Amenities

The size of the storage space and kitchenette combined shall be blockwork with room size 5.5m (length) x 2.2m (width) x 2.2m (height). However, there will be some flexibility of modifications during the detailed design stage.

Fencing

For maximum security against theft and other damages due to external factors, a barbed wire fencing will be provided for the Dakrupe CMDC for additional security against vandalism.

Construction and Operation and Maintenance Periods

It is expected to use 6 months for the construction works while the Operation and Maintenance will continue throughout the life of the mines supplying the CMDC at Dakrupe.

A general block plan for the CMDC at Dakrupe is as shown in **Figure 1-3**.

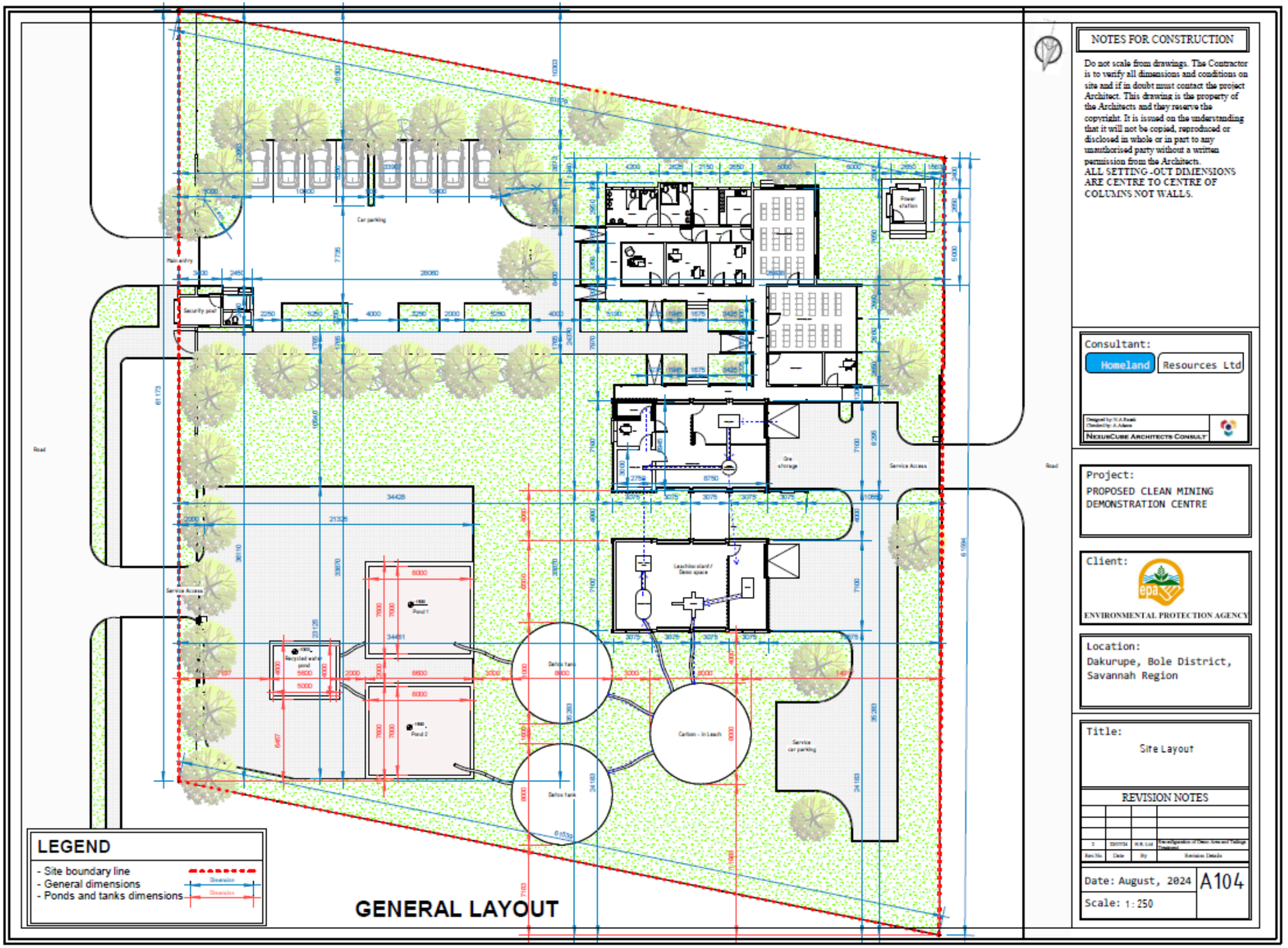


Figure 1-3: General Layout of the Dakrupe CDMC

1.2.2 Sources of the Ore at Dakrupe

The sources of the ore at Dakrupe are in three locations namely (i) Camp, (ii) Waste Line and (iii) Sonyo Road and they are all legal concessions. The mining locations at Dakrupe are shown in **Figure 1-4.**

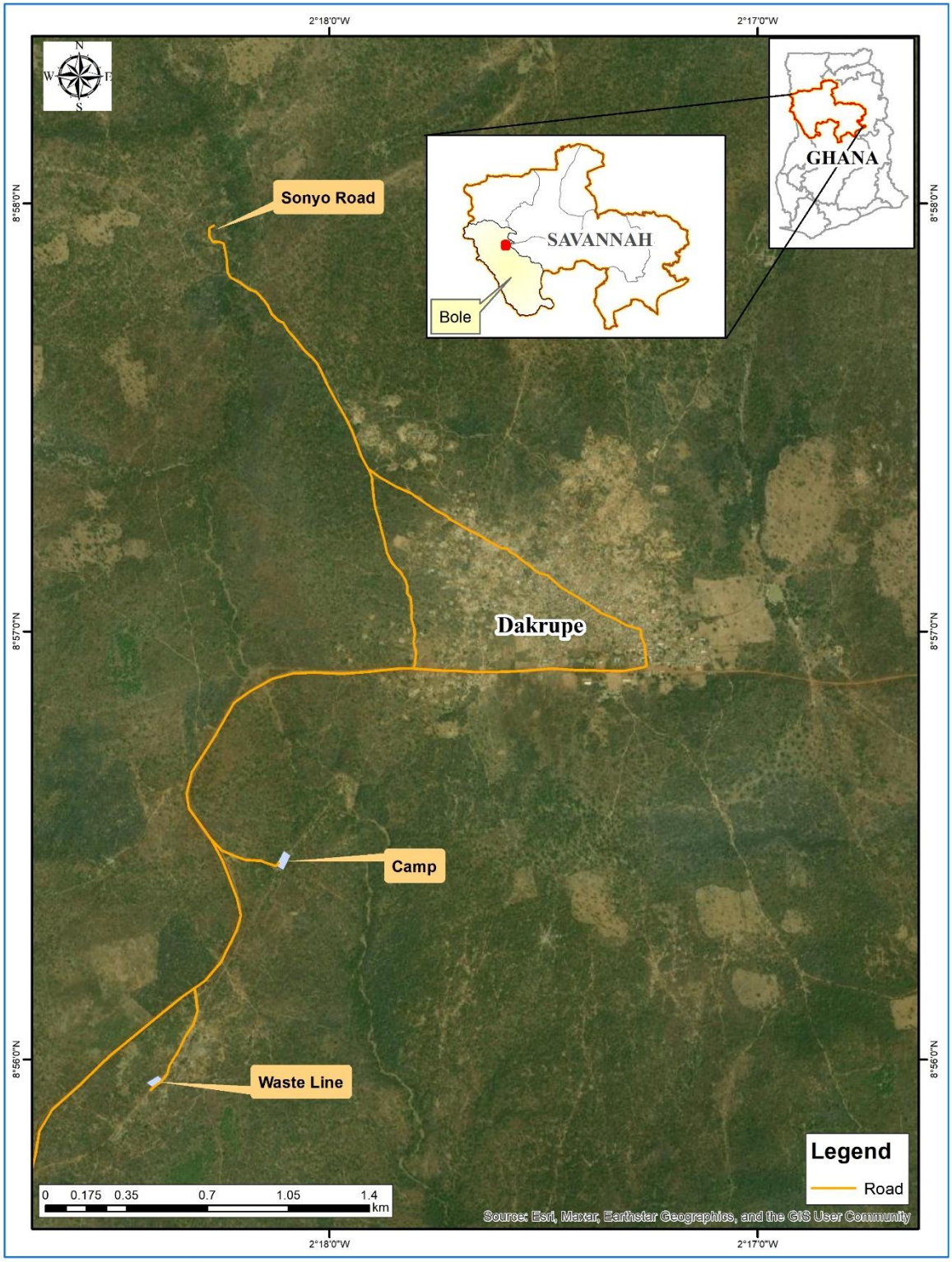


Figure 1-4: Approximate mining locations at Dakrupe.

Camp

The Camp site derived its name from an old exploration camp that was once located there. Although it was not actively producing during the study, it was described as deep and high-grade and will be operated at the appropriate time. Therefore, this ASGM site which is owned by the Chairman of the Dakrupe Community Mining Scheme is neither abandoned nor illegal. The rocks in this Camp mining segment of Dakrupe consist mainly of granitoids and metavolcanics, and the gold is found in quartz veins. **Plate 1-1** shows the main representative rock samples at the Camp mining site.

(a) Rock Types at Camp Mining Site

(b) The Shaft at Camp Mining Site

Plate 1-1: Scenes of the Camp Mining Site.

Waste Line

This site was actively being mined, with compressors in operation. The site is connected to the national electricity grid and currently serves as the main mine for the Dakrupe Community Mining Scheme. It was observed that both the waste and ore piles contain granitoids, metavolcanics, and quartz veins. These rocks appear sheared and brecciated. According to explanations provided by some of the miners, any of the rock types at this mining site could contain good gold grades hence the site earned the name Waste Line because it is easy to misclassify a mineralized rock as waste, as gold is not associated with only one rock type.

(a) The Waste Line Area

(b) Examining the Rocks at Waste Line

Plate 1-2: Scenes from the Waste Line

Sonyo Road

The Sonyo Road mine, which is permitted, and forms part of the Dakrupe Community Mining Scheme is not active due to the absence of electricity hence only eight miners were on site. The gold is hosted in quartz veins. The primary lithology is granitoid, which appears strongly sheared or mylonitized. The Camp and Waste Line pits seem to align along the same trend, while the Sonyo Road pit appears to be oriented at right angles to the Camp-Waste Line trend.

(a) A Shaft at Sonyo Road

(b) Gathering the Ore at Sonyo Road

Plate 1-3: Scenes from Sonyo Road

Current Milling and Gold Processing Practices

The crushing, milling and gold extraction facilities are situated at the outskirts of the town and it was observed that the town is getting closer to these facilities and may require relocation. **Plate 1-4** depicts the crushing and milling facility, with some ore awaiting crushing (a)- pit for processing the milled ore before washing and extraction of the gold with mercury (b), while **Figure 1-5** shows the environmentally based flow diagram of the milling and gold extraction process at Dakrupe.

(a) Milling the Ore

(b) Extracting the Gold

Plate 1-4: Scenes from the Ore Processing Area

1.2.3 Construction Materials and Equipment

The construction materials will include building materials such as cement, cement block, sand, gravel, stone chippings, concrete, iron rods, water, PVC/HDM pipes and admixtures. Other accessories will include barbed wire, wire mesh, balustrade, etc. The construction equipment to be used includes excavators, backhoes, shovels/ pickaxes, concrete mixers, haulage trucks, dump trucks, concrete dispensing trucks, water pumps etc.

1.2.4 Construction Labor

It is estimated that between 30 to 50 persons will be engaged during the construction phase of the project works. This will include unskilled labor, drivers, masons, carpenters, plumbers, electricians, mechanics, plant operators, engineers, and administrators. Although the Dakrupe community is endowed with youth who are currently unemployed and so will be available for employment as unskilled labor. The use of skilled labor from outside of the community and associated risks such as social conflict, increased sexually transmitted diseases (STD, HIV/AIDs) and gender-based violence may occur. In this regard, adequate measures have been provided in this ESMP including a Code of Conduct to regulate the conduct of the contractor and the workers to ensure the risks associated with labor from outside the project location are minimized. Labor camps will not be established to house workers during construction, rather the workers will go to their various homes and proceed from there to work. During the operational and

maintenance phase, the project plans to engage between 4-8 persons who will be responsible for maintenance.

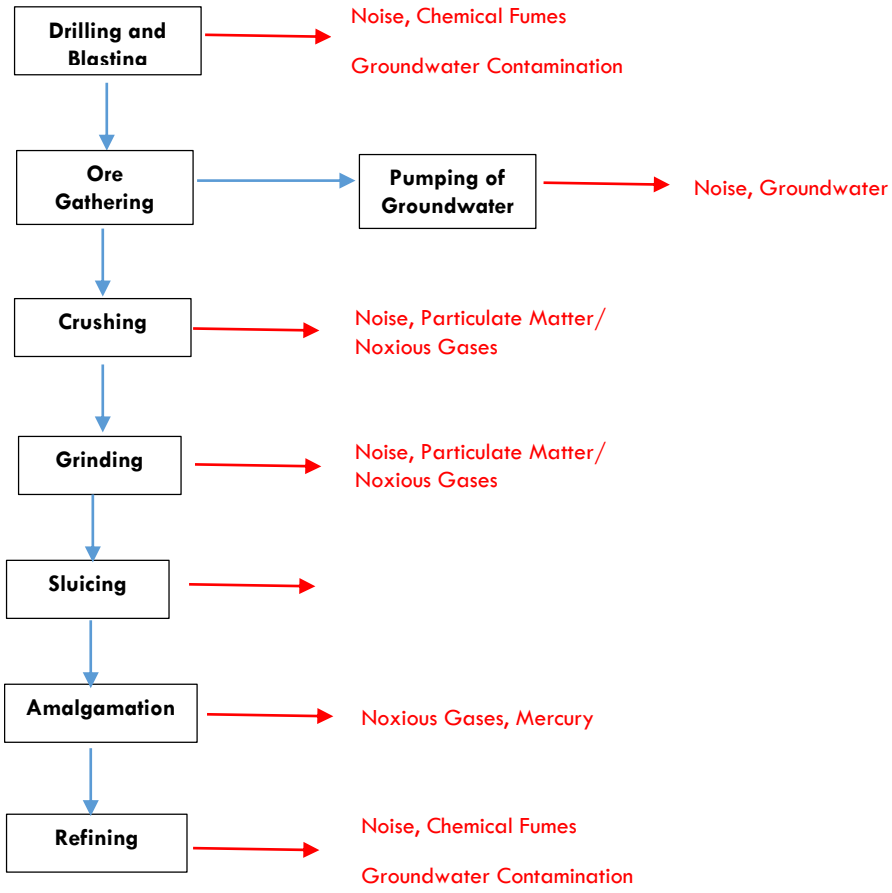


Figure 1-5: Environmentally Based Process Flow Diagram of the Mining and Ore Processing at Dakrupe

1.3 Justification for the Project

The ASGM sector predominantly deals with underground hard rock ores, which is the case at Dakrupe.

For the ore at Dakrupe, the method of extracting the gold include crushing and milling as a prerequisite to further processing. Typical equipment observed in the processing include disc mills (modified corn mills). The milled material is mixed with water and sluiced to obtain a gold concentrate. The gold concentrate obtained after sluicing is further concentrated through panning, followed by gold extraction by amalgamation i.e., the use of mercury for gold extraction from concentrate. The tailings generated after sluicing are stockpiled at the processing center and sold to others including some Chinese or companies from Burkina Faso for further processing.

1.4 Purpose and Objectives of the ESMP

The purpose of the ESMP is to provide guidance for the environmental and social risk management associated with the construction, operation and decommissioning of the CMDC at Dakrupe when completed. It provides adequate mitigation and management measures to eliminate and mitigate significant adverse environmental and social impacts, thereby reducing them to acceptable levels. The ESMP document defines roles, responsibilities, and procedures to guide implementation of the activities, in compliance with the World Bank and National requirements.

The specific objectives of the ESMP are to:

- Identify significant adverse environmental and social impacts, conflicts and concerns likely to arise as a result of the implementation of the project;
- outline mitigating/enhancing, monitoring, consultative and institutional measures for managing adverse environmental and social impacts and risks or to enhance the beneficial impacts; and
- address capacity-building requirements needed to strengthen key institutional stakeholders as well as affected local groups or communities' environmental and social capacities.

1.5 Scope of Work

The scope of work comprised the following:

1. Baseline studies at the Dakrupe project site involving the collection and analysis of information on the land, water, air and the social environments, and with emphasis on the project Area of Influence (AoI). It consisted of the following activities:
    - desk studies to review project information and understand the scope of the proposed intervention while undertaking a gap assessment;
    - desk surveys to obtain secondary data and develop field survey tools for compiling information on the environmental and social features/ characteristics of the proposed site;
    - sites surveys to identify the project area of influence and issues of urgent environmental concern related to the proposed development and peculiarities of the existing environment;
    - sampling of environmental media – air, water and land;
    - laboratory analyses for relevant physico-chemical and bacteriological parameters;
    - interviews, administration of questionnaires and sampling of public opinions on social and cultural concerns relating to the project sites and the area of influence;
2. Legislative and regulatory considerations including national, international and WB requirements;
3. Identification of the potential direct, induced and cumulative impacts;
4. Analysis of feasible project alternatives;
5. Provision of mitigation and management measures for negative impacts identified;
6. Institutional capacities to address adverse impacts; and
7. Preparation of an ESMP including monitoring and institutional roles for the Dakrupe CMDC facility for review and acceptance by the PIU for securing an environmental permit for the intervention to commence.

1.6 Methodology and Approach to the Assignment

The activities carried out to accomplish this assignment are divided into four main categories as follows:

- Consultations;
- Desk work/Document Review;
- Field inspections/visits; and
- Reporting.

1.6.1 Stakeholder Consultations

The following institutions or organizations were consulted or contacted:

- Bole District Assembly;
- Dakrupe Community Opinion Leaders;
- Dakrupe Community Mining Committee;
- The Miners at Dakrupe;
- Youth Representatives at Dakrupe;
- Women In Mining at Dakrupe;
- Local Mining Investors in Dakrupe;
- Partners in Participatory Development, Non-Governmental Organization (NGO) operating in the Savannah Region/ Bole District; and
- Environmental Protection Agency (EPA)- Head Office, Accra.

Consultations with stakeholders identified some important environmental and social baseline conditions and issues as well as impacts that have been addressed in the ESMP. Details of stakeholder engagement are provided under Chapter 4 of this report.

Previous consultations with some of the relevant stakeholders was also utilized.

Plate 1-5: Engagement with Some Executive of the Dakrupe Community Mining Committee

1.6.2 Document Review/Desk Study

Information from relevant documents from the PIU was of immense help to completing the ESMP assignment. Key documents reviewed for this study include the following among others:

1. Relevant World Bank ESS especially ESS 1;
2. The World Bank, AEHPMP (P167788) Project Information Document (PID) dated 16 December 2019;
3. Draft Environmental and Social Management Framework (ESMF), Africa Environmental Health and Pollution Management Program (P167788), undated;
4. Draft Stakeholder Engagement Plan (SEP), Republic of Ghana/ Environmental Protection Agency, Africa Environmental Health and Pollution Management Program (P167788), December 2019;
5. Draft Environmental and Social Commitment Plan (ESCP), Republic of Ghana/ Environmental Protection Agency, Africa Environmental Health and Pollution Management Program (P167788), December 2019;
6. Preliminary Design Reports of the Project;
7. The Coordinated Programme of Economic and Social Development Policies (CPESDP) - Agenda for Jobs: Creating Prosperity and Equal Opportunity for All 2017-2024, October 2017;
8. 2021 Population and Housing Census, Results- Ghana Statistical Services, General Report Highlights in Different Volumes, February 2022;
9. Relevant National Policies;
10. Relevant Laws of Ghana including;
    a. The Constitution of the Republic of Ghana, 1992,
    b. Environmental Protection Agency (EPA) Act 1994, Act 490,
    c. Environmental Assessment Regulations (EAR) 1999, LI 652,
    d. Land Act 2020, Act 1036,
    e. Land Use and Spatial Planning Act 2016, Act 925,
    f. National Building Regulation 1996, LI 1630; and
    g. Mining Laws and Policies of Ghana.

Other relevant documents reviewed for this study include:

❍ ESMP documents on other projects obtained from the WB.

1.6.3 Field Inspections/ Visits

Field inspections were undertaken to the Dakrupe site and its immediate environs to confirm the project AoI, appreciate existing socio-economic and cultural conditions as well as existing terrestrial, conditions. The field visits were undertaken in April and July 2024.

1.6.4 Reporting

The ESMP report organization and contents satisfies both the WB ESSs and the EPA environmental assessment requirements. The major headings of the ESMP comprise:

- Introduction;
- Policy, Legal and Institutional Framework;
- Baseline Environmental and Social Conditions;
- Stakeholder Consultations and Disclosure;
- Assessment of Potential Environmental and Social Risks and Impacts, and Alternative Analysis;
- Environmental and Social Management Plan and Recommended Mitigation Measures for Adverse Impacts;
- Environmental and Social Action Plans and Monitoring Programs;
- Institutional Capacity Requirement for ESMP Implementation;
- Decommissioning Plan;
- Conclusion;
- Bibliography; and
- Annexes.

2.0 RELEVANT POLICIES, LEGAL AND INSTITUTIONAL FRAMEWORK

The relevant World Bank Environmental and Social Standards (ESSs) and the national legal, policy and administrative frameworks applicable to the preparation and implementation of the site specific ESMP at Dakrupe are described below to guide implementation of project.

2.1 Relevant World Bank Environmental and Social Standards

The World Bank published a revised version of the safeguard policies in its Environmental and Social Framework (ESF) document (August 2016) in 2018. The ESF sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards (ESS) that are designed to support Borrowers' projects, with the aim of ending extreme poverty and promoting shared prosperity. The ESF comprises:

1. A Vision for Sustainable Development, which sets out the Bank's aspirations regarding environmental and social sustainability;
2. The World Bank Environmental and Social Policy for Investment Project Financing, which sets out the mandatory requirements that apply to the Bank; and
3. The Environmental and Social Standards, together with their Annexes, which set out the mandatory requirements that apply to the Borrower and projects.

There are ten (10) Environmental and Social Standards (ESS) that establishes the standards that the Borrower and the project will meet through the project life-cycle and they are summarized in **Table 2-1**.

Table 2-1: Summary of WB Environmental and Social Standards

Standard	Summary of Core Requirements	Key Requirements of the ESS	Relevance to the Project
ESS 1	Assessment and Management of Environmental and Social Risks and Impacts	ESS 1 places the responsibility of ameliorating the environmental impacts of a Bank-financed project on the borrower. Specifically, the objectives of ESS1 are to: ❍ Identify, evaluate, and manage the environment and social risks and impacts of a Bank financed project in a manner consistent with the Bank's Environmental and Social Standards. ❍ To adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and they are not disadvantaged in sharing development benefits and opportunities resulting from the project. ❍ To utilize national environmental and social institutions, systems, laws, regulations and procedures in the assessment, development, and implementation of projects, whenever appropriate. ❍ To promote improved environmental and social performance, in ways which recognize and enhance Borrower capacity.	ESS 1 is relevant because the project activities in Dakrupe are expected to cause some environmental and social risks and impacts, which will be mitigated accordingly. Thus, ESS 1 is the basis for the preparation of this ESMP.
ESS 2	Labor and Working Condition	Employment creation, income generation and welfare of labor are the core of ESS 2. It recognizes the importance of these in the pursuit of	Activities under the proposed Project at Dakrupe will make use of direct workers and contracted workers,

Standard	Summary of Core Requirements	Key Requirements of the ESS	Relevance to the Project
		poverty reduction and economic growth. It requires management to treat workers fairly and provide them with safe and healthy working conditions to enhance the development benefits of projects.	thus making ESS 2 relevant to the project.
ESS 3	Resource Efficiency and Pollution Prevention and Management	ESS 3 sets out the requirements to address resource efficiency and pollution prevention (air, water and land pollution and management arising out of economic activities and urbanization) throughout the project life-cycle consistent with Good International Industry Practice (GIIP).	The Project at Dakrupe will result in multiple, small and diverse sources of emissions, as well as the generation of waste, thus, making ESS 3 relevant to the Project.
ESS 4	Community Health and Safety	ESS4 addresses the potential health, safety, and security risks and impacts of Bank financed projects (resulting from project activities, equipment, and infrastructure) on project-affected communities. It places a responsibility on the Borrower to avoid or minimize such risks and impacts, with particular attention to people who, because of their circumstances, may be vulnerable.	ESS 4 is relevant because of the potential community health and safety issues to be generated by the Project at Dakrupe e.g., the potential risk of increased Gender-Based violence (GBV) and Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH) due to use of labor outside Dakrupe
ESS 5	Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	ESS 5 recognizes that Bank funded projects may result in involuntary resettlement, which, if unmitigated will lead to severe consequent undesirable socio-economic and environmental impacts on project communities.	This is not relevant as land for the Project at Dakrupe has been donated by the community
ESS 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	ESS 6 recognizes that Bank funded projects could negatively impact on biodiversity and that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development.	ESS 6 is not relevant because the Project will not cause loss of biodiversity. Results of the ecological survey done indicate that the subproject area is a modified habitat, and that small scale mining has led to a decline in the quality of vegetation and loss of flora and fauna.
ESS 7	Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	This ESS applies to a distinct social and cultural group referred to variously as 'Indigenous Peoples', "Sub-Saharan African historically underserved traditional local communities," "indigenous ethnic minorities," "aboriginals," "hill tribes," "vulnerable and marginalized groups," "minority nationalities," "scheduled tribes," "first nations," or "tribal groups ."	This is not relevant as no indigenous peoples will be impact. No such indigenous peoples are in Ghana
ESS 8	Cultural Heritage	ESS 8 recognizes the importance of cultural heritage (natural areas with cultural and/or spiritual value such as sacred groves, sacred bodies of water and waterways, sacred mountains, sacred trees, sacred rocks, burial grounds, and sites) as a source of valuable scientific and historical information, as an economic and social asset for development, and as an integral part of people's cultural identity and practice. It provides continuity in tangible and intangible forms between the past, present and future and reflects constantly	Although no tangible cultural heritage could be found at the Project site at Dakrupe, ESS 8 is relevant because the use of labor outside Dakrupe may infringe on some unique cultures of the community and the civil works may expose some cultural artefact or relic that may call for the attention of the relevant authorities

Standard	Summary of Core Requirements	Key Requirements of the ESS	Relevance to the Project
		evolving values, beliefs, knowledge, and traditions.	
ESS 9	Financial Intermediaries	This ESS applies to Financial Intermediaries (FIs) that receive financial support from the Bank. FIs include public and private financial services providers, including national and regional development banks, which channel financial resources to a range of economic activities across industry sectors.	This is not relevant as no financial intermediaries will be used for the Project at Dakrupe
ESS 10	Stakeholder Engagement and Information Disclosure	This ESS places premium on open and transparent engagement between the Borrower and project stakeholders as an essential element of good international practice.	ESS 10 is relevant to the Project at Dakrupe because it involves diverse stakeholders at every stage (design, planning, construction and operations). In line with this, a standalone Stakeholder Engagement Plan (SEP) has been prepared for the Project.

2.2 National Environmental and Social Policy Framework

The national policies identified as relevant or applicable to the Dakrupe CMDC are presented in this section in **Table 2-2**:

Table 2-2: Relevant National Policies and Applicability to the Proposed Project at Dakrupe

No.	Policy and Key Requirements	Applicability/ Relevance to Proposed Project
1	**The Coordinated Program of Economic and Social Development Policies (CPESDP) 2017-2024- Agenda for Jobs: Creating Prosperity and Equal Opportunity for All** The Agenda for Jobs is the medium-term national development policy framework of Economic and Social Development Policies (CPESDP), 2017-2024 – An Agenda for Jobs: Creating Prosperity and Equal Opportunity for All. It serves as the implementation framework to guide the overall economic and social development of the country. This vision is informed by the need for a strong economy that expands opportunities, inspires people to start businesses, stimulates expansion of existing businesses that ultimately leads to creation of jobs, increased economic growth and higher incomes. The vision also takes cognizance of Ghana's international commitments such as the African Union (AU) Agenda 2063 and the United Nations Sustainable Development Goals (SDGs).	The proposed Project at Dakrupe involves the elimination of mercury in gold mining and promotes enhanced gold production, and associated employment generation and thus in line with the policy objectives
2	**National Environmental Policy (NEP), 2014** The ultimate aim of the National Environmental Policy of Ghana is to improve the surroundings, living conditions and the quality of life of the entire citizenry, both present and future. It seeks to promote sustainable development by ensuring a balance between economic development and natural resource conservation.	The proposed Project at Dakrupe seeks to promote sustainable development by including biophysical environment, economic, social and institutional considerations in its formulation.
3	**National Environmental Action Plan (NEAP), 1991** The NEAP defined a set of policy actions, related investments, institutional mandates and strengthening activities to make Ghana's development approaches environmentally sustainable. The adoption of the NEAP in 1991 led to several significant developments necessary to ensure sound resource management in the following major areas: Land management; Forestry and wildlife; Water management; Marine and coastal ecosystems; Industrial pollution; Mining; Hazardous chemicals control; and Human settlements. The NEAP was thus the strategy through which the key issues to the protection of the environment and better management of renewable resources were to be pursued. Some of the specific resultant developments from the NEAP was the establishment of the Ghana Environmental Protection Agency (EPA) with more enhanced mandate than its predecessor Environmental Protection Council (EPC), to regulate, set standards and enforce them, etc; and, the establishment of the Water Resources Commission, and subsequent adoption of policy framework for water abstraction for different uses, water law, and control of waste discharges into water bodies, etc.	The proposed Project at Dakrupe seeks to promote sustainable development and eliminate mercury use in small scale mining.

No.	Policy and Key Requirements	Applicability/ Relevance to Proposed Project
4	**National Land Policy (NLP), 1999** The Land Policy of Ghana aims at the judicious use of the nation's land and all its natural resources by all sections of the Ghanaian society in support of various socio-economic activities undertaken in accordance with sustainable resource management principles and in maintaining viable ecosystems. One key objective is to ensure that every socio-economic activity is consistent with sound land use through sustainable land use planning in the long-term national interest.	The construction and operation of the proposed CMDC at Dakrupe will be on a land donated by the community through the Dakrupe community mining scheme
5	**National Water Policy (NWP), 2007** The National Water Policy of Ghana provides a framework for the sustainable development of Ghana's water resources. The policy also recognises the various cross-sectoral issues related to water-use and the links to other relevant sectoral policies such as those on sanitation, agriculture, transport and energy among others. It recognizes the competing and conflicting demands of water between mining and adjacent communities. Some of the key policy objectives include ensuring: (i) availability of water for hydropower generation, various industrial/ commercial uses, mining operations, water transport and recreational purposes; and (ii) ensure adequate protection of water sources in mining and other industrial areas.	The Environmental and Social Management Plan (ESMP) includes mitigation measures against traversing water bodies and against water pollution as well as complying with the riparian buffer zones policy.
6	**Riparian Buffer Zone Policy (RBZP), 2014** The Buffer Zone Policy is aimed at protecting, regenerating and maintaining the native /established vegetation in riparian buffer zones to improve water quality. The Policy also designates the following as water pollution hazards and must be setback from any stream or water body by the following distances: o Storage of hazardous substances – 45m; o Raised septic systems – 75m; and o Solid waste landfills- 90m.	The ESMP includes mitigation measures to protect buffer zones of water bodies (streams/ rivers) against setting up processing plants in the buffer zone. The setback distances provided to minimize water pollution will be applied especially for storage of hazardous substances.
7	**Forest and Wildlife Policy, 2012** The policy aims at the conservation and sustainable development of forest and wildlife resources for the maintenance of environmental stability and continuous flow of optimum benefits from the socio-cultural and economic goods and services that the forest environment provides to the present and future generations, whilst fulfilling Ghana's commitments under international agreements and conventions.	The proposed location although not in designated forest zones are in areas where there is substantial vegetative cover in the surroundings hence the need to avoid deforestation and hunting for wildlife.
8	**Ghana National Climate Change Policy (GNCCP), 2013** The objective of the policy is to mitigate and ensure an effective adaptation in key sectors of the economy, such as natural resources management, energy, industry and infrastructure among others. The main principles adduced in the policy for disaster preparedness and response regarding building of climate resilient infrastructure are: o The development of infrastructure and associated facilities has a direct influence on the sustainable development of the nation; and o Incorporating climate-resilient codes into basic infrastructure will significantly reduce the vulnerability of the nation to climate change risks.	The clean mine demonstration center at Dakrupe will be climate resilient and help prevent further impact on climate change in the country.
9	**National Health Policy (NHP), 2020** The National Health Policy (NHP) document which aims at creating wealth through health, among other things places emphasis on improvements in personal hygiene, the practice of safe sex and the prevention of injuries at both workplaces and on the road. The policy objectives include among others to: (i) encourage the adoption of healthy lifestyles; (ii) improve the physical environment; (iii) improve the socio-economic status of the population.	The project will contribute to the elimination of mercury use in mining in the long term and also ensure community health and safety and occupational health and safety compliant measures at the clean mine demonstration centers including safety awareness creation and HIV/ AIDS prevention
10	**National Workplace HIV/AIDS Policy, 2012** The policy goal is to provide broad national guidelines to direct the formulation and implementation of workplace HIV and AIDS policies and programs. The broad objectives of the policy are to: o provide protection from all forms of stigma and discrimination in the workplace, to people with real or perceived HIV infection. o prevent the spread of HIV amongst workers and their families and dependents; and o provide access to treatment, care and support for persons infected and affected by HIV and AIDS.	The project will ensure provision of occupational health and safety measures at the workplaces that will include HIV/ AIDS awareness creation and prevention

No.	Policy and Key Requirements	Applicability/ Relevance to Proposed Project
11	**National Employment Policy (NEmP), 2014** The National Employment Policy indicates that poverty is still high at about 28.5% and that there is a strong correlation between the employment situation and poverty. The policy states that the key source of demand for labor emanates from the productive sectors of the economy, namely, agriculture, industry and service.	The project will provide employment and skills development opportunities for Ghanaians during the pre-construction, construction and operational phases.
12	**National Gender Policy, 2015** The National Gender Policy aims at mainstreaming gender equality concerns into the national development processes by improving the social, legal, civic, political, economic and socio-cultural conditions of the people of Ghana. It also seeks to empower the vulnerable groups particularly women, children, and people with special needs such as persons with disabilities and the marginalized.	The management of the Dakrupe clean mine demonstration center will ensure that an employment quota is given to women and the vulnerable. The criteria for selecting workers will include gender and disability in as far as the person can perform the task assigned.

2.3 Relevant Legal and Regulatory Framework

In Ghana, all minerals in their natural state in or upon any land or water are the property of the Republic of Ghana and vested in the President on behalf of the people of Ghana as enshrined in The 1992 Constitution of the Republic of Ghana, Article 257(6) of Act 527 of 1996. The Minerals Commission was established under the Minerals Commission Act, 1993, (Act 450) which mandates the commission as responsible for the regulation and management of the utilization of the mineral resources of Ghana and the co-ordination of the policies in relation to them. The Act also mandates the Minerals Commission to grant applicable licenses/ lease to registered and qualified mining firms and to ensure compliance with laid down Mineral and Mining Laws and Regulations of Ghana.

In order to manage properly all the issues involved in mining, the Government of Ghana (GoG) has promulgated the following regulations to give meaning to the Minerals and Mining Act, 2006 (Act 703) as amended by the Minerals and Mining (Amendment) Act, 2015 (Act 900) and the Minerals and Mining (Amendment) Act, 2019 (Act 995):

- Minerals and Mining (General) Regulations, 2012 (LI 2173);
- Minerals and Mining (Support Services) Regulations, 2012 (LI 2174);
- Minerals and Mining (Compensation and Settlement) Regulations, 2012 (LI 2175);
- Minerals and Mining (Licensing) Regulations, 2012 (LI 2176);
- Minerals and Mining (Explosives) Regulations, 2012 (LI 2177);
- Minerals and Mining (Health, Safety and Technical) Regulations, 2012 (LI 2182);
- Minerals and Mining (Ground Rent) Regulations, 2018 (LI 2357);
- Minerals and Mining (Mineral Operations- Tracking of Earth Moving and Mining Equipment) Regulations, 2020 (LI 2404); and
- Minerals and Mining (Local Content and Local Participation) Regulations, 2020 (LI 2431);

Thus, the relevant regulatory obligations to guide the project from its conceptualisation to its implementation and monitoring as well as decommissioning include the following and as explained in **Table 2-3**:

Table 2-3: Relevant Legal Framework and Applicability to the Proposed Project at Dakrupe

No.	Legal Framework and Key Compliance Requirements	Applicability to Proposed Project
	Environmental Protection, Planning and Permitting	
1	**The Constitution of the Republic of Ghana, 1992** The Constitution provides for in Article Article 41(k) as a duty of a citizen of Ghana "to protect and safeguard the environment".	This project has been designed to contribute to the protection and safeguarding of Ghana's environment for present and future generations.
2	**Environmental Protection Agency (EPA) Act, 1994 (Act 490)** The Environmental Protection Agency (EPA) Act 1994 (Act 490) gives mandate to the Agency to ensure compliance of all investments and undertakings with	The Agency is ensuring compliance with laid down Environmental Assessment

No.	Legal Framework and Key Compliance Requirements	Applicability to Proposed Project
	laid down Environmental Assessment (EA) procedures in the planning and execution of development projects, including compliance in respect of existing ones. The Environmental Protection Agency (EPA) Act 490 Section 12 of 1994 confers enforcement and control powers on the EPA to compel existing companies to meet environmental or pollution management plans on their operations as a management tool for effective pollution control. The EPA is the responsible for issuing environmental permits for operations such as this project subject to EPA review.	(EA) procedures in the planning and execution of the project. An environmental permit from the EPA is required prior to commencement of works and would be obtained using this ESMP document.
3	**Environmental Assessment Regulations, 1999 (LI 1652)** The Environmental Assessment Regulations 1999 (LI 1652) enjoins any proponent or person to register an undertaking with the Agency and obtain an Environmental Permit prior to commencement of the project. This regulation allows the EPA to place proposed undertakings at the appropriate level of environmental assessment. The LI 1652 seeks to ensure that development is undertaken in a sustainable environment. Part 1 of the Environmental Assessment Regulations, 1999 LI 1652 on Environmental Permit describes undertakings requiring registration and issuance of environmental permit, as: '1. (1) No person shall commence any of the undertakings specified in Schedule 1 to these Regulations or any undertaking to which a matter in the Schedule relates, unless prior to the commencement, the undertaking has been registered by the Agency and an environmental permit has been issued by the Agency in respect of the undertaking. 2. No person shall commence activities in respect of any undertaking which in the opinion of the Agency has or is likely to have adverse effect on the environment or public health unless, prior to the commencement, the undertaking has been registered by the Agency in respect of the undertaking.'	An ESMP (or a Preliminary Environmental Report in the case of country requirements) is being prepared in compliance with the requirements of the World Bank, and Ghana's Environmental Assessment Regulations, 1999 (LI 1652). The project activities will not occur in an environmental sensitive area (as no environmental sensitive areas have been identified in the project area, which is a mining concession)
4	**Fees and Charges (Miscellaneous Provision) Act, 2022(Act 1080)** The Fees and Charges (Miscellaneous Provision) Act 2022 replaces the Fees and Charges (Amendment) Instrument 2019 (L.I. 2386) and it provides comprehensive rates, fees and charges collectable by Ministries, Department and Agencies (MDAs) for goods and services delivered to the public.	All stipulated fees and charges including Processing and Permit Fees shall be paid by the PIU in order to obtain the environmental permit from EPA
5	**Water Resources Commission (WRC) Act, 1996 (Act 522)** The Water Resources Commission Act, 1996 (Act 522) establishes and mandates the Water Resources Commission (WRC) as the sole agency responsible for the regulation and management of the utilisation of water resources and for the co-ordination of any policy in relation to them. Section 13 prohibits the use of water (divert, dam, store, abstract or use water resources or construct or maintain any works for the use of water resources) without authority. Section 16 empowers the Commission to grant Water Rights (water use permits) to prospective users. The Act states under Section 24 that any person who pollutes or fouls a water resource beyond the level that the EPA may prescribe, commits an offence and is liable on conviction to a fine or a term of imprisonment or both.	The project will involve the use of water for the mercury free gold processing plants. The appropriate authorization will be sought from the WRC prior to the commencement of the work(s).
6	**Water Use Regulations, 2001 (LI 1692)** The Water Use Regulations 2001, LI 1692 prohibits the use of water resources without authority from the Water Resources Commission. The Act provides under section 16 for any person to apply to the Commission in writing for the grant of water right. The Regulations also prescribe the raw water charges and processing fees to be paid by prospective water users with respect to the water use permits. The Commission is also mandated to request for evidence that an EIA or an EMP has been approved by the EPA before issuance of the Water Use Permit.	The PIU will be required to acquire a water use permit after obtaining the environmental permit. The abstraction of water for any aspect of the Project at Dakrupe will also require a water use permit from the Commission.
7	**Hazardous and Electronic Waste Control and Management Act, 2016 (Act 917)** The Act prohibits the importation, exportation, transportation, selling, purchasing or dealing in hazardous wastes or other waste, or depositing of hazardous wastes or other wastes on any land in the country or in the territorial waters of Ghana except as otherwise provided for in the Act.	All hazardous and electronic waste arising out of the proposed project implementation will be managed in compliance with this law. Waste oils, e-waste chemical additives/ admixtures for construction and any expired chemicals requiring disposal will fall under this law
	Health/Safety	
8	**Public Health Act, 2012 (Act 851)** The Act makes provision with respect to the protection of public health in Ghana to prevent diseases, promote, safeguard, maintain, and protect the health of humans and animals in the country and lays down rules relative to environmental sanitation (Part 5).	The project activities will be guided by this Act in (i) ensuring the prevention of communicable diseases to workers and (ii) that the project activities do not

No.	Legal Framework and Key Compliance Requirements	Applicability to Proposed Project
	The Act among other things, provides rules relative to food vending and food-borne diseases. Part 7 of the Act mandates the Food and Drugs Authority (FDA) to protect the public through the regulation of food, drugs, household chemical substances, cosmetics and medical devices.	adversely affect the health of communities hosting the clean mine demonstration center.
9	**Ghana National Fire Service Act, 1997 (Act 537)** The Act re-establishes the National Fire Service to provide for the management of undesired fires and to make provision for related matters. The objective of the Service is to prevent and manage undesired fire. For the purpose of achieving its objective, the Service is to organise public fire education programs to create and sustain awareness of the hazards of fire, heighten the role of the individual in the prevention of fire and provide technical advice for building plans in respect of machinery and structural layouts to facilitate escape from fire, rescue operations and fire management. The GNFS has a rural fire department responsible for the control and management of bushfires.	This act requires the PIU and miners to register their facilities/work offices with GNFS who will provide advisory and emergency response services in the detection/prevention and management of fire outbreaks at the project sites and facilities. The GNFS is mandated to create awareness and conduct sensitization programs on fire prevention and control as well as issue fire permits for proposed project sites and facilities.
	Minerals and Mining	
10	**Minerals Commission Act, 1993 (Act 450)** The act establishes the Minerals Commission and provides for its composition and functions relating to the regulation and management of the utilisation of minerals. The act also provides for other related matters.	The Act requires the miners to comply with the requirements of the Minerals Commission
11	**The Minerals and Mining Act, 2006 (Act 703)** The Act revises and consolidates the law relating to minerals and mining and provides for connected purposes. It states that every mineral is "vested in the President in trust for the people of Ghana". Section 73 of Act 703 provides for compensation for disturbance of owner's rights which includes resettlement. It indicates that the owner or lawful occupier of any land subject to mineral right is entitled to compensation for disturbance of his/her rights and the amount of compensation should be determined by agreement between the parties, the Lands Valuation Division will determine the compensation payable. Section 74 of the act provides for the compensation principles to be applied. Where resettlement is triggered, it shall be carried out with due regard to the economic well-being and social and cultural value of the affected people and the cost of resettlement borne by the holder of mineral right. The subsidiary legislations for the management of the minerals and mining industry to operationalize the Minerals and Mining Act, 2006 (Act 703) as indicated supra include the following: o Minerals and Mining (General) Regulations, 2012 (LI 2173); o Minerals and Mining (Support Services) Regulations, 2012 (LI 2174); o Minerals and Mining (Compensation and Settlement) Regulations, 2012 (LI 2175); o Minerals and Mining (Licensing) Regulations, 2012 (LI 2176); o Minerals and Mining (Explosives) Regulations, 2012 (LI 2177); o Minerals and Mining (Health, Safety and Technical) Regulations, 2012 (LI 2182); o Minerals and Mining (Ground Rent) Regulations, 2018 (LI 2357); o Minerals and Mining (Mineral Operations- Tracking of Earth Moving and Mining Equipment) Regulations, 2020 (LI 2404); and o Minerals and Mining (Local Content and Local Participation) Regulations, 2020 (LI 2431); Excerpts of aspects of the listed regulations are as presented hereunder: Among the many regulations of LI 2173 is the requirement to ensure good record keeping and reporting obligations (Regulation 8). LI 2174 regulates the registration of entities to provide support services to a holder of a mineral right and what is required of them. LI 2175 regulates the requirements for compensation payment and resettlement. It specifies the formulation of resettlement plan and engagement of the affected persons among others. LI 2176 regulates the grant of various licenses in the mining sector including the grant of mining leases. LI 2177 regulates the conveyance, storage, possession, manufacture, and use of explosives for mining, quarrying, and civil works as well as substances used for manufacture of explosives.	The Act requires the miners to comply with a number of legislations providing for the health, safety and other issues pertaining to the operation of the mine

No.	Legal Framework and Key Compliance Requirements	Applicability to Proposed Project
	The regulation 8(1) of the Minerals and Mining (Health, Safety and Technical) Regulations 2012, LI 2182 stipulates that the holder of a mining lease must obtain a Mining Operating Permit from the Inspectorate Division of the Minerals Commission prior to commencement of operations by submitting to the Division a Mining Operating Plan (MOP), the content of which is as set out in Regulation 9. The regulation 11(1) of the Minerals and Mining (Health, Safety and Technical) Regulations 2012, LI 2182 stipulates that the owner or manager of a mine shall submit to the Inspectorate Division for Approval, an Emergency Response Plan (ERP) capable of being implemented at any time in response to an emergency that occurs in the mine. The LI 2357 specifies the ground rent payable annually by a mineral rights holder in respect of a cadastral unit of land. The purpose of LI 2404 is to (i) provide for the registration and tracking of earth moving and mining equipment used in mineral operations and (ii) ensure that the earth moving and mining equipment are used only in the specific mineral rights area that the earth moving and mining equipment is registered for. LI 2431 reinforces the need for local participation and local content in the mining value chain. The implication for the project will be to comply with above mentioned LIs presented supra.	
	Labour Rights	
12	**<u>The Labour Act, 2003 (Act 651)</u>** Section 118(1) of the Labour Act 2003 (Act 651) stipulates that it is the duty of an employer to ensure that every worker employed works under satisfactory, safe and healthy conditions. Act 651 contains several specific provisions relating to an employer's duty of care to its workers. These include providing and maintaining "at the workplace, plant and system of work that are safe and without risk to health" and taking "steps to prevent contamination of the workplaces by, and protect the workers from, toxic gases, noxious substances, vapours, dust, fumes, mists and other substances or materials likely to cause risk to safety or health". A worker is required to report situations that he believes may pose "an imminent and serious danger to his or her life, safety or health". The law prohibits persons below the age of eighteen from employment to operate any lifting machine driven by mechanical power or to give signals to its operator.	This Act requires the PIU and the miners to ensure the welfare of workers. The miners will be committed to ensure the safety and health of their workers by providing a safe working environment and providing the required apparatus and measures to mitigate impacts.
13	**<u>Workmen Compensation Law, 1987 (PNDCL 187)</u>** The law holds employers responsible for the payment of compensation to workmen for personal injuries caused by accidents arising out and in the course of their employment.	The Law enjoins the PIU to ensure and be responsible for the safety of its workers and provide compensation to its workers for injuries arising in the course of work in accordance with this Law
14	**<u>Persons with Disability Act, 2006 (Act 715)</u>** The Act covers key thematic provisions such as rights, accessibility, employment, education and transportation for Persons with Disabilities (PWDs) amongst others. Section 6 states that the owner or occupier of a place to which the public has access shall provide appropriate facilities that make the place accessible to and available for use by a person with disability. Section 10 of the Act 10. (1) The Government shall grant a person who employs a person with disability an annual tax rebate of the taxable income in respect of each person with disability employed as shall be prescribed in Regulations made under this Act.	The PIU and the miners will be guided by this Act in the design of the mercury free plants and the employment of labour for the proposed project and will ensure that there is no discrimination against PWDs
15	**<u>The Children's Act, 1998 (Act 560)</u>** The Act spells out the rights of the child, quasi-judicial/ judicial child adjudication, parentage/ custody/ access/ maintenance, fosterage/ adoption and employment of children issues. The Act defines a child as a person below the age of 18 years. The minimum age for admission of a child to employment is fifteen years and the minimum age for the engagement of a person in hazardous work is eighteen years. No person shall engage a child in exploitative labour; labour is exploitative of a child if it deprives the child of its health, education or development.	The PIU and the miners will be guided by this Act in the employment of labor for the proposed facility and will ensure all persons engaged are not below the minimum age.
	Land Acquisition/Land Use	
16	**<u>Land Act, 2020 (Act 1036)</u>** The Land Act, 2020 (Act 1036) repeals the State Lands Act, 1962 (Act 125), and other related laws. Section 2 of Chapter 3 of the Act 1036 states that "A holder of an interest or right in land may, by an instrument, transfer that interest or right to any person with or without consideration."	The PIU will ensure that the Dakrupe CMDC has acquired all the necessary land documents and are valid.

No.	Legal Framework and Key Compliance Requirements	Applicability to Proposed Project
	Section 234(2) of the Act 1036 also states that "the State may accept land as gift from the owner of the land and the land shall, where the donor specifies a purpose for the gift, be used for the purpose determined by the owner."	
17	**The Land Use and Spatial Planning Act, 2016 (Act 925)** The Act seeks to revise and consolidate the laws on land use and spatial planning, provide for sustainable development of land and human settlements through a decentralized planning system, ensure judicious use of land in order to improve quality of life, promote health and safety in respect of human settlements and to regulate national, regional, district and local spatial planning, and generally to provide for spatial aspects of socio-economic development and for related matters. This Act therefore repeals the following: (i) Town and Country Planning Act 1945 CAP 84; (ii) Part II of Act 462 on Planning Functions; (iii) Towns Act of 1892, CAP 86; and Towns and Country Planning (Amendment) Act 1960, Act 33.	The design of the proposed project facilities must conform with the planning regime of LUSPA
18	**National Building Regulations, 1996 (LI 1630)** The National Building Regulations, LI 1630 provides guidance and standard to any person who intends to erect any building; or make any structural alteration to any building; or executes any works or installs any fittings in connection with any building. As per clause 14.14 of the National Building Regulations, "…buildings of four floors and over shall be subject to such requirements as may be laid down by the District Planning Authority for each particular case". The process of obtaining a development permit makes it contingent on the issuance of an environmental permit by the EPA.	The implication of this Act is that a Development Permit would have to be obtained from the Bole District Assembly
Local Governance and Alternative Dispute Resolutions		
19	**Local Governance Act, 2016 (Act 936)** The Local Governance Act 2016, which repeals the Local Government Act 1993 (Act 462) re-establishes and regulates the local government system and gives authority to the Regional Coordinating Council (RCC) and the District Assembly (DA) to exercise political and administrative power in the Regions and District, provide guidance, give direction to, and supervise all other administrative authorities in the regions and district respectively. The Assembly is mandated to initiate programs for the development of basic infrastructure and provide municipal works and services as well as be responsible for the development, improvement and management of human settlements and the environment in the district. The Local Governance Act 2016 also empowers the Assemblies to establish Waste Management Departments to be responsible for the development and management of waste disposal within their areas of jurisdiction. Therefore, the management of waste at the construction and operational stages of the proposed project will have to be done in conjunction with the relevant MMDAs	The Bole District Assembly will provide the needed supervisory roles in the implementation of the proposed Project at Dakrupe and the ESMP.
20	**Alternative Dispute Resolution Act, 2010 (Act 798)** The purpose of the Act is to "…provide for the settlement of disputes by arbitration, mediation and customary arbitration, to establish an Alternative Dispute Resolution Center and to provide for related matters." The Act further defines Alternative Dispute Resolution "as the collective description of methods of resolving disputes otherwise than through the normal trial process" (Section 135). The ADR Act covers both domestic and international arbitration in Ghana and the enforcement of both domestic and foreign arbitral awards within the jurisdiction.	The PIU and the miners will ensure that the alternative dispute resolution option is used to address disputes and conflicts within the frame of the EPA GRM and other indigenous ways of resolving disputes instead of the more expensive and time-consuming legal court system.

2.3.1 Ghana Standards on Environmental Quality

The Ghana Standards Authority (GSA) has in collaboration with the EPA and through various National Technical Committees issued Ghana Standard (GS) requirements for Noise Control and Measurements, and Air Quality, and Requirements for Effluent Discharge (General Industry) as follows:

1. GS 1236:2019- Environment and Health Protection – Requirements for Ambient Air Quality and Point Source/ Stack Emissions;
2. GS 1222:2018- Health Protection – Requirements for Ambient Noise Control; and
3. GS 1212:2019- Environmental Protection Requirements for Effluent Discharge (General Industry).

2.3.1.1 GS 1236:2019

The GS 1236:2019 provides for permissible levels for a variety of air pollutants as shown in **Table 2-4.**

Table 2-4: National Ambient Air Quality – GS 1236:2019

NO.	SUBSTANCE	TIME WIGHTED AVERAGE, (TWA)	AVERAGING TIME
1.	Sulphur Dioxide (SO_2)	*520* µgm^{-3} 50 µgm^{-3}	*1hr* 24hrs
2.	Nitrogen Oxides (measured as NO_2)	*250* µgm^{-3} 150 µgm^{-3}	*1hr* 24hrs
3.	Total Suspended Particulate (TSP/SPM)	*150* µgm^{-3} 80 µgm^{-3}	*24hrs* 1yr
4.	PM_{10}	*70* µgm^{-3} 70 µgm^{-3}	*24hrs* 1yr
5.	$PM_{2.5}$	*35* µgm^{-3}	*24hrs*
6.	Carbon Monoxide (CO)*	*100 mg/m^3* 60 mg/m^3 30 mg/m^3 10 mg/m^3	*15mins* 30mins 1hr 8hrs

(Source: GSA, 2019) *……Fenceline Air Pollutant Standard*

2.3.1.2 GS 1222:2018

The GS 1222:2018 provides for permissible night and day noise levels as shown in **Table 2-5.**

Table 2-5: Ambient Noise Control Levels

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

(Source: GSA, 2018)

2.3.1.3 GS 1212:2019

The environmental protection- requirements for effluent discharge are as provided in **Table 2-6.**

Table 2-6: Environmental Protection - Requirements for Effluent Discharge for Gold Mining

Parameter	Unit	GS 1212:2019+
Color	TCU	200
Conductivity	µS/cm	1,500
Temperature	°C	≤ 3° above ambient
Turbidity	NTU	75
pH	pH Units	6 - 9
Total Dissolved Solids (TDS)	mg/l	1,000
Total Suspended Solids (TSS)	mg/l	50
COD	mg/l	250
Ammonia as Nitrogen	mg/l	1
Nitrate as Total Nitrogen	mg/l	50
Oil/ Grease	mg/l	5
Fluoride	mg/l	10
Cyanide (Total)	mg/l	1
Free Cyanide	mg/l	0.2

Parameter	Unit	GS 1212:2019+
WAD Cyanide	mg/l	0.6
Silica	mg/l	20
Selenium	mg/l	1
Copper	mg/l	5
Arsenic (Total)	mg/l	1.0
Arsenic (Soluble)	mg/l	0.1
Chromium (Total)	mg/l	0.5
Lead	mg/l	0.1

(Source: GSA, 2019)

2.3.2 Project Standards

The proposed project will apply the stricter of either national laws or the WBG standards (EHS Guidelines). The Project standards for emissions and performance therefore are the stricter of:

- Ghana standards; and
- Applicable standards of the World Bank Group EHS Guidelines.

2.4 World Bank Group Environment, Health and Safety (EHS) Guidelines

The World Bank Group (WBG) Environmental, Health, and Safety (EHS) Guidelines (General EHS Guidelines, April 30, 2007) are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The industry sector EHS guidelines are designed to be used together with the General EHS Guidelines document. The applicable EHS guidelines include:

1. General EHS Guidelines.
2. EHS Guidelines for Mining; and
3. EHS Guidelines for Base Metal Smelting and Refining.

2.4.1 General EHS Guidelines

The General EHS Guidelines (April 30, 2007) provides guidance to users on common EHS issues potentially applicable to all industry sectors. The general guidelines provide GIIP advice relating to the following elements to protect human health and the environment.

The WBG General EHS Guidelines are relevant to the proposed project as they provide internationally accepted GIIP for relevant EHS issues. The recommendations contained in the guidelines will be reviewed during the preparation of the ESMPs and will be incorporated into the prescribed management and mitigation measures as appropriate.

2.4.2 EHS Guidelines for Mining

The EHS Guidelines for Mining are applicable to underground and open-pit mining, alluvial mining, solution mining, and marine dredging. Potential environmental issues associated with mining activities may include management of the following:

- Water use and quality;
- Wastes;
- Hazardous materials;
- Land use and biodiversity;
- Air quality;
- Noise and vibrations;
- Energy Use; and
- Visual Impacts.

2.4.3 EHS Guidelines for Base Metal Smelting and Refining

The EHS Guidelines for Smelting & Refining cover information relevant to base metal smelting and refining of lead, zinc, copper, nickel, and aluminum. It does not include the mining and concentration of the raw materials, which is covered in the EHS Guidelines for Mining. Significant environment aspects of smelting and refining during the operational phase relate to:

- Air Emissions;

- Wastewater;
- Hazardous materials;
- Residues and waste; and
- Noise

2.5 Relevant International Conventions and Protocols

The following international laws and conventions which Ghana is a signatory are considered applicable to this proposed project:

- African Charter on Human and Peoples' Rights (adopted 1998, entered into force 2005);
- African Convention on the Conservation of Nature and Natural Resources (adopted 1968, entered into force 1969);
- International Covenant on Economic, Social and Cultural Rights (adopted 1966, entered into force 1976);
- International Labor Organization's (ILO) Core Labor Standards on Freedom of association and collective bargaining; conventions 87 (1950) and 98 (1951);
- Elimination of forced and compulsory labor; conventions 29 (1932) and 105 (1959)
- Elimination of discrimination in respect of employment and occupation; conventions 100 (1953) and 111 (1960)
- Abolition of child labor; conventions 138 (1976) and 182 (2000)
- United Nations Convention on the Protection of the Rights of All Migrant Workers and Members of their Families (adopted 1990, entered into force 2003)
- United Nations Framework Convention on Climate Change (adopted 1992, entered into force 1994)
- Kyoto Protocol to the United Nations Framework Convention on Climate Change (adopted 1997, entered into force 2005)
- United Nations Convention on Biological Diversity (adopted 1992, entered into force 1993)

Also applicable to this project is the International Cyanide Management Code.

2.5.1 SDGs and ASGM

The Sustainable Development Goals (SDGs) are global problems defined into 17 goals with 169 specific targets. These goals recognize that ending poverty must go hand-in-hand with strategies that build economic growth and address a range of social needs including education, health, social protection, and job opportunities while tackling climate change and environmental protection. They serve as a guidebook to drive a country's specific focus areas, policies, regulations, financing, stimulus programs, and many other activities aimed to achieve sustainable development. The proposed Project at Dakrupe will yield a CMDC for the development of a sustainable ASGM in the area. The infrastructure of the Dakrupe CMDC will ensure that current unsustainable mining methods including mercury use are eliminated ensuring a more economic, financial, social, environmental (including climate resilience), and institutional sustainability over the entire life cycle of the Project at Dakrupe. The Project will impact all the SDG goals especially Goal 1- eliminating poverty of all forms, Goal 3- ensure a healthy working environment by preventing the spread of infectious diseases such as HIV/AIDS, COVID 19 and others as well as diseases due to mercury contamination, Goal 5- to give equal employment opportunity for both men and women, Goal 8- to ensure the employment of youth, consultants and local artisans such as plumbers, electricians and many others, Goal 13- to build a climate change resilient infrastructure, Goal 15- ensure environmental sustainability in the process of construction and goal 17- fostering partnerships between financiers and miners.

2.5.2 Paris Agreement

The Paris Agreement was adopted in 2015 as an international agreement to address climate change that required deeper emissions reduction commitments from all countries both developed and developing. It seeks to hold global warming to below 2.0°C above pre-industrial levels and pursue further to limit this to 1.5°C. The Paris Agreement calls for sustainable development by providing opportunities for the Parties to reduce their emissions through economy-wide and

sectoral mitigation actions, in accordance with their state of development, their national circumstances, and in full compliance with the principles and provisions of the UN Framework Convention on Climate Change (UNFCCC) through their Nationally Determined Contributions (NDCs). In their NDCs, countries communicate actions they will take to reduce their Greenhouse Gas emissions in order to reach the goals of the Paris Agreement. Countries also communicate in the NDCs, actions they will take to build resilience to adapt to the impacts of rising temperatures. The lands and natural resources sector which encompasses minerals and mining is one of Ghana's focal areas for climate change mitigation of which the proposed AEHPMP will take cognizance of this agreement.

2.5.3 GHA-Nationally Determined Contributions (NDCs): 2020 – 2030

Ghana's NDCs sought to reduce emissions by 15% to 45% below business-as-usual scenario by 2030 and strengthen climate resilience in close alignment with its development priorities. In all, 20 mitigation and 11 adaptation actions were outlined to take place across seven priority economic sectors - energy, agriculture, industry, transport, waste, and forestry and other land uses. The 20 mitigation measures have strong development imperatives and aim to scale up renewable energy, promote clean cooking and lighting, double energy efficiency in households and industry, promote mass urban transportation, reducing emissions from deforestation and forest degradation (REDD+), and promote alternative solid waste management. The 11 adaptation measures aim to build resilience in vulnerable agriculture landscapes, enhance value addition in the utilization of forest resources, promote resilient infrastructure, promote early warning systems and disaster prevention; manage climate-induced health risk; promote integrated waste management, and address gender considerations. The proposed Project at Dakrupe will take cognizance of this commitment.

2.5.4 Convention on Biological Diversity (1992)

The Convention of Biological Diversity (CBD) was signed by 150 government leaders at the 1992 Rio Earth Summit, dedicated to promoting sustainable development. Conceived as a practical tool for translating the principles of Agenda 21 into reality, the convention recognize that biological diversity is not only about plants, animals and microorganisms and their ecosystems but also about people and our need for food security, medicines, fresh air and water, shelter and a clean and health environment in which we live in. The objective of CBD is to ensure preserving and sustaining biological diversity.

2.5.5 The Fundamental Conventions on Occupational Safety and Health (OSH): ILO Convention No. 155 (1981) on OSH and 187 (2006) on Promotional Framework for OSH

These Conventions are fundamental rights for a safe and healthy working environment. They express a renewed collective commitment to the protection of life and health at work. The core principles of Conventions Nos. 155 and 187 are fully complementary, and together they constitute a blueprint for progressive and sustained improvements towards the provision of safe and healthy working environments. Conventions Nos. 155 and 187 serve as the basis for additional occupational safety and health measures provided in other specific OSH instruments e.g., Convention No. 148 i.e., Working Environment (Air Pollution, Noise and Vibration). Additionally, to progressively achieve a safe and healthy working environment, Members need to take into account the principles set out in the ILO instruments relevant to the promotional framework for OSH.

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

The Convention encourages employers that in consultation with their workers, they should understand project hazards related to air pollution, noise pollution, and vibrations. Under the Convention No 148, national laws or regulations shall prescribe those measures be taken for the prevention and control of, and protection against, occupational hazards in the working environment due to air pollution, noise and vibration.; and provisions concerning the practical implementation of the measures so prescribed may be adopted through technical standards, codes of practice and other appropriate methods.

2.5.7 The United Nations Convention of the Child

The United Nations Convention of the Child is an important agreement by countries who have promised to protect children's rights. It defines a child as any person under the age of 18 years. The Convention explains who children are, all their rights, and the responsibilities of governments. All the rights are connected, they are all equally important and they cannot be taken away from children. All children have all these rights, no matter who they are, where they live, what language they speak, what their religion is, what they think, what they look like, if they are a boy or girl, if they have a disability, if they are rich or poor, and no matter who their parents or families are or what their parents or families believe or do. No child should be treated unfairly for any reason.

2.5.8 International Cyanide Management Code

The International Cyanide Management Code for the Manufacture, Transport, and Use of Cyanide in the Production of Gold (Cyanide Code) is a voluntary, performance driven, certification program of best practices for gold and silver mining companies and the companies producing and transporting cyanide used in gold and silver mining. It provides a mechanism of assurance for enhancing the protection of human health and reducing the potential for environmental impacts. The objective of the Cyanide Code is to improve the management of cyanide used in gold and silver mining and to improve the protection of human health and the reduction of environmental impacts, while assuring stakeholders of the safe handling of cyanide through the disclosure of results from periodic audits by independent professional auditors.

Based on Principles and Standards of Practice, the Cyanide Code provides a management system for the safe management of cyanide throughout its use cycle.

2.5.9 Gap Analysis – Comparison of Ghana's Regulations/ Policies and World Bank ESF for Handling Environmental and Social Risks

From the above discussions, it is clear that significant gaps exist between Ghanaian national regulations and the applicable World Bank ESSs. These are summarized in **Table 2-7**. These gap bridging measures are to ensure compliance with the ESSs.

Table 2-7: Comparison of Ghana's Regulations/ Policies and World Bank ESF for Handling Environmental and Social Risks

Scope/Objective	Description of Bank Policy	Description of Government of Ghana Regulation	Gaps Identified	Gap Bridging Actions
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts				
○ Identify, evaluate and manage the environment and social risks and impacts of the project in a manner consistent with the ESSs. ○ To adopt a mitigation hierarchy approach to: - Anticipate and avoid risks and impacts - Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels; - Once risks and impacts have been minimized or reduced, mitigate; and - Where significant residual impacts remain, compensate for or offset them, where technically and financially feasible.	The standard provides guidance on assessing the Project's potential environmental and social risks and impacts and addressing potential impacts through planning and mitigation hierarchy approach.	Environmental Assessment. Regulation 1 (2) of LI 1652 mandates that no person shall commence an undertaking which in the opinion of the Agency has or is likely to have adverse effects on the environment or public health unless, prior to the commencement, the undertaking has been registered by the EPA and an environmental permit has been issued by the Agency in respect of the undertaking.	Even though the regulation seeks to anticipate and mitigate/avoid risks and impacts, it does not fully address potential impacts and mitigation hierarchy approach e.g., content wise it does not address impacts on the vulnerable.	○ The capacities of the PIU staff on world bank ESF will also be built at the early stage of project implementation to enable them collaborate effectively in addressing this gap
ESS2: Labor and Working Conditions				
○ To promote safety and health at work, fair treatment, non-discrimination and equal opportunity of project workers including vulnerable workers such as women, persons with disabilities, children etc. ○ To prevent the use of all forms of forced labor and child labor. ○ To support the principles of freedom of association and collective bargaining of project	ESS2 promotes the fair treatment, non-discrimination and provision of equal opportunities for workers engaged on projects it supports. It strongly encourages protection of all project workers, including vulnerable groups such as women, persons with disabilities, children (of working age) and migrant workers, contracted workers and primary supply workers, as appropriate. It provides certain requirements that the project must meet in terms of	○ The Labor Act 2003 (Act 651) provides for the rights and duties of employers and workers; legal or illegal strike; guarantees trade unions the freedom of associations and establishes Labor Commission to mediate and act in respect of all labor issues. Under Part XV (Occupational Health Safety and Environment), the Act explicitly indicates that it is the duty of an employer to ensure	Although the Labor Commission makes provision for anticipated labor-related complaints and redress, beneficiaries' access (distance and processes) to the commission at the district-level may be a challenge.	○ The project will use the Project Grievance Redress Mechanism (GRM) which addresses concerns promptly

Scope/Objective	Description of Bank Policy	Description of Government of Ghana Regulation	Gaps Identified	Gap Bridging Actions
workers in a manner consistent with national law. ○ To provide project workers with accessible means to raise workplace concerns.	working conditions, protection of the work force (especially the prevention of all forms of forced and child labor), and provision of a grievance mechanism that addresses concerns on the project promptly and uses a transparent process that provides timely feedback to those concerned.	the worker works under satisfactory, safe and healthy conditions. ○ The Workmen's Compensation Act 1987 (PNDCL 187) seeks to address the necessary compensations needed to be awarded to workers for personal injuries arising out of and in the course of their employment.		
OHS Hazard identification and right of employees to remove themselves from such workplaces without being punished.	Under ESS 2, workplace processes will be put in place for project workers to report work situations that they believe are not safe or healthy, and to remove themselves from a work situation which they have reasonable justification to believe presents an imminent and serious danger to their life or health. Project workers who remove themselves from such situations will not be required to return to work until necessary remedial action to correct the situation has been taken. Project workers will not be retaliated against or otherwise subject to reprisal or negative action for such reporting or removal.	Regulation 85 and 550 of LI 2182 details some obligations of workmen pertaining to their safety	The law requires an employee to assist others in removing them form an unsafe situation and to assist the manager in performing some relevant duties, but such duties have not been explicitly stated.	
ESS3: Resource Efficiency and Pollution Prevention and Management				
To achieve the sustainable use of resources, including implementing measures that avoids or reduces pollution resulting from project/ activities	The ESS 3 provides requirements for projects to achieve the sustainable use of resources, including energy, water and raw materials, as well as implement measures that avoids or reduces pollution resulting from project activities. The standard places specific consideration on hazardous wastes or materials and air emissions (climate pollutants) given that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens	The Act 490 mandates the EPA to enforce compliance with established EIA procedures among companies and businesses in the planning and execution of development projects, including existing ones.	To achieve the sustainable use of resources, including implementing measures that avoids or reduces pollution resulting from project activities	The ESS3 provides requirements for projects to achieve the sustainable use of resources, including energy, water and raw materials, as well as implement measures that avoids or reduces pollution resulting from project activities. The standard places specific consideration on hazardous wastes or materials and air emissions to be complied with.

Scope/Objective	Description of Bank Policy	Description of Government of Ghana Regulation	Gaps Identified	Gap Bridging Actions
	the welfare of present and future generations.			
ESS4: Community Health and Safety				
○ To anticipate and avoid adverse impacts on the health and safety of project affected communities during the project lifecycle from both routine and non-routine circumstances. ○ To promote quality and safety, and considerations relating to climate change, in the design and construction of infrastructure. ○ To ensure that safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.	This standard recognizes that project activities, equipment and infrastructure increase the exposure of project stakeholder communities to various health, safety and security risks and impacts and thus recommends that projects implement measures that avoids or limits the occurrence of such risks. It provides further requirements or guidelines on managing safety, including the need for projects to undertake safety assessment for each phase of the project, monitor incidents and accidents and preparing regular reports on such monitoring. ESS4 also provides guidance on emergency preparedness and response.	Public Health Act, 2012, Act 851 revises and consolidates all the laws and regulations pertaining to the prevention of disease, promote, safeguard and maintain and protect the health of human and animals, and to provide for related matters. The law has merged all provisions in the criminal code, ordinances, legislative and executive instruments, acts, by-laws of the District Assemblies etc. The Act enjoins the provision of sanitary stations and facilities, destruction of vectors including mosquitoes, protection of water receptacles and the promotion of environmental sanitation. The LI 2182 however, provides for the provision of an Emergency Response Plan (ERP) as part of the mines Mining Operation Plan (MOP).	The Act does not consider assessment of events and measures to deal with occurrences and emergencies. This is however achieved in the Emergency Response Plan (ERP) required under LI 2182.	An Emergency Response Plan has been provided as part of the ESMP
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources				
○ To protect and conserve biodiversity and habitats. ○ To apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity. ○ To promote the sustainable management of living natural resources. ○ To support livelihoods of local communities, including Indigenous Peoples, and inclusive economic development, through the adoption of	ESS 6 promotes the conservation of biodiversity or natural habitats and supports the protection and maintenance of the core ecological functions of natural habitats and the biodiversity they support. It also encourages projects to incorporate into their development, environmental and social strategies that address any major natural habitat issues, including identification of important natural habitat sites, the ecological functions they perform, the degree of threat	The 1994 Forest and Wildlife Policy was revised in 2011 and subsequently approved in 2012 aims at the conservation and sustainable development of forest and wildlife resources for the maintenance of environmental stability and continuous flow of optimum benefits from the socio-cultural and economic goods and services that the forest environment provides to the present and future generations, whilst fulfilling Ghana's commitments under international agreements and conventions.	Adequate provisions have been made under a number of national laws and policies.	The project will take measures to protect and conserve biodiversity and habitats and all requirements specified in the ESS 6

Scope/Objective	Description of Bank Policy	Description of Government of Ghana Regulation	Gaps Identified	Gap Bridging Actions
practices that integrate conservation needs and development priorities.	to the sites, and priorities for conservation.			
ESS8: Cultural Heritage				
○ To protect cultural heritage from the adverse impacts of project activities and support its preservation. ○ To address cultural heritage as an integral aspect of sustainable development. ○ To promote meaningful consultation with stakeholders regarding cultural heritage. ○ To promote the equitable sharing of benefits from the use of cultural heritage.	This standard sets out general provisions on cultural heritage preservation and recommends protecting cultural heritage from the adverse impacts of project activities. It addresses physical or tangible cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be in urban or rural settings, and may be above or below ground, or underwater. It also addresses intangible cultural heritage such as practices, representations, expressions, instruments, objects and cultural spaces that communities recognize as part of their cultural heritage. Projects involving significant excavations, demolition, movement of earth, flooding, or other environmental changes are to take cognizance of this standard.	The Fourth Republic Constitution (1992) recognizes culture as a necessary tool for national integration and development and, under the Directive Principles of State Policy (Article 39), declares as follows: (1) Subject to clause (2) of this article, the State shall take steps to encourage integration of appropriate customary values into the fabric of national life through formal and informal education and the conscious Introduction of cultural dimensions to relevant Aspect of national planning. (2) The State shall ensure that appropriate customary and cultural values are adapted and developed as an integral part of the growing needs of the society as a whole; and in particular, that traditional practices which are injurious to the health and well-being of the person are abolished. (3) The State shall foster the development of Ghanaian languages and pride in Ghanaian culture. The Ghana cultural policy (2004) enjoins the National Commission on Culture to undertake the following actions to protect and preserves monument, forests reserves, national parks and recreational facilities	The regulations and policies do not address cultural heritage as an integral part of sustainable development and promotion of equitable sharing of benefits	The National commission on culture provides a platform for collaboration with Chiefs, opinion leaders and community representatives and other institutions to protect cultural assets. The project will go by the procedures outlined by the Commission in respect of cultural assets. The project will also go the extra mile to complement this collaboration with stakeholder engagement procedures enshrined in the SEP to educate the project communities to appreciate the role of cultural values and assets in sustainable development and also the need to share benefits accruing from the use of cultural assets. A chance find procedure will be established as part of the ESMP
ESS10: Stakeholder Engagement and Information Disclosure				
○ To establish a systematic approach to stakeholder engagement that will help	ESS10 seeks to encourage open and transparent engagement between the Borrower and the project	○ The key laws most relevant to stakeholder engagement are:	The regulations to the RTI Act, has not been developed to fully operationalize mechanisms for	○ The project has developed a SEP that also includes a GRM based on an existing grievance

Scope/Objective	Description of Bank Policy	Description of Government of Ghana Regulation	Gaps Identified	Gap Bridging Actions
Borrowers identify stakeholders and build and maintain a constructive relationship with them, in particular project-affected parties. To assess the level of stakeholder interest and support for the project and to enable stakeholders' views to be taken into account in project design and environmental and social performance ○ To promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle on issues that could potentially affect them. ○ To ensure that appropriate project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format. ○ To provide project-affected parties with accessible and inclusive means to raise issues and grievances and allow Borrowers to respond to and manage such grievances.	stakeholders including project-affected parties throughout the project life cycle. The standard establishes a systematic approach to stakeholder engagement that potentially helps the Borrower to identify stakeholders and build and maintain a constructive relationship with them, as well as disclose information on the environmental and social risks and impacts to stakeholders in a timely, understandable, accessible and appropriate manner and format. It recommends that stakeholder engagements are commenced as early as possible in the project development process and continued throughout the lifecycle of the Project. This allows for stakeholders' views to be considered in the project design and environmental and social performance. The Borrower is also expected to implement a grievance mechanism to receive and facilitate resolution of concerns and grievances.	○ Article 21(1) (f) of the 1992 Constitution of Ghana which recognizes the right to information for all citizens as a fundamental human right. To fully operationalize the right to information, people need to be effectively engaged and provided with information on issues that affect their lives. ○ The *Right to Information Act, 2019 (Act 989)* is meant to put into effect the aforementioned article in the constitution of the Republic of Ghana. ○ *Articles 40 to 48 of the Local Governance Act, 2016 (Act 936),* mandate local authorities to create opportunities for residents and other stakeholders to access information and to participate in decision making and for inclusion of marginalized groups. ○ Stakeholder engagement is an integral part of the Environmental Impact Assessment process. The LI 652 requires effective public consultation and participation as an integral component of Environmental Impact Assessment (EIA) in Ghana. ○ Strategic goal 4 of the National Environmental Policy, which focuses on participation and coordination in environmental governance, charges the lead institutions in environmental governance to ensure active participation in all environmental matters.	disclosure or dissemination of information and grievance redress.	redress mechanism for resolving grievances for the project ○ The GRM is a decentralized and transparent system which ensured quick resolution of complaints and disputes, it also has the structure for disclosing vital information to requisite stakeholders ○ It also provides means for effective and inclusive engagement. This instrument which satisfies almost all the requirements of ESS 10 will be applied during the project implementation to bridge the gaps in national regulations and policies

2.6 Institutional Framework

Key institutions involved in in the proposed Project are provided in this section:

2.6.1 Environmental Protection Agency (EPA)- PIU

The EPA is established under the EPA Act, 1994 (Act 490) and is responsible for the protection of the environment and this include the human/ socioeconomic environment as well. The Agency is under the Ministry of Environment, Science, Technology and Innovation. Its functions include the following amongst others:

- Advise the Minister on the formulation of policies on all aspects of the environment and in particular make recommendations for the protection of the environment;
- Ensure compliance with any laid down environmental impact assessment procedures in the planning and execution of development projects, including compliance in respect of existing projects;
- Act in liaison and co-operation with government agencies, district assemblies and other bodies and institutions to generally protect the environment; and
- To promote effective planning in the management of the environment.

The EPA is the main government body for receiving and reviewing all Environmental and Social Impact Assessment reports. Currently, Resettlement Plan reports sent to the EPA for review are usually attached to the mainstream Environmental Impact Assessment (EIA) Reports. The Agency is yet to develop a general guideline or format for the preparation of a Resettlement Plans as it has done for the preparation of an EIA report. The EPA has offices in all the previous ten (10no.) regions of Ghana and zonal offices which takes care of a cluster of districts.

2.6.2 MMDAs and the Physical Planning Department

The Local Governance Act 2016, Act 936 establishes and regulates the local government system and gives authority to the Metropolitan, Municipal and District Assemblies (MMDAs) to exercise political and administrative power in the districts, provide guidance, give direction to, and supervise all other administrative authorities in the districts. The MMDAs are under the Ministry of Local Government, Decentralization and Rural Development (MLGDRD).

The MMDAs are mandated to initiate programs for the development of basic infrastructure and provide municipal works and services as well as be responsible for the development, improvement and management of human settlements and the environment in the district.

The Land Use and Spatial Planning Authority (LUSPA) is responsible for sustainable development of land and human settlements through a decentralized planning system, and currently operates at the regional and district levels, with the responsibility for designing plans (planning schemes) and controlling settlements.

LUSPA, as a decentralized institution, forms part of the District Assembly structure as the Physical Planning Departments, which replaced the erstwhile Town & Country Planning Department; and at the regional level as the Regional Land use and Spatial Planning Authority.

The Physical Planning Departments which have the mandate of planning schemes and controlling settlements would lead the DAs in the land acquisition process.

2.6.3 Minerals Commission (MC)

The MC is mandated under the Minerals Commission Act 1993, Act 450 with responsibility for the regulation and management of the utilization of the mineral resources of Ghana and the coordination and implementation of policies related to mining in the country. As stipulated in Act 450, the MC functions are to:

- formulate recommendations of national policy for exploration and exploitation of mineral resources with special reference to establishing national priorities having due regard to the national economy;
- advise the Minister of Lands and Natural Resources on matters relating to minerals;

- monitor the implementation of laid down Government policies on minerals and report on this to the Minister;
- monitor the operations of all bodies or establishments with responsibility for minerals and report to the Minister;
- receive and assess public agreements relating to minerals and report to Parliament;
- secure a firm basis of comprehensive data collection on national mineral resources and the technologies of exploration and exploitation for national decision making; and
- perform such other functions as the Minister may assign to it.

In fulfilling its functions, the Commission engages in the following activities;

- Investigate the background, process applications for mineral rights and recommend their grant or otherwise to the Minister responsible for Mines;
- Review agreements relating to minerals;
- Collect, collate and analyze data on the operations of mining companies for decision making and for dissemination;
- Organize and attend workshops/seminars/conferences, as well as issue publications to promote mineral sector activities;
- Liaise with other governmental agencies, notably the Bank of Ghana and the Ghana Revenue Authority), to ensure that the spirit of the sector's fiscal regime is maintained; and
- Liaise with other governmental agencies, notably the Geological Survey Authority (GSA) and EPA, to monitor and ensure the adherence of mining companies to the terms and requirements of mineral rights granted to them; etc.

2.6.4 Lands Commission (LC)

The LC currently has the following Divisions:

- Public and Vested Lands Management;
- Land Valuation;
- Land Registration; and
- Survey and Mapping.

Public and Vested Lands Management Division of the Lands Commission

The Public and Vested Lands Management Division of the Lands Commission is the principal land management organization of the government. All public land is vested in the President of Ghana and held in trust by him for the people of Ghana. The Public and Vested Lands Management Division manages all public land on behalf of the President. In each of the regions of Ghana (occur for the previous ten regions and new offices yet to be created for the new 6 regions), a branch, known as the Regional Lands Commission, performs the functions of the Lands Commission. In addition to managing public lands on behalf of government, its other mandates include among others providing:

- Advise the government and local authorities on policy matters, and to ensure that the development of individual parcels of land is consistent with area development plans; and
- Advise on and assist in the execution of a comprehensive program of land title registration.

The acquisition of any rights of exclusive possession over public lands would necessitate discussions with the relevant Regional Lands Commission for a lease over the selected site.

Land Valuation Division (LVD)

It was established in 1986 (PNDC Law 42) as the Land Valuation Board (LVB). However, the LVB was brought under the Lands Commission as the Lands Valuation Division (LVD) with the promulgation of the Lands Commission Act 2008, Act 767. The LVD is responsible for all valuation services for the government, including assessing compensation to be paid as a result of land acquisition or damage to an asset in view of a government project.

The Division keep rates for crops which are applicable nation-wide. The LVD has offices in all sixteen (16no.) regions of Ghana and over 44 district offices. The district offices are involved only in 'rating valuation' and that any valuation taking place has to be undertaken by the Regional offices which have certified valuers. The LVD also keep records of private sector certified valuers.

Land Registration Division of the Lands Commission

It was established in 1986 as the Title Registration Advisory Board under Section 10 of the Land Title Registration Act, 1986. However, it was brought under the Lands Commission as the Lands Registration Division with the promulgation of the Lands Commission Act 2008, Act 767. The Division ensures registration of title to land and other interests in land; maintains land registers that contains records of land and other interests in land; ensures registration of deeds and other instruments affecting land, among other functions.

Survey and Mapping Division of the Lands Commission

It was established in 1962 under the Survey Act 1962, Act 127 as the Survey Department. The Department was brought under the Lands Commission as the Survey and Mapping Division with the promulgation of the Lands Commission Act 2008, Act 767. The Division supervises, regulates and controls the surveys and demarcation of land for the purposes of land use and land registration. It also supervises, regulates, controls and certifies the production of maps. It is responsible for planning all national surveys and mapping among other functions.

2.6.5 Traditional Authorities

In the 1992 Constitution, chieftaincy together with its traditional councils is guaranteed and protected as an important institution in the country. This institution operates in tandem with the Ministry for Chieftaincy and Traditional Affairs, which is the official Ghanaian agency responsible the creation of linkages between the Government of Ghana and the traditional authorities in the country.

In Ghana land is owned predominantly by customary authorities (stools, skins, clans and families). Together they own about 78% of all lands while the State owns about 20% with the remaining 2% owned by the state and customary authorities in a form of partnership (split ownership), (Larbi W O, 2008). Article 267 (1) of the 1992 Constitution avers that all stool lands in the country shall vest in the appropriate stool on behalf of, and in trust of the subjects of the stool in accordance with customary law and usage. All revenue from stool lands are collected and disbursed by the Office of the Administrator of Stool Lands (OASL).

2.7 Project Measures to Ensure Compliance with World Bank Policy

The Ghanaian laws and regulations make provision for environmental assessment and management, however, there are some differences between the World Bank ESS and Ghanaian laws as indicated in Table 2-7 supra.

In order to harmonize such differences and ensure effective management of the environmental and social impacts and risks arising out of the project implementation satisfies the World Bank requirements as well as the national laws.

The site specific ESMPs in addition to the ore characterization and mine reserve estimation aspects will combine the World Bank ESS and the national laws as well as institutional synergies for managing the impacts and risks of the Project at Dakrupe.

3.0 ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

This chapter presents the environmental and social baseline information of the project area of Dakrupe. The project area of influence includes the immediate area, which is the mining areas/ pits, ore processing areas and environs of Dakrupe. Description of the environmental settings includes the characteristics of the area in which the activity of the project would occur and the cover area likely to be impacted. The environmental and social information used to draft the baseline has been obtained through literature reviews, publicly available information and observations made during the field visits.

The project area is an existing mining area where most of the natural features have been converted/ transformed, also due to farming and grazing. The chapter is subdivided into three major headings as follows:

- Physical Environment;
- Biological Environment; and
- Socioeconomic Environment.

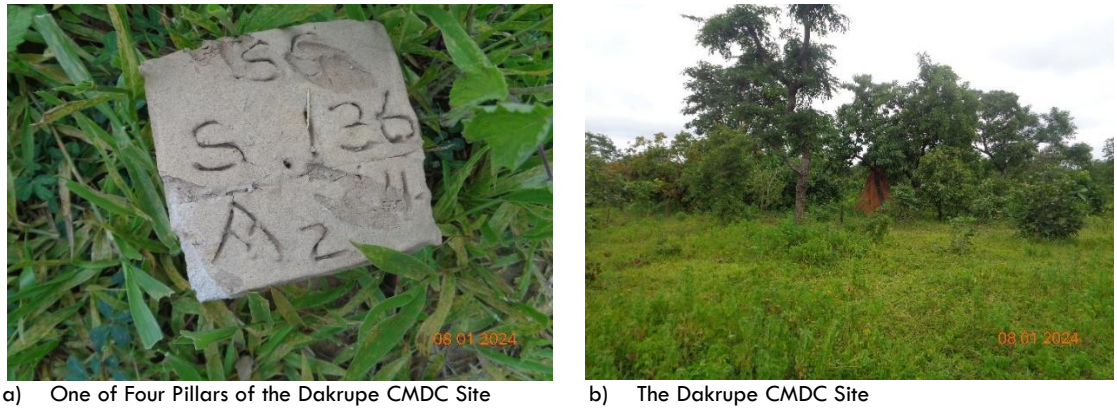
3.1 Physical Environment

3.1.1 Location

Dakrupe (2° 18' 19" W and latitude 8° 56' 5" N) is a typical rural community in the Savannah Region of Ghana and located about 54km from the regional capital of Damongo (northeast) and about 30km from Bole the District capital (northwest). It is Muslim dominated and accounts from some leaders in the community is that they are related to the people of Larabanga, a prominent Muslim community in the region where an ancient Sudan Sahel architectural style of mosque is located. Indeed, it is reported that a similar mosque used to be at Dakrupe. It is circa 12km off the main Bole-Bamboi highway i.e., from Seripe. **Figure 3-1** is a map of the Bole District showing the location of Dakrupe.

3.1.2 The Dakrupe Project Site/ Land Use

The Dakrupe CMDC site is located approximately on 08°57'16.0"N, 002°17'54.7"W on the global scale. This land, along with access roads to the site, is within areas designated for Community Mining Scheme (CMS). The designation of a place for Community Mining Schemes (CMS) is done by the Minerals Commission of Ghana, in close consultation and involvement of relevant Traditional Authorities, District Assembly representatives and community people. In practice, such designated areas are free from any other uses and encumbrances, including farming activities. It is currently lying fallow with no activities on it. (see Plate 3-1). The site lies between the Wasteline and Sonyo Road mining areas in Dakrupe. The 0.92-acre (0.37Ha) land was acquired by GoG through a Voluntary Land Donation (VLD) arrangement with the Dakrupe community, led by the Traditional Authority. The donation followed the VLD Protocol through which it was confirmed that the donation was completely voluntary, and that the owners (Dakrupe community) finalize the donation after they were duly informed about their right to refuse the donation and to be compensated for land so donated. No households were displaced by the donation.



a) One of Four Pillars of the Dakrupe CMDC Site b) The Dakrupe CMDC Site

Plate 3-1: Pictures Showing the Land Use at the Dakrupe CMDC Site

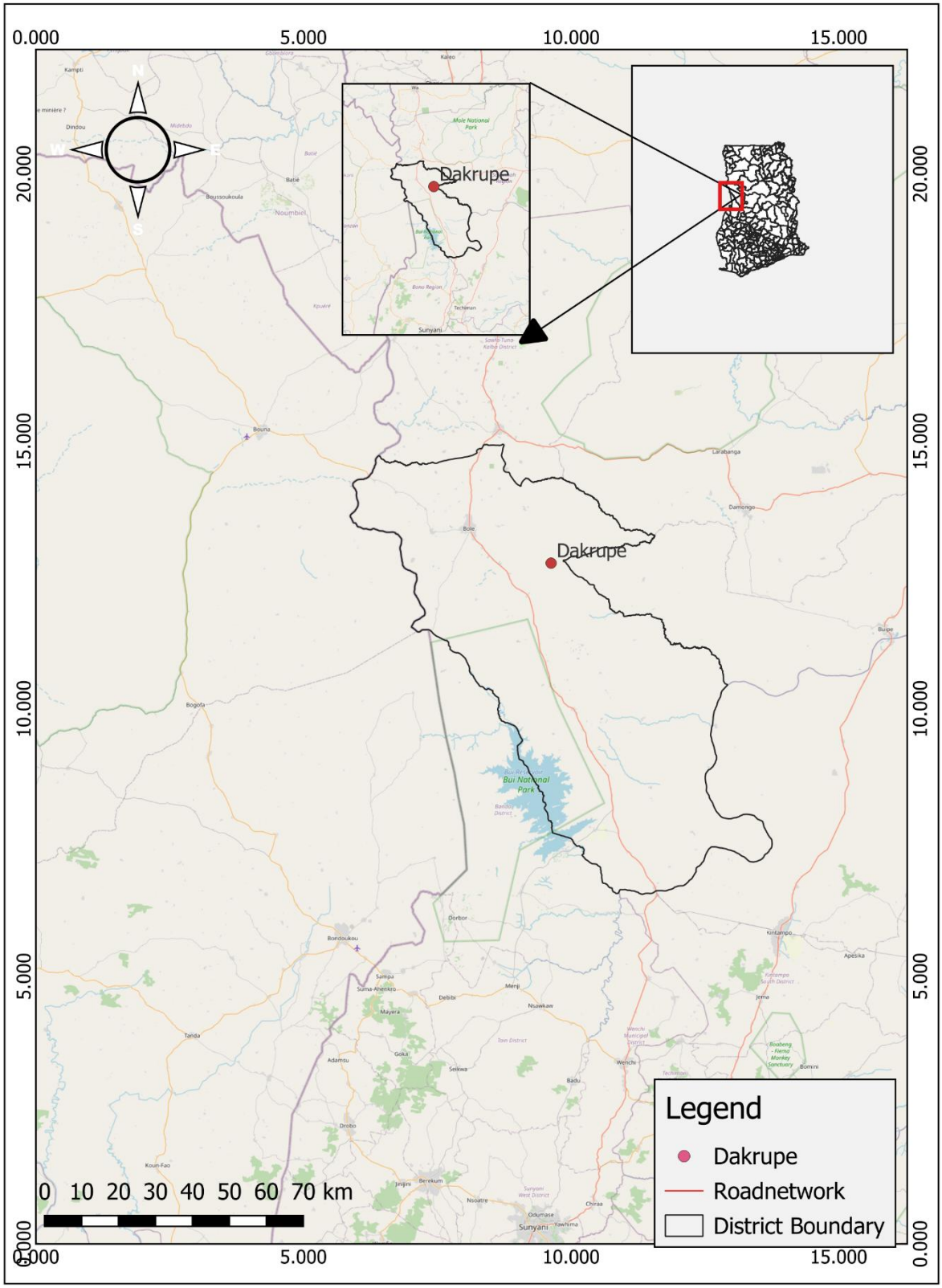


Figure 3-1: Map of the Bole District Showing Location of Dakrupe

3.1.3 Geology and History of Mining in Dakrupe

The Dokrupe prospect lies close to the southeastern margin of the Bole-Nangodi gold belt which appears to be dominated by metavolcaniclastic units interbedded with metasedimentary rocks. The Dokrupe area is basically underlain by Birimian metasediments and the gold mineralization

appears to be largely confined to a major NE trending shear system. The gold mineralization is closely associated with a complex quartz vein system that is hosted by metasediments and a hornblende granitoid.

The pre-colonial history of artisanal mining in the area is poorly documented. The big gold exploration boom of the 1930s saw the London junior, Gold Coast Selection Trust acquiring large exploration licenses over northern Ghana, including the Dokrupe area (Junner, 1935; Cooper, Arch Rept. 6., 1991). By the late 1930s, there was evidently some small-scale mining of high-grade veins as the Mines Department (Annual Report 1938/39) recorded gold production of about 4150 ozs from 2300 tons of ore in 1938 but the operations apparently closed in 1939.

It was not until during the 1960s when geologists from the Soviet Geological Survey in collaboration with their Ghanaian counterparts carried out regional surveys in the area. The teams' work from trenches led to the execution of a very limited shallow drilling program (Mescherakov and Yakzhin, 1991). This work confirmed that gold mineralization extended well into the host rocks and that there was considerable potential for a large, low-grade resource.

In the early 1990s, the Australian junior, Takoradi Gold conducted exploration activities in the area including soil geochemistry, trenching and fairly extensive RC and diamond drilling to shallow depth of 100m. In their 1996 Annual Report, Takoradi Gold reported after an in-house evaluation that the principal deposit at Dokrupe is estimated to contain a resource of almost 1.8 million tons with an average grade of 2.8g/t. Takoradi Gold reckons the relatively high grades and the presence of fairly coarse gold would probably favor a conventional CIP (Carbon in Pulp) or CIL (Carbon in Leach) milling system.

Over the years, a number of other companies have expressed interest in the Dokrupe area and attempted to re-assess the work carried out by Takoradi Gold. The extent and nature of more recent follow-up work in the area is not known or readily available.

Seasonal gold winning has also been an ongoing activity by local inhabitants in the Dokrupe area since pre-colonial times. However, for the past several decades the area has been the site of significant illegal small-scale gold mining activities.

3.1.4 Soils

There are various kinds of soils in the Bole district that support plant growth. The main types of soils include savannah ochrosols, tropical brown earth and terrace soils. The savannah ochrosols are generally poor in organic matter and nutrients because of the absence of dense vegetation caused by bush burning, overgrazing and poor farming practices in the area.

3.1.5 Climate

The climate of the Project Area is determined by the movement of air masses which differ in air moisture and relative stability rather than temperature. Two air masses can easily be identified, the tropical continental air mass which moves from the Sahara Desert towards the sea and the tropical maritime air mass which moves from the South Atlantic Ocean towards the land.

Like most parts of the country, two main physical phenomena, the equatorial trough and the associated Inter Tropical Convergence Zone (ITCZ)/ Inter Tropical Boundary (ITB) influence the climatic conditions of the project area. The ITCZ/ ITB influences the attraction of the alternate air masses from the north and the south called the tropical continental (northeast trade winds) and the maritime continental (southwest monsoon) winds respectively. The tropical continental winds are associated with a dry cool wind known as the harmattan which affects most part of the country during the months of December to February when it's very intense.

Climatic data, comprising monthly rainfall data, monthly temperatures and monthly relative humidity is provided in **Table 3-1** based on 20 years of data obtained from the Ghana Meteorological Agency (GMet).

- Relative Humidity in the Project area is generally high, averaging 65.5%. The average relative humidity ranged from 34.3% in January to 82.4% in August.

- Temperature in the Project area is generally high, averaging 27.1°C. Average maximum temperature is 32.6°C and a minimum of 21.6°C. The hottest months are February to May; and
- The rainy season occurs between March to October and peaks in September. The average annual rainfall is 1,060mm. The dry season, also known as the harmattan, occurs between November and February. This long period of dryness makes the Project area very vulnerable and susceptible to bush fires and drought.

Table 3-1: Average Annual Climate Data for Bole (2003 2023)

Parameter	Unit of Measure	Annual Total	Month											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Precipitation	mm	1,060.4	1.3	16.8	54.5	101.4	120.8	140.0	133.0	155.3	206.0	110.9	15.5	4.9
Average No of Days with Precipitation	Days	86	0.3	1	4	7	10	11	11	13	16	10	2	1
Average Temperature	°C	-	27.1	29.7	29.6	29.8	28.6	27.0	26.1	25.8	24.8	25.7	26.0	25.3
Average Relative Humidity	%	-	34.3	39.8	55.4	67.1	73.8	78.6	80.8	82.4	81.9	76.4	67.9	47.7

Source: GMet

3.1.6 Groundwater Quality

Sampling of groundwater in the project area for quality analysis was carried out in August 2024 from one of the mining pits at Waste Line. The sampling point was at a discharge pipe connected to a pump fix to the mining pit with the coordinates 08°56'03.6"N, 002°18'19.0"W. The detail report of the assessment is provided as **Annex 3-1** of this ESMP.

Methodology, Analysis and Results

Grab samples were collected into 1 liter bottles at each sampling location by means of a clean container and kept in an ice chest. The water samples were sent to the Water Research Institute (WRI) of the Council for Industrial and Scientific Research (CSIR) for the analysis. Specified methods as laid in "Standard Methods for the Examination of Water and Wastewater" published jointly by the American Water Works Association (AWWA), American Public Health Association (APHA) and the Water Environment Federation (WEF) 23rd Edition, 2017 were followed. The results of the groundwater quality analysis are as shown in **Table 3-2**.

Table 3-2: Groundwater Quality in Dakrupe- (sampled on 1st August, 2024)

Parameter	Unit	BHW	GS 175-1	WHO Guideline
Turbidity	NTU	1.33	5	5
Color (apparent)	Hz	2.50	5	15
Odor	-	offensive	Inoffensive	Inoffensive
pH	pH Units	7.33	6.5-8.5	6.5-8.5
Conductivity	µS/cm	805.0	-	-
Total Suspended Solids (TSS)	mg/l	1.00	0	-
Total Dissolved Solids (TDS)	mg/l	483.0	1,000	1,000
Sodium	mg/l	76.0	200	200
Potassium	mg/l	3.1	30	30
Calcium	mg/l	32.7	200	200
Magnesium	mg/l	36.9	150	150
Total Iron	Mg/l	0.513	0.3	0.3
Ammonium (NH_4-N)	mg/l	<0.001	0.00-1.5	0.00-1.5
Chloride	mg/l	5.960	250	250
Sulphate (SO_4)	mg/l	73.200	250	250
Phosphate (PO_4-P)	mg/l	0.130	-	-
Manganese	mg/l	0.198	0.4	0.4
Nitrite (NO_2-N)	mg/l	0.004	1.0	1.0
Nitrate (NO_3-N)	mg/l	0.052	10	10
Fluoride	mg/l	<0.010	1.5	1.5
Total Hardness (as $CaCO_3$)	mg/l	234.0	500	500

Parameter	Unit	BHW	GS 175-1	WHO Guideline
Total Alkalinity (as $CaCO_3$)	mg/l	300.0	-	-
Calcium Hardness (as $CaCO_3$)	mg/l	81.8	-	-
Mag. Hardness (as $CaCO_3$)	mg/l	152.0	-	-
Bicarbonate (as $CaCO_3$)	mg/l	366.0	-	-
Carbonate	mg/l	0.00	-	-

In summary

The results have been compared with the available GS 175-1 and the WHO Guideline values for drinking water.

- Total Iron concentration exceeded the respective GS 175-1 and the World Health Organisation Guideline value of 0.3mg/l.
- All the other parameters including Turbidity, TSS TDS, Colour, pH, Calcium, Fluoride, Magnesium, Manganese, Ammonium, Sodium, Potassium, Chloride, Nitrite, Nitrate, Sulphate and Total Hardness were all below the respective GS 175-1 and WHO Guideline values for drinking water.

3.1.7 Surface Water (Drainage)

The Project area falls within the Sur River sub-catchment of the Black Volta River catchment. The Project area is principally drained by a minor tributary of the Sur River named Yakamba. It is ephemeral and no water was in the stream channel during the fieldwork. The discharge from the Sur into the Black Volta is downstream of the Bui Dam.

The Black Volta Basin is the third largest sub basin of the Volta System, after the Lower and White Volta Basins. It constitutes about 21% of the Volta System and occupies the western portions of Upper West, Savannah and Northwestern portions of the Bono Regions.

The Black Volta Basin is located approximately between longitudes 1.0°W and 2.9°W, and latitudes 7.5°N and 11°N. The Basin has a total catchment area of 142,056.32km^2 including catchments outside Ghana. The catchment area in Ghana is 33,302.2km^2 and the rest are in Cote d'Ivoire and Burkina Faso. There is considerable variation in local relief, varying from 150m to 300m and increasing from the south to the north. A considerable length of the northern reaches of the Black Volta in Ghana forms the boundary between Ghana and the Cote d'Ivoire. The major tributaries are the Sur, Yerada, Tombe, and the Sepi.

The Black Volta lies mainly in the northern savanna zone except for the southern portion in the Bono Region, which lies in the transitional zone of secondary forest and scrub. Annual rainfall in the basin varies from about 1,143mm in the north to about 1,270mm in the south. Pan evaporation is of the order of 2,540mm/year. The average annual runoff from the Black Volta is about 217m^3/s following the construction of the Bui Dam at Bui for hydropower generation by the Bui Power Authority (BPA).

3.1.8 Air Quality Assessment

As part of the preparation of the ESMP, ambient air quality assessment was carried out at specified locations in the Project area in August 2023 using the Osiris Particulates Monitor for dust and the Aeroqual series 500 for noxious gas measurements (**see Plate 3-1**). The detail report of the assessment is provided as **Annex 3-1** of this ESMP.

The main objective of the air quality assessment is to provide a basis for determining the impacts on human health and the environment as a result of the implementation of the project. The sampling locations were so chosen because they were close to the project site and associated facilities- the mining and ore processing locations. The locations also ensured the safety and security of personnel and equipment. The selected sampling locations/sites are provided in **Table 3-3.** The sampling locations have been shown in **Figure 3-3**. The parameters of interest were Total Suspended Particles (TSP), PM_{10} and $PM_{2.5}$ (Inhalable particles, diameter <10 µm and diameter <2.5 µm respectively), Sulphur Dioxide (SO_2) and Nitrogen Dioxide (NO_2).

Plate 3-2:The Osiris Particulates Monitor at Location AN1 (Demarcated CMDC Site)

Table 3-3: Ambient Air and Noise Monitoring Locations

ID	Sampling Site	Coordinates
AN1	Demarcated CMDC Site	08°57'16.0"N, 002°17'54.7"W
AN2	Sonyo Road	08°57'55.1"N, 002°18'15.4"W
AN3	Waste Line	08°55'56.5"N, 002°18'24.7"W
AN4	Milling Site	08°57'09.5"N, 002°17'34.1"W

The results of the air quality monitoring exercise are shown in **Table 3-4**. The prevailing wind direction during the air quality monitoring periods was from South-West to North-East. The detail report of the assessment is provided as **Annex 3-1** of this ESMP.

Table 3-4: Ambient Air Quality- (monitored 1st August, 2024)

ID	Sampling Site	TSP/ μgm^{-3}	PM_{10}/ μgm^{-3}	$PM_{2.5}$/ μgm^{-3}	NO_2/ μgm^{-3}	SO_2/ μgm^{-3}
AN1	Demarcated CMDC Site	26.1	15.8	5.42	0.723	0.000
AN2	Sonyo Road	138.5	33.8	6.66	0.742	7.500
AN3	Waste Line	142.5	100.2	10.27	0.743	0.833
AN4	Milling Site	205.9	106.1	13.28	1.400	13.520
GS 1236:2019- Ambient Air Pollutants		**150.0***	**70.0***	**35.0***	**150.0***	**50.0***
WHO Guideline Value		**na**	**50.0***	**25.0***	**200.0***	**50.0***
WBG Guideline Value		**na**	**50.0***	**25.0***	**200.0****	**20.0***

*.....24 hours averaging time **.....1 hour averaging time

GS 1236:2019 is "Environment and Health Protection- Requirements for Ambient Air Quality and Point Source/ Stack Emissions"

The results show that:

- Dust levels in the ambient air ranged from 26.1μgm^{-3} at the designated CMDC Site to 205.9μgm^{-3} at the Ore Milling Site for TSP compared with the GS value of 150μgm^{-3} and from 15.8μgm^{-3} at the designated CMDC Site to 106.1μgm^{-3} at the Ore Milling Site for PM_{10} compared with the GS value of 70μgm^{-3}. $PM_{2.5}$ values ranged from 5.42μgm^{-3} at the designated CMDC Site to 13.28μgm^{-3} at the Ore Milling Site.
- Noxious gases emission was within the respective GS values. SO_2 was 0.000μgm^{-3} at the Demarcated CMDC Site to 13.520μgm^{-3} at the Ore Milling Site compared with the GS value of 50.0μgm^{-3}, while NO_2 ranged from 0.723μgm^{-3} at the Demarcated CMDC Site to 1.400μgm^{-3} at the Ore Milling Site, compared with the GS value of 150.0μgm^{-3}.
- PM_{10} for Waste line and the Ore Milling Site was in excess of the WHO and WBG Guideline value of 50μgm^{-3} respectively, which may be attributable to the crushing and grinding at the Ore Milling site and the movement of motor bikes and tricycles on the dusty road at the Waste Line. All the other parameters showed values below the respective WBG and WHO guideline values.

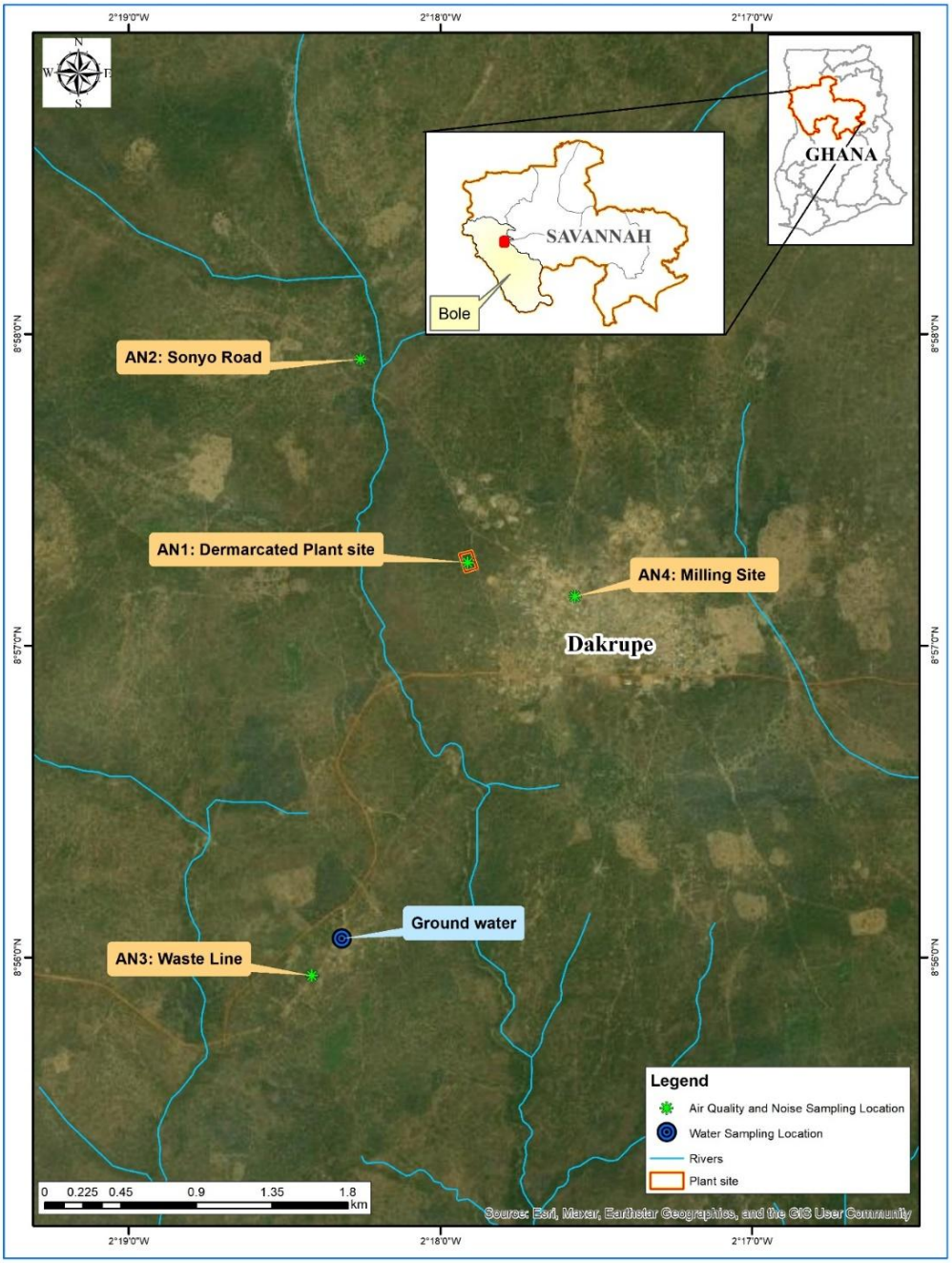


Figure 3-2: Ambient Air, Noise and Groundwater Sampling/ Monitoring Locations at Dakrupe

3.1.9 Noise Assessment

As part of the preparation of this ESMP, ambient noise assessments were carried out at the air quality monitoring locations in the Project area in August 2024. The noise monitoring was carried out for daytime only. The sampling locations are same for that of the ambient air quality (see **Figure 3-3**). Noise measurements at the sites were determined using the portable Pulsar Nova Integrated Sound Level Meter which enables real-time monitoring of the noise (**see Plate 3-2**).

Plate 3-3:The Noise Monitor Positioned at AN2 (Sonyo Road)

Measurements were done in line with GS 1253:2018, and Noise Levels were captured in situ in decibels on the A scale, i.e., dB(A). The noise monitoring results are provided in **Table 3-5**, and compared with the GS value for Mixed Used Areas.

Table 3-5: Noise levels- (monitored 1st August, 2024)- measurements done in line with GS 1253:2018

ID	Sampling Site	L_{eq}	L_{max}	L_{min}	L_{10}	L_{50}	L_{90}
AN1	Demarcated CMDC	37.0	49.5	30.2	38.9	35.8	32.8
AN2	Sonyo Road	45.7	64.0	32.6	48.1	40.3	34.2
AN3	Waste Line	47.8	68.5	35.8	47.2	44.4	30.9
AN4	Milling Site	57.7	67.6	49.1	61.0	55.8	52.7
GS 1222:2018 (Mixed Use)		**60.0**					
WHO Guideline Value (Industrial, Commercial Shopping and Traffic Areas, Indoors and Outdoors)		**70.0**					
WBG Guideline Value (Industrial, Commercial)		**70.0**					

Legend

L_{EQ} Equivalent Sound Level representing the average integrated sound level accumulated during the sampling period
L_{MAX} Maximum Sound Level obtained during the sampling period
L_{MIN} Minimum Sound Level obtained during the sampling period
L_{10} Nuisance noise level during the sampling period
L_{50} Average noise level recorded during the sampling period
L_{90} Background noise level recorded during the sampling period
GS 1222:2018 is "Health Protection- Requirements for Ambient Noise Control"
GS 1253:2018 is "Acoustic- Guide for Measurement of Outdoor A-Weighted Sound Levels"

The results showed that:

- Equivalent Noise Levels (Leq) ranged from 37.0dB(A) at the designated CMDC Site to 57.7dB(A) at the Ore Milling Site compared with the GS value of 60dB(A) for a mixed use Area and 70dB(A) for WHO Guideline Value (Industrial, Commercial Shopping and Traffic Areas, Indoors and Outdoors) and WBG Guideline Value (Industrial, Commercial).
- The Lmax values recorded ranged from 49.5dB(A) at the designated CMDC Site to 68.5dB(A) at Waste line.

3.2 Biological Environment

3.2.1 Terrestrial Flora

The project area, Dakrupe, in the Bole District of the Savanna Region, lies in the northern Guinea Savanna vegetation zone of Ghana (Taylor, 1960; Innes, 1977). This vegetation is characterised by a continuous grassy ground layer with an open canopy tree stratum. The vegetation is thus open in several places. The ground layer is annually or periodically burnt. Parts of the area have been intensively farmed.

The vegetation of this zone is characterised by trees such as *Parkia biglobosa*, *Vitellaria paradoxa, Burkea africana, Daniellia oliveri, Afzelia africana, Parinari polyandra, Hymernocardia acida, Vitex doniana, Terminalia glaucescens, Lophira lanceolata, Piliostigma thonningii* and *Diospyros mespiliformes*. The common grasses of the Guinea Savanna-Woodland are *Andropogon* sp., *Brachiaria brevis, Digitaria gayana, Eleusine indica, Eragrostis aspera,*

Hyparrhenia sp., *Pennisetum pedicellatum, Schizachyrium* sp., *Rottboellia* sp., *Cymbopogon giganteus* and *Panicum* sp. Places that are heavily farmed and thus of low fertility usually have short wiry grass species e.g. *Aristidia kerstingii, Ctenium elegans, Schoenefeldia gracilis, Schizachyrium exile, Hyparrhenia* sp. and *Monocymbium ceresiiforme.*

The terrestrial flora and fauna survey was carried out in the Project area as part of this ESMP formulation. The field survey was conducted on 01st August 2024.

The detailed results of the flora survey carried out are summarised as follows:

- The project area has a generally flat or gently undulating topography with well drained soils. The project area has open canopy woodland and secondary thickets vegetation while the mined-out areas were degraded with mined out pits and isolated trees.
- The open canopy woodland and secondary thickets have tree species such as *Vitellaria paradoxa, Combretum adenogonium, Diospyros mespiliformis, Piliostigma thonningii, Nauclea latifolia and Opilia amentacea.* The shrubs and herbs common to the site include *Cassia obtusifolia, Sansevieria liberica, Hyptis suaveolens, Sida acuta* and *Triumfetta cordifolia.*
- The species list compiled for the 3 sample sites is presented in Appendix 2 of **Annex 3-2**. The survey recorded 39 species in 35 genera belonging to 21 families of flowering plants. The dominant families were the Fabaceae (10), Anacardiaceae (3), Combretaceae (3), and Moraceae (3). These four families accounted for about 48.7% of the species recorded. All other families had less than 3 species present. The vegetation of the site is low in species diversity due to the mining activities which have left several areas degraded.
- The life form composition of the flora showed a dominance of tree species (51.3%) in the Project area of influence followed by the Herbs with 28.2% while the Shrub and Climber life forms followed with 15.4% and 5.1% respectively.
- The species list compiled shows that one (1) alien invasive species commonly occurs in the Project area viz., *Chromolaena odorata* (Shrub). This species should be managed (controlled or eliminated) during the construction phase to prevent their spread to other areas.

3.2.2 Fauna Survey

The faunal list of the Project area is based on the information gathered from various methods (interviews, desk surveys and direct observations), and is presented in Appendix 3 of **Annex 3-1** of this ESMP. According to the hunters interviewed, most of the large mammals which were common in the area have moved further away into the Mole National Park due to human activities such as farming, grazing and mining. Notable among these are the elephant, lion, leopard, warthog, several parrots, terns, songbirds (passerines), land tortoises, pythons and other snakes, lizards, bats, birds of prey, mongooses, bovids (e.g. the African buffalo and several duikers), egrets, ducks and pigeons. A number of the species known to occur in the area are of both national and global (IUCN, CITES) conservation significance.

3.3 Social Environment

This section describes the socio-economic characteristics of the project area.

3.3.1 Socio-Economic Conditions of the project Community- Dakrupe

History of the Community: Dakrupe is under the Sonyo Wura Paramountcy of Gonjaland. Languages spoken include Gonja, Largbanga, Wala, Dagaati, Twi and Frafra. Twi is the predominant language. The community is under the Larabanga Chief but managed by a group of elders. A brief history about Dakrupe indicates that the founder of the town is Kabiru. He lived in the area with his junior brother named Ibrahima who later founded Larabanga. Anytime anyone went to visit they would say, they were going to the "old man's house" which translates to Dakrupe.

The Project Site: An inspection of the site earmarked for the CMDC revealed that the site was far removed from the community. It is a one-hectare land with no risks of displacement. There are neither houses nor farms located nearby. There are a couple of Shea trees and mostly shrubs. A couple of goats were seen grazing on the land.

Population Size, Structure and Composition: The population of Dakrupe is estimated at 3,200 out of which majority are males (55%), while females constitute 45%.

The average age in the communities is 25 years which is slightly lower than the regional average age of 24.4 years. As depicted in **Table 3-6**, the age structure of Dakrupe is typical of a young population, which is in keeping generally with the Savannah Regional average. Based on analytical age brackets within Dakrupe, 34.8% are less than 15 years, 62.8% are between 15 years and 64 years while the older age groups (64 years and older) form 2.4% of the population. The trend in these figures compare favourably with the Savannah region age distribution figure of 36.1% for15 years, 60.8% between 15 and 64 years and 3.1% for 65 years and older (GSS, 2021).

Table 3-6: Age Distribution of the Population

Item	0-4 years	Less than 15 years	15-64 years	Over 64 years	Under 15 years & Over 64 years
No	477	1,113	2,010	77	1,187
%	14.9%	34.8%	62.8%	2.4%	37.1%

Household Size, composition and structure: The community has circa 640 households. The average household size is 5 persons. Children constitute the largest proportion of the household structure.

Marital status: About 45% of the adult population aged 12 years and older are said to be married, 35% have never married, 14% are in consensual unions, 3.5% are widowed, 1% are divorced and 1.5% are separated.

Literacy and education: Of the population 11 years and older, 45% are literate and 55% are non-literate. The proportion of literate males is higher (48 %) than that of females (36%). About 30% indicated they could read and write both English and a Ghanaian language.

Poverty level: According to Ghana Statistical Service's 2024 *Multidimensional Poverty* Report (which presents statistics on the proportion of the population that is multidimensionally poor, focusing on household size, sex, age, locality, education level, employment sector, and marital status). Dakrupe recorded the least incident of poverty[1] among 20 communities in the Bole district with a headcount ration of 7.4. This compared favorably with the district average where approximately four out of ten people in the district are recorded to be poor. The highest proportion of deprivation is observed in employment, health insurance coverage, school attendance and unimproved toilet. Employment and health insurance coverage are the largest contributors to multidimensional poverty in the district. Multidimensional poverty is predominant in households headed by persons working in the private informal or, agriculture sector, as well as those who have never attended school. Additionally, it is notably prevalent among households headed by young persons.

Disability: About 1% of the population is estimated to have one form of disability or the other. The types of disability include sight, hearing, speech, physical, intellect, and emotion. Persons with sight disability recorded the highest of 30% followed by physical disability (45%).

Type, tenancy arrangement and ownership of dwelling units: About 45% of all dwelling units in the community are separate houses; 40% are compound houses and 15% are semi-detached houses. More than three quarters (80%) of the dwelling units are owned by members of the household; 13% are owned by private individuals; 5% are owned by a relative who is not a member of the household and only 2% are owned by public or government.

Utilities and household facilities: The three main sources of lighting in dwelling units in the community are flashlight/torch (65%), electricity (30%) and kerosene lamp (5%). The main source of fuel for cooking for most households is charcoal (50%), wood (35%), and gas (15%). The three main sources of water in the community are borehole, river stream, and pipe borne water. Over two-third of households (67%) use sachet water as the main source of drinking

[1] *This refers to the percentage of people who are multidimensionally poor. It is also called the headcount ratio.*

water. The most common toilet facility used is public toilet (WC, KVIP, Pit, Pan) representing 20%, followed by VIP (5%). About 75 percent of the population has no toilet facility.

Waste disposal: The most widely used method of solid waste disposal is by public dump in the open space accounting for close to 70%. About 40% of households dump their solid waste indiscriminately.

Religion: Dakrupe is a Muslim-majority community. The Christian population is quite small that they have not yet been able to put up a church building. So, currently, Christians congregate and worship in school buildings. The community has about 15 mosques (see **Plate 3-3**).

Plate 3-4:One of the Many Mosques in Dakrupe

Agriculture: Close to half of the population (49%) of households in the community are engaged in agriculture in some form. Yam, groundnut and maize are mostly cultivated in the area. Cashew is the dominant tree crop grown by farmers (see **Plate 3-4**). Most of the farmers are involved in crop farming. Livestock raised in the community include sheep, cattle, and poultry (chicken).

Plate 3-5:Community Cashew Farm

Transportation: The main means of transportation in the community is a tricycle. The survey revealed that over 30 households own at least a tricycle. Several young men are engaged in riding these tricycles which are taxi-like modes that rely on comparatively slow, lightweight vehicles that provide lower quality services than exclusive ride taxis, although at considerably cheaper fares. There are two main types of tricycles in the community which are used for commercial purposes. They are the passenger tricycle or *Pragia* as they are popularly known, and freight tricycle which is also popularly known as Aboboyaa or *Motor King (*see **Plate 3-5**).

Road and Transport: According to residents, many of the culverts and bridges at the Kablima-Kalidu-Dakrupe roads are always washed away and left with deep potholes in the middle of the roads. This is particularly worrying because this usually occurs during the start of the crop harvesting, which makes it difficult for *motor king*s (tricycles) that carry goods for famers and traders to use.

Plate 3-6:Tricycles Used by Inhabitant for Transporting Goods and Humans

Mining: Mining, legally registered as community mining scheme is the major economic activity, employing over 86% of the active adult population. There are about 40 ore processing sites in the community. While some of the sites are currently dormant, new ones can be seen springing up. Farmers make up 25% of the working population and other workers such as artisans of various backgrounds (e.g. carpenters, masons, dressmakers and traders etc.) make up the remaining 5%. There are instances where some farmers double as miners. Dakrupe has two mine sites.

There is the legal concession where operators have been licensed to carry out the community mining (see **Plate 3-6**). According to some of the workers and community members interviewed, at peak seasons (normally between December and July) the labor force could be between 4,000 to 5,000 workers. Electricity is sourced from the national grid that extends into the community. *Chanfan* or Diesel-powered ore processing machines are hardly used at these sites. Instead, electric motorized crushers are deployed for the crushing of the gold ore. At the community mining concession, every quantity of ore mined is shared among committee members who represent the Dakrupe community, the miners, owners of rented equipment such as compressors and water pumps and finally the sponsor who owns the "ghetto".

Plate 3-7:Dakrupe Ore Processing and Mining Sites

Dakrupe Community Mine is an artisanal underground mine that mines hard rock deposits. The rock goes through a comminution process to produce grits, then the grits are further processed for sluicing and panning to extract the gold from the ore deposit. The metallurgical process of gravity recoverable gold involves the mining of ore deposits to the smelting of sponge gold. Through consultations, the team observed that the miners have a lot of tacit knowledge about the site's geology. According to some of the miners on-site, the mine has many levels, stretches over a wide area, and is very deep. The site has a ventilation machine that supplies air to the underground spaces. It also has standby water pumping machines to pump groundwater from the mine.

The majority of inhabitants (83.8%) depend on Artisanal Small Scale Mining (ASM) as their sole source of livelihood, as they do not do any other paid work. A few (16%) indicated that they work in farming from time to time. Also emerging from the discussions, the majority (84%) feel they do not have any alternative means of employment. Most of the miners (51%) were born in the area, while 39% have lived in the area for more than five years while only 10% have for less than one year.

Women in Mining: Women are an integral part of the mining process. Based on demographic data collected during the focus group discussion (FGD), most of the circa 40 women are aged between 19 and 50, with a third of them within childbearing age - between 19 and 35. A few were over the age of 50 and 60 years. The majority (81%) are married, and 71% live in male-headed households. The majority (76%) live in large households with more than five people. They mostly speak local languages such as Sisala (38%), Twi (28%) and Gonja (22%). They live in households with several children but the majority (65%) live in households with between three (3) and seven (7) children. Several of the women working at the site are students. They come to the site during vacation so they can work and earn some money for school and leave when school resumes.

The women are mostly migrants who have come for work; others migrated there due to marriage. Most of the women engaged in the mining are from Damongo and Larabanga, others are Dagaatis. They claim the job is tedious but they cannot leave because there is no other source of livelihood that is more rewarding in the area. Most of them have been working in the mines for about 1 year. Most women say the cost of feeding their families is what consumes a greater part of their income. They also spend quiet some amount on their children's health.

Plate 3-8:Women Involved in the Transporting and Processing of the Ore

There are roles typically reserved for women at the various mining and processing sites. After the ore has been brought from the mining pits, it is the women's responsibility to dry the rocks and send them to the crushers for the initial crushing. They then send the crushed rocks for smoothening which is a secondary crushing process. Thereafter, they carry the powdered material to the washing plant for men to take over the remaining of the extraction process. A typical pit has an average of 40 workers consisting of 1 blast man, 8 chiselers, 15 "loco boys" these are men who work as a team to convey the ore from the pit to the surface. Averagely, nine (9) women and 7 men are involved in the crushing and extraction with mercury.

Children in Mining: ASM often involves considerable numbers of children. Children typically work in mines to help their parents, and to supplement family income in order to buy basic food and clothing items. Child labor is closely linked to poverty, and while the 1999 ILO Convention 182 identified child labor in mines as one of the worst forms of child labor, it is unlikely to cease unless alternative opportunities for income generation and poverty reduction exist in impoverished mineral rich locations (Aubyn *et al*, 2010).

There is evidence of children involvement in the milling of the ore at Dakrupe although not a major occurrence. One underage boy was encountered at one of the milling sites.

Migration: People from all walks of life are migrating into the community in search of gold. Many of such people include foreigners from Burkina Faso, Niger and Nigeria. Crime rate is low as a result of an age-old practice of excommunicating culprits from the community.

Health: The community has a CHPS compound. Malaria, diarrhea, urinary tract infection, upper respiratory tract infection, peptic ulcer and skin diseases as some of the most commonly reported diseases at the medical facility. It was confirmed during the engagement meetings that indeed the mercury they use is harmful to their health. Some miner's shared personal experiences where they had severe headaches and sleeplessness after they had used mercury. Others reported of hearing of other colleagues being diagnosed with Tuberculosis. Catarrh is the most common health complaint especially among women due to the fact that they have to be present all through the crushing and smoothening process. ASM is often associated with negative health impacts, ranging from increased HIV/AIDS and STD prevalence, due to large predominantly male squatter camps in the case of "influx" ASM, through to health impacts associated with environmental damage. Flooding of abandoned pits or lands adjacent to waterways increases the net area of standing water, thereby contributing to increased incidence of malaria and other mosquito-transmitted diseases. Poor sanitation in camps and squatter settlements can also lead to water contamination resulting in the spread of diseases such as cholera and typhoid.

Education: There are 2 basic schools in the community. One of the basic schools which is government owned is in a very deplorable state, the roof is ripped off at various sections and the concrete floor is cracked, there is no furniture. According to residents, the school is on the brink of collapse as most of them prefer enrolling their wards in the private school. Truancy is also on the rise, partly due to the deplorable nature of facilities in the school and the trappings of making money at the *galamsey* pit.

Plate 3-9:A Basic School at Dakrupe

Market Access: Farmers will only produce beyond subsistence when their products are assured of good market. Lack of access to markets and storage facilities can lead to post-harvest losses as far as perishable produce are concern. The markets in the district are few and far apart. This increases transportation cost to and from the market and hence the cost of items in general.

Cultural Heritage: One of the Dakrupe Mosque is a 19th century mosque built in the Sudanese architectural style in the village. The Sudanic style, though rectangular, has timber frame structures or pillars supporting the roof. It is characterized by two pyramidal towers (the minaret and the mihrab), and by a number of irregular shaped buttresses, with pinnacles projecting above the parapet, which enlivens the mosque's elevations. Apart from their usual role as Friday prayer grounds, the ancient mosques also serve as places of pilgrimage to the Muslim communities in the country. On eventful days, a lot of faithful worshippers gather at these mosques for prayers and listen to Koranic readings. Private readings are also organized on request for individuals who have serious problems to solve, or who seek spiritual protection on their ventures. In return for the readings, the Chief Imam normally requests the sacrifice of a cow and other donations for the community.

Knowledge of the Project: During this engagement, they made reference to an earlier EPA visit to brief the community about the program and also to educate them on the harmful effects of using mercury in gold extraction process. They reiterated their appreciation and asked that the process of setting up the demonstration center be expedited. Others, however, expressed their apprehension. They claimed that similar exercises had been carried out in the past and nothing has been heard of it.

4.0 STAKEHOLDER CONSULTATIONS AND DISCLOSURE

The World Bank ESSs and the Ghana Environmental Assessment Procedures for the conduct of ESIA/ EIA or ESMP/ EMP studies respectively require the involvement of all relevant stakeholders in the process. This is aimed at providing opportunities for especially Interested and Affected Parties (I&AP) e.g., Project Affected Persons (PAPs) and all public and private groups including local Non-Governmental Organizations (NGOs) with interest or concern for various aspects of the Project to participate in the successful formulation and implementation of all aspects of the project.

4.1 Stakeholder Engagement Objectives

Stakeholder participation in project planning, design and implementation is widely recognized as an integral part of ESMP preparation in order to assure project success. Local communities, their representatives, government, national and international NGOs may all be able to contribute to (and benefit from) dialogue directed at identifying and resolving key project-related issues.

The objectives of the engagement exercise are to:

- provide information related to the activities of the proposed Project;
- facilitate and maintain dialogue,
- seek participation of all interested parties;
- identify stakeholder interests as well as issues including community concerns and expectations;
- support participation in the Project decision-making process and design;
- create solutions for addressing any concerns and integrating them into project design, operations, and management; and
- enhance the project by learning from, and incorporating the expertise of individuals, professionals, communities and organizations.

4.2 Stakeholder Engagements Activities

A number of stakeholders have been identified and engaged (**see Annex 4-1**). Stakeholders engaged thus far included national, regional and district authorities, the Dakrupe Community Mining Committee, miners and millers and gold dealers.

4.3 Stakeholder Methodology and Tools

During the stakeholder engagement process the following information dissemination and data gathering tools and methodologies were adopted:

i. **Focus Group Discussions (FGDs):** FGDs were carried out with community members, and District Assembly Officials. Each group was engaged separately and asked a series of questions and requested to raise any issues of concern and expectations of the project.
ii. **Key Informant Interviews (KIIs):** Key informants interviewed included EPA staff at the PIU, Head Office and in the project area- Bole,
iii. **Telephone Interviews:** Some of the stakeholders were able to comment on the proposed project by means of telephone conversation e.g., the coordinator of the community mining project at Dakrupe.

4.4 Stakeholder Identification and Engagements Activities

The Consultants identified and met with the relevant stakeholders (mostly the institutions and miners) to gauge their levels of interest as well as their concern for the environment and any social considerations. Both formal and informal discussions were held with individuals representing the institutions. Key Person Interviews (KPI) and Focus Group Discussions (FGD) were also adopted for meetings with miners. In addition, formal correspondences with other stakeholders were used.

The groups consulted include among others officials of the:

- Bole District Assembly;
- Dakrupe Community Opinion Leaders;
- Dakrupe Community Mining Committee;
- Miners at Dakrupe;
- Youth Representatives at Dakrupe;
- Women In Mining at Dakrupe;
- Local Mining Investors in Dakrupe;
- Partners in Participatory Development, Non-Governmental Organization (NGO) operating in the Savannah Region/ Bole District; and
- Environmental Protection Agency (EPA)- Head Office, Accra and Savannah Region Office, Damongo.

It is significant to note that not all the stakeholders consulted:

- provided comments on the proposed project;
- completed a stakeholder engagement form provided;
- could sign the stakeholder engagement form provided; and
- could be captured photographically.

4.5 Stakeholder Analysis and Prioritization

The stakeholders are grouped according to their roles, interests and influence on the project, as well as to the extent to which they will be negatively or positively impacted by the proposed Project. The degree to which the identified stakeholders will be impacted by the Project and the level of influence of the stakeholders on the Project outcome are rated as *low, medium or high* as defined hereunder.

Degree of Project Impact on Stakeholders

The impact of the project on the stakeholder is the extent of benefits or losses/ damages that the affected stakeholder will gain/ suffer due to Project implementation, and are categorized as low, medium and high as provided below.

***Low*:** The project is assessed to have an insignificant (positive or negative) impact on the stakeholder.

Medium: The project will have measurable (positive or negative) impact on the stakeholder.

High: The project will have a significant (positive or negative) impact on the stakeholder.

Degree of Stakeholder Influence on Project Outcome

The degree of stakeholder influence on project outcome is the extent, ability or capacity of the stakeholder to positively influence project outcome (i.e., promote, facilitate or enable project implementation etc.) or negatively influence project outcome (i.e., delay, halt, prevent project implementation etc.).

Low: The stakeholder has minimal capability to positively or negatively influence the outcome of the project.

Medium: The stakeholder has measurable capability to positively or negatively influence the outcome of the project.

High: The stakeholder has significant capability to positively or negatively influence the outcome of the project.

The frequency of engagement and management of these stakeholder groups will then depend upon the level of priority placed on them. High priority stakeholders should be properly or carefully managed, engaged more often during the Project development and implementation

than moderate and low priority stakeholders. **Table 4-1** describes the criteria for determining priority levels and **Table 4-2** provides the stakeholder analysis in more detail as far as the establishment of the Dakrupe CMDC is concerned.

Table 4-1: Criteria for Determining Level of Priority

		Extent of Project impact on stakeholder		
		Low	**Medium**	**High**
Level of influence of stakeholder	**Low**	*Low priority*	*Moderate priority*	*High priority*
	Medium	*Moderate priority*	*Moderate priority*	*High priority*
	High	*High priority*	*High priority*	*High priority*

4.6 Stakeholder Engagement Strategy

4.6.1 Guiding Principles of the Stakeholder Engagement Strategy

The stakeholder engagement strategy for the proposed Project is in accordance with the requirements of WBG's basic principles of good practice in stakeholder consultation, which states that a good consultation process should be:

- Targeted at those most likely to be affected by the project;
- Early enough to scope key issues and have an effect on the Project decisions to which they relate;
- Informed as a result of relevant information being disseminated in advance;
- Meaningful to those consulted because the content is presented in a readily understandable format and the techniques used are culturally appropriate;
- Two-way so that both sides have the opportunity to exchange views and information, to listen, and to have their issues addressed;
- Gender-inclusive through awareness that men and women often have differing views and needs;
- Localized to reflect appropriate timeframes, context, and local languages;
- Free from manipulation or coercion;
- Documented to keep track of who has been consulted and the key issues raised;
- Reported back in a timely way to those consulted, with clarification of next steps; and
- Ongoing as required during the life of the project.

4.6.2 Engagement Strategy and Approach

The stakeholder engagement process begins at the preliminary stages during, which this ESMP for the proposed project has been prepared, and would continue through to ESMP submission to EPA for permit and during project implementation. **Table 4-3** summarizes the proposed approach for stakeholder engagement.

Table 4-2: Stakeholder Identification and Analysis

No.	Groups of Stakeholders	Stakeholder(s)	Role of Stakeholder/ Relation to the Project	Degree of Project Impact on Stakeholder	Level of Influence on Project Outcome	Level of Priority
1.	Project Proponents and Partners	EPA- PIU	❍ Accountable entities responsible for successful implementation of the Project including design, construction and operation of the CMDC at Dakrupe	High	High	High
2.	Regulatory Agencies	EPA	❍ The Agency will issue a permit for the construction and operation of the facility and will monitor the Project to ensure compliance to the permit conditions and adherence to the Environmental Assessment Regulations, 1999 (LI 1652).	High	High	High
		Ghana National Fire Service (GNFS)	❍ To provide fire permit /certificate for the CMDC at Dakrupe and any work camp to be established by the contractor	Medium	Medium	Moderate
		Mines Inspectorate Division (MID) of the Minerals Commission (MC)	❍ To provide Mining Service Operating Permit for the CMDC at Dakrupe and other service providers during construction and operations of the Project	Medium	Medium	Moderate
3	Relevant Government Agencies/ Institutions	Lands Commission (LC)	❍ Will assist the PIU for registration of the land for the Dakrupe CMDC	Medium	Medium	Moderate
4	Right of Way Users/Utility Companies	Northern Electricity Distribution Company (NEDCo)	❍ Will assist the PIU to extend power to the Dakrupe CMDC	Medium	Medium	Moderate
5	Administrative/Local Government Authorities	The District Assembly	❍ The proposed sub project is within the jurisdiction of the Bole District. ❍ The district is responsible for the political administration and issuance of development permits. Will provide business registration license for the Contractor to operate in that MMDA. ❍ The Bole District Assembly will provide development permit for the CMDC at Dakrupe during construction and a Business Operating Permit (BOP) during its operations ❍ Will be involved with grievance resolutions	High	Medium	High
6	Traditional Authorities and local communities	Traditional Councils or relevant stools (Paramount chiefs/ community chiefs and elders)	❍ Traditional Councils in the MMDAs/ Towns are the original traditional landowners and have traditional/ cultural oversight of local communities.	Medium	High	High

No.	Groups of Stakeholders	Stakeholder(s)	Role of Stakeholder/ Relation to the Project	Degree of Project Impact on Stakeholder	Level of Influence on Project Outcome	Level of Priority
			❍ Traditional Councils facilitates development and resolution of conflicts/ disputes among community members.			
		Local communities	❍ Local people may not get access to the land to be used for the Dakrupe CMDC and restrict them from accessing any ecosystem services the land and its resources may offer them.	High	Medium	High
7	NGOs/ CBOs	NGOs	❍ Support to EPA to ensure implementation of the Dakrupe CMDC.	Medium	High	High
		Mass media	❍ Responsible for information dissemination, communication and education of the general public and local communities through electronic and print media	Medium	High	High
		General public/ citizenry	❍ People interested in the Dakrupe CMDC	Medium	Medium	Moderate
			❍ The portion of the public that will be affected by the proposed project	High	Medium	High
			❍ The portion of the public that will benefit from the Dakrupe CMDC	Medium	Medium	Moderate

Table 4-3: Stakeholder Engagement Strategy/ Plan for the Project

No.	Activity	Identified Stakeholder(s) Groups	Focus of Consultation/ Information to be shared and or discussed	Timelines/ Frequency	Forms of Communication/ Method of Engagement	Facilitator/ Responsibility
1.	Consultations for the preparation of ESMP for the proposed Dakrupe CMDC	❍ Environmental Protection Agency (EPA) ❍ LVD of Lands Commission ❍ Project affected persons/ institutions ❍ Bole District Assembly ❍ Selected opinion leaders from Dakrupe ❍ Selected NGOs	❍ Potential environmental and social issues of concern from the proposed Dakrupe CMDC implementation ❍ Compliance with EPA and WB requirements ❍ Suggestions for mitigating the potential adverse impacts and successful maintenance of the Project facilities during operation ❍ Public and occupational health and safety at construction sites	During the ESMP study period	❍ One on one Interviews ❍ Focus group discussions (FGD) ❍ Field visitations ❍ Sharing and review of relevant reports ❍ Email and phone calls	ESMP Consultant
2.	Draft ESMP Consultations and Disclosure	❍ Opinion Leaders from Dakrupe ❍ Project Affected Persons (PAPs)	❍ Feedback on issues and concerns raised during the ESMP preparation ❍ Changes in the Project designs	After Submission of draft ESMP to EPA- PIU	❍ Draft ESMP notification in a national daily newspaper	ESMP Consultant EPA- PIU

No.	Activity	Identified Stakeholder(s) Groups	Focus of Consultation/ Information to be shared and or discussed	Timelines/ Frequency	Forms of Communication/ Method of Engagement	Facilitator/ Responsibility
		❍ Key institutional stakeholders engaged during the preparation of the ESMP ❍ Bole District Assembly and traditional authorities	❍ Presentations on findings from the ESMP study including proposed mitigation measures, grievance redress arrangements ❍ Receiving of comments from participants and potentially affected people and responding to comments.		❍ Public engagement forum	
3.	Disclosure of the final ESMP.	❍ Bole District Assembly ❍ Relevant Regulatory Bodies ❍ Traditional authorities/ councils ❍ Mass Media ❍ Selected NGOs	❍ Make available copies of the approved ESMP	After Issuance of the environmental permit for the Project by EPA	❍ Publication of the approved ESMP to inform the public where they can access the document ❍ Deliver hard and/or soft copy of the approved ESMP to relevant stakeholders	ESMP Consultant EPA- PIU
4.	Pre – mobilization/ Site preparation prior to construction	❍ Bole District Assembly ❍ Relevant Regulatory bodies including MID of MC and GNFS ❍ Utility companies e.g., NEDCo ❍ PAPs ❍ Traditional authorities/ local communities ❍ Selected NGOs	❍ Information on schedule of preparation and construction works ❍ Awareness creation on the potential impacts and remedial measures to PAPs/ I&APs) ❍ Integration of the ESMP into planning for construction (impacts and mitigation measures) ❍ Grievance redress procedures	At least 2- 3 months prior to construction	❍ Sharing of relevant reports ❍ Institutional / PAPs notifications via mass media.	EPA- PIU
5.	Start of construction	❍ Bole District Assembly ❍ Relevant Regulatory bodies including MID of MC and GNFS ❍ Utility companies e.g., NEDCo ❍ PAPs ❍ Traditional authorities/ local communities ❍ Selected NGOs ❍ Contractor	❍ Information on Schedule of construction works, activities and progress of construction ❍ Awareness creation on the potential impacts and mitigation measures ❍ Sensitization on ESMP Implementation (impacts and mitigation measures) ❍ Code of Conduct for Contractor ❍ Grievance redress mechanism	Throughout the construction period	❍ General stakeholder meetings for Consultants and Contractor ❍ Notification and sensitization via mass media.	EPA- PIU
6.	End of construction /	❍ Bole District Assembly	❍ Information on Schedule of decommissioning works, activities and progress of decommissioning	Decommissioning phase	❍ General stakeholder	EPA- PIU

No.	Activity	Identified Stakeholder(s) Groups	Focus of Consultation/ Information to be shared and or discussed	Timelines/ Frequency	Forms of Communication/ Method of Engagement	Facilitator/ Responsibility
	Decommissioning of construction equipment and machinery	❍ Relevant Regulatory bodies including MID of MC and GNFS ❍ Utility companies e.g., NEDCo ❍ PAPs ❍ Traditional authorities/ local communities ❍ Selected NGOs ❍ Contractor	❍ Awareness creation on the potential impacts and mitigation measures to stakeholders ❍ Grievance redress mechanism		meetings for Contractor and EPA- PIU ❍ Community/ ❍ Institutional notification and sensitization via mass media.	
7.	Commissioning and handing over	❍ Bole District Assembly ❍ Relevant Regulatory bodies including MID of MC and GNFS ❍ Utility companies e.g., NEDCo ❍ PAPs ❍ Traditional authorities/ local communities ❍ Selected NGOs	❍ Relevance of the Project ❍ Roles and responsibilities during operation and maintenance (O&M)	Commissioning	❍ Public durbar / meeting	EPA- PIU

4.7 Stakeholder Engagements Held, Issues or Concerns Raised and Information Received

A number of public stakeholders have been consulted for the establishment of the CMDC at Dakrupe. As much as possible, the community/ opinion leaders, EPA officials and officials of the Bole District Assembly were interviewed/ consulted. **Plate 4-1** show consultations with the Community Mining Leaders and Miners at Dakrupe among others. The detailed consultation outcomes with names, contact of persons engaged, designation etc. has been provided in **Annex 4-1**.

The following are highlights of the issues/concerns raised by stakeholders/ I&APs during the consultations:

- Some community members/ miners had doubts that the Project will see the light of day.
- The miners expressed concern about whether the CMDC will be able to process all the ore mined in Dakrupe.
- Aside the CMDC to be established, miners also require implements such as water pumps, PPEs at the mine shafts to be able to increase ore production and to ensure their safety.
- The executive of the Dakrupe Community Mine requires support in extending electricity to the Sonyo Road site to ensure increased production of the gold ore.
- The miners are aware of the mercury problem are eager to support the Project at Dakrupe to succeed.
- Concerns were raised by the directorate of agriculture about possible food shortages as more people are venturing into mining coupled with the low rainfall events in recent times.
- The Director of the EPA in the Savannah Region highlighted issues of impact on biodiversity, health and safety issues, dust emissions, social and gender issues, fire risks and hazards and further engagements and awareness creation and provided suggestions/ recommendations for mitigating each issue (see Annex 4.1).

Adequate responses to the consultees were provided by the Consultant as much as possible. A summary of how the issues have been addressed in the ESMP is provided hereunder:

- The need for the project to be taken through environmental assessment leading to the acquisition of an Environmental Permit from EPA and for the project to have a no objection from the World Bank is provided in sections 5.1 and 7.5 as well as in Tables 5-5, 6-1 and 7-1. That these processes require some time for construction of the project to commence.
- The baseline section adequately captures the availability of national electricity grid in the Dakrupe community such that it should be feasible to extend electricity to the site. Also, Table 4-2 indicates the role of NEDCo as responsible to assist the PIU in extending the power to the site.
- Tables 5-6 and 5-7 in the section on identification of potential environmental and social issues (Section 5.3) provides adequate assessment of the impacts/ risks.

<u>Social Acceptability of Project</u>

The people at Dakrupe and environs are generally receptive and open for discussion on the need to eliminate mercury in their mining operations. All stakeholders from both government agencies and local groupings and community leaders the consulting team interacted with showed strong need for improvement of their mining and gold processing needs and are very willing to work and cooperate with the PIU to implement the proposed interventions. They are therefore prepared to make concessions and sacrifices that may be necessary during the project construction and operation.

(a) Meeting with Community Mining Leaders

(b) Meeting with Community Mining Leaders

(c) Engagement with a Miner at the Camp Mining Site

(d) Engagement with Miners at the Sonyo Road Mining Site

(f) Consultations with Women in Mining

Plate 4-1:Consultation with Community Mining Leaders and Miners at Dakrupe

5.0 ASSESSMENT OF POTENTIAL ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS, AND ALTERNATIVE ANALYSIS

This chapter presents environmental and social risks and impacts that are likely to result from the implementation of the Dakrupe CMDC as a result of the interaction between the project components and the environmental and social elements. The method employed for the impacts and risk assessment/ evaluation has also been provided under this chapter.

Overall, the preconstruction, construction, operation and decommissioning phases of the proposed Project at Dakrupe may result in a number of potential environmental and social impacts and risks. These potential impacts could be positive, negative or neutral for which the adverse ones should be mitigated, and the positive ones enhanced and forms part of this ESMP.

5.1 Specific Project Activities of Environmental and Social Concern

The potential environmental and social impacts and risks are evaluated under the four phases of activities and interventions. The phases are as follows:

- Pre-construction Phase;
- Construction Phase;
- Operational Phase; and
- Decommissioning Phase.

5.1.1 Preconstruction Phase

The activities to be carried out at the preparatory or pre-construction phase prior to the implementation of the project include:

- Clearing of the Dakrupe project site (0.92 acres) including site preparation, collection and disposal of vegetal wastes to make way for the actual construction and related activities;
- Mobilization of construction materials and equipment to the construction site;
- Continued stakeholder engagement and sensitization activities;
- Acquisition of statutory permits e.g., Environmental Permit from EPA, Developmental Permit from Bole District Assembly and ting activities; and
- Pegging the exact boundaries of the project site.

5.1.2 Constructional Phase Activities

The major constructional phase activities to potentially impact on the biophysical and social environments include the following among others:

- Removal of tree stumps and further clearing of the project site;
- Excavation and civil works for the foundation of the CMDC structure and facilities;
- Haulage of construction materials to the project site; and
- Collection, transportation, and disposal of construction waste- i.e., vegetal waste and spoil.

5.1.3 Operational Phase Activities

The operational activities that have potential to result in environmental and social impacts include the following:

- Handling and disposal of wastewater/ effluent in accordance with the applicable Ghana Standards for the Gold Mining Sector- Quarry and Mining Industry;
- Dust
- Facility Maintenance and repair works;
- Insects/ Pest management e.g., Tsetsefly and termites;
- Materials management and storage;
- Occupational Health and Safety (OHS);
- Provision of security services; and
- Solid waste management including hazardous waste

5.1.4 Decommissioning Phase

The main decommissioning phase activities to potentially impact on the environment consist of the following:

- Post-construction activities including the demobilisation of construction equipment, dismantling of construction site offices/ work camps, etc., and
- Post operational activities including removal of the Dakrupe CMDC.

Decommissioning of the Dakrupe CMDC following the expiration of its design life or for massive improvements may impact on public and occupational health and safety, noise and air quality.

5.2 Impact Assessment/ Evaluation Approach

5.2.1 Impact Identification and Characterization

Impacts are described in terms of their characteristics, including the impact's type and the impact's spatial and temporal features (extent, duration, scale and frequency). The definitions of the terms used are described in **Table 5-1.**

Table 5-1: Impact Characteristics

	Definition	Terms
Type	A descriptor indicating the relationship of the impact to the project (in terms of cause and effect).	**Direct** - Impacts that result from a direct interaction between the project and a resource/receptor (e.g., between occupation of a plot of land and the habitats that are affected). **Indirect** - Impacts that follow on from the direct interactions between the project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land). **Induced** - Impacts that result from other activities (which are not part of the project) that happen because of the Project. **Cumulative** - Impacts that arise because of an impact and effect from the project interacting with those from another activity to create an additional impact and effect.
Duration	The time period over which a resource/ receptor is affected.	**Temporary** - (period within 1 year -negligible/associated with the notion of reversibility) **Short term** - (period of up to 3 years i.e., construction period or production ramp up period) **Medium term** -(period of more than 3 years to 10 years) **Long term** - (period of more than 10 years and less than 20 years i.e., life of facility) **Permanent** - (a period that exceeds the life of the facility – i.e., irreversible. Or may last for a very long time)
Extent	The reach of the impact (i.e., physical distance an impact will extend to)	**On-site** - impacts that are limited to the project site. **Local** - impacts that are limited to the project site and adjacent properties. **Regional** - impacts that are experienced at a regional scale, i.e., beyond adjacent properties, covering the district and beyond **National** - impacts that are experienced at a national scale. **Trans-boundary/International** - impacts that are experienced outside of Ghana
Scale	Quantitative measure of the impact (e.g., the size of the area damaged or impacted; the fraction of a resource that is lost or affected, etc.). or the professional viewpoint of the measure of impact	Quantitative measures as applicable for the feature or resources affect/ professional viewpoint of expert as applicable for the feature or resource in terms of severity of impact measure (i.e., minor, moderate, severe)
Frequency	Measure of the constancy or periodicity of the impact.	No fixed designations; intended to be a numerical value or a qualitative description, e.g., intermittent, once, daily, annually, continuous etc.
Likelihood	Characteristic that pertains to unplanned events determined either qualitatively or quantitatively estimated on the basis of experience and/or evidence that such an outcome has previously occurred.	**Unlikely** – The event is unlikely but may occur at some time during normal operating conditions. **Possible** – The event is likely to occur at some time during normal operating conditions. **Likely** - The event will occur during normal operating conditions (i.e., it is essentially inevitable).

5.2.2 Determining Impact Magnitude

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

- Extent;
- Duration;
- Scale; and
- Frequency.

Magnitude (from small to large) is in practice a continuum, and evaluation along the spectrum, requires the exercise of professional judgment and experience. Each impact was evaluated on a case-by-case basis, and the rationale for each determination noted. The universal magnitude designations, for negative effects, are: negligible, small, medium and large. The magnitude designations themselves are universally consistent, but the definition for the designations varies by issue.

5.2.3 Determining Receptor Sensitivity

The other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are a range of factors taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. The sensitivity of receptor used is low, medium and high as shown in **Table 5-2.**

Table 5-2: Sensitivity Criteria

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

5.2.4 Assessing Significance

Once magnitude of impact and sensitivity of a receptor have been characterised, the significance can be determined for each impact. The impact significance rating was determined, using the matrix provided in **Table 5-3.** The definitions or explanations of the impact significance assessment rating is provided in **Table 5-4.**

Table 5-3: Impact Significance Rating Matrix

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

Table 5-4: Definition of the Impact Significance Assessment Rating

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

5.3 Identification of Potential Environmental and Social Impacts

Identified potential environmental and social impacts are outlined under the four main phases of the Project activities; preconstruction, construction, operation and decommissioning phases.

5.3.1 Potential Positive Environmental and Social Impacts for the Pre-construction Phase

The positive impacts from the preparatory phase activities include:

- Awareness on impacts and risks of mercury use in ASGM in Dakrupe;
- Employment and business opportunities in ASGM in Dakrupe;
- Improvement in local economy; and
- Improved institutional revenue.

The positive impact assessment for the pre-construction phase is summarised in Table 5-5.

5.3.2 Positive Environmental and Social Impacts of Construction Phase

The potential positive impacts from the construction phase activities include:

- Construction health and safety education and awareness in Dakrupe;
- Employment opportunities;
- Improvement in local economy;
- Improved Institutional coordination in the mining sector; and
- Increase in institutional and national revenue.

The positive impact assessment summary for the construction phase is provided in Table 5-6.

5.3.3 Positive Operational Phase Environmental and Social Impacts

The positive impacts or benefits from the operational phase activities include but not limited to the following:

- Enhanced Image of Dakrupe as a model mercury free mining community;
- Improved health of miners and community members;
- Employment of some community members at the CMDC at Dakrupe; and
- Improvement in local and national economy.

The positive impact assessment for the operational and maintenance phase is summarized in Table 5-7.

Table 5-5: Positive Impacts and Risks Assessment Matrix for the Pre-Construction Phase

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
Environment and Social											
Awareness on impacts and risks of mercury use in ASGM in Dakrupe	The consultation process will create awareness on the risks and impacts in ASGM on the Dakrupe CMDC	Direct	Long-term	Local	Once	Likely	Moderate	Medium	Stakeholders	Medium	Moderate
Employment and business opportunities in ASGM in Dakrupe	Some local consultancy companies as well as individual Ghanaian specialists will be contracted to carry out various studies/surveys (e.g. topographic surveys, geotechnical investigations, architectural and engineering designs, ESIA study etc) and these will create jobs for local firms or Ghanaian individuals.	Direct	Long-term	National	Once	Likely	Moderate	Medium	Local Firms involved in the project	Medium	Moderate
Improvement in local economy	The hospitality industry as well as the car rental service providers will also benefit, which will improve their businesses.	Direct	Long-term	Local	Once	Likely	Moderate	Medium	Bole District	Medium	Moderate
Improved institutional revenue	The various regulatory bodies will charge processing and permit fees (e.g., EPA, Lands Commission, GNFS, Municipal Assemblies etc) in providing approvals or permits for project facilities and implementation. These fees will improve the revenue base of these institutions.	Indirect	Long-term	National	Once	Likely	Moderate	Medium	Institutions involved in the project	Medium	Moderate

Table 5-6: Positive Impacts and Risks Assessment Matrix for the Construction Phase

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
Environment and Social											
Construction health and safety education and awareness in Dakrupe	The construction workers will gain knowledge from the project on construction health and safety through awareness creation workshops/ talks	Direct	Long-term	Local	Once	Likely	Moderate	Medium	Stakeholders	Medium	Moderate
Employment and business opportunities	The contractor will employ some local labor for the works	Direct	Long-term	National	Once	Likely	Moderate	Medium	Local Firms involved in the project	Medium	Moderate
Improvement in local economy	The contractor will be encouraged to purchase some materials from the local market to shorten the supply time and reduce cost of materials such as sand, aggregates, stones, rocks, cement, fuel, water and spare parts of equipment. Local individuals/traders will also bring their goods and food items near construction sites to sell and this will generate income for the local people.	Direct	Long-term	Local	Once	Likely	Moderate	Medium	Bole District	Medium	Moderate
Improved Institutional Coordination in the Mining Sector	The coordination between institutions in the mining sector e.g., EPA, Minerals Commission, and those responsible for contractor registration etc is expected to improve	Direct	Long-term	National	Once	Likely	Moderate	Medium	Bole District	Medium	Moderate
Improved institutional revenue	Revenue will accrue to the State in the form of tax deductions from wages of workers and Contractor fees.	Indirect	Long-term	National	Once	Likely	Moderate	Medium	Institutions involved in the project	Medium	Moderate

Table 5-7: Positive Impacts and Risks Assessment Matrix for the Operation and Maintenance Phase

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
Environment and Social											
Enhanced Image of the Dakrupe as a model mercury free mining area	The activities of the CMDC at Dakrupe will enhance the image of the community as a mercury free mining area as other small scale miners will embrace the mercury free technology in their operations	Direct	Long-term	Local	Once	Likely	Moderate	Medium	Stakeholders	Medium	Moderate

Improved health of miners and community members	The miners who hitherto uses mercury in their operations will avoid any health impact from mercury usage	Direct	Long-term	National	Once	Likely	Moderate	Medium	Local Firms involved in the project	Medium	Moderate
Employment of some community members at the CMDC at Dakrupe	Some community members in the Dakrupe community will gain employment at the Dakrupe CMDC	Direct	Long-term	Local	Once	Likely	Moderate	Medium	Bole District	Medium	Moderate
Improvement in local and national economy	Revenue will accrue to the State in the form of tax deductions from wages of workers of the Dakrupe CMDC.	Indirect	Long-term	National	Once	Likely	Moderate	Medium	Institutions involved in the project	Medium	Moderate

5.4 Potential Negative/Adverse Environmental and Social Impact Evaluation

The potential negative/adverse impact evaluations for the preparatory/pre-construction, construction, operational and decommissioning phases of Project implementation are assessed in **Tables 5-8, 5-9 and 5-10.**

Table 5-8: Adverse Impacts and Risks Assessment Matrix for the Pre-Construction Phase

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
Environment and Social											
Preconstruction Waste Generation and Management	Site preparation for construction to start	Direct	Short-term	Local	Once	Possible	Moderate	Medium	Technical and Consulting Teams	Medium	Moderate
Project Landtake/ Ease of Access to project Land	The Dakrupe CMDC is a 0.92 acre site and restricted to only one location on the site. The land is currently unoccupied	Direct	Long-term	Local	Once	Likely	Moderate	Medium	Users of the land	Medium	Moderate
Anxiety on the part of Miners, Institutions and Users of the Dakrupe CMDC	Lack of awareness and anxiety on the part of Miners, Institutions and Potential Users of the Dakrupe CMDC as preconstruction activities e.g., surveys, assessments, stakeholder engagements etc. are ongoing	Indirect	Short-term	Regional	Intermittent	Possible	Moderate	Medium	Landowners/ Dakrupe Community	Medium	Moderate
Risk of Not Acquiring all Permits	The project is funded by the World Bank, hence there should be a "No Objection" from the bank. The Project is required to obtain an Environmental Permit for the project and also a developmental permit from the Bole District Assembly among others. However, the preparation of this ESMP is to provide the basis of obtaining the World Bank "No Objection" and also an Environmental Permit from EPA	Indirect	Short-term	National	Annually	Possible	Moderate	Medium	Contractor, World Bank, Government and People of Ghana	Medium	Moderate
Occupational Health and Safety Concerns/ Risks	Exposure of technical teams carrying out topographical, geotechnical, and environmental baseline surveys to stepping on sharp objects e.g., broken nails and bottles, and bites from insects and dangerous reptiles e.g., snakes, scorpions and insects e.g., tsetse flies, bees and ants is possible	Direct	Short-term	Regional	Intermittent	Possible	Moderate	Medium	Technical/ Consulting Teams	Medium	Moderate

Table 5-9: Adverse Impacts and Risks Assessment Matrix for the Construction Phase

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
Environment and Social											
Air Quality Deterioration	Emissions from machinery and vehicles is expected to deteriorate the air quality in the project area, which may affect the health of workers and the community members.	Direct	Short-term	Local	Intermittent	Likely	Moderate	Medium	Workers, Community Members	High	Major
Vibration and Noise Nuisance	Excavation, construction and installation works in general and transportation activities to and from the site will all create noise nuisance due to site preparation, transportation of materials/ equipment, piling, blowing of horns from vehicles/ equipment etc.	Direct	Short-term	Local	Intermittent	Likely	Moderate	Medium	Users of the land	High	Major
Loss of Vegetation and Effect on Flora and Fauna	The clearing, excavation and construction activities will destroy/displace limited habitats of fauna such as small mammals, rodents, reptiles, insects and nesting birds. No large mammals will be affected.	Direct	Temporary	Local	Once	Likely	Minor	Small	Flora and Fauna	Medium	Minor
Surface Water Pollution	The Yakamba river at Dakrupe is ephemeral and dry for most part of the year unless there is heavy rain event. The river is circa 0.7km from the project site. There is however the potential for silt to be carried from the Project site into the river channel during construction if works are carried out during rain events/ rainy season	Direct	Short-term	Local	Intermittent	Likely	Minor	Small	Yakamba River / Sur River	Medium	Minor
Fire Outbreaks	The Dakrupe area is in a climatic region where fire outbreaks occasionally occurs and more of a yearly phenomenon especially during the dry season. Leaving dried leaves and stumps of	Direct	Short-term	Local	Once	Likely	Moderate	Medium	Flora and Fauna	Medium	Moderate

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
	trees close to the site can engender fire outbreaks. Fire from nearby areas may also stray to the CMDC.										
Land degradation and effect on soil resources	Without adequate protection measures, during heavy rainfalls and windy occasions, soil erosion could occur on the excavated Dakrupe CMDC site for construction. Soil contamination will occur if spillages of fuel/oil occur from construction equipment during the works.	Direct	Temporary	Local	Intermittent	Likely	Moderate	Medium	Dakrupe CMDC site	Medium	Moderate
Waste Generation and Sanitation Concerns	Waste to be generated includes spoil or excavated material from the Dakrupe CMDC site, biomass from clearing activities within the site, general waste including food wastes, water and food packaging/ containers, waste from maintenance of equipment/machinery such as waste oils, scrap metals, concrete waste among others. The construction activities will lead to significant generation of solid waste. In addition to solid waste, the construction workers will also generate liquid waste/ wastewater in the form of urine and fecal matter. The generation and management of both solid and liquid waste during the construction period is of significant sanitation concern.	Direct	Temporary	Local	Daily	Likely	Moderate	Medium	Dakrupe CMDC Site and Waste Disposal Site at Dakrupe	Medium	Moderate
Visual Intrusion/ Attraction	Site preparation and civil works/ general construction activities, movement of materials and equipment/machines to and from the Project site and the presence of vehicles, trucks, construction equipment, and workers will attract the attention of local residents. Heaps of excavated material, stockpiles of aggregates, sand and gravels, as well as the parking of construction machinery and trucks will intrude into the visual quality of the area	Direct	Temporary	Local	Once	Likely	Moderate	Medium	Miners, Dakrupe Community Members	Medium	Moderate
Labor Influx	Job seekers, mainly unskilled youth and some skilled persons will throng the Dakrupe CMDC Site to look for employment and may end up engaging in illicit behaviors in the communities as the character of these people may not be known.	Direct	Short Term	Local	Intermittent	Likely	Moderate	Medium	Dakrupe community	Medium	Moderate
Child Labor	Children may be exploited for economic gain by the contractor. Employing children not only violates international labor standards and national laws but also undermines their right to education and healthy development. Furthermore, it can lead to increased risks of accidents, injuries, and long-term health problems for the child.	Direct	Short term	Local	Intermittent	Possible	Minor	Small		Medium	Minor
Occupational Health and Safety and Labor Issues	Workers will be exposed to risks during construction works. The risks include hazards from operation of construction machinery/ equipment, transportation of construction materials, inhalation of dust and fumes, noise from machinery, accidents from falling objects, cuts, slips, fall from high heights etc. Unhygienic working conditions, discriminatory practices, engagement of child labor could bring about social and labor conflicts and may trigger labor rights concerns. Poor management of waste and improper housekeeping could significantly affect safety in the workplace. The improper handling of hazardous materials such as lubricants is also a health threat to workers. There is also risk of exposing the workers to dangerous reptiles such as snakes. However,	Direct	Short Term	Local	Daily	Likely	Moderate	Medium	Construction workers	High	Major

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
	construction workers will be provided with appropriate Personal Protective Equipment (PPE) such as hard boots, gloves, hard hats, etc. to wear to safeguard their health and safety during the works. Furthermore, the contractor will be required to prepare and implement a health and safety strategy for the works which will be enforced by the supervising consultant and the PIU										
Community Health, Safety and Security	The people of Dakrupe community will be exposed to dust, exhaust fumes and noise nuisance from the construction activities. Construction activities may result in the movement of workers, mainly able-bodied young men, to the Dakrupe area in search of job opportunities. The influx of these workers during the construction period may promote irresponsible sexual behavior which could lead to teenage pregnancies, HIV/AIDS and other STD infections and serve as a public health concern. The influx of labor into the Dakrupe community will be a security concern for the local people. Thieves may take advantage as job seekers to also come into the community to steal or rob residents and workers.	Direct	Short Term	Local	Intermittent	Likely	Moderate	Medium	Dakrupe community and the miners/ construction workers	High	Major
Traffic Impacts	Dakrupe is circa 32km from Bole and 12km from Seripe on the Bole-Bamboi Road. The Seripe-Dakrupe road is a feeder road with no traffic congestions. However, some pressure will be put on the road during the construction phase	Direct	Short-term	Local	Intermittent	unlikely	Minor	Small	Road Users/ motorists and local residents	Medium	Minor
Impact on socioeconomic norms or taboos	Field investigations indicate that no shrine, cemeteries or sacred groves will be affected under this Project at Dakrupe. However, being a predominantly Muslim community that frowns on Christian congregation, it is possible for the contractor or the workers to break such norms, which may result in conflicts	Direct	Short-term	local	-	Possible	Low	medium	Dakrupe community	High	major
Emergency events such as fires and workplace accidents	Fires, personal and vehicular accidents can occur at the Project site. The Project area is known to experience annual bush fire events during the dry season. Some flooding is known to have occurred at Dakrupe during heavy downpours or rains with rivers overflowing their banks. The use of construction machinery, presence of fuel, and misconduct of workers such as improper disposal of cigarette butts after smoking, or creating naked fire or burning at or near the construction sites can cause unfriendly fires. Vehicular accidents can occur during transport of materials to the Project site and materials such as concrete or aggregates can spill causing delays in work schedule. Workplace and vehicular accidents can cause serious injurious to workers or medical emergencies for that matter.	Direct	Temporary	Local	Intermittent	Possible	Moderate	Medium	Workers, road users, miners	Medium	Moderate
Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH) Risks	SEA/ SH pose significant risk especially for the Project in a rural community. SEA involves the exploitation of vulnerable individuals through coercive or manipulative behaviors, leading to severe psychological and physical harm. In contrast, SH creates a hostile work environment through unwelcome advances or demeaning conduct, compromising the dignity and well-being of workers. These behaviors can undermine morale, cause emotional distress, and damage professional relationships,	Direct	Short term	Local	Intermittent	Possible	Low	Small	Dakrupe community and construction workers	High	Moderate

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
	ultimately leading to decreased productivity and increased turnover. Additionally, failure to address SEA and SH can tarnish a project's reputation, lead to legal liabilities, and incur financial penalties. Addressing these risks is crucial to maintaining a safe and respectful workplace environment and upholding ethical standards in construction projects of this nature.										

Table 5-10: Adverse Impacts and Risks Assessment for the Operation and Maintenance Phase

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
Environment and Social											
Emergency Events and Impacts on Businesses	The occurrence of natural disasters such as earthquakes/ tremors may be unlikely due to the location of Dakrupe. Although flooding may be a possibility but its occurrence may be unlikely due to the location of the CMDC. However, emergencies such as power failure, accidents spillages etc. may result is shutting down the center for some time which may impact the fortunes of other businesses that may be depending on it.	Direct	Long-term or permanent	local	Intermittent	Unlikely	Minimal	Small	miners	medium	Minor
Air Quality Deterioration	The baseline air quality assessment at the Dakrupe CMDC was below the permissible GS and WHO guideline values. However, during the harmattan season the baseline dust levels could exceed the GS and WHO guideline values. Generally, the operations of the CMDC at Dakrupe would not cause a deterioration of the of air quality in the project area	Direct	long-term	Local	Intermittent	Likely	Moderate	Medium	Users of the Dakrupe CMDC, workers	Medium	Moderate
Noise Nuisance	The operation of the Dakrupe CMDC will generate some noise, which is expected to be contained in the production area. Fenceline noise is therefore expected to be below the GS value of 60dB(A) for a mixed use area. Higher noise from other operations may be intermittent and short lived	Direct	temporary	Local	Intermittent	Likely	Moderate	medium	Dakrupe community/ residents, workers	Medium	Moderate
Waste Generation	There is possibility of inappropriate management of waste from the Dakrupe CMDC. Inappropriate disposal of the wastes will result in insanitary conditions at the center. Maintenance and repair works, and office duties will also generate wastes that must be disposed of appropriately. Furthermore, improper handling of waste water can lead to the infection of water sources, soil and human health	Direct	Short-term	local	Daily	Likely	Moderate	Medium	Dakrupe CMDC and surroundings	High	Major
Fire Outbreaks	The Dakrupe project area is in a climatic region where fire outbreaks occasionally occurs and more of a yearly phenomenon especially during the dry season. During the operation and maintenance phase of the Dakrupe CMDC, various fire risks could arise e.g., overheat from the smelting furnace, electrical fires from faulty wiring or overloaded circuits. There is potential for the center to be torched as a result of bush fires.	Direct	Short-term	Local	Intermittent	Likely	Moderate	Medium	Dakrupe CMDC	High	Major

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
	Fire from nearby areas may also stray to the Dakrupe CMDC.										
Occupational Health and Safety Concerns	During the operation and maintenance phase of the Dakrupe CMDC, occupational health and safety issues can be substantial if not properly managed. Workers may face exposure to burns, dust, noise and hazardous/ toxic substances if the right PPEs have not been supplied for use. Poor ergonomic conditions on the part of workers may result in pain.	Direct	Temporary	Local	Intermittent	Likely	Moderate	Medium	Dakrupe CMDC site	Medium	Moderate
Labor Influx and conflicts with locals	During the operation and maintenance phase of the Dakrupe CMDC, job seekers may visit the center in search of non-existing jobs. This may create tension between them and the locals. Also, the labor influx could lead to increased demand for housing, services, and infrastructure in the close knit community	Direct	Temporary	Local	Intermittent	Likely	Moderate	Medium	Dakrupe community/ residents/ miners	Medium	Moderate
Community Health, Safety and Security	The Dakrupe CMDC when operational will provide job opportunities for some youth from outside the community exposing the community members to such youth. The influx of these workers during the operation and maintenance phase may promote irresponsible sexual behavior which could lead to teenage pregnancies, HIV/AIDS and other STD infections and serve as a public health concern. The influx of labor into the Dakrupe community will be a security concern for the local people. Thieves may take advantage as job seekers to also come into the community to steal or rob residents and workers.	Direct	Short Term	Local	Intermittent	Likely	Moderate	Medium	Dakrupe community and the miners/ construction workers	High	Major
Traffic Impacts	Dakrupe is circa 32km from Bole and 12km from Seripe on the Bole-Bamboi Road. The Seripe-Dakrupe road is a feeder road with no traffic congestions. However, some pressure will be put on the road during the operation and maintenance phase although the impact will be minor	Direct	Short-term	Local	Intermittent	unlikely	Minor	Small	Road Users/ motorists and local residents	Medium	Minor
Impact on socioeconomic norms or taboos	The workers who may be staying in the community may not be aware of some norms and taboos in the community and may fall foul of such norms and taboos e.g., not congregating as a Christian in the community. Such issues may create tensions between locals and the workers if not properly checked/ handle since Dakrupe is a predominantly Muslim community	Direct	Short-term	local	-	Possible	Low	Medium	Dakrupe community	High	Major
Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH) Risks	SEA/ SH pose significant risk especially being in a rural community. During the operation and maintenance phase of the Dakrupe CMDC, potential risks of SEA/ SH may arise from diverse workplace dynamics such as extended working hours, interactions with external stakeholders, insufficient training on appropriate code of conduct, and	Direct	Short term	Local	Intermittent	Possible	Low	Small	Dakrupe communityand Miners	High	Moderate

Impact / Risks	Description of Risks and Impact	Impact Characteristics							Receptor	Sensitivity	Significance of Impact
		Type	Duration	Extent	Frequency	Likelihood	Scale	Magnitude			
	cultural norms that may not prioritize respect and equality.										
Process Impacts Due to Winnowing, Cyanidation and Direct Smelting of Gold	**Winnowing:** This technique uses controlled airflow to separate lighter waste particles from heavier gold concentrates. This process can create significant dust and need to be properly managed. Inadequate ventilation or containment can lead to worker health risks and local air pollution.	Direct	Long-term	local	Daily	Possible	Moderate	Medium	Dakrupe CMDC	High	Major
	Cyanidation: This technique applies a sodium cyanide solution to dissolve gold from ore. The use of cyanide in gold extraction presents risks such as cyanide spills, cyanide-laden tailings, and the potential release of hydrogen cyanide gas.	Direct	Long-term	local	Daily	Possible	Moderate	Medium	Dakrupe CMDC	High	Major
	Direct Smelting: Direct smelting heats gold concentrates (plus fluxes such as borax, soda ash, and silica) until molten, separating waste from the metal without using mercury. This process avoids mercury hazards but involves high temperatures, toxic fumes, and burn risks if not properly controlled.	Direct	Long-term	local	Daily	Possible	Moderate	Medium	Dakrupe CMDC	High	Major

5.5 Alternative Analysis

This project is intended to establish a Clean Mine Demonstration Center at Dakrupe to eliminate mercury use in ASGM in the Project area. The alternative analyses consider the following:

- Site Selection Option;
- Choice of Building Materials for the Dakrupe CMDC
- Choice of Technology; and
- Do nothing scenario.

5.5.1 Site Selection Option

Three locations were considered for siting the proposed CMDC at Dakrupe. They were Sonyo Road site, Waste Line site and the site lying between Waste Line and Sonyo Road sites. The Sonyo Road and Waste Line site were discarded since they are active mining zones and will be impacted by the use of explosives at the mining sites.

The site selected at Dakrupe lies between the Waste Line/ Camp and the Sonyo Road mining locations. The site is a greenfield with no farms or housing structures and the nearest residence is about 300m off the site. The closest community facility is a park, about 200m from the site. The site is easy to access by vehicle and centrally placed between the mining areas. Although the road is not developed the site is well positioned to receive ore from the mining sites.

Major structures, mainly ore milling facilities and close by residences are about 500m from the site.

5.5.2 Choice of Building Materials for the Dakrupe CMDC

Two main materials were considered for the construction of the Dakrupe CMDC and they are (i) the use of typical brick/block and mortar and (ii) prefabricated containerised structures.

The use of typical brick/ block and mortar have been proposed for Dakrupe CMDC i.e., masonry roofed blockwork office since the use of containers will involve cutting down a number of tree crops along the route leading to the site. Again, the containers are not readily available in the Savannah region and transportation of the containers from Tema may be costly coupled with public safety concerns along the transport route (Tema – Bole).

5.5.3 Choice of Technology for the Dakrupe CMDC

According to the May 2024 Draft Report on the Technology Road Map and Access Finance for ASGM in Ghana by Projekt Consult of Germany and University of Mines and Technology (UMaT) of Tarkwa, Ghana, the processing of gold can be divided into three main steps, each of which is critical and should be tailored to the specific characteristics of the raw material to ensure a high yield linked to efficient use of resources (water, electricity, fuel, chemicals etc.) and a manageable environmental impact. The steps are:

- **Comminution** of gold-bearing material in order to liberate the fine-grained gold particles from the gangue mineral and other waste material in the feed.
- **Gravimetric concentration** of gold due to its very high relative density compared to other minerals from crushed and milled material to obtain the most enriched concentrate possible, which often still contains large amounts of other heavy minerals such as Fe-Ti oxides.
- **Gold separation** in order to finally extract the gold from the concentrate is mainly carried out by mercury amalgamation, (cyanide) leaching or, depending on the fraction of gold in the final concentrate, by applying direct smelting methods.

In terms of alternative processing methods that completely avoid use of mercury, the Project Consult/ UMaT consortium provides the following technologies as explained hereunder.

Winnowing

In the application of winnowing, air is blown across the concentrate at a controlled velocity to remove the waste material which is lighter than the gold, thereby leaving free gold particles behind. Winnowing requires that the gold particles be coarse and thus cannot be applied to all types of concentrates.

Improved Gravity Separation Techniques
Some advanced gravity separation techniques have the potential to produce a gold concentrate virtually free from black sands. Some centrifugal concentrators, such as the Knelson and Icon concentrators, can produce relatively clean concentrates depending on how they are used. Other varieties of equipment such as the ANT and Gold Kachas also produce clean concentrates that can be smelted without recourse to amalgamation.

A comparison between winnowing and gravity separation techniques suggests the following making winnowing the preferred method due to its environmental advantage although winnowing may be less efficient than gravity separation:

- Winnowing a simple sustainable gold extraction method has minimal environmental impact while Gravity Separation requires water, which may lead to sedimentation issues.
- Winnowing is best for dry, loose materials where gold is relatively coarse while Gravity Separation works well for placer and hard rock gold deposits, especially when gold is fine.

Intensive Leaching Using Chlorides
Intensive leaching is applied to concentrates because the gold particles are relatively coarse. The two main chemicals used in intensive leaching are cyanide and hydrochloric acid/hypochlorite. High cyanide concentrations in the region of 2,000mg/l may be used while for ores, the normal concentration could be 250mg/l. Leaching with hydrochloric acid and hypochlorite is much faster than cyanide. However, this combination is very corrosive.

In the case of cyanide, the steps involved include leaching, adsorption, elution, precipitation / electro-winning and smelting while for hydrochloric acid/ hypochlorite the steps are leaching, precipitation, filtration, calcination and smelting. These steps are too many and may not be embraced by small-scale miners.

Cyanide Leaching
Gold may be recovered from ore or tailings by leaching with sodium cyanide and the process is referred to as cyanidation. The process requires a high dissolved oxygen concentration, usually above 12mg/l and pH between 10.5 and 11.0. The high pH is necessary to stabilize cyanide in solution and also prevent the evolution of hydrogen cyanide gas, which is toxic. Sodium cyanide dissolves gold according to the following Equation:
$4Au+8NaCN+O_2+2H_2O \rightarrow 4Na[Au(CN)_2]+4NaOH$

The cyanidation process could be conducted in agitation systems or non-agitation systems. In agitation systems, the ore is milled very fine in water (below 106 μm) and cyanide is introduced into the slurry after pH modification with lime. Leaching may be conducted in tanks for about 24 hours. In the non-agitation processes, the crushed or milled ore may be piled in vats or on impervious floors (heap leaching) and leached over several weeks by ponding or spraying with the leaching reagent.

Also, a comparison between Leaching using chlorides and cyanidation suggests the following making cyanidation the preferred method for gold extraction:

- Cyanide Leaching is highly efficient, with gold recovery rates often exceeding 90% while Chloride Leaching although it can be effective, it may require higher temperatures and stronger oxidizers to achieve comparable recovery rates.
- Cyanide Leaching although toxic has established protocols to make its use safe while Chloride Leaching may be less toxic but can lead to corrosion issues and also requires careful handling.
- Cyanide Leaching is a well-established gold extraction method, with existing infrastructure in most gold-processing plants while Chloride Leaching requires specialized equipment and may have higher operational costs.

Direct Smelting
Direct smelting is a mercury-free process that is applied to the secondary gravity concentrate. This small mass of concentrate, usually less than 100g, is heated with some chemicals known as

fluxes and while in the molten state the waste and gold are separated into different layers which are maintained when they solidify.

For direct smelting to be efficient all iron or steel pieces that were abraded from the grinding equipment during grinding should be removed. Low intensity magnets such as those available in the magnetic alphabet set (educational toy for children) have been found to have the right intensity to remove the abraded material without robbing gold particles.

There are variations in the application of direct smelting. One version, referred to as the 'borax method' uses borax for smelting the concentrate. The borax, which is about three times the mass of concentrate, is mixed with the concentrate and smelted in a furnace. Another version uses the oxy-acetylene flame to smelt gold particle. The version is applied to gold particles that have been cleaned of virtually all the waste material. The flux used is borax and smelting is conducted in shallow crucibles. Due to the very high temperatures generated by the oxy-acetylene flame, smelting is very fast and can be completed within 15 minutes.

A version of direct smelting which was developed in Ghana applies borax and soda ash to concentrates before smelting. The ratio of concentrate: borax: soda ash: silica sand = 1:1:2:0.1. Due to crucible sizes available, about 50g of concentrate containing a minimum of 0.5g of gold is acceptable. The concentrate is mixed with the flux in the ratios indicated and introduced into a furnace. After some 30 minutes, the crucible is picked from the furnace and poured into a mould, the melt solidifies and the gold can then be separated from the glassy slag.

Borax Method
The 'borax method' uses borax for smelting the concentrate. Borax, which is about three times the mass of the concentrate, is mixed with the concentrate and smelted in a furnace. Smelting can also be conducted using the oxy-acetylene flame. It is applied to gold particles that have been cleaned of virtually all the waste material. Due to the very high temperatures generated by the oxy-acetylene flame, smelting is very fast and can be completed within 15 minutes.

International Experiences from Mercury Reduction Technologies
Any process that can potentially replace mercury must necessarily produce the final gold in a fast, transparent and cheaper way. Considering the mercury-free technologies discussed, winnowing and direct smelting are more suited to the recovery of gold from concentrates. Winnowing is more suitable for coarse gold particles as occurs in some alluvial deposits, but direct smelting can be applied to all.

For the Dakrupe CMDC, a combination of Winnowing, Cyanidation and Direct Smelting will be used.

5.5.4 Do Nothing Scenario
This will mean maintaining the status quo, which is no CMDC will be established at Dakrupe and mercury use in in the capturing the gold through amalgamation will continue. The existing use of mercury will persist with its attendant impact on health of miners in the community and the citizens at large.

6.0 RECOMMENDED MITIGATION MEASURES FOR ADVERSE IMPACTS

This chapter presents a description of enhancement measures for the positive impacts and the various mitigation and management measures for adverse impacts and risks, which were characterized as moderate and major in chapter 5. These measures cover the preconstruction, construction, operations and maintenance, and decommissioning phases of the establishment of the Dakrupe CMDC.

6.1 Proposed Enhancement of Potential Positive Impacts

The implementation of the Dakrupe CMDC will create employment opportunities for some Ghanaians in general and residents of Dakrupe in particular. The contractor will put in measures to enhance local employment and business opportunities in the Project area. The contractor will continue with the stakeholder engagement and involvement programmed during the construction phase to enhance better relationships between the contractor and the community.

The AEHPMP PIU will encourage the project contractor to adopt a recruitment policy that is geared towards giving priority to residents of Dakrupe in its recruitment of labor and to some extent those residing in the Bole District. Employment of the youth of the Dakrupe would be prioritized in the hiring of unskilled labor. The recruitment policy will seek to promote gender equality and guard against GBV/ SEA/ SH. Qualified women will not be discriminated against and would be encouraged to apply for suitable vacancies when they become available.

The positive impacts of the Dakrupe CMDC on the local and national economy will continue to be sustained through sourcing of materials and equipment from local or Ghanaian suppliers and employment of local subcontractors if required in the delivery of the interventions. With elimination of mercury use in the community, a healthy and conducive environment would be created for individuals and organizations to operate their mining businesses.

6.2 Proposed Adverse Environmental and Social Impacts Mitigation and Management

This section presents a description of various mitigation and management measures for adverse environmental and social impacts which were identified as moderate and major in the preceding chapter. These measures cover the construction, operations and maintenance, and decommissioning phases of the Project.

Table 6-1: Proposed Mitigation and Management Measures of Potential Adverse Environmental and Social Impacts for Dakrupe

Anticipated Environmental & Social Impacts/ Risks	Source of Impact	Receptor(S)	Proposed Mitigation and Management Measures	Responsibility	Estimated cost of implementation **(GHS)/ annum**
PRE-CONSTRUCTION PHASE					
Waste generation and disposal	Clearing of solid waste materials i.e. tree stumps, pieces of wood, vegetal waste etc. at the Dakrupe CMDC site	Dakrupe CMDC site and the construction environment	○ Provide tricycle to convey solid waste/ vegetal waste from the Dakrupe CMDC site. ○ personnel engaged in site preparation should deposit all waste generated into the tricycle ○ tricycle should convey solid waste to the district approved waste dump at Dakrupe.	Supervising consultant, contractor	15,000.00
project Landtake/ Ease of Access to the Project Land	The 0.92 acre CMDC site at Dakrupe has been permanently taken by AEHPMP from the community for the Project implementation denying them further access to the piece of land although currently unoccupied	Dakrupe community	○ ensure land is not for any other use by the community and has been given out by the community themselves ○ document agreement on voluntary donation of the land ○ Obtain appropriate permits	AEHPMP PIU	25,000.00
Anxiety on the part of Miners, Institutions and Users of the Dakrupe CMDC	Lack of involvement/engagement of community people, Miners and other stakeholders' during the project planning phase.	Dakrupe community members and I&APs	○ Hold consultative meetings with key stakeholders i.e., miners, promoters of the community mining scheme at Dakrupe during the Project planning phase. ○ Implement the Stakeholder Engagement Plan (SEP).	AEHPMP PIU, Project Consultants	12,000.00
Risk of halting the Project construction by regulatory authorities and the World Bank for not acquiring all permits	Non-compliance with national and other relevant laws and regulations triggered by the proposed Project at Dakrupe i.e. LI 1652 (1999), World Bank OP ESSs among others Absence of environmental permit and Bole District Assembly Developmental Permit for the works.	AEHPMP PIU	○ Identify and engage relevant regulatory bodies during the Project planning stage. ○ Prepare the relevant instruments necessary for obtaining environmental permit and other relevant authorization permits. ○ Obtain Environmental Permit from EPA and other relevant permits prior to commencement of the construction works	AEHPMP PIU	Included in Project cost
Occupational/ community health and safety concerns	Surveying and pegging of Dakrupe CMDC site	Project Engineers/ PIU Staff, Contractor, Consultants and Dakrupe community representatives	○ Provide personnel engaged in survey and pegging with appropriate PPEs (nose masks, hard hats, hard boots, reflective jackets etc.) ○ Appoint a contractor and for preparation of Contractor's Health and Safety Plan and ESMP to guide the implementation of environment, health and safety measures for the construction works ○ Educate personnel and engineers engaged in the survey works on the health and safety plan/ code of conduct.	AEHPMP PIU, Project Engineers, Contractor	30,000.00

Anticipated Environmental & Social Impacts/ Risks	Source of Impact	Receptor(S)	Proposed Mitigation and Management Measures	Responsibility	Estimated cost of implementation **(GHS)/ annum**
			○ Provide first aid box stocked with relevant first aid drugs to treat emergency injuries before transfer of the injured to the nearest health facility for treatment i.e., Dakrupe CHPS or Bole Government Hospital ○ Installation of appropriate safety signages at appropriate sections of the works area and at other vantage points.		
SUBTOTAL					**82,000.00**
CONSTRUCTION PHASE					
Air Quality Deterioration (Dust & exhaust emission generation)	Excavations at the Dakrupe CMDC	Dakrupe community	○ Watering of active construction areas to suppress dust generation. ○ Cover construction materials in haulage trucks to construction site (sand, stone, cement, chippings) with tarpaulin ○ Cover construction waste materials during haulage to disposal site ○ Set and enforce speed limits of 20km/hr for haulage and construction trucks on routes to and from the Dakrupe CMDC site ○ Provide adequate speed limit signage ○ Maintain construction equipment (trucks, concrete mixers, etc.) to minimize exhaust fume emissions ○ Enforce zero-tolerance for burning of construction waste at construction site. ○ Provide construction workers with nose musts during dusty construction activities. ○ Avoid delivery of sand and aggregates during windy conditions ○ Implement the manufacturer recommended engine maintenance programs for all construction equipment and vehicles to minimize the emission of fumes into the environment.	Supervising consultant, Contractor, contractor's safeguards Officer	12,000.00
Vibration and noise nuisance	Use of construction equipment (backhoe, concrete mixer, etc.	Community people, pedestrians and miners who ply the environs of the Dakrupe CMDC site	○ Deploy light duty construction equipment for the works. ○ Employ standard noise abatement measures (e.g. turning off engine of machinery/ equipment when not in use) and engineering good practices to ensure that the impacts are minimized and reduced to acceptable limits. ○ Ensure that all equipment/ machinery are regularly maintained and operated in accordance with appropriate industry and equipment standards including specifications for noise levels and manufacturer's specifications (including regular checks and maintenance). ○ Shut down idle construction equipment not in us.	Supervising Consultant	5,000.00

Anticipated Environmental & Social Impacts/ Risks	Source of Impact	Receptor(S)	Proposed Mitigation and Management Measures	Responsibility	Estimated cost of implementation **(GHS)/ annum**
			○ All construction and earthworks should be carried out during the daytime to avoid disturbing the serene nights of residents. ○ Set speed limit of 20km/hr for construction vehicles/equipment and monitor over speeding. ○ Provide construction workers with earplugs and earmuffs to wear during noisy activities.		
Loss of Vegetation and Effect on Flora and Fauna	Clearing of the vegetation, excavation and construction activities	Dakrupe CMDC Site and environs	○ Remove trees/ plants on only the designated 0.92 acre site ○ Replant only indigenous plant species in place of cut trees in the environs of the Dakrupe CMDC site.	Supervising Engineer	3,000.00
Fire Outbreak	General construction activities	Dakrupe CMDC Site and environs	○ create fire belt around the Dakrupe CMDC site ○ obtain fire permit from GNFS prior to construction ○ educate construction workers to avoid throwing away cigarette buts indiscriminately ○ appoint a fire team to fight any fires	Contractor, Supervising Engineer	12,000.00
Land degradation and effect on soil resources	Clearing of the Dakrupe CMDC site in an aggressive weather condition and oil spillages or exposure of the cleared site to the elements of the weather- rain and wind	Dakrupe CMDC site and environs	○ Backfill all trenches for foundation work as quickly as possible ○ Avoid excavation activities during stormy weather conditions. ○ Avoid indiscriminate excavation of land at the construction site and excavations should be within the perimeter of the demarcated site	Supervising consultant; contractor	Included in construction cost
Waste generation and disposal	General construction activities	Contractor's site camp, Dakrupe CMDC site and the construction environment	○ Provide a tricycle for collection of solid waste only at the Dakrupe CMDC site. ○ ensure solid waste are disposed of at the approved dump site at Dakrupe ○ mobile toilet or an improved pit latrine should be established for the construction workers.	Supervising consultant, contractor	30,000.00
Visual Intrusion/ Attraction	General construction activities	Dakrupe CMDC site	○ Hoarding should be provided for the CMDC site ○ educative materials and caution notices should be fixed to the hoarding material	Supervising consultant, contractor	Included in construction cost
Labor Influx and related impacts and risks- theft, labor unrest etc.	Job seekers, mainly unskilled youth and some skilled persons. Contractor resorting to the use of cheap labor	Dakrupe community	○ Minimize labor influx by prioritizing engagement of unskilled labor from within the Dakrupe community ○ The contractor must exercise due diligence in the hiring of labor from outside the community, including background checks where necessary by involving local opinion leaders ○ Contractor should provide code of conduct of good ethics for construction workers. The Code of conduct must be prepared and approved by the supervising consultant prior to the commencement of the construction works. ○ Train construction workers to be familiar with the code of conduct. ○ Enforce the code of conduct during the construction activities. ○ The Code of Conduct must include zero-tolerance for the		Included in construction cost

Anticipated Environmental & Social Impacts/ Risks	Source of Impact	Receptor(S)	Proposed Mitigation and Management Measures	Responsibility	Estimated cost of implementation **(GHS)/ annum**
			construction company, foremen, associates and representatives from mistreating women, children and pedestrians and to accord them with respect regardless of dialect, religion, political opinion, ethnic, nationality, social origin or disability status. o The Code of Conduct should be made a part of employment contracts and include sanctions for non-compliance. o The construction company must monitor and enforce the Code of Conduct. o Proactively, engage and implement all grievance redress actions required		
Child labor	Contractor resorting to use of cheap labor; improper monitoring of construction labour force	Underage persons	o Do not engage children under the age of 18 years as construction workers. o ***apply also measures for labor influx above***	Contractor, supervising consultant	Included in construction cost
Occupational Health and Safety- risk of injury and harm to construction workers	Handling of construction materials while unprotected; Handling of faulty construction equipment; slip and fall at construction site; injury from obstructions at construction site; vehicular accidents; noisy construction environment	Construction workers	o Prepare contractor's Health and Safety Plan to provide guidance for ensuring health and safety of construction workers o Educate construction workers on the Health and Safety Plan o Employ only experienced workers to handle construction equipment o Deploy only well serviced construction equipment for the works o Ensure regular maintenance of the construction equipment o Provide construction workers with appropriate PPEs and enforce their use. o Provide safety inductions for construction workers o Provide First Aid Box at the construction site stocked with first aid drugs and kits o Provide portable toilets at construction site for construction works or an appropriate pit for their use o Provide signage at construction site to caution construction workers of potential dangers at the site o Report incidents and accidents to the World Bank 24 hours after becoming aware of an incident/accident	Supervising consultant, Contractor.	25,000.00
Community Health and Safety including community safety and security including impacts on community norms and taboos (risk of social conflict)	All construction activities Disrespect towards community people and community norms	Dakrupe community	o Provide construction site with adequate/ appropriate hoarding o Enforce speed limit of 20km/hr for construction vehicles o Educate staff on taboos and norms in the Dakrupe community including the code of conduct for construction workers o community entry engagement should be held with the Dakrupe community and in line with the Project's SEP	Contractor, supervising consultant	20,000.00

Anticipated Environmental & Social Impacts/ Risks	Source of Impact	Receptor(S)	Proposed Mitigation and Management Measures	Responsibility	Estimated cost of implementation **(GHS)/ annum**
			○ Proactively, engage and implement all grievance redress actions required		
Emergencies such as fires, and vehicular accidents	Occurrence of bush fires, natural heavy downpour, transport of materials, handling of construction equipment/ machinery/fuel/ naked fires, excavation/trenching etc.	Dakrupe community, workers, visitors, road users, soil, drains/water bodies	○ Implement Emergency response plan included in Section 7.9. ○ Educate workers on the emergency response plan	Contractor, supervising engineer	20,000.00
Risk of Gender Based Violence (GBV) i.e., Sexual Exploitation and Abuse (SEA) during the Project construction	Discrimination or abuse of worker based on the gender of the worker	Construction labor including women, children	○ The contractor must prepare and submit Code of conduct with sanctions for non-compliance. ○ The Code of conduct must acknowledge a zero-tolerance for SEA/ SH on agents, subcontractors, and construction workers. ○ The code of conduct must be submitted and approved by the client through the supervising consultant prior to commencement of the construction works. ***Applicable to code of conduct issues supra (see labor influx impacts)*** ***All workers shall be mandated to sign the CoC prior to commencing work.***	Contractor, supervising consultant	Included in the construction cost
Risk of Sexually Transmitted Diseases (STD) including HIV/ AIDS	Promiscuous attitude of some construction workers	Construction workers, Dakrupe community	○ Provide STD, HIV/AIDS education and awareness for the construction workers and the Dakrupe community members to drum home the implications of illicit sex ○ Provide construction workers with condoms, for their use. ○ The contractor's code of conduct should prohibit sexual promiscuity among some construction workers	Contractor, supervising consultant	17,500.00
SUBTOTAL					**144,500.00**
OPERATIONAL PHASE					
Air Quality Deterioration	Processing of the ore, vehicular movement on dusty roads	Dakrupe community, Dakrupe CMDC	○ ensure dampening of road ways/ access road to the CMDC ○ ensure filters and other equipment function appropriately and all the time ○ provide nose masks to staff working within the processing operations ○	Management of Dakrupe CMDC	48,000.00
Noise Nuisance	Processing of the ore, equipment repairs, vehicular movement etc.	Dakrupe community, Dakrupe CMDC	○ equipment manufacturer to integrate noise abating mechanisms in the CMDC equipment and to ensure it is functional all the time ○ equipment including vehicles not in use to be turned off as appropriate	Management of Dakrupe CMDC	24,000.00

Anticipated Environmental & Social Impacts/ Risks	Source of Impact	Receptor(S)	Proposed Mitigation and Management Measures	Responsibility	Estimated cost of implementation **(GHS)/ annum**
Waste Generation	Workers of the Dakrupe CMDC and equipment maintenance team	Dakrupe CMDC and Dakrupe Waste Dump	○ Immediately collect and dispose all wastes generated during normal operations and also during maintenance. ○ Do not abandon the maintenance waste generated at the CMDC. ○ Unsure separation of waste generated and appropriate handling of hazardous wastes ○ Ensure that an accredited waste management service provider works along with the maintenance team to immediately collect and transport the wastes to appropriate dump site while recyclables are given to licensed agents. ○ Prepare and implement CMDC facility management plan	Management of Dakrupe CMDC	36,000.00
Fire Outbreaks and other emergencies	Bush fires and electrical fires	Dakrupe CMDC and surroundings	○ obtain and renew fire permits obtained from GNFS ○ provide fire extinguishers including fire hydrant for the Dakrupe CMDC ○ Ensure fire resistant PPE is used in smelting area ○ create fire belt around the Dakrupe CMDC ○ Form fire teams in conjunction with GNFS and ensure their regular training ○ maintain fire teams to fight any fires	Management of Dakrupe CMDC	30,000.00
Waste water management	Ore processing at Dakrupe CMDC site	Dakrupe community and Dakrupe CMDC	○ monitor waste water quality to ensure that the waste water discharged from the site complies with relevant standards ○ Using appropriate methods of treatment such as physical, chemical or biological ○ Using treated water for non-potable purposes like dust suppression	Management of Dakrupe CMDC	20,000.00
Occupational health & Safety as well as labor concerns	Work at the Dakrupe CMDC	Dakrupe CMDC workers	○ Provide all staff with appropriate PPEs (boots, hard hats, reflective jackets, etc.) ○ Engage only experienced personnel for the maintenance worksincluding a qualified HSE officer ○ Provide regular health screening for staff. ○ Provide clinic at the Dakrupe CMDC stocked with First Aid facilities	Management of Dakrupe CMDC	60,000.00
Labor Influx and related impacts and risks- conflicts with locals	Dakrupe CMDC workers	Dakrupe community	○ Minimize labor issues by developing a labor management plan for the Dakrupe CMDC ○ The management of the Dakrupe CMDC must exercise due diligence in the hiring of labor from outside the community, including background checks where necessary by involving local opinion leaders ○ Workers shall be provided with a code of conduct assuring of good ethics for workers. The Code of conduct must be prepared and approved by the management of Dakrupe CMDC.	Management of Dakrupe CMDC	60,000.00

Anticipated Environmental & Social Impacts/ Risks	Source of Impact	Receptor(S)	Proposed Mitigation and Management Measures	Responsibility	Estimated cost of implementation **(GHS)/ annum**
			○ All the staff must be trained on the code of conduct and be familiar with it. ○ Enforce the code of conduct throughout the operations of the center. ○ The Code of Conduct should be made a part of employment contracts and include sanctions for non-compliance. ○ Management must monitor and enforce the Code of Conduct. ○ Proactively, engage and implement all worker grievance redress actions required ○ Provision of adequate water and sanitation facilities for workers		
Community Health and Safety including community safety and security including impacts on community norms and taboos (risk of social conflict)	Disrespect towards community people and community norms	Dakrupe community	○ Enforce speed limit of 50km/hr for staff/ operational vehicles ○ Educate staff on taboos and norms in the Dakrupe community including the code of conduct for workers ○ Proactively, engage and implement all worker or community grievance redress actions required	Management of Dakrupe CMDC	30,000.00
Risk of Gender Based Violence (GBV) i.e., Sexual Exploitation and Abuse (SEA) during operation of the Dakrupe CMDC	Discrimination or abuse of worker based on the gender of the worker	Staff of Dakrupe CMDC and Dakrupe community members	○ Management must ensure availability of Code of conduct with sanctions for non-compliance for all staff ○ The Code of conduct must acknowledge a zero-tolerance for SEA/ SH on agents, and maintenance subcontractors. ○ All staff should be introduced to the Dakrupe community and for briefing on their norms and taboos	Management of Dakrupe CMDC	60,000.00
Process Impacts Due to Winnowing, Cyanidation and Direct Smelting of Gold	<u>Winnowing</u> Processing of the ore <u>Cyanidation</u> Processing of the ore <u>Direct Smelting</u> Processing of the gold	Staff of Dakrupe CMDC	○ The processing equipment should have dust suppression systems and filter bags affixed to it for dust collection ○ Also to be provided are screens to help contain fugitive dust ○ Filter bags should be emptied and cleaned regularly ○ Workers are to be provided with appropriate nose masks ○ A secure area for cyanide storage should be established with the provision of a secondary containment of capacity 1.5 times the storage capacity of the cyanide solution ○ There should be continuous pH monitoring to confirm no cyanide leakages from the plant, ○ Training on cyanide handling should be established for operators with reference to the International Cyanide Management Code for best practices in its handling and disposal. ○ Provide Cyanide Antidote Kits at the CDMC ○ The smelting area should have good ventilation ○ Operators should be provided with appropriate PPE for heat	Management of Dakrupe CMDC	120,000.00

Anticipated Environmental & Social Impacts/ Risks	Source of Impact	Receptor(S)	Proposed Mitigation and Management Measures	Responsibility	Estimated cost of implementation **(GHS)/ annum**
			exposure ○ Operators should be provided training on flux mixing, furnace operation, and emergency procedures		
SUBTOTAL					**488,000.00**
DECOMMISSIONING PHASE					
Breach of environmental regulatory compliance pertaining to decommissioning of the Dakrupe CMDC	Lack of conforming to national laws and international regulations regarding decommissioning of a CMDC	Regulatory bodies and funding agency i.e., EPA, World Bank	○ Prepare a comprehension ESMP including health and safety plan for decommissioning of the Dakrupe CMDC ○ Obtain all necessary permits and approvals prior to decommissioning of the Dakrupe CMDC	Management of Dakrupe CMDC	Cost to be provided by Management of Dakrupe CMDC
Injury, harm and accident to personnel engaged in decommission	All decommissioning works, use of equipment	Construction workers and supervisors engaged in decommissioning	○ Provide decommissioning personnel with PPE (boots, hard hats, reflective jackets) ○ Engage only experienced workers. ○ Provide the workers portable toilets on site. ○ Provide workers with First Aid Box ○ Provide appropriate signage on the decommissioning	Management of Dakrupe CMDC	Cost to be provided by Management of Dakrupe CMDC
Waste generation and management	Wastes generated from decommissioning	Miners and Dakrupe community	○ Prepare a Waste Management Plan to manage the decommissioning solid and liquid wastes. ○ Immediately collect and dispose all wastes generated during decommissioning ○ Dispose all municipal solid waste at Dakrupe dump site and release recyclables to agents for reuse/ recycle. ○ Do not dispose decommissioned waste into a water body	Management of Dakrupe CMDC	Cost to be provided by Management of Dakrupe CMDC
Occupational health and safety/ Community health and safety issues		(Similar to construction phase)	(apply mitigation measures for construction phase)	Management of Dakrupe CMDC	Cost to be provided by Management of Dakrupe CMDC
Air pollution and Noise			(apply mitigation measures for construction phase)		
All other environmental and social impacts		Bio-physical and social environments	A detailed ESIA/ ESMP will be carried out for approval and permitting before final decommissioning of facilities and to confirm impacts and appropriate mitigation measures for implementation	Management of Dakrupe CMDC	Cost to be provided by Management of Dakrupe CMDC

7.0 ENVIRONMENTAL AND SOCIAL ACTION PLANS AND MONITORING PROGRAMMES

7.1 Environmental Monitoring Plan

The monitoring of various environmental and social parameters will help to confirm any impacts or risks and assess the effectiveness of the implementation of the mitigation measures outlined. By way of monitoring, a change in a predicted impact can be reviewed. Where observed impact levels exceed the expected levels, additional appropriate mitigation measures will then be instituted. Monitoring will also identify and confirm any residual impacts, which are normal with the development of such a Project and ensure that these do not escalate to significant adverse levels.

7.1.1 Monitoring Objectives

The AEHPMP PIU is committed to ensuring effective protection of the environment, the construction site, workers and the general public. The objectives of the monitoring program are to:

i. Confirm any predicted impact or otherwise made from the environmental and social assessment during Project implementation;
ii. Ensure that all mitigation and control measures are operating efficiently and with desired effect;
iii. Provide information to develop improved practices and procedures for environmental protection, community health/safety and worker safety, if necessary;
iv. Detect changes in the receiving environment and enable analysis of their causes; and
v. Enable effective liaison with stakeholders and community members, including addressing complaints and concerns.

The Plans are also expected to provide useful guidance for the successful planning and implementation of similar projects that will be undertaken by the AEHPMP PIU.

7.1.2 Environmental Monitoring Program

A monitoring programme will be instituted and carried out and relevant records will be kept to ensure compliance with sound environmental and social practices. The major environmental and social issues for which monitoring will focus on include:

- Ambient air quality, in conformity with the Ghana Standards on Ambient air Quality Requirements GS 1236: 2019;
- Ambient noise levels, in conformity with the Ghana Standards on Ambient Noise Control Requirements GS 1212:2018
- Effluent Quality, in conformity with the Ghana Standards on Effluent Discharge Requirements GS:1212: 2019
- Surface water quality;
- Loss of vegetation/habitat and impact on fauna;
- Waste generation and disposal;
- Use of personal protective equipment (PPE);
- Accidents, worker injury and health/safety;
- Labour issues such as engaging underage persons and labour influx at construction sites/local communities;
- Emergency Flooding.
- Community/ public safety/health/ security and traffic; and
- Stakeholder engagement and public/community complaints.

The environmental monitoring program/plan for the Dakrupe CMDC is set out in **Table 7-1**.

Table 7-1: Environmental and Social Impacts and Risks Mitigation Measures Implementation Monitoring Plan for Dakrupe CMDC

Anticipated Environmental & Social Impacts/ Risks	Proposed Mitigation and Management Measures	Parameters for monitoring	Monitoring location	Method	Frequency of monitoring	Responsibility	Estimated cost of implementation (GHS)/ annum
PRE-CONSTRUCTION PHASE							
Anxiety on the part of potentially affected persons/ stakeholders	○ Hold consultative meetings with key stakeholders i.e. Dakrupe Community Mining Committee, I&APs during the Project planning phase. ○ Implement Stakeholder Engagement Plan (SEP). ○ Put in place Grievance Redress Mechanism and involve local residents and key stakeholders in the grievance resolution processes	○ Record of stakeholder meetings ○ Availability of SEP for the project ○ Availability of GRM for the project	Dakrupe CMDC. Dakrupe community.	Review of relevant reports/records	Monthly	AEHPMP PIU	Included in Dakrupe CMDC project cost
Risk of halting the project construction by regulatory authorities and the World Bank	○ Identify and engage relevant regulatory bodies during the Project planning stage. ○ Prepare the relevant instruments necessary for obtaining environmental permit and other relevant authorization permits. ○ Obtain Environmental Permit from EPA and other relevant permits prior to commencement of the construction works	○ Availability of EPA Environmental permit and other developmental permits for the works	AEHPMP PIU	Inspections of relevant plans and reports including validity of permits/licences	Yearly	AEHPMP PIU,	Included in Dakrupe CMDC project cost
Occupational/ public health and safety concerns	○ Provide personnel engaged in survey and pegging with appropriate PPEs (hard hats, hard boots, reflective jackets etc.) ○ Prepare Contractor's Health and Safety Plan to guide the implementation of health and safety measures for the construction works ○ Educate personnel and construction workers engaged in the survey works on the health and safety plan. ○ Provide first aid box stocked with relevant first aid drugs to treat emergency injuries before transfer of the injured to the nearest health facility at for treatment	○ Availability of Contractor's Health and Safety Plan. ○ Knowledge of workers on the Contractor's Health and Safety Plan ○ Personnel wearing appropriate PPEs. ○ Availability of first aid box stocked with relevant drugs	AEHPMP PIU	Inspections of health and safety plan, and review of incident and other relevant records and reports	Inspection of contractor's health and safety plan will be done one time, prior to commencement of construction Education of workers will be done at induction, semi-annually, and refreshers after major incidents Weekly inspection of first aid box,	AEHPMP PIU	Included in Dakrupe CMDC project cost

Anticipated Environmental & Social Impacts/ Risks	Proposed Mitigation and Management Measures	Parameters for monitoring	Monitoring location	Method	Frequency of monitoring	Responsibility	Estimated cost of implementation (GHS)/ annum
					PPE and signage		
Waste generation and disposal	○ Provide tricycle for disposal of waste, spoil wood etc. ○ Personnel engaged in site preparation should gather and deposit all waste generated into the tricycle ○ Tricycle should transport waste to the approved waste dump at Dakrupe.	○ Availability of dust bins to personnel to store waste ○ All construction waste deposited in appropriate and labelled waste	AEHPMP PIU	Site Inspections	Quarterly	AEHPMP PIU	Included in Dakrupe CMDC project cost
CONSTRUCTION PHASE							
Air Quality Deterioration (Dust & exhaust emission generation)	○ Watering of active construction site to suppress dust generation. ○ Cover construction materials in haulage to construction site (sand, stone, cement, chippings) with tarpaulin ○ Cover construction waste materials during haulage to disposal sites ○ Set and enforce speed limits of 20km/hr for haulage and construction trucks at dusty areas in the construction sites and community. ○ Provide adequate speed limit signages. ○ Maintain construction equipment (trucks, concrete mixers, etc.) to minimize exhaust fume emissions ○ Switch off idle construction machinery and equipment ○ Enforce zero-tolerance for burning of construction waste at construction sites. ○ Provide construction workers with nose musts during dusty construction activities. ○ Avoid delivery of sand and aggregates during windy conditions ○ Implement the manufacturer recommended engine maintenance programs for all construction equipment and vehicles to minimize the emission of fumes into the environment.	○ Absence of observable particulate matter and exhaust fumes in air within the construction site ○ Record of watering at construction site ○ Construction workers wearing nose masks ○ Availability of signages showing speed limits for construction vehicles and machinery ○ Record of maintenance of construction equipment/trucks deployed for the construction	Dakrupe CMDC site	Visual monitoring	Weekly	Contractor, contractor's safeguards Officer, Supervising consultant	60,000.00
Vibration and noise nuisance	○ Deploy light duty construction equipment for the works. ○ Employ standard noise abatement measures (e.g. turning off engine of machinery/ equipment when not in use) and engineering good practices to ensure that the impacts are minimized and reduced to acceptable limits. ○ Undertake earthworks and other noise and vibration making activities in phases to reduce noise generation during construction.	○ Leq, Lmax, Lmin (dBA) measurements meeting GS 1222: 2018 limits ○ Record of maintenance of construction equipment/machinery ○ Complaints by the Dakrupe community about excessive noise	Dakrupe CMDC site	Inspection of Grievance reports	Weekly	Contractor, contractor's safeguards Officer, Supervising consultant	12,000.00

Anticipated Environmental & Social Impacts/ Risks	Proposed Mitigation and Management Measures	Parameters for monitoring	Monitoring location	Method	Frequency of monitoring	Responsibility	Estimated cost of implementation (GHS)/ annum
	○ Ensure that all equipment/ machinery are regularly maintained and operated in accordance with appropriate industry and equipment standards including specifications for noise levels and manufacturer's specifications (regular checks and maintenance). ○ Shut down idle construction equipment not in use. ○ All construction and earthworks should be carried out during the daytime to avoid disturbing the serene nights of residents. ○ Set speed limit of 20km/hr for construction vehicles/ equipment and monitor over speeding. ○ Provide construction workers with earplugs and earmuffs to wear during noisy activities.	from the construction ○ Construction workers wearing earplugs during noisy activities					
Soil erosion of excavated land at Dakrupe CMDC site	○ Backfill all trenches for foundation work as quickly as possible ○ Avoid excavation activities during stormy weather conditions. ○ Avoid indiscriminate excavation of land at the construction site and excavations should be within the perimeter of the demarcated site	○ Backfilling observed at the CMDC site and well compacted ○ All excavated areas reinstated and landscaped.	Dakrupe CMDC site	Site inspections	Weekly	Contractor, contractor's Safeguards Officer, Supervising consultant.	Included in construction cost
Risk of injury and harm to construction workers (Occupational Health and Safety)	○ Prepare contractor's Health and Safety Plan to provide guidance for ensuring health and safety of construction workers ○ Educate construction workers on the Health and Safety Plan ○ Employ only experienced workers to handle construction equipment ○ Deploy only well serviced construction equipment for the works ○ Ensure regular maintenance of the construction equipment ○ Provide construction workers with appropriate PPEs and enforce their use. ○ Provide safety inductions for construction workers ○ Provide First Aid Box at the construction site stocked with first aid drugs and kits ○ Provide portable toilets at construction site for construction works or an appropriate pit for their use ○ Provide signage at construction site to caution construction workers of potential dangers at the site	○ Availability of contractor's Health and Safety Plan ○ Awareness of construction workers of the Contractor's Health and Safety Plan ○ Observable availability of PPEs for construction workers ○ First Aid Box available at construction site stocked with appropriate kits ○ Construction workers wearing appropriate PPEs. ○ Record of induction trainings for workers ○ Toilet provided at	Dakrupe CMDC site	Inspection of plan, and review of incident and other relevant records and reports	Inspection of contractor's health and safety plan will be done one time, prior to commencement of construction. Education of workers will be done at induction, semi-annually, and refreshers after major incidents	Contractor, contractor's Safeguards Officer, Supervising consultant.	Included in construction cost

Anticipated Environmental & Social Impacts/ Risks	Proposed Mitigation and Management Measures	Parameters for monitoring	Monitoring location	Method	Frequency of monitoring	Responsibility	Estimated cost of implementation (GHS)/ annum
		construction site for construction workers use. ○ Appropriate signage at construction. ○ Workers understanding of each signage ○ Number of construction workers injured			Weekly inspection of first aid box, PPE and signage.		
Community Health and safety	○ Provide construction site with adequate/ appropriate hoarding ○ Enforce speed limit of 20km/hr for construction vehicles ○ Educate staff on taboos and norms in the Dakrupe community including the code of conduct for construction workers ○ community entry engagement should be held with the Dakrupe community and in line with the Project's SEP ○ Proactively, engage and implement all grievance redress actions required	○ Hoarding provided at construction site. ○ Absence of unauthorized persons within the inner perimeter working area ○ Observable availability of appropriate signage at the construction site ○ Observable absence of construction materials and construction wastes stockpiled at the construction site ○ Construction drivers observing 20km/hr speed limit. ○ Number of members of the public injured/harmed at the construction site	Dakrupe CMDC site	Site inspections and review of incident reports	Weekly	Contractor, contractor's Safeguards Officer, Supervising consultant.	Included in construction cost
Emergencies such as fires, and vehicular accidents	○ Implement Emergency response plan included in Section 7.9. ○ Educate workers on the emergency response plan	○ records of emergencies e.g., fire incidents ○ number of engagements / training conducted	Dakrupe CMDC site	Review of incident and training reports/records	Monthly	Contractor, contractor's Safeguards Officer, Supervising consultant.	Included in construction cost
Waste generation and disposal	○ Provide a tricycle for collection of solid waste only at the Dakrupe CMDC site. ○ ensure solid waste are disposed of at the approved dump site at Dakrupe ○ mobile toilet or a pit latrine should be established for the construction workers.	○ Availability of contractor's Waste Management Plan ○ Observable availability of tricycle to convey waste to dump site. ○ Construction workers	Dakrupe CMDC site	Site inspections and record keeping of waste manifest	Weekly	Contractor, contractor's Safeguards Officer, Supervising consultant.	Included in construction cost

Anticipated Environmental & Social Impacts/ Risks	Proposed Mitigation and Management Measures	Parameters for monitoring	Monitoring location	Method	Frequency of monitoring	Responsibility	Estimated cost of implementation (GHS)/ annum
		disposing construction solid waste and housekeeping waste into designated area and into tricycle ○ Regular transfer of waste to approved waste dump ○ Absence of stockpile of construction waste at construction site ○ Record of disposal of construction waste to approved sites					
Visual Intrusion/ Attraction	○ Hoarding should be provided for the CMDC site ○ educative materials and caution notices should be fixed to the hoarding material	○ Hoarding in place ○ caution notices provided on hoarding material	Dakrupe CMDC site	Incident reports	Weekly	Contractor, contractor's Safeguards Officer, Supervising consultant.	Included in construction cost
Labor Influx and related impacts and risks- theft, labor unrest etc.	○ Minimize labor influx by prioritizing engagement of unskilled labor from within the Dakrupe community ○ The contractor must exercise due diligence in the hiring of labor from outside the community, including background checks where necessary by involving local opinion leaders ○ Contractor should provide code of conduct of good ethics for construction workers. The Code of conduct must be prepared and approved by the supervising consultant prior to the commencement of the construction works. ○ Train construction workers to be familiar with the code of conduct. ○ Enforce the code of conduct during the construction activities. ○ The Code of Conduct must include zero-tolerance for the construction company, foremen, associates and representatives from mistreating women, children and pedestrians and to accord them with respect regardless of dialect, religion, political opinion, ethnic, nationality, social origin or disability status.	○ Record on code of conduct training held for the workers. ○ Number of labour related complaints reported ○ Complaints by residents	Dakrupe CMDC site	Site inspections Inspections and reports of violations/incidents	Weekly	Contractor, contractor's Safeguards Officer, Supervising consultant.	Included in construction cost

Anticipated Environmental & Social Impacts/ Risks	Proposed Mitigation and Management Measures	Parameters for monitoring	Monitoring location	Method	Frequency of monitoring	Responsibility	Estimated cost of implementation (GHS)/ annum
	○ The Code of Conduct should be made a part of employment contracts and include sanctions for non-compliance. ○ The construction company must monitor and enforce the Code of Conduct. ○ Proactively, engage and implement all grievance redress actions required						
Child labour	○ Do not engage underage people as construction workers. ○ ***apply also measures for labor influx above***	○ Record on code of conduct training held for the workers. ○ Number of child labor incidents reported ○ Complaints by residents	Dakrupe CMDC site	Site inspections Inspections and reports of violations/incidents	Weekly	Contractor, contractor's Safeguards Officer, Supervising consultant.	Included in construction cost
Risk of Gender Based Violence (GBV) i.e., Sexual Exploitation and Abuse (SEA) during the project construction	○ The contractor must prepare and submit Code of conduct with sanctions for non-compliance. ○ The Code of conduct must acknowledge a zero-tolerance for SEA/ SH on agents, subcontractors, and construction workers. ○ The code of conduct must be submitted and approved by the client through the supervising consultant prior to commencement of the construction works. ***Applicable to code of conduct issues supra (see labor influx impacts)***	○ Availability of contractor's code of conduct ○ Number of workers who signed the Code of conduct as condition for their employment. ○ Records of sanctions for workers who abused the code of conduct. ○ Record of periodic sensitization of construction workers on GBV issues ○ Number of construction workers charged with GBV offence	Dakrupe CMDC site	Incident reports Signed copies of CoCs Training reports	Weekly	Contractor, contractor's Safeguards Officer, Supervising consultant.	Included in construction cost
Risk of Sexually Transmitted Diseases (STD) including HIV/ AIDS	○ Provide STD, HIV/AIDS education and awareness for the construction workers and the Dakrupe community members to drum home the implications of illicit sex ○ Provide construction workers with condoms, for their use. ○ The contractor's code of conduct should prohibit sexual promiscuity among some construction workers	○ Record of HIV/STD education and awareness campaigns ○ Availability of condoms for construction workers ○ Contractor's code of conduct prohibiting sexual promiscuity.	Dakrupe CMDC site	Engagement and incident reports	Weekly	Contractor, contractor's Safeguards Officer, Supervising consultant.	Included in construction cost
SUBTOTAL							**72,000.00**

Anticipated Environmental & Social Impacts/ Risks	Proposed Mitigation and Management Measures	Parameters for monitoring	Monitoring location	Method	Frequency of monitoring	Responsibility	Estimated cost of implementation (GHS)/ annum
OPERATIONAL PHASE							
Air Quality Deterioration	○ ensure dampening of roadways/ access road to the CMDC ○ ensure filters and other equipment function appropriately and all the time	○ Availability of air quality monitoring records ○ Air quality measurements meeting GS1236: 2019 limits for NOx, COx, SOx, $PM_{2.5}$, PM_{10} and TSP. measurements	Dakrupe CMDC	Insitu measurement	Monthly measurements in line with GS 1236:2019	CMDC Management	95,000.00
Noise nuisance	○ equipment manufacturer to integrate noise abating mechanisms in the CMDC equipment and to ensure it is functional all the time ○ equipment including vehicles not in use to be turned off as appropriate	○ Leq, Lmax, Lmin (dBA) measurements meeting GS 1222: 2018 limits ○ Complaints by the Dakrupe community about excessive noise from the operations ○ Workers wearing earplugs in designated areas in the CMDC	Dakrupe CMDC	Insitu measurement	Monthly measurements in line with GS 1222:2018	CMDC Management	18,000.00
Waste Generation and Management	○ Immediately collect and dispose all wastes generate during normal operations and also during maintenance. ○ Do not abandon the maintenance waste generated at the CMDC. ○ Ensure that an accredited waste management service provider works along with the maintenance team to immediately collect and transport the wastes to appropriate dump site while recyclables are given to licensed agents. ○ Prepare and implement CMDC facility management plan	○ Absence of stockpiled waste at the Dakrupe CMDC. ○ Availability of waste bins at Dakrupe CMDC ○ Availability of Facility management plan ○ Record of disposal of maintenance waste at approved disposal site	Dakrupe CMDC	Insitu measurement	Weekly	CMDC Management	54,000.00
Management of Hazardous Chemicals including Cyanide	Winnowing ○ The processing equipment should have dust suppression systems and filter bags affixed to it for dust collection ○ Also to be provided are screens to help contain fugitive dust ○ Filter bags should be emptied and cleaned regularly ○ Workers are to be provided with appropriate nose masks Cyanidation ○ A secure area for cyanide storage should be	○ Dust measurements meeting GS1236: 2019 limits for $PM_{2.5}$, PM_{10} and TSP	Processing Plant at Winnowing	Insitu measurement	Monthly	Dakrupe CMDC Management	36,000.00

Anticipated Environmental & Social Impacts/ Risks	Proposed Mitigation and Management Measures	Parameters for monitoring	Monitoring location	Method	Frequency of monitoring	Responsibility	Estimated cost of implementation (GHS)/ annum
	established with the provision of a secondary containment of capacity 1.5 times the storage capacity of the cyanide solution ○ There should be continuous pH monitoring to confirm no cyanide leakages from the plant, ○ Training on cyanide handling should be established for operators with reference to the International Cyanide Management Code for best practices in its handling and disposal. Direct Smelting ○ The smelting area should have good ventilation ○ Operators should be provided with appropriate PPE for heat exposure ○ Operators should be provided training on flux mixing, furnace operation, and emergency procedures	○ Monitoring of wastewater quality discharges for Cyanide and pH ○ Monitoring of Heat Stress	Recycling Ponds Smelting Plant	Insitu Measurement of pH and Lab analysis for Cyanide Heat Stress Monitoring Instrument	Monthly Quarterly	Dakrupe CMDC Management Dakrupe CMDC Management	24,000.00 30,000.00
Fire Outbreaks and other emergencies	○ obtain and renew fire permits obtained from GNFS ○ provide fire extinguishers including fire hydrant for the Dakrupe CMDC ○ create fire belt around the Dakrupe CMDC ○ Form fire teams in conjunction with GNFS and ensure their regular training ○ maintain fire teams to fight any fires	○ Renewed Fire Permit ○ availability of fire extinguishers at the Dakrupe CMDC ○ evidence of fire belt ○ records of training of staff by GNFS of fire safety ○ evidence of fire team at the Dakrupe CMDC	Dakrupe CMDC	Inspect Permits Confirm adequacy of fire extinguishers Review effectiveness of fire belts, fire trainings and responsiveness of fire teams	Yearly	CMDC Management	24,000.00
Occupational Health & Safety issues	○ Provide all staff with appropriate PPEs (boots, hard hats, reflective jackets) ○ Engage only experienced personnel for the maintenance works; ○ Provide regular health screening for staff. ○ Provide clinic at the Dakrupe CMDC stocked with First Aid facilities	○ Dakrupe CMDC personnel wearing appropriate PPEs at work ○ Record of regular health screening for personnel ○ established clinic at the	Dakrupe CMDC	Impromptu checksInspection of health screening records Inspection of first aid facilities	Monthly	CMDC Management	60,000.00

Anticipated Environmental & Social Impacts/ Risks	Proposed Mitigation and Management Measures	Parameters for monitoring	Monitoring location	Method	Frequency of monitoring	Responsibility	Estimated cost of implementation (GHS)/ annum
		Dakrupe CMDC					
Labor Influx and related impacts and risks- conflicts with locals	○ Minimize labor issues by developing a labor management plan for the Dakrupe CMDC ○ The management of the Dakrupe CMDC must exercise due diligence in the hiring of labor from outside the community, including background checks where necessary by involving local opinion leaders ○ Workers shall be provided with a code of conduct assuring of good ethics for workers. The Code of conduct must be prepared and approved by the management of Dakrupe CMDC. ○ All the staff must be trained on the code of conduct and be familiar with it. ○ Enforce the code of conduct throughout the operations of the center. ○ The Code of Conduct should be made a part of employment contracts and include sanctions for non-compliance. ○ Management must monitor and enforce the Code of Conduct. ○ Proactively, engage and implement all worker grievance redress actions required	○ Evidence of a labor management plan and being implemented ○ Availability of signed Code of Conduct by all staff	Dakrupe CMDC	Review labour management reports Review hiring reports Review record on infractions or breaches to the Code of Conduct Review training records Assess effectiveness of GRM structures	Quarterly	CMDC Management	60,000.00
Public Health and Safety including community safety and security including impacts on community norms and taboos (risk of social conflict)	○ Enforce speed limit of 50km/hr for staff/ operational vehicles ○ Educate staff on taboos and norms in the Dakrupe community including the code of conduct for workers ○ Proactively, engage and implement all worker or community grievance redress actions required	○ Record of accidents/ incidents involving people community	Dakrupe CMDC	Inspection of accident records Inspection of training records	Monthly	CMDC Management	60,000.00
Risk of Gender Based Violence (GBV) i.e., Sexual Exploitation and Abuse (SEA) during the operation of the Dakrupe CMDC	○ Management must ensure availability of Code of conduct with sanctions for non-compliance for all staff ○ The Code of conduct must acknowledge a zero-tolerance for SEA/ SH on agents, and maintenance subcontractors. ○ All staff should be introduced to the Dakrupe community and for briefing on their norms and taboos	○ Availability of code of conduct and signed by all staff	Dakrupe CMDC	Review record on infractions or breaches to the Code of Conduct Review GBV-SEA/SH training records	Monthly	CMDC Management	36,000.00
SUBTOTAL							**497,000.00**

7.1.3 Key Responsibilities for the Monitoring Program

The primary responsibility for implementation of the environmental and social monitoring program during the construction phase is the Contractor. The Contractor will be required to hire an Environment, Health and Safety (EHS) Officer or Manager (Environmental and Social Safeguards Officer) responsible for implementing the Environment, Social, Health and Safety (ESHS) mitigation and management actions, including the schedule to the environmental permit (permit conditions) and other lending covenants of the World Bank.

Through the Safeguards Officer, the Contractor must ensure day-to-day monitoring of all environmental and social impacts mitigation measures implementation by the workers and provide regular standalone bi-weekly safeguards monitoring reports to the Client including violation of any approved procedures i.e., Code of Conduct, etc.

All the reports should capture progress and status on implementation of the mitigation measures arising from the ESMP implementation, considering the monitoring indicators but not limited to the following:

- Contractors' performance on implementing environmental and social safeguards;
- Progress on mitigation measures in relation to identified risks and impacts;
- Emerging impacts and proposed mitigation measures (if encountered);
- A presentation on parameters monitored in the reporting period;
- Activities to be taken in the following period;
- Capacity building needs that may be required

Relevant pictures should be included in the report.

Supervising Consultant

Staff of the Inspectorate Division of the Minerals Commission and the Regional EPA Office will provide oversight responsibility to ensure that the contractor is fulfilling the mitigation measures implementation responsibility under this ESMP. The contractor will submit their monitoring reports through the supervising consultant who will validate and forward them to the PIU through any of the safeguards persons at the PIU. The supervising consultant will coordinate the day-to-day monitoring of the implementation of the ESMP, Permit Conditions, and the contractors' safeguards commitment documents.

AEHPMP Safeguards Specialists

The AEHPMP-PIU Safeguards Focal Person(s) will regularly conduct monitoring field visits to the construction site at Dakrupe to inspect activities and verify the reports presented by the contractor and supervising consultant and make their own findings. They will provide guidance for any remedial actions where there is the need to prevent non-compliance and recurrence of inaction on the part of any stakeholder. The ESMP monitoring results will be continuously evaluated by the AEHPMP PIU as part of the Project supervision and this will allow for corrective actions to be taken when needed. The PIU will compile a regular safeguard monitoring reports for submission to the World Bank and EPA in line with environmental permit conditions requirement.

It is proposed to establish an ESHS committee for the purposes of the following:

- Hold regular meetings where representatives from contractor and the client can discuss progress, challenges, and mitigation efforts.
- Ensure that schedules, activities, and resource requirements are prioritized to minimize conflicts and maximize efficiency.
- Review and ensure that the contractor is adhering to the environmental and social management plans developed and the monitoring of their implementation.
- Share best practices, lessons learned, and strategies for mitigating potential impacts on the environment and social norms at the local level.
- Identify and assess potential risks and impacts that may arise from the implementation of the Project at Dakrupe.
- Develop strategies to mitigate and manage risks effectively, including emergency response protocols and contingency plans.

- Coordinate community engagement efforts to ensure consistent messaging and outreach across all Project components.
- Address community concerns, feedback, and grievances to enhance transparency and trust.
- Establish health and safety protocols and standards to promote a safe working environment for all workers involved in the Project.
- Share information on safety incidents, near misses, and lessons learned to enhance safety performance across other Projects.

The ESHS committee so constituted will not be limited to representatives from the Contractor, Project Engineer and/ or Supervising Consultant, Safeguards Officer, Dakrupe Community Mining Committee and the Bole District Assembly:

By addressing the above-mentioned key issues through the ESHS committee in regular coordination meetings, the AEHPMP PIU will foster collaboration, synergy, and alignment with the contractor to ensure performance across all the components of the Project, and greater overall efficiency in project implementation.

Although the primary responsibility for the implementation of the monitoring program during the construction phase is the Contractor, it is preferable that the Contractor engages an independent specialist or company to undertake the air quality, noise level and water/ wastewater quality monitoring to ensure objectivity of the results/recommendations.

The Management of the Dakrupe CMDC has the primary responsibility for ESHS monitoring during the operational and maintenance phase of the Project.

During the construction and operational phases, the EPA will periodically carry out site visits and review monitoring reports received from the AEHPMP-PIU to verify compliance with the monitoring program and the schedule to the environmental permit (permit conditions).

7.2 Contractors Environmental and Social Safeguards Commitment Strategy

Documents Requirements

Prior to their selection and commencement of the construction works and in line with international good practices, the Contractor will be required to prepare a few safeguards commitment documents which will provide the contractor's specific strategies for dealing with the potential environmental and social impacts mitigation requirements as provided in this ESMP document. The documents shall be reviewed and assessed for their adequacy by the supervising consultant. Together with this ESMP, the contractor's strategies will be monitored for compliance during the construction period. The strategies shall describe the resources allocated to and the personnel responsible for the execution of each task and requirements contained therein, roles and responsibilities of key construction staff including construction supervisors, the EHS Officer/ and the Project Manager in the monitoring and management of key environmental and social impacts mitigation activities. These documents are outlined below:

7.2.1 Contractor's Health and Safety Plan/Strategy

The contractor's health and safety plan will provide information on the contractor's procedures relating to occupational health and safety of his workers and public health and safety for the work they are responsible for under the contract. The Plan shall be guided by the World Bank's Health and Safety Guidelines as well as the Ghana Factories, Offices and Shops Act 328 (1970), etc.

The Contractor shall appoint an Environment Social Health and Safety (ESHS) Manager for the Project, who will report to the Project Manager (PM) of the PIU. The responsibilities of the ESHS Manager include, among other things:

- Implement the environmental, health and safety measures on the Project.
- Enforce the environmental permit conditions and mitigation, monitoring and management measures.

- Liaise with the PM to ensure all required PPEs, waste bins and other logistics are provided for the works;
- Identify appropriate training programs in ESHS for the workers.
- Ensure all machinery and equipment are in good working condition and are well serviced;
- Ensure all operators adhere to environment, health and safety procedures;
- Liaise with regulatory institutions such as EPA on all ESHS matters relating to the execution of the proposed Project at Dakrupe;
- Keep records and reports of all incidents/accidents and illnesses.
- Report all complaints from the community and other stakeholders/workers concerning environmental, social, health and safety issues to the PM of the PIU;
- Report all non-compliances of environmental, social, health and safety procedures to the PM of the PIU for appropriate action; and
- Enforce disciplinary actions against workers who don't comply with health and safety procedures.

7.2.2 Contractor's Environmental and Social Management Plan (C-ESMP)

The C-ESMP shall be based on this ESMP with a focus on construction activities. The C-ESMP shall, among other things, identify the construction phase activities, risks/impacts, take into consideration the mitigation and monitoring measures and their management arrangements captured in the ESMP, describe resource allocation and assign roles and responsibilities for the execution of each task.

7.2.3 Contractor's Waste Management Plan

The contractor's Waste Management Plan should cover both solid and liquid waste that will be generated during the construction activities to ensure environmental protection and a clean environment. The Plan should include specific procedures for tracking of loads of solid waste, disposal site and protocols for the maintenance of records of the quantities of wastes generated, reused, and disposed.

7.2.4 Contractor's Traffic Management Plan

The Contractor's Traffic Management Plan should address issues including strategies for ensuring safety of workers, pedestrians, and other motorists. Traffic may not be a major concern but the nature of the road from Seripe to Dakrupe requires trucks to move below the 50km/hr mark.

7.2.5 Contractor's Code of Conduct/Ethics

The contractor's Code of Ethics/Conduct shall contain obligations on the company to foster a well-organized, respectful, and collaborative environment at the workplace and in the Project community of Dakrupe during the period of the contract. Code of Conduct shall be provided to include but not limited to the following:

i.Compliance with applicable laws, rules, and regulations of the jurisdiction;

ii. Compliance with applicable health and safety requirements (including wearing prescribed personal protective equipment (PPE), preventing avoidable accidents and at duty to report conditions or practices that pose a safety hazard or threaten the environment.

iii. Zero tolerance to the use of illegal substances (such as alcohol and narcotics during working hours);

iv. Non-Discrimination (e.g. on the basis of family status, ethnicity, race, gender, religion, language, disability, or political conviction);

v. Attitude of respect and non-discrimination during interactions with community members (e.g. to convey an attitude of respect and non- discrimination);

vi. Sexual harassment, sexual exploitation (e.g. to prohibit use of language or behavior, in particular towards women or children, that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate);

vii. Violence or exploitation (e.g. the prohibition of the exchange of money, employment, goods, or services for sex, including sexual favors or other forms of humiliating, degrading or exploitative behavior);

viii. Protection of children (including prohibitions against abuse, defilement, or otherwise

unacceptable behavior with children, limiting interactions with children, child labor and ensuring their safety in the Project area);

ix. Protection and proper use of property (e.g., to prohibit theft, carelessness or waste);

x. Duty to report violations of this Code;

xi. No retaliation against workers who report violations of the Code, if that report is made in good faith;

xii. The Code must include sanctions against violations of the Code; and

xiii. Provision that all Company Managers and individual construction workers shall sign the Code of Conduct Declaration Form as below:

Code of Conduct Declaration Form

I hereby acknowledge receipt of my copy of the Contractor's code of ethics/conduct which has been written in plain language and explained to me. I acknowledge that adherence to this Code of ethics/conduct is a condition of my employment and I understand that violation of this code can result in serious consequences, up to and including dismissal, referral to legal authorities, forfeiting payments, termination of contract and eventually may have debarments implications.

- ***Name of Employee***
- *Name……..……..……Position*
- *Signature……..……*
  Date……

In addition to the Contractor's own Code of Ethics/Conduct, they shall adopt wholly and implement the requirements of the Client's own Code of Conduct for Preventing Gender- Based Violence (GBV)/Sexual Exploitation and Abuse (SEA)/Sexual Harassment (SH) and Violence Against Children (VAC) provided in **Annex 7-1** of this document. All requirements therein are obligatory and bidding on the Contractor under the contract of the works he/she is responsible for.

7.3 Environmental Committee for the Operational Phase

The PIU will constitute an ESHS committee comprising safeguard staff and representatives of relevant regulatory institutions such as EPA, Bole District Assembly, GNFS at the district among others. The main task of this committee is to formulate and implement policies to address environmental and social impacts during the operational phase.

7.4 Annual Environmental and Safety Audit and Reviews

The PIU will in collaboration with consultants undertake an annual environmental, social, health and safety audit of the AEHPMP interventions at Dakrupe. Issues or gaps identified will be referred and for redress by the PIU. The PIU will also carry out quarterly reviews of its safeguards performance. The monitoring program will also provide relevant information for effective auditing and reviews.

7.5 Compliance with Statutory Obligations

The PIU and the Management of the Dakrupe CMDC will comply with all relevant statutory obligations including:

i. Obtaining an Environmental Permit from the EPA, through submission of this ESMP and paying the relevant processing and permit fees.

ii. Compliance with the schedule/ conditions to be attached to the EPA's environmental permit for the Dakrupe CMDC including.
   a. Submitting necessary monthly/quarterly monitoring reports to EPA or as provided in the permit schedule to be issued.
   b. Submitting an Annual Environmental Report (AER) of the Dakrupe CMDC activities after 12 months from the commencement of works in accordance with Regulation 25 of LI 1652.

iii. Complying with the requirements of the Bole District Assembly/ by-laws.

Submission of EMP During Operations in Line with LI 1652

The PIU will submit an Environmental Management Plan (EMP) of the Dakrupe CMDC activities to the EPA within 18 months of commencement of operations in accordance with Regulation 24 of LI 1652.

The PIU/ Management of Dakrupe CMDC and Contractor will also be required to comply with all WB monitoring and reporting requirements.

7.6 Document Control and Tracking

Documentation

The PIU/ Management of the Dakrupe CMDC will keep records on all environmental, social health and safety (ESHS) data including, environmental emergencies. The ESHS data will be kept in both electronic and hard copy formats. A format for documentation of information in electronic form will be developed to capture daily/weekly information on environmental sampling/monitoring, environmental quality results, waste generation and disposal, environmental incidences and emergencies, training and awareness creation programs such as community fora/ workshops and meetings.

Document Tracking and Control

PIU/ Management of the Dakrupe CMDC will establish and maintain procedures to control all documents and permits that are required to ensure compliance and to make sure that:

- All documents and permits are easily traceable;
- All statutory documents are periodically reviewed, revised as necessary and approved as adequate by the relevant regulatory agencies;
- All permits and approvals are renewed as and when necessary; and
- Current versions of relevant documents are available on site.

7.7 Facilities Management

The facilities will be maintained and managed in accordance with international good practices. The potential environmental/technical concerns that will be addressed include:

i. quality of the construction materials to ensure the safety and security of their usage;
ii. provision of quality assurance backstopping by the Supervising Engineer/ consultant; and
iii. response to emergencies.

Measures adopted to manage these concerns include:

i. Monthly Inspections and Damage Control;
ii. Quality Assurance and Security; and
iii. Provisional Emergency Response Action.

Monthly Inspections and Damage Control

The PIU will carry out its monthly inspections with the aim of correcting any defects at every stage of construction.

Quality Assurance

In order to avoid any substandard construction works, all materials/facilities will be pretested to the required standard before approval for installation/ construction.

Housekeeping

A disorderly or dirty workplace can introduce its own hazards in addition to those associated with the construction works. Good housekeeping is the first principle of health, safety and fire prevention. The following measures will be ensured to ensure good housekeeping at the works site:

i. All areas will be kept clear of non-essential equipment and materials;
ii. All equipment will be kept clean and leakages sealed;
iii. Management will ensure that all equipment and materials are in their assigned place and that no loose or unnecessary tools are left lying about in the workplace; and
iv. Caution notices such as “Do Not Litter” will be provided at vantage areas.

7.8 Continued Public Participation

The PIU and the PIU/ Management of the Dakrupe CMDC will always open its doors to the general public for complaints, suggestions and advice on environmental and social related issues and they will be quickly addressed.

7.9 Emergency Response Action

Responsibility

The proposed emergency response plan for the construction phase is provided. Emergency situations will be managed by the EHS Unit of the Contractor. The EHS Manager or Supervisors can declare an emergency.

Emergency Service Providers and Communication Channels

After declaration of an emergency, the following organizations or emergency service providers will be notified immediately, depending on the type of emergency:

i. GNFS- call 999 or 192
ii. Ghana Police Service -call 18555 or 191
iii. Ghana Ambulance Service- call 112

Emergency services (e.g. fire services, medical services, etc.) can be contacted by phone call, using the contact numbers supra. The EHS Manager or Supervisors can contact emergency services and provide them with all appropriate information. Contact with the emergency services provider must be kept until they arrive on site.

Stakeholder Communication Roles

All information on the emergency to the media and other stakeholders will be sent from one focal person who is the responsible person for emergency coordination. This will be the Project Manager or in his absence the EHS Manager.

In case of all emergencies, all workers are to note the following:

- DO NOT CALL the local media to report the emergency (It is the responsibility of the Project Manager and in his absence the EHS Manager)
- DO NOT CALL the family or friends of the persons involved in the emergency (It is the responsibility of the Project Manager and in his absence the EHS Manager)

System for Raising Alarm

Construction workers will be informed and educated on the system for raising alarms at the workplace. Generally, workers are expected to shout at least three times using the nature of the emergency. Example if the emergency is fire, the worker who first sees or observes it will shout FIRE! FIRE! FIRE! If the emergency is an accident, worker will shout ACCIDENT! ACCIDENT! ACCIDENT! If the emergency is spillage, worker should shout SPILLAGE! SPILLAGE! SPILLAGE!. If the emergency occurs offsite, the worker is expected to call the Project Manager or EHS Manager immediately if he/she is able to do so.

Emergency Assembly Point at the Treatment Plant Site

The contractor for the Dakrupe CMDC site will create an emergency assembly point at the site. The Emergency Assembly Point (EAP) is where all staff and visitors will assemble during the occurrence of an emergency which requires all workers and visitors to be accounted for.

Equipment and Resources

The contractor will ensure that there are adequate equipment and resources as well as appropriate measures in place for its preparedness for an emergency. The equipment/resources and measures to be put in place include:

- Availability of PPEs including safety googles, hand gloves, reflective jackets, raincoats, life jackets, wellington boots/safety shoes;
- Provision of fire extinguishers;

- Availability of equipment/tools (e.g. vehicle, wheel barrows, shovels etc.) for emergencies;
- Creation of an emergency response team;
- Provision of mobile phones to supervisors to enable relevant stakeholders to be promptly informed and reached during emergencies.

Specific Emergency Situations

Fuel will not be stored on site. In the event of accidental spillage of construction materials, a recovery truck will be dispatched to the scene quickly to recover the product. **Table 7-2** provides specific emergency situations envisaged and the response measures proposed, while a general emergency response flow chart has been developed for use as shown in **Figure 7-1.**

Table 7-2: Specific Emergency Situations and Proposed Responses

WORKPLACE FIRES	
Response	**Any discovering fire should shout FIRE! FIRE! FIRE!** Assess fire before contacting GNFS immediately. Isolate fire where possible using appropriate extinguishers. Call the Fire Service emergency number 192 or general emergency line 999 if extinguishers are not helpful Evacuate all items and equipment in danger and ensure workers move to safe place Assist Fire Service if needed to control fire If there are injuries, provide first aid and send victims to nearest clinics/hospital Complete an incident report.
Preventive and control measures	Have strategically placed and properly serviced firefighting equipment especially fire extinguishers at vantage points at the construction at Dakrupe CMDC site. Remove or protect combustible or flammable materials from heat sources. Suppress and control sparks on site. Suppress and control heat/fire (e.g. no burning or naked fire on or around the site; idling engines should be put off etc.). Routing checking and supervision of works/site.
PERSONAL ACCIDENT/INJURY	
Response	Work to be stopped if accident occurs at work camp/ construction site. Apply first aid. Assess condition of the injured, and contact Dakrupe CHPS / ambulance if required. Complete accident report.
Prevention and control measures	Well-stocked first aid kits to be maintained. Provide clear signage onsite. Provide appropriate PPEs for workers and ensure its use. Educate and train workers on the use of PPEs and relevance of signages. Evaluate hazards at workplaces. Carry out regular inspection of work activities and workers behaviour
FLOOD	
Response	Where possible move machinery and workers to higher ground.
Prevention and control measures	Monitor weather data and flood warnings for advice. Inspect nearby drains close to the Dakrupe CMDC especially the main road to Seripe for any signs of flooding.
SPILL QUARRY DUST, AGGREGATES AND CONCRETE	
Response	Remove remaining quarry dust, aggregates and/ or concrete from spill area. Clean up spillage. Rectify the source of spillage. Complete incident report.
Preventive and control measures	Regularly inspect potential points of spills. Monitor levels of storage of products Do not sweep or hose concrete spillage or aggregates into storm water drains Do not stockpile spill aggregates on roads or walkway/ paths
VEHICLE ACCIDENT	
Response	EHS Manager must be informed immediately by staff available or the driver of the vehicle who will intend report to the Project Manager/ Supervising Engineer Driver or staff on board vehicle should erect reflective triangles at a safe distance in front and behind vehicle The EHS Manager shall visit the scene of the accident, inform and invite the Police to the accident scene or spot. The EHS Manager shall investigate the cause of the accident and submit a report on the incident/ accident. Where casualties are involved, the EHS Manager must ensure they are sent to the nearest clinic or hospital. Complete an accident report
Prevention and control measures	All drivers shall observe the specified speed limits of 20 km/h - 50km/h on the Seripe – Dakrupe road and 20km/hr at Dakrupe to the construction site. All drivers on major roads shall observe a highway speed limit of 60km/h and the mandatory speed limit of 50km/h in communities.

	Make sure the accident area is safe and be alert for physical dangers such as fires or smoke and if fire is suspected call fire service on 192 immediately. Ensure cars are parked safely and well away from the accident spot. Make vehicles safe by switching off the ignition of all damaged and affected cars Call emergency line 999 or 112 for ambulance service if there are injuries or medical emergencies. Assess the casualties quickly and provide first aid if possible
ELECTRIC SHOCK AND ASSOCIATED INJURIES	
Response	Isolate power line/ power, if safe to do so. If not, use a dry, non-conducting object made of cardboard, plastic or wood to move the source away and from the injured person. Provide injured from shock with first aid and then to nearest clinic/ hospital for medical care or call ambulance on 112 Complete incident report
Prevention and Control Measures	Ensure all electrical power sources and cables are properly insulated Avoid loose hanging wires Never use a damaged extension cord or defective electrical device. Keep wet hands away from electrical outlets. Check and report all electrical hazards. Train employees on electrical safety.

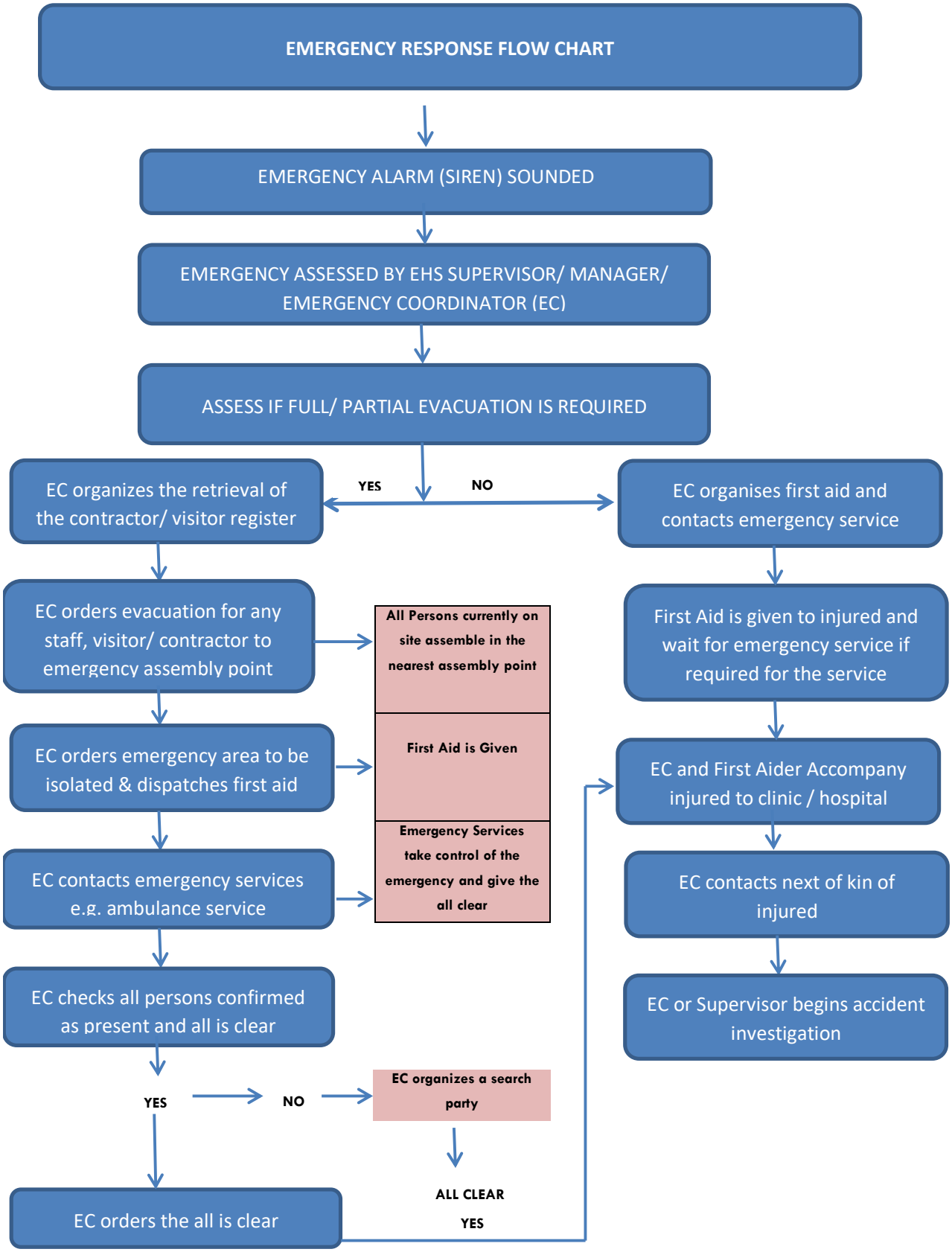


Figure 7-1: Emergency Response Flow Diagram for Managing Emergencies at the Construction Site

7.10 Key Roles and Responsibilities of Major Actors

A summary of the roles and responsibilities of key stakeholders in the implementation of the ESIA/ESMP are provided in **Table 7-3**.

Table 7-3: Key Roles and Responsibilities of Major Actors

#	Key Actor	Key Roles and Responsibilities
1.	Environmental Protection Agency - Regional Office and Head Office	❍ Offering guidance for screening, scoping, review of draft report, receiving comments from stakeholders, public hearing. ❍ Issue environmental permit with a schedule / conditions to the permit for the Project implementation ❍ Monitoring of ESA/EMP and compliance with environmental permit schedule/ conditions ❍ Environmental liability investigations ❍ Site visits and follow-ups ❍ Promote environmental awareness
2.	Ministry of Environment, Science Technology and Innovation	❍ Has overall responsibility for the AEHPMP and compliance with the World Bank Safeguards Policies applicable to the project ❍ In conjunction with the EPA/ AEHPMP PIU, has overall responsibility for successful implementation of the ESMP.
3.	AEHPMP PIU	❍ Liaise closely with the EPA and other regulators to obtain the needed permits and approvals for the Project implementation. ❍ Disclose the approved ESMP document to the public ❍ Coordinate and ensure the implementation of the Project and the environmental/social requirements. ❍ Identify and liaise with all stakeholders involved with the environmental / social related issues of the Project. ❍ Establish partnerships and liaise with organizations, stakeholders and civil society groups to ensure successful implementation of the Project. ❍ Promote environmental, social, health and safety awareness ❍ Coordinate and present project implementation E&S monitoring report to EPA and World Bank on regular basis.
4.	Minerals Commission	❍ Has overall responsibility for the Community Mining Scheme at Dakrupe ensuring they have a valid Mining Operating Permit at all times. ❍ Provide a Mining Services Operating Permit for the Dakrupe CMDC. ❍ Liaise closely with the EPA and other regulators to supervise the operation of the CMDC at Dakrupe.
5.	Contractor	❍ Compliance with BOQ specifications. ❍ Provide their strategies on management of Health and Safety, Waste Management, Traffic Management, Code of Conduct ❍ Engage in grievance redress during project implementation ❍ Implement mitigation/monitoring program captured in the ESIA / ESMP and permit schedules related to the construction phase during the Project implementation. ❍ Periodically review construction activities and ensure compliance with ESHS regulations and laws. ❍ Prepare and submit relevant ESHS reports to regulatory agencies. ❍ Ensure workplaces are safe and construction workers are provided with appropriate PPEs. ❍ Comply with traffic management plan provisions. ❍ Promote environmental awareness among workers.
6.	Supervising Engineer/ Consultant	❍ Supervise contractor and ensure compliance with BoQ specifications. ❍ Ensure that Contractor and subcontractors comply with their Environmental, Health and Safety plans and monitoring programs. ❍ Review and approve all construction method statements from the contractor
7.	Bole District Assembly	❍ Provide development and building approvals for the Project buildings and structures. ❍ Provide suggestions and concerns to ensure smooth implementation of the Project during stakeholder meetings. ❍ Participate in the EA processes and in the Project decision-making that helps prevent or minimize impacts and to mitigate them. ❍ Assist in resolving community complaints or grievances that are beyond the Contractor. ❍ Approve disposal sites for construction wastes and other wastes generated during the construction phase.

#	Key Actor	Key Roles and Responsibilities
8.	Community opinion leaders, Assemblymember Residents, including Miners	❍ Partnering in project stakeholders' awareness creation ❍ Support the Project implementation and follow due process in addressing grievances and complaints. ❍ Reporting grievances through the established GRM structures for the Project ❍ Provide comments, advice and/or complaints on issues of nonconformity. ❍ Attend public meetings organized for stakeholders on Environmental and Social Safeguards. ❍ Provide feedback to Contractor/ AEHPMP PIU on complaints from locals on construction activities creating environmental/social nuisance or problems to the community or individuals in the community.
9.	NGOs/CSOs	❍ Promote ESHS awareness ❍ Provide feedback to AEHPMP PIU on complaints from locals on construction activities creating ESHS nuisance or problems to the community or individuals in the community. ❍ Publicize GRM arrangements for the Project. ❍ Act as an environmental/social mobilizer and mediator when required.
10.	World Bank	❍ Provide adequate funding for the Project implementation. ❍ Overall supervision and provision of technical support and guidance. ❍ Recommend additional measures for strengthening the management framework and implementation performance.
11.	Media	❍ Publicize or discuss the Project information approved by AEHPMP PIU ❍ Identify issues that could derail the project implementation and bring them to the attention of stakeholders. ❍ Promote environmental and safety awareness on the Project.
12.	Ghana National Fire Service GNFS)	❍ Be involved with emergency response situations that is beyond the capability of the Contractor.
13.	Ghana Police Service	❍ Be involved with any violations of national laws and order, GBV/ SEA/ SH and human right abuses by construction personnel and community members.
14.	Medical facilities	❍ Help in treating accident victims with major injuries that occur onsite or offsite involving either construction personnel or community members during the implementation of the Project.

7.11 Grievance Redress Mechanism

7.11.1 Basis of Grievance Redress Mechanism

Even though during this ESMP preparation processes, stakeholder consultation was carried out in a consultative and participatory manner, experience has shown that grievances are further raised sometimes by project-affected persons/ I&APs during the project implementation. In the light of this, grievance resolution procedures for projects are necessary to resolve disputes that may arise from an aggrieved person.

A Grievance Redress Mechanism (GRM) is a system by which queries or clarifications or problems that arise out of implementation of a project are resolved and addressed efficiently and effectively. When addressed, the grievances are expected to ensure support, as well as help achieve results and sustainability of project activities.

As part of this ESMP, a GRM with multiple avenues or channels for lodging complaints and their resolution in a way that is transparent, prompt and timely and with clear procedures is established hereunder. The establishment of the GRM on all the AEHPMP Projects is a requirement by the World Bank to ensure resolution of project related conflicts or complaints.

7.11.2 Objectives of the Grievance Redress Mechanism

The objectives of the Grievance Redress Mechanism among others is to:

❍ Resolve grievances or complaints from affected persons, groups and institutions promptly, fairly and in a manner, that to extent possible acceptable to all parties;

- Provide affected people with avenues for making a complaint or resolving any dispute that may arise during the implementation of the project
- Ensure that appropriate and mutually acceptable redress actions are identified and implemented to the satisfaction of complainants; and
- Avoid the need to resort to judicial proceedings.

7.11.3 The Grievance Redress Structure

The grievance redress structures use the already existing EPA Grievance Redress framework to address complaints that may arise as a result of the proposed construction of the Dakrupe CMDC (Grievance Redress Mechanism (GRM) | Environmental Protection Agency, Ghana (epa.gov.gh).

The Safeguards Specialist or a dedicated staff at the PIU would be responsible for management the central Grievance Redress System relating to the Dakrupe CMDC project of AEHPMP. The proposed GRM recommends four key steps as follows:

- Receive and register grievances or complaints;
- Acknowledge, assess and assign (Acknowledge receipt of grievance, outline how grievance will be processed, assess eligibility and assign responsibility);
- Propose Response; and
- Agreement on Response.

If agreement is reached, implement agreement. If agreement is not reached, review case and if no agreement is reached under the review process, then the case can be referred to the law courts.

7.11.4 Steps of the Grievance Process

Table 7-4 presents the recommended time frames for addressing a grievance or dispute.

Table 7-4: Proposed GRM Time Frame

Step	Process	Timeframe
1	Receive and register grievance	Within 24 hours
2	Acknowledge the grievance	Within 24 hours
3	Assess the grievance	Within 24 hours
4	Assign responsibility	Within 2 Days
5	Develop a response	Within 7 Days
6	Implement response if agreement is reached	Within 7 Days
7	Close the grievance	Within 2 Days
8	Initiate grievance review process if no agreement is reached at the first instance	Within 7 Days
9	Implement review recommendations and close grievance	Within 14 Days
10	Grievance taken to court by complainant if no agreement is reached	-

7.11.5 Grievance Documentation and Reporting

Resolved and escalated grievances/cases would be documented daily (as tickets) into the EPA centralized GRM system by the assigned grievance Officer. The Safeguards Specialist or a dedicated staff at the PIU would exercise oversight over the system and track the resolution of all grievances/cases.

Monthly case/ grievance reports will be generated from the system by the Safeguards Specialist or a dedicated staff at the PIU and report to the Project Coordinator to inform management decisions. Quarterly reports would also be generated and reported to the MESTI as part of the Project's Progress Reporting to the World Bank. Periodic reports will also be generated within a reasonable time frame for stakeholders upon request irrespective of the period (e.g. bi-annual, annual etc.).

8.0 INSTITUTIONAL CAPACITY REQUIREMENTS FOR ESMP IMPLEMENTATION

To effectively implement this ESMP document, training will be undertaken by the AEHPMP PIU to equip key stakeholders who will be involved in the implementation, monitoring, and reporting on the ESMP. The capacity building will be carried out prior to the commencement of the civil works and subsequently prior to operations. The training is aimed at providing knowledge and understanding on the ESMP requirements, the skills required, and the roles and responsibilities. A proposed plan for the capacity building is presented in **Table 8-1**. The Plan is estimated to cost Seven Hundred and Fifty Thousand Ghana Cedis (GHS750,000.00).

Table 8-1: Training Plan for the ESMP Implementation

Training Required	Targeted Participants	Duration	When	Estimated training cost (GHS)/ annum
Overview of World Bank and EPA Policies triggered by the project.	**Contractor Key Staff**-Project Engineer, Foreman, Safeguards Officer, Clerk of Works, Health and Safety Manager. **Supervising Consultant staff-** Project Engineer, Safeguards Officer, Clerk of Works. **Bole District Assembly**- District Chief Executive, Metropolitan Coordinating Officer, Metropolitan Planning Officer Metropolitan Social Development & Gender Officer, Waste Management Engineers, Metropolitan Works Engineer, Elected Assemblymember of the Project community	1 day	Prior to commencement of civil works	150,000.00
Overview of the ESMP, Potential E&S impacts, Mitigation and management measures, E&S monitoring, Roles and Responsibilities	**Contractor Key Staff**-Project Engineer, Foreman, Safeguards Officer, Clerk of Works, Health and Safety Manager. **Supervising Consultant staff-** Project Engineer, Safeguards Officer, Clerk of Works. **Bole District Assembly** - District Chief Executive, Metropolitan Coordinating Officer, Metropolitan Planning Officer, Metropolitan Social Development & Gender Officer, Waste Management Engineers, Metropolitan Works Engineer, Elected Assemblymember of the Project communities **Other Stakeholders**- Community Opinion Leaders/NGOs/CBOs/ Project Affected Persons, Miners and other stakeholders.		Prior to commencement of civil works	150,000.00
Health and Safety (Occupational & Public Health & Safety)	**Contractor Key Staff**-Project Engineer, Foreman, Safeguards Officer, Clerk of Works, Health and Safety Manager, other construction workers. **Supervising Consultant staff-** Project Engineer, Safeguards Officer, Clerk of Works. **Bole District Assembly**- District Planning Officer, Metropolitan Social Development & Gender Officer, Waste Management Engineers, Metropolitan Works Engineer, Elected Assemblymember of the Dakrupe community **Other Stakeholders**- Community Opinion Leaders/NGOs/CBOs/ Project Affected Persons, Miners and other stakeholders.	1 day	Prior to commencement of civil works	150,000.00
Code of Conduct for construction workers (integrating GBV and Child labor issues)	**Contractor Key Staff**-Project Engineer, Foreman, Safeguards Officer, Clerk of Works, Health and Safety Manager, other construction workers. **Supervising Consultant staff-** Project Engineer, Safeguards Officer, Clerk of Works. **Other Stakeholders**-Representatives of Community Opinion Leaders/NGOs/CBOs/ Project Affected Persons, Miners and other stakeholders **Bole District Assembly** District Planning Officer, Metropolitan Social Development & Gender	½ day	Prior to commencement of civil works & during construction period	75,000.00

Training Required	Targeted Participants	Duration	When	Estimated training cost (GHS)/ annum
	Officer, Waste Management Engineers, Metropolitan Works Engineer, Elected Assemblymember of the Dakrupe community			
Construction Waste Management	**Contractor Key Staff**-Project Engineer, Foreman, Safeguards Officer, Clerk of Works, Health and Safety Manager, other construction workers. **Supervising Consultant staff- P**roject Engineer, Safeguards Officer, Clerk of Works. **Bole District Assembly**- District Planning Officer, District Social Development & Gender Officer, Waste Management Engineers, Metropolitan Works Engineer, Elected Assemblymembers of the Project communities	½ day	Prior to commencement of civil works & during construction period.	75,000.00
Grievance Redress Mechanisms	**Contractor Key Staff**-Project Engineer, Foreman, Safeguards Officer, Clerk of Works, Health and Safety Manager. **Supervising Consultant staff-** Project Engineer, Safeguards Officer, Clerk of Works. **Bole District Assembly**- District Coordinating Officer, Metropolitan Planning Officer, Metropolitan Social Development & Gender Officer, Waste Management Engineers, Metropolitan Works Engineer, Elected Assemblymembers of the Project communities **Grievance Redress Committee Members: Other Stakeholders**-Representatives of Community Opinion Leaders/NGOs/CBOs/ Project Affected Persons, Miners and other stakeholders	1 day	Prior to commencement of civil works	150,000.00
Subtotal (construction)				**750,000.00**
ESMP Implementation for Operational Phase	**Staff of Dakrupe CMDC**-4 management team. **Management of Dakrupe Community Mining Scheme-** 4 staff. **Bole District Assembly** **Grievance Redress Committee Members: Other Stakeholders**-Representatives of Community Opinion Leaders/NGOs/CBOs/ Project Affected Persons, Miners and other stakeholders	1 day	During Operations and Maintenance Phase	180,000.00
Requirements of Ghana EPA	**Staff of Dakrupe CMDC**-representatives of management team. **Management of Dakrupe Community Mining Scheme-** 4 staff	1 day but twice in a year	During Operations and Maintenance Phase	120,000.00
Hazardous Materials/ Chemicals Management	**Staff of Dakrupe Mine CMDC**-4 management team. **Management of Dakrupe Community Mining Scheme -** 4 staff	1 day but twice in a year	During Operations and Maintenance Phase	120,000.00
Subtotal (operation)				**420,000.00**
Grand Total				**1,170,000.00**

9.0 DECOMMISSIONING PLAN

9.1 Post-Construction Phase

9.1.1 Equipment and other Site Facilities

The Contractor will dismantle and relocate all equipment and other facilities and leftover materials such as pieces of wood, iron rods, spent concrete and chipping, broken manholes, scrap metals, debris, obsolete construction equipment, etc., at the Project sites upon completion of the construction works. Besides wastes that can be given out or sold out for reuse or recycling, all other wastes generated will be disposed of at the community's approved waste disposal site after the decommissioning.

Decommissioning of the equipment and other facilities will take into consideration the intended use and in compliance with both Ghanaian and international policies governing decommissioning of such facilities.

Guidelines to help in decommissioning any site office and other project installations are presented in **Table 9-1**.

Table 9-1: Guidelines for Decommissioning Site Offices and other Installations

ITEM	DECOMMISSION ACTIVITY	SAFETY MEASURE	MATERIALS REQUIRED
Superstructures			
Pieces of wood, iron rods, metal scraps, corrugated iron sheets, etc.	Reuse or sold/given out to accredited recycling providers	PPE for workers, including leather gloves (potential for the sheets to injure the handler).	Claw hammer
Plastic Sheets	Plastic sheets that will be re-used should be removed and washed with disinfectant, dried and stored safely. Other sheets that will not be reused should be disposed of properly at the community's approved dumpsite.	Workers should be allowed to work only after wearing their PPE. Ensure that after cleaning, the workers shall take a bath and wash themselves with disinfectant and bathing soap	Disinfectant, Chlorine solution, Brushes, Bathing Soap, PPE's for workers (Gloves, reflective Overall, Safety boots, Head cover).
Timber	The timber should be sprayed with disinfectant for reuse. Those not reusable should be donated to local community members for use as firewood.	PPE for workers, including leather gloves (potential for the sheets to injure the handler).	Claw hammer, Digging bar, Spraying equipment and Disinfectant
Sanitation facilities			
Squatting pan and trap or WC, PVC sewage piping	Care should be taken when handling these items as they have been in direct contact with human excreta. If planned for re-use, the pan, trap & PVC items will be removed and wash with disinfectant, to be dried and stored safely.	Workers should be allowed to work only after wearing their PPE. Ensure that after cleaning the workers will take a bath and wash themselves with disinfectant and bathing soap.	Disinfectant, Chlorine solution, Brushes, Bathing Soap, PPE for workers (Gloves, reflective Overall, Safety boots, Head cover).
Masonry Foundations (cement/rings platform)	All above ground structure should be demolished (smashed)	Workers should be allowed to work only after wearing their PPE (and ensuring that the workers take a bath and wash with disinfectant and bathing soap.	Shovels, Pick-axe, PPE for workers (Gloves, Overall, Safety boots, Head cover)
Mobile Toilets			
Mobile toilet /urinal units	Care should be taken when handling these items as they have been in direct contact with human wastes. Relocate all mobile toilet/units to new work sites or to contractor yard for future use at new sites.	Workers should be allowed to work only after wearing their PPE.	Disinfectant, Chlorine solution, Brushes, Bathing Soap, PPE for workers (Gloves, reflective Overall, Safety boots, Head cover).
Pit Latrine			
Pit Latrine /urinal units	The pit should be covered with soil material and levelling it up and the area disinfected. Wooden slabs should be buried if applicable.	Workers should be allowed to work only after wearing their PPE.	Disinfectant, Chlorine solution, Pick-axes, shovel, wheelbarrow Bathing Soap, PPE for

ITEM	DECOMMISSION ACTIVITY	SAFETY MEASURE	MATERIALS REQUIRED
			workers (Gloves, reflective Overall, Safety boots, Head cover).
Bathroom			
Washroom and bathing place	The plastic sheet and wooden structures to be broken. Concrete platform to be smashed and the debris moved to a disposal site	Ensure that working crew move the debris to a disposal site	Shovels, Pick-axe, wheelbarrow locally available

9.1.2 Project Equipment/Machinery and Materials

The Project equipment such as excavators, generators, vehicles and other machinery will be relocated to new or other work sites in the country. Any leftover materials like sand, chippings will be removed from the site.

9.2 Post-Operational Phase – Project Facilities

The Contractor is expected to handover the Project facilities to the PIU after construction for operation of the Dakrupe CMDC. The PIU and other stakeholders will ensure that CMDC last for the period it has been designed for and even beyond. The CMDC will not be decommissioned entirely after the designed period but rehabilitation and expansion works will be carried out as appropriate for further improvement using modern and appropriate technologies.

Any such large-scale rehabilitation and improvement works to be carried out in the long term will be undertaken in line with the environmental assessment procedures of the country. The intended rehabilitation and improvement works will be registered with the EPA to enable the Agency advise on the level of environmental assessment and reporting to be carried out in accordance with the Environmental Assessment Regulations 1999, LI 1652.

Other stakeholders and relevant institutions will be informed prior to the commencement of any major rehabilitation work on the Dakrupe CMDC, and these include:

- Bole District Assembly – Local government authority in charge of developmental projects in the project area;
- Minerals Commission – Government Agency responsible for the mining sector; and
- PIU – responsible for implementation of the Project at Dakrupe.

10.0 CONCLUSION

The intervention, a community-focused cleaner technology seeks to address current policy challenges as well as to strengthen regulatory frameworks and facilitate their implementation, to better address environmental health risks associated with mercury use in ASGM sector.

The proposed establishment of a CMDC at Dakrupe is to assist in eliminating mercury exposure and use in ASGM and improve the health risks and effects associated with mercury in the community and Ghana as a whole. Mercury is a known neurotoxin with high exposures linked to some health challenges including kidney and autoimmune dysfunction.

The various stages in the existing Dakrupe ASGM activities have some environmental and social risks and impacts which the proposed CMDC seeks to address, which also has some impacts albeit minor. This ESMP therefore seeks to provide mitigation and management measures to realize the benefits from the intervention while eliminating any cumulative impacts.

The overall strategy for the intervention is designed to improve ASGM operations in mining communities such as Dakrupe. While eliminating the health risks associated with mercury use in ASGM as the main benefit of the intervention other multiplier effects such as employment opportunities, poverty reduction and improved national reputation, some negative impacts during implementation have been identified during construction and operation of the ASGM sector. Such negative impacts include air quality deterioration, noise level elevation and landscape destruction during construction and wastewater generation during operation and maintenance which have been identified as minor.

The studies towards the preparation of this ESMP has revealed that the execution of the CMDC at Dakrupe will not severely impact negatively on the existing environmental, social, safety and health of the community.

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12.0 LIST OF ANNEXES

Annex 3-1: Report of Ambient Air Quality Noise Assessment and Ground Water Quality Baseline Study
Annex 3-2: Report of Terrestrial Ecology Study
Annex 4-1: Stakeholder Engagement Results
Annex 7-1: Sample Code of Conduct Forms

Annex 3-1: Report of Ambient Air Quality Noise Assessment and Ground Water Quality Baseline Study

ENVIRONMENTAL PROTECTION AGENCY (EPA)

GHANA, AFRICA ENVIRONMENTAL HEALTH AND POLLUTION MANAGEMENT PROGRAMME (AEHPMP)

AMBIENT AIR, NOISE, AND GROUNDWATER QUALITY BASELINE STUDY REPORT

FOR THE PREPARATION OF ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS (ESMP) FOR DAKRUPE CLEAN MINE DEMONSTRATION CENTRE (CMDC)

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AUGUST 2024

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❑ EXECUTIVE SUMMARY

The Environmental Protection Agency (EPA) has proposed to establish a Clean Mine Demonstration Centre (CMDC) at Dakrupe in the Bole District of the Savannah Region of Ghana as part of the Africa Environment Health and Pollution Management Programme (AEHPMP) funded by the World Bank. The centre will be supplied with ore from the Camp, Wasteline and Sonyo Road mining pits. These mines form the Dakrupe Community Mining.

The establishment of the CMDC at the Dakrupe requires the preparation of an Environmental and Social Management Plan (ESMP). This report of the ambient air quality, noise levels and surface water quality baseline characteristics of the catchment area of the proposed establishment of the Dakrupe CMDC forms part of the baseline studies for the ESMP preparation. It describes the baseline ambient concentration of particulate matter, noxious gases and groundwater quality at specified locations in Dakrupe. The monitoring was carried out by Messrs E**nvirorich Consult Limited** on 1st August, 2024. The samples were collected from the following locations described hereunder with their respective Global Positioning System (GPS).

For Ambient Air and Noise

ID	Sampling Site	Coordinates
AN1	Demarcated CMDC Site	08°57'16.0"N, 002°17'54.7"W
AN2	Sonyo Road	08°57'55.1"N, 002°18'15.4"W
AN3	Waste Line	08°55'56.5"N, 002°18'24.7"W
AN4	Milling Site	08°57'09.5"N, 002°17'34.1"W

For Groundwater Quality

ID	Sampling Point	Coordinates
BHW1	Groundwater at Wasteline site	08°56'03.6"N, 002°18'19.0"W

The concession for the community mining falls within the Tropical continental or savanna climatic region of Ghana characterised by a distinct wet and dry seasons where rainfall occurs during a particular period during the year (the wet season). During this time, these areas are under the influence of the ITCZ. It lies within the tropical grassland or savanna vegetative zone of Ghana where the dry season is clearly marked. High temperatures are also experience at this climatic region throughout the year.

The purpose of the assignment was to monitor and confirm the baseline concentration of particulate matter, noxious gases, noise levels and surface water quality of the project area/ concession as part of the ESMPs study and depicting the baseline conditions.

The scope of work involved (1) fieldwork, (2) laboratory analysis, (3) data analysis and (4) report preparation.

The results are as detailed in the tables hereunder:

for ambient air quality- (monitored 1st August, 2024)

ID	Sampling Site	TSP/ µgm^{-3}	PM_{10}/ µgm^{-3}	$PM_{2.5}$/ µgm^{-3}	NO_2/ µgm^{-3}	SO_2/ µgm^{-3}
AN1	Demarcated CMDC Site	26.1	15.8	5.42	0.723	0.000
AN2	Sonyo Road	138.5	33.8	6.66	0.742	7.500
AN3	Waste Line	142.5	100.2	10.27	0.743	0.833
AN4	Milling Site	205.9	106.1	13.28	1.400	13.520
GS 1236:2019- Ambient Air Pollutants		**150.0***	**70.0***	**35.0***	**150.0***	**50.0***
WHO Guideline Value		**na**	**50.0***	**25.0***	**200.0***	**50.0***
IFC Guideline Value		**na**	**50.0***	**25.0***	**200.0****	**20.0***

*…….24 hours averaging time **……..1 hour averaging time

GS 1236:2019 is "Environment and Health Protection- Requirements for Ambient Air Quality and Point Source/ Stack Emissions"

for noise levels- (monitored 1st August, 2024)- measurements done in line with GS 1253:2018

ID	Sampling Site	L_{eq}	L_{max}	L_{min}	L_{10}	L_{50}	L_{90}
AN1	Demarcated CMDC	37.0	49.5	30.2	38.9	35.8	32.8
AN2	Sonyo Road	45.7	64.0	32.6	48.1	40.3	34.2
AN3	Waste Line	47.8	68.5	35.8	47.2	44.4	30.9
AN4	Milling Site	57.7	67.6	49.1	61.0	55.8	52.7
GS 1222:2018 (Mixed Use)		**60.0**					
WHO Guideline Value (Industrial, Commercial Shopping and Traffic Areas, Indoors and Outdoors)		**70.0**					
IFC Guideline Value (Industrial, Commercial)		**70.0**					

Legend

L_{EQ} Equivalent Sound Level representing the average integrated sound level accumulated during the sampling period

L_{MAX} Maximum Sound Level obtained during the sampling period

L_{MIN} Minimum Sound Level obtained during the sampling period

L_{10} Nuisance noise level during the sampling period

L_{50} Average noise level recorded during the sampling period

L_{90} Background noise level recorded during the sampling period

GS 1222:2018 is "Health Protection- Requirements for Ambient Noise Control"

GS 1253:2018 is "Acoustic- Guide for Measurement of Outdoor A-Weighted Sound Levels"

For Groundwater Quality- (sampled on 1st August, 2024)

Parameter	**Unit**	**BHW**	**GS 175-1**	**WHO Guidline**
Turbidity	NTU	1.33	5	5
Colour (apparent)	Hz	2.50	5	15
Odour	-	offensive	Inoffensive	Inoffensive
pH	pH Units	7.33	6.5-8.5	6.5-8.5
Conductivity	µS/cm	805.0	-	-
Total Suspended Solids (TSS)	mg/l	1.00	0	-
Total Dissolved Solids (TDS)	mg/l	483.0	1,000	1,000
Sodium	mg/l	76.0	200	200

Parameter	Unit	BHW	GS 175-1	WHO Guidline
Potassium	mg/l	3.1	30	30
Calcium	mg/l	32.7	200	200
Magnesium	mg/l	36.9	150	150
Total Iron	Mg/l	0.513	0.3	0.3
Ammonium (NH_4-N)	mg/l	<0.001	0.00-1.5	0.00-1.5
Chloride	mg/l	5.960	250	250
Sulphate (SO_4)	mg/l	73.200	250	250
Phosphate (PO_4-P)	mg/l	0.130	-	-
Manganese	mg/l	0.198	0.4	0.4
Nitrite (NO_2-N)	mg/l	0.004	1.0	1.0
Nitrate (NO_3-N)	mg/l	0.052	10	10
Fluoride	mg/l	<0.010	1.5	1.5
Total Hardness (as $CaCO_3$)	mg/l	234.0	500	500
Total Alkalinity (as $CaCO_3$)	mg/l	300.0	-	-
Calcium Hardness (as $CaCO_3$)	mg/l	81.8	-	-
Mag. Hardness (as $CaCO_3$)	mg/l	152.0	-	-
Bicarbonate (as $CaCO_3$)	mg/l	366.0	-	-
Carbonate	mg/l	0.00	-	-

The results show that:

For Dust/ Noxious Gases

- Dust levels in the ambient air ranged from 26.1µgm^{-3} at the Demarcated CMDC Site to 205.9µgm^{-3} at the Ore Milling Site for TSP compared with the GS value of 150µgm^{-3} and from 15.8µgm^{-3} at the Demarcated CMDC Site to 106.1µgm^{-3} at the Ore Milling Site for PM_{10} compared with the GS value of 70µgm^{-3}. $PM_{2.5}$ values ranged from 5.42µgm^{-3} at the Demarcated CMDC Site to 13.28µgm^{-3} at the Ore Milling Site.
- Noxious gases emission was within the respective GS values. SO_2 was 0.000µgm^{-3} at the Demarcated CMDC Site to 13.520µgm^{-3} at the Ore Milling Site compared with the GS value of 50.0µgm^{-3}, while NO_2 ranged from 0.723µgm^{-3} at the Demarcated CMDC Site to 1.400µgm^{-3} at the Ore Milling Site, compared with the GS value of 150.0µgm^{-3}.
- PM_{10} for Waste line and the Ore Milling Site was in excess of the WHO and IFC Guideline value of 50µgm^{-3} respectively, which may be attributable to the crushing and grinding at the Ore Milling site and the movement of motor bikes and tricycles on the dusty road at the Waste Line. All the other parameters showed values below the respective IFC and WHO guideline values.
- The prevailing wind direction was from South-West to North-East.

The following recommendations are therefore made:

- Miners should be trained on use of Personal Protective Equipment (PPE) e.g., googles and nose masks for their operations.
- Regular monitoring of air quality should be instituted during construction and operation of the Dakrupe CMDC.

- The ambient air quality should be sustained even during construction or operation and maintenance phase of the subproject.

For Noise

- Equivalent Noise Levels (Leq) ranged from 37.0dB(A) at the Demarcated CMDC Site to 57.7dB(A) at the Ore Milling Site compared with the GS value of 60dB(A) for a mixed use Area and 70dB(A) for WHO Guideline Value (Industrial, Commercial Shopping and Traffic Areas, Indoors and Outdoors) and IFC Guideline Value (Industrial, Commercial).
- The Lmax values recorded ranged from 49.5dB(A) at the Demarcated CMDC Site to 68.5dB(A) at Waste line.

The following recommendations are therefore made:

- The serene environment in the town should be maintained during construction and operation of the Dakrupe CMDC.
- Miners should be trained on use of Personal Protective Equipment (PPE) e.g., ear plugs/ muffs for their operations.

For Groundwater Quality

The results have been compared with the available GS 175-1 and the WHO Guideline values for drinking water.

- Total Iron concentration exceeded the respective GS 175-1 and the World Health Organisation Guideline value of 0.3mg/l.
- All the other parameters including Turbidity, TSS TDS, Colour, pH, Calcium, Fluoride, Magnesium, Manganese, Ammonium, Sodium, Potassium, Chloride, Nitrite, Nitrate, Sulphate and Total Hardness were all below the respective GS 175-1 and WHO Guideline values for drinking water.

The following recommendation is therefore made:

- The groundwater can be utilized to provide water for the Dakrupe CMDC and a further study of the iron contamination is required to further diagnose the problem- be it the dissolved iron and/ or presence of bacteria iron to understand treatment options available.

1. INTRODUCTION

1.1 Background

Dakrupe is a typical rural community in the Savannah Region of Ghana and located about 54km from the regional capital of Damongo. Dakrupe is located in the Bole District of the Savannah Region of Ghana and about 25km to 30km apart. It is circa 10km off the main Bole-Bamboi highway i.e., from Seripe. The small-scale mining is 100% community owned at Dakrupe and environs at three different locations where they mine from, namely: (i) Camp, (ii) Sonyo Road and (iii) Waste line. However, the waste line site is currently where most of the ore is mined.

As part of the Preparation of Environmental and Social Management Plans (ESMPs), Ore Characterization and Reserve Estimation for Selected Clean Mine Pilot Sites, air quality and noise monitoring exercise has been carried out by Messrs **Envirorich Consult Limited** for Dakrupe, which is one of the Clean mine Demonstration Centres (CMDCs) to determine the baseline conditions of air, noise level and ground water of the proposed project area. The report of the assignment is presented hereunder.

1.2 Environmental Quality Standard Values

The Ghana Standards Authority (GSA) has in collaboration with the Environmental Protection Agency (EPA) and through various National Technical Committees issued Ghana Standard (GS) requirements for Ambient Air Quality, Noise Control and Measurements and Effluent Quality, and the relevant standard values are as presented in **Table 1**, **Table 2** and **Table 3** respectively. Also included in Table 3 is the Water Resources Commission (WRC) administered Raw Water Quality Guideline values.

Table 2: Maximum Limits of Ambient Air Pollutants- GS1236:2019

NO.	SUBSTANCE	TIME WIGHTED AVERAGE, (TWA)	AVERAGING TIME
1.	Sulphur Dioxide (SO_2)	*520* μgm^{-3} 50 μgm^{-3}	*1hr* 24hrs
2.	Nitrogen Oxides (measured as NO_2)	*250* μgm^{-3} 150 μgm^{-3}	*1hr* 24hrs
3.	Total Suspended Particulate (TSP/SPM)	*150* μgm^{-3} 80 μgm^{-3}	*24hrs* 1yr
4.	PM_{10}	*70* μgm^{-3} 70 μgm^{-3}	*24hrs* 1yr
5.	$PM_{2.5}$	*35* μgm^{-3}	*24hrs*
6.	Carbon Monoxide (CO)*	*100 mg/m³* 60 mg/m³ 30 mg/m³ 10 mg/m³	*15mins* 30mins 1hr 8hrs

(Source: GSA, 2019) **……Fenceline Air Pollutant Standard*

Table 3: Requirements for Ambient Noise Control Level Based on Categorized Zones- GS 1222:2018

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

(Source: GSA, 2018)

Table 4: Environmental Protection – Requirements for Effluent Discharge for Mining and Quarry Industry (Gold Mining) and WRC Raw Water Quality Guidelines

Parameter	Unit	WRC Raw Water Quality Guidelines	GS 1212:2019
Turbidity	NTU	0-1	75
Temperature	°C	-	≤ 3° above ambient
Colour	Hz	-	150
pH	pH Units	6-9	6 - 9
Conductivity	µS/cm	0-700	1,500
Alkalinity	mg/l	-	
Total Suspended Solids (TSS)	mg/l	-	50
Total Dissolved Solids (TDS)	mg/l	0-450	1,000
Fluoride	mg/l	0-1	10
Sulphate	mg/l	-	-
Sulphide	mg/l	-	-
Ammonia-Nitrogen	mg/l	-	1
Total Phosphorus	mg/l	-	-
Chloride	mg/l	0-100	-
Nitrate (NO_3-N)	mg/l	0-6	50
Calcium	mg/l	-	-
Magnesium	mg/l	-	-
Sodium	mg/l	-	-
Silica	mg/l	-	20
Copper	mg/l	-	5
Lead	mg/l	0-10	0.1
Arsenic (Total)	mg/l	-	1
BOD	mg/l	-	
COD	mg/l	-	250
Oil/ Grease	mg/l	-	5
Total Iron	mg/l	0-0.1	-
Cadmium	mg/l	-	-

Parameter	Unit	WRC Raw Water Quality Guidelines	GS 1212:2019
Chromium	mg/l	-	-

(Source: GSA, 2019)

Table 5: Water Quality – Specification for Drinking Water -GS 175:2021

Parameter	Unit	GS 175-1	WHO Guideline
Turbidity	NTU	5	5
Colour	Hz	5	15
Odour	-	Inoffensive	Inoffensive
pH	pH Units	6.5-8.5	6.5-8.5
Conductivity	µS/cm	-	-
Total Suspended Solids (TSS)	mg/l	0	-
Total Dissolved Solids (TDS)	mg/l	1000	1000
Sodium	mg/l	200	200
Potassium	mg/l	30	30
Calcium	mg/l	200	200
Magnesium	mg/l	150	150
Ammonium (NH_4-N)	mg/l	0.00-1.5	0.00-1.5
Chloride	mg/l	250	250
Sulphate (SO_4)	mg/l	250	250
Phosphate (PO_4-P)	mg/l	-	-
Manganese	mg/l	0.4	0.4
Nitrite (NO_2-N)	mg/l	1.0	1.0
Nitrate (NO_3-N)	mg/l	10	10
Fluoride	mg/l	1.5	1.5
Total Hardness (as $CaCO_3$)	mg/l	500	500
Total Alkalinity (as $CaCO_3$)	mg/l	-	-
Calcium Hardness (as $CaCO_3$)	mg/l	-	-
Mag. Hardness (as $CaCO_3$)	mg/l	-	-
Bicarbonate (as $CaCO_3$)	mg/l	-	-
Carbonate	mg/l	-	-
Total Iron	mg/l	0.3	0.3
Total Coliform	CFU/100ml	0	0
Faecal Caliform	CFU/100ml	0	0
E Coli	CFU/100ml	0	0

(Source: DGS 175:2021)

❑ *1.3 Objective*

The purpose of the assignment was to monitor the environmental media to confirm the baseline concentration of particulate matter, noxious gases, noise levels and groundwater quality of the subproject area as part of preparation of the ESMP for Dakrupe.

❑ *1.4 Scope of Work*

The scope of work included the following among others:

- Surface Water/Groundwater/ Sediment Quality sampling and laboratory analysis for physicochemical and other quality parameters for surface water/ groundwater and sediments;
- Monitoring of ambient air quality parameters involving the following at the selected points within the project area and environs viz: (i) Sulphur Dioxide (SO_2), (ii) Nitrogen Dioxide (NO_2), (iii) Total Suspended Particulate (TSP), and (iv) Respirable Dust ($PM_{2.5}$ & PM_{10}),
- Noise level assessment at the selected points within the concession;
- Laboratory analysis of samples;
- Climatic assessment;
- Analysis of data; and
- Report preparation.

1.5 General Climatic Conditions

The Dakrupe CMDC falls within the Tropical continental or savanna climatic region of Ghana characterised by a distinct wet and dry seasons where rainfall occurs during a particular period during the year (the wet season). It lies within the tropical grassland or savanna vegetative zone of Ghana where the dry season is clearly marked. High temperatures are also experience at this climatic region throughout the year.

The climate of the project area is determined by the movement of air masses which differ in air moisture and relative stability rather than temperature. Like most parts of the country, two main physical phenomena, the equatorial trough and the associated Inter Tropical Boundary (ITB) or Inter Tropical Convergence Zone (ITCZ) influence the climatic conditions of the area. The ITB or ITCZ influences the attraction of alternate air masses from the north and the south called the northeast trade winds and the southwest monsoon winds respectively. The northeast trade winds are associated with a dry cool wind known as the harmattan, which affects the project area during the months of November to March.

2. WORK CARRIED OUT

The monitoring exercise was carried out by a three- man team on 1st August 2024 at the specified locations in the proposed project area. The Community people provided support.

2.1 Monitoring Locations

The samples were collected from the following sampling/ monitoring points, and analysed for specified parameters as shown in **Tables 5, and 6** for Ambient Air Quality and Noise, and for Ground Water Quality respectively. **Figure 1** is a map showing the air quality, noise and groundwater monitoring locations at Dakrupe.

Table 6: Ambient Air and Noise Monitoring Location

AN1	Demarcated CMDC Site	08°57'16.0"N, 002°17'54.7"W
AN2	Sonyo Road	08°57'55.1"N, 002°18'15.4"W
AN3	Waste Line	08°55'56.5"N, 002°18'24.7"W
AN4	Ore Milling Site	08°57'09.5"N, 002°17'34.1"W

Table 7: Groundwater Sampling Point

ID	Sampling Point	Coordinates
BHW1	Groundwater at Wasteline site	08°56'03.6"N, 002°18'19.0"W

The sampling points were so chosen to ensure coverage of the baseline conditions in the project area.

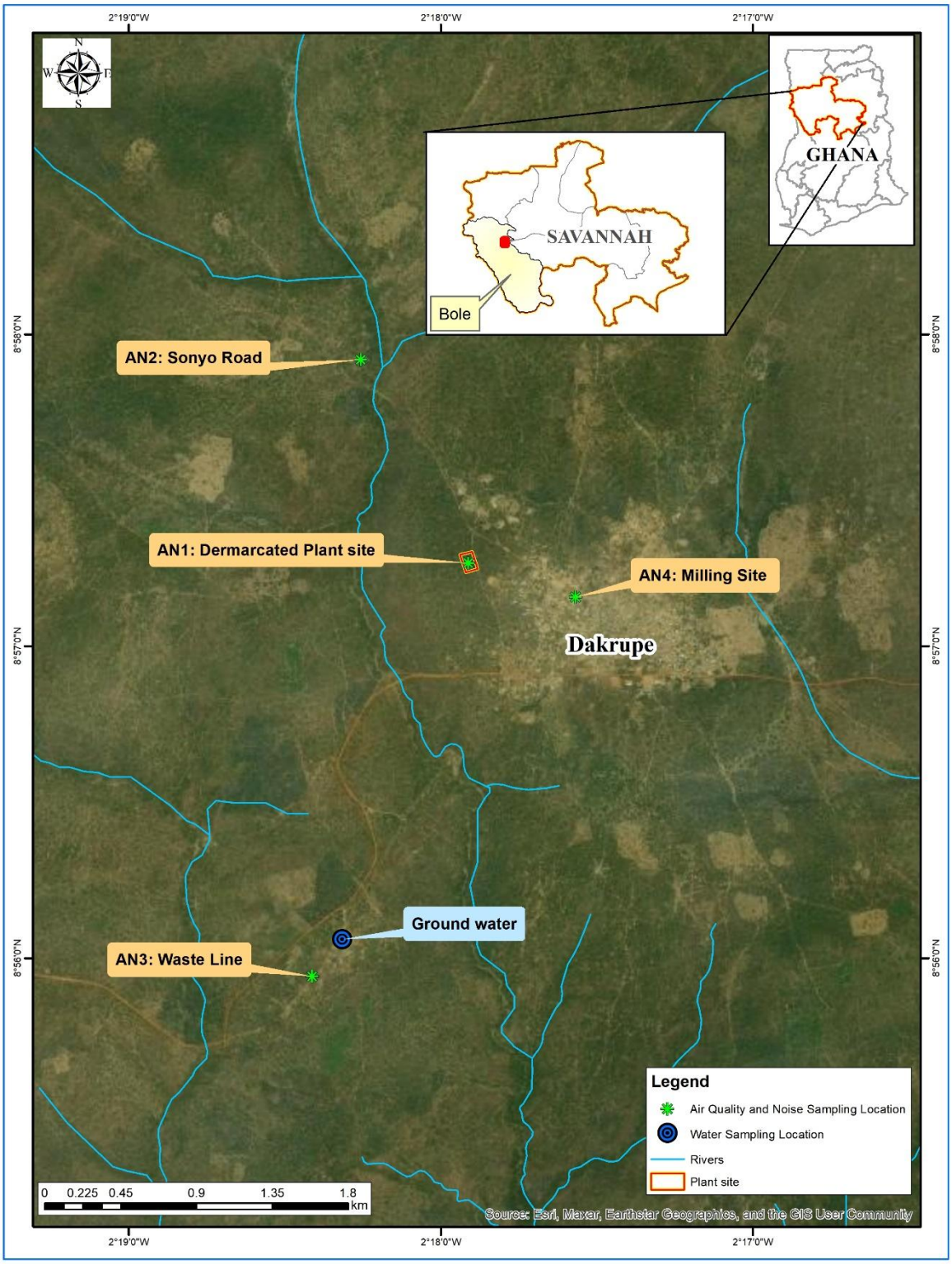

Figure 2: Ambient Air, Noise and Groundwater Sampling/ Monitoring Locations at Dakrupe

2.2 Methodology

-

- ### 2.2.1 Particulate Matter and Noxious Gases Measurement

The ambient air quality was monitored for concentrations of Total Suspended Particulates (TSP), Respirable Dust ($PM_{2.5}$ PM_{10}), Sulphur Dioxide (SO_2), and Nitrogen Dioxides (NO_2), at the designated sampling locations as well as the noise level.

Particulate Matter

The Osiris, a Turnkey Instrument's direct reading airborne particulates monitor was used to measure the concentrations of the TSP, PM_{10} and $PM_{2.5}$ in the ambient air. The Osiris particulates monitor is time-integrated and configured to measure the particulates mentioned above in real time, and provides the time-weighted average values over the monitoring period- 24- hour averaging time. It works by using Turnkey's specially-developed nephelometer i.e., air samples are continuously drawn through the nephelometer, which analyses individual particles as they pass through a laser beam. The particles are then collected on the reference filter. The Osiris has achieved the Environment Agency's MCERTS certification, ensuring its accuracy in recording data. **Plate 1** shows the Osiris mounted at the site of the points monitored.

Plate 2: The Osiris Particulates Monitor at Location AN1 (Demarcated CMDC Site)

Noxious Gases

Levels of sulphur dioxide, nitrogen dioxide and carbon monoxide in the ambient air at different sampling locations in the site was determined using the Aeroqual Series 500 gas monitor with sensor heads of the required noxious gas as shown in **Plate 2.** It enables real time monitoring of the particular gas and provides the time-weighted average values over the monitoring period- 24- hour averaging time at the points monitored.

Plate 3: The Aeroqual Series 500 Gas Monitor Deployed at AN4 (Ore Milling Site)

2.2.2 Noise Assessment

Noise Levels were captured in-situ in decibels on the A scale, i.e. dB(A) using a portable Pulsar Integrated Sound Level Meter with data logging system. Measurement of noise is often 'A-weighted' to take into account the fact that some sound wavelengths are perceived as being particularly loud and not sensitive to the human ear. Thus the A scale gives greater weight to the frequencies of sound to which the human ear is most sensitive.

Noise levels were measured for a period of time and the data logged into the equipment memory. The statistical summaries were later retrieved for analysis (**See Plate 3**).

Plate 4: The Noise Monitor Positioned at AN2 (Sonyo Road)

2.2.3 Ground Water Quality

Specified methods as laid in "Standard Methods for the Examination of Water and Wastewater" published jointly by the American Water Works Association (AWWA), American Public Health Association (APHA) and the Water Environment Federation (WEF) 24th Edition, 2017 were followed. The methods are as shown in **Table 7.**

Table 8: Analytical Methods Employed for Stream Water Analysis

Parameter	Method of Analysis
pH	pH Electrode Probe
Conductivity	Cond/ TDS Electrode Probe
Total Dissolved Solids (TDS)	Cond/ TDS Electrode Probe
Alkalinity	Titrimetric
Colour (TCU)	Nessleriser
Turbidity (NTU)	Nephelometric
Biochemical Oxygen Demand (BOD)	Winkler Azide Modification
Chemical Oxygen Demand (COD)	Winkler Azide Modification
Total Suspended Solids (TSS)	Gravimetric
Oil/Grease	Gravimetric Through Extraction
Ammonia-N	Direct Nesslerisation
Nitrate-N	Spectrophotometry (Hydrazine Reduction)
Chloride	Titrimetric (Argentometric)
Fluoride	Spaans
Total Phosphorous	Spectrophotometry (Stannous Chloride)
Iron	Atomic Absorption Spectrophotometry (AAS)
Lead	Atomic Absorption Spectrophotometry (AAS)
Zinc	Atomic Absorption Spectrophotometry (AAS)
Total Coliform, counts/100ml	Membrane Filtration
E coli, counts/100ml	Membrane Filtration

- ***2.3 Analysis of Data***

Direct comparison with the GS values for the various emissions was employed.

Particulate Matter/ Noxious Gases

Air quality and meteorological data were analysed and compared with the GS values and the possible areas of impact respectively.

Noise

The following statistical summaries were automatically retrieved from the sound level meter and are as explained below and compared with the GS value for Predominantly Commercial Areas:

- L_{EQ} Equivalent Sound Level representing the average integrated sound level accumulated during the sampling period;
- L_{MAX} Maximum Sound Level obtained during the sampling period;
- L_{MIN} Minimum Sound Level obtained during the sampling period;
- L_{10} Nuisance noise level obtained during the sampling period;
- L_{50} Average noise level recorded during the sampling period; and
- L_{90} Background noise level recorded during the sampling period.

- ***2.4 Calibration of Equipment***

All equipment used for the exercise were calibrated at the laboratory prior to carrying out the assignment using Standard Operating Procedures (SOPs).

3. RESULTS AND DISCUSSIONS

3.1 Results

3.1.1 Ambient Air Quality Results

The results of the air quality monitoring exercise are as shown in **Table 8.**

Table 9: Ambient Air Quality Results - (monitored 1st August, 2024)

ID	Sampling Site	TSP/ μgm^{-3}	PM_{10}/ μgm^{-3}	$PM_{2.5}$/ μgm^{-3}	NO_2/ μgm^{-3}	SO_2/ μgm^{-3}
AN1	Demarcated CMDC Site	26.1	15.8	5.42	0.723	0.000
AN2	Sonyo Road	138.5	33.8	6.66	0.742	7.500
AN3	Waste Line	142.5	100.2	10.27	0.743	0.833
AN4	Ore Milling Site	205.9	106.1	13.28	1.400	13.520
GS 1236:2019- Ambient Air Pollutants		**150.0***	**70.0***	**35.0***	**150.0***	**50.0***
WHO Guideline Value		**na**	**50.0***	**25.0***	**200.0***	**50.0***
IFC Guideline Value		**na**	**50.0***	**25.0***	**200.0****	**20.0***

*…….24 hours averaging time **……..1 hour averaging time

GS 1236:2019 is "Environment and Health Protection- Requirements for Ambient Air Quality and Point Source/ Stack Emissions"

3.1.2 Noise Level Results

The results of the noise monitoring exercise are as shown in **Tables 9.**

Table 10: Noise - (Monitored 1st August, 2024) – measurements done in line with GS 1253:2018

ID	Sampling Site	L_{eq}	L_{max}	L_{min}	L_{10}	L_{50}	L_{90}
AN1	Demarcated CMDC Site	37.0	49.5	30.2	38.9	35.8	32.8
AN2	Sonyo Road	45.7	64.0	32.6	48.1	40.3	34.2
AN3	Waste Line	47.8	68.5	35.8	47.2	44.4	30.9
AN4	Ore Milling Site	57.7	67.6	49.1	61.0	55.8	52.7
GS 1222:2018 (Mixed Use)		**60.0**					
WHO Guideline Value (Industrial, Commercial Shopping and Traffic Areas, Indoors and Outdoors)		**70.0**					
IFC Guideline Value (Industrial, Commercial)		**70.0**					

Legend

L_{EQ} Equivalent Sound Level representing the average integrated sound level accumulated during the sampling period

L_{MAX} Maximum Sound Level obtained during the sampling period

L_{MIN} Minimum Sound Level obtained during the sampling period

L_{10} Nuisance noise level during the sampling period

L_{50} Average noise level recorded during the sampling period

L_{90} Background noise level recorded during the sampling period

GS 1222:2018 is "Health Protection- Requirements for Ambient Noise Control"

GS 1253:2018 is "Acoustic- Guide for Measurement of Outdoor A-Weighted Sound Levels"

❑ 3.1.3 Stream Water Quality Results

The results of the ground water quality analysis are as shown in **Table 10.**

Table 11: Ground Water Quality Results – (Sampled on 4th August, 2024)

Parameter	Unit	GS 175-1	WHO Guideline
Turbidity	NTU	5	5
Colour	Hz	5	15
Odour	-	Inoffensive	Inoffensive
pH	pH Units	6.5-8.5	6.5-8.5
Conductivity	µS/cm	-	-
Total Suspended Solids (TSS)	mg/l	0	-
Total Dissolved Solids (TDS)	mg/l	1000	1000
Sodium	mg/l	200	200
Potassium	mg/l	30	30
Calcium	mg/l	200	200
Magnesium	mg/l	150	150
Ammonium (NH_4-N)	mg/l	0.00-1.5	0.00-1.5
Chloride	mg/l	250	250
Sulphate (SO_4)	mg/l	250	250
Phosphate (PO_4-P)	mg/l	-	-
Manganese	mg/l	0.4	0.4
Nitrite (NO_2-N)	mg/l	1.0	1.0
Nitrate (NO_3-N)	mg/l	10	10
Fluoride	mg/l	1.5	1.5
Total Hardness (as $CaCO_3$)	mg/l	500	500
Total Alkalinity (as $CaCO_3$)	mg/l	-	-
Calcium Hardness (as $CaCO_3$)	mg/l	-	-
Mag. Hardness (as $CaCO_3$)	mg/l	-	-
Bicarbonate (as $CaCO_3$)	mg/l	-	-
Carbonate	mg/l	-	-
Total Iron	mg/l	0.3	0.3
Total Coliform	CFU/100ml	0	0
Faecal Caliform	CFU/100ml	0	0
E Coli	CFU/100ml	0	0

3.1.4 Ambient Weather Conditions

The prevailing wind direction during the air quality monitoring periods was from South-West to North-East.

3.2 Discussions

The results show that:

For Dust/ Noxious Gases

- Dust levels in the ambient air ranged from 26.1µgm^{-3} at the Demarcated CMDC Site to 205.9µgm^{-3} at the Ore Milling Site for TSP compared with the GS value of 150µgm^{-3} and from 15.8µgm^{-3} at the Demarcated CMDC Site to 106.1µgm^{-3} at the Ore Milling Site for PM_{10} compared with the GS value of 70µgm^{-3}. $PM_{2.5}$ values ranged from 5.42µgm^{-3} at the Demarcated CMDC Site to 13.28µgm^{-3} at the Ore Milling Site.
- Noxious gases emission was within the respective GS values. SO_2 was 0.000µgm^{-3} at the Demarcated CMDC Site to 13.520µgm^{-3} at the Ore Milling Site compared with the GS value of 50.0µgm^{-3}, while NO_2 ranged from 0.723µgm^{-3} at the Demarcated CMDC Site to 1.400µgm^{-3} at the Ore Milling Site, compared with the GS value of 150.0µgm^{-3}.
- PM_{10} for Waste line and the Ore Milling Site was in excess of the WHO and IFC Guideline value of 50µgm^{-3} respectively, which may be attributable to the crushing and grinding at the Ore Milling site and the movement of motor bikes and tricycles on the dusty road at the Waste Line. All the other parameters showed values below the respective IFC and WHO guideline values.
- The prevailing wind direction was from South-West to North-East.

For Noise

- Equivalent Noise Levels (Leq) ranged from 37.0dB(A) at the Demarcated CMDC Site to 57.7dB(A) at the Ore Milling Site compared with the GS value of 60dB(A) for a mixed use Area and 70dB(A) for WHO Guideline Value (Industrial, Commercial Shopping and Traffic Areas, Indoors and Outdoors) and IFC Guideline Value (Industrial, Commercial).
- The Lmax values recorded ranged from 49.5dB(A) at the Demarcated CMDC Site to 68.5dB(A) at Waste line.

For Ground Water Quality

The results have been compared with the available GS 175-1 and the WHO Guideline values for drinking water.

- Total Iron concentration exceeded the respective GS 175-1 and the World Health Organisation Guideline value of 0.3mg/l.

- All the other parameters including Turbidity, TSS TDS, Colour, pH, Calcium, Fluoride, Magnesium, Manganese, Ammonium, Sodium, Potassium, Chloride, Nitrite, Nitrate, Sulphate and Total Hardness were all below the respective GS 175-1 and WHO Guideline values for drinking water.

4. CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

for ambient air quality

- All the other parameters recorded values below the respective IFC and WHO guideline values except at Waste line and Milling Site for PM_{10}.
- Thus, TSP $PM_{2.5}$, SO_2, and NO_2 were all compliant with the respective GS values, WHO Guideline Value and IFC Guideline Value at all the monitoring locations except TSP at Ore Milling Site.

for noise levels

- The equivalent noise levels (Leq) of all the monitoring locations of the project area were below the GS value of 60dB(A) during the monitoring period.

4.2 Recommendations

The following recommendations are therefore made:

For Dust/ Noxious Gases

- Miners should be trained on use of Personal Protective Equipment (PPE) e.g., googles and nose masks for their operations.
- Regular monitoring of air quality should be instituted during construction and operation of the Dakrupe CMDC.
- The ambient air quality should be sustained even during construction or operation and maintenance phase of the subproject.

For Noise

- The serene environment in the town should be maintained during construction and operation of the Dakrupe CMDC.
- Miners should be trained on use of Personal Protective Equipment (PPE) e.g., ear plugs/ muffs for their operations.

For Ground Water Quality

- The groundwater can be utilized to provide water for the Dakrupe CMDC and a further study of the iron contamination is required to further diagnose the problem- be it the dissolved iron and/ or presence of bacteria iron to understand treatment options available.

Annex 3-2: Report of Terrestrial Ecology Study

ECOLOGICAL STUDY REPORT FOR DAKRUPE

CONSULTANCY SERVICE FOR THE PREPARATION OF ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS (ESMPS), ORE CHARACTERIZATION AND RESERVE ESTIMATION FOR SELECTED CLEAN MINE DEMONSTRATION CENTRES

AUGUST 2024

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• 1.0 INTRODUCTION

As part of the ESMP preparation, an ecological study was undertaken to establish the baseline composition of flora and fauna of the subproject area at Dakrupe.

The ecological survey for the Dakrupe Clean Mine Demonstration Centre (CMDC) was conducted on 01 August 2024.

• 1.1 Objective of Assignment

The objective is to conduct terrestrial ecology study within the proposed subproject site of about 1 ha to monitor the changes in flora and fauna of the subproject ar ea. The study will address structure and composition, focal habitats (i.e. sites important for biodiversity), and focal species, with particular attention paid to the status (abundance and distribution of identified species of conservation concern).

• 1.2 Scope of the Study

Specifically, the study covered:

- terrestrial flora studies, including comparison of structural characteristics of current and baseline vegetation conditions such as occurrence of large trees and trees known to be important for biodiversity and presence of regeneration, coarse woody debris or deadwood, and other elements specific to the agroecological zone, such as anthills, etc.
- focal habitat sites especially those important for biodiversity e.g. for shelter, feeding or reproduction and monitoring and management recommendations for their maintenance and enhancement. Examples of such sites include wetlands, streams, marshes, etc.
- focal species – status of species of national and regional conservation concern and the level of awareness about occurrence, status, condition, and abundance.
- terrestrial fauna studies to monitor changes in terrestrial fauna of conservation importance in the project area.
- impacts and threats – among others, this should assess presence of trees of commercial or local value, presence of invasive species, evidence of fires, illegal hunting, poisoning, capturing or collecting, vegetation clearance for charcoal production, etc.

- **2.0 METHODOLOGY FOR TERRESTRIAL ECOLOGICAL SURVEY**

- **2.1 Flora Survey**

The flora survey was in two parts:

1. Literature Review – relevant literature on the vegetation and ecological characteristics of the subproject affected area was carried out. The literature consulted included Hawthorne and Musah (1995), Hawthorne and Jongkind (2006), Hall and Swaine (1981), Hutchinson and Dalziel (1954-1972), Rose Innes (1977), and Taylor (1960), with the objective of obtaining a general overview of the vegetation and environment of the subproject area.
2. Field survey – A rapid survey was conducted within the subproject site and its external boundaries to obtain an overview of the extent, topography and complexity of the vegetation. A total of 3 quadrat sample plots (20 m x 20 m) were studied in the proposed subproject site. The survey revealed that the subproject site has undulating topography. Species lists were compiled for each sample, and the habitat types determined. The locations of the samples were recorded with a Garmin 64s GPS. Table 1 shows the sample location coordinates and their associated vegetation types.

Table 12: Coordinates of Sampling Locations and Associated Vegetation Types

Sample No.	Latitude (N)	Longitude (W)	Elevation (m.a.s.l)	Description
1	08.95453	002.29864	285	Open canopy woodland/secondary thicket
2	08.96536	002.30421	283	Open canopy woodland/mined out area
3	08.93454	002.30540	276	Degraded mine site/open canopy/woodland/secondary thicket

Table 2 provides a description of the Star Rating System while Table 3 provides a description of the IUCN Red List Categories.

Table 13: Star Rating System

Rating	Description
Black Star species	Species rare internationally and at least uncommon in Ghana; urgent attention to conservation of populations needed
Gold Star species	Fairly rare internationally and/or locally
Blue star species	Widespread internationally but rare in Ghana or vice-versa
Scarlet star species	Common, but under serious pressure from heavy exploitation
Red Star species	Common, but under pressure from exploitation
Pink Star species	Common and moderately exploited. Also, non-abundant species of high potential value
Green Star species	No particular conservation concern, common in Ghana

Table 14: IUCN Red List Categories

Category	Description
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is endangered when the best available evidence indicates that it meets any of the criteria for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking.
Not Assessed (NA)	A taxon is Not yet Assessed when it is has not yet been evaluated against the criteria

- ## 2.2 Fauna Survey

The main methods used in the faunal survey were:

- Desk Survey: As part of the desk survey, references were made to available literature including those of Cansdale (1948; 1951), Booth (1958), Schiotz (1969), Hughes and Barry (1969), Decher (1997a), Decher et al. (1997), Kingdon (1997).

- Direct/opportunistic observation and identification of animal spoors: Direct/opportunistic observation involved recording any animal sightings while driving or walking along the main road or animal trails to the areas bordering the proposed subproject site. General walks through the subproject sites to spot animal *spoors* (any sign left by a living animal, such as feeding sites, regular pathways, tracks, footprints, faecal pellets, nests, etc.) were also undertaken. The animals identified were classified as either S.1 or S.2 depending on the degree of protection they enjoy under the national wildlife conservation regulation (Schedules, 1995) as follows:

S.1. (Schedule 1) - The hunting, capturing or destroying of these species is prohibited at all times.
S.2. (Schedule 2) **-** The hunting capturing or destroying of these species is absolutely prohibited between 1st August and 1st December of any season. The hunting, capturing or destroying of any young animal, or adult accompanied by its young, of these species is absolutely prohibited at all times.

- **2.3 Data Analyses**

A total of 3 vegetation samples were taken during the survey. The total number of species encountered in the survey was determined and used in determining the floristic composition of the subproject site. Floristic analysis (Appendix 2) was carried out to determine the dominant families, species frequency distributions life form composition and the ecological guilds of the species. The analysis also included the composition of species in terms of their Star Rating and IUCN threat status. The species list was inspected for alien invasive species.

- **2.4 Survey Limitations**

Complete flora and fauna surveys require multiple surveys at different times of the year and over a number of years to enable observations of all species present. Some flora, such as annuals, are available for collection at certain times of the year (e.g., when they are flowering). Climatic and other events (human disturbances like clearing, fires) may affect the presence of species.

- **3.0 RESULTS OF THE TERRESTRIAL ECOLOGICAL SURVEY**

- **3.1 Flora Survey**

- 3.1.1 Regional Context

The subproject area, Dakrupe in the Bole District of the Savanna Region, lies in the northern Guinea Savanna vegetation zone of Ghana (Taylor, 1960; Innes, 1977). This vegetation is characterised by a continuous grassy ground layer with an open canopy tree stratum. The vegetation is thus open in several places. The ground layer is annually or periodically burnt. Parts of the area have been intensively farmed. The vegetation of this zone is characterised by trees such as *Parkia biglobosa*, *Vitellaria paradoxa, Burkea africana, Daniellia oliveri, Afzelia africana, Parinari polyandra, Hymernocardia acida, Vitex doniana, Terminalia glaucescens, Lophira lanceolata, Piliostigma thonningii* and *Diospyros mespiliformes*. The common grasses of the Guinea Savanna-Woodland are *Andropogon* sp., *Brachiaria brevis, Digitaria gayana, Eleusine indica, Eragrostis aspera, Hyparrhenia* sp., *Pennisetum pedicellatum, Schizachyrium* sp., *Rottboellia* sp., *Cymbopogon giganteus* and *Panicum* sp. Places that are heavily farmed

and thus of low fertility usually have short wiry grass species e.g. *Aristidia kerstingii, Ctenium elegans, Schoenefeldia gracilis, Schizachyrium exile, Hyparrhenia* sp. and *Monocymbium ceresiiforme.*

Table 4 shows some tree species and conservation status of the dry semi-deciduous zone.

Table 15: Characteristic tree species of Dry Semi-deciduous (Inner Zone subtype) and their conservation statuses (after Taylor, 1960)

Characteristic Species	IUCN Threat Status	Star Rating
Vitellaria paradoxa	VU	NA
Azelia Africana	VU	Red
Vitex doniana	LC	NA
Diospyros mespiliformis	LC	Green
Daniellia oliveri	LC	Green
Parkia biglobosa	LC	NA
Lophira lanceolata	LC	NA
Burkea Africana	LC	NA

…..Vulnerable (VU), Least Concern (LC)

- 3.1.2 Habitat Types in the Project Site

The subproject site has a generally flat or gently undulating topography with well drained soils. Most of the area has been mined out. The treatment plant site had open canopy woodland and secondary thickets vegetation while the mined-out areas were degraded with mined out pits and isolated trees Plates 1 to 4.

The open canopy woodland and secondary thickets have tree species such as *Vitellaria paradoxa, Combretum adenogonium, Diospyros mespiliformis, Piliostigma thonningii, Nauclea latifolia and Opilia amentacea.* The shrubs and herbs common to the site include *Cassia obtusifolia, Sansevieria liberica, Hyptis suaveolens, Sida acuta* and *Triumfetta cordifolia.*

Plate 5: Open canopy woodland with shrub and herb undergrowth at Dakrupe Proposed CMDC

Plate 6: Mined out area at Dakrupe

Plate 7: Mine waste dump at Dakrupe

Plate 8: Background - Active Gold Mine Shaft at Dakrupe

- 3.1.3 Floristic Analysis

The species list compiled for the 3 sample sites is presented in Appendix 2. The survey recorded 39 species in 35 genera belonging to 21 families of flowering plants. The dominant families were the Fabaceae (10), Anacardiaceae (3), Combretaceae (3), and Moraceae (3). These four families accounted for about 48.7% of the species recorded. All other families had less than 3 species present. The vegetation of the site is low in species diversity due to the mining activities which have left several areas degraded.

The life form Composition of the flora is presented in Table 5. Trees constituted the dominant life form (51.3%) in the subproject area of influence followed by the Herbs with 28.2% while the Shrub and Climber life forms followed with 15.4% and 5.1% respectively.

Table 16: Life Form Composition of the Project Site

Life Form	**No of Species**	%
Climber	2	5.1
Herb	11	28.2
Shrub	6	15.4
Tree	20	51.3
Total	39	100.0

- 3.1.4 Species of Conservation Concern in the Subproject Area

A summary of the Star Rating of species in the subproject area is presented in Table 6. About 95% of the species encountered are of no immediate conservation concern in Ghana i.e. Green Star and Not Evaluated (NE) species.

Two (2) species of conservation concern in Ghana were recorded during the survey viz., *Afzelia africana* (Red Star) and *Sansevieria liberica* (Blue Star). The Red Star species are common but under pressure from exploitation while the Blue Star species are rare in Ghana and are faced with habitat decline.

Table 17: Summary of Star Rating Composition of Flora of the Dakrupe Subproject Area

Star Rating	**No.**	%
Blue	1	2.6
Green	6	15.4
NE	31	79.5
Red	1	2.6
Total	39	100.0

Table 7 summarizes the IUCN Threatened species assessment of subproject area.

Table 18: Summary of IUCN Threatened species Categories for the Dakrupe Subproject Area

IUCN	No.	%
LC	15	38.5
NE	22	56.4
VU	2	5.1
Total	39	100.0

- 3.1.5: Alien Invasive Species

The species list compiled shows that one (1) alien invasive species commonly occurs in the subproject area viz., *Chromolaena odorata* (Shrub). This species should be managed (controlled or eliminated) during the construction phase to prevent their spread to other areas.

- **3.2 Fauna Survey**

The faunal list of the subproject area is based on the information gathered from various methods (interviews, desk surveys and direct observations), is presented in Appendix 3. According to the hunters interviewed, most of the large mammals which were common in the area have moved further away into the Mole National Park due to human activities such as farming, grazing and mining. Notable among these are the elephant, lion, leopard, warthog, several parrots, terns, songbirds (passerines), land tortoises, pythons and other snakes, lizards, bats, birds of prey, mongooses, bovids (e.g. the African buffalo and several duikers), egrets, ducks and pigeons. A number of the species known to occur in the area are of both national and global (IUCN, CITES) conservation significance.

- **4.0 CONCLUSIONS AND RECOMMENDATIONS**

The results of the survey indicate that the subproject area is human modified habitat. Small scale mining in the project area has led to a decline in the quality of vegetation and loss of flora and faunal species diversity.

The subproject will have no significant impact on the existing vegetation or fauna of the subproject site.

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APPENDICES

Appendix 1: Samples and their Profiles

Dakrupe CMDC

Sample Area 1

Treatment Plant site, open canopy,woodland regrowth

N 08.95453

W002.29864

Elevation 285m

Aframomum elliotii

Hyptis suaveolens

Combretum adenogomiium

Vitellaria paradoxa

Piliostigma thonningii

Ficus umbellata

Diospyros mespiliformis

Combretum macroptera

Sansevieria liberica

Cissus populnea

Nauclea latifolia

Burkea africana

Opilia amentacea

Triumfetta cordiofolia

Spermacoce verticellata

Indigofera hirsuta

Combretum grutinosum

Monotes kerstingi

Lannea acida

Afzelia africana

Entada africana

Ficus umbellata

Scadoxus multiflorus

Lannea kerstingii

Sample 2. Sonyo Road

Open canopy woodland scattered pits

N08.96536

W002.30421

Elevation 283m

Piliostigma thonningii

Hyptis suaveolens

Vitellaria paradoxa

Cynodon dactylon

Desmodium trifloyum

Ficus glumosa

Burkea africana

Chromolaena odorata

Nauclea latifolia

Parkia biglobosa
Brachiaria lata
Triumfetta cordifolia
Lannea acida
Lannea kerstingii
Sida acuta
Eclipta prostrata
Ficus sur
Cissus populnea
Entada africana
Diospyros mespilifomis
Daniellia olivera
Aframomum elliotii

Sample 3. Waste Line
Opening canopy,woodland,Mine site /degraded
N08.93454
W002.30540
Elevation 276m
Chromolaena odorata
Calotropis procera
Nauclea latifolia
Acacia hockii
Hyptis suaveolens
Vitellaria paradoxa
Solanum torvum
Piliostigma thonningii
Ficus glumosa
Musa sp.
Parkia biglobosa
Sclerocarya birrea
Combretum glutinosum
Combretum adenogomiium
Striga hermonthica
Burkea africana

Appendix 2: Floristic Composition of Dakrupe Subproject Area

Species	Family	Life Form	Star Rating	IUCN
Acacia hockii	Fabaceae	Tree	NE	NE
Aframomum elliotii	Zingiberaceae	Herb	NE	NE
Afzelia africana	Fabaceae	Tree	Red	VU
Brachiaria lata	Poaceae	Herb	NE	NE
Bridelia ferruginea	Euphorbiaceae	Tree	NE	LC
Burkea africana	Fabaceae	Tree	NE	LC
Calotropis procera	Apocynaceae	Tree	NE	NE
Chromolaena odorata	Asteraceae	Shrub	Green	NE
Cissus populnea	Vitaceae	Climber	NE	NE
Combretum adenogonium	Combretaceae	Tree	NE	LC
Combretum glutinosum	Combretaceae	Shrub	NE	LC
Cynodon dactylon	Poaceae	Herb	NE	NE
Daniellia oliveri	Fabaceae	Tree	NE	LC
Desmodium triflorum (Grona trifolia)	Fabaceae	Herb	NE	NE
Diospyros mespiliformis	Ebenaceae	Tree	Green	NE
Eclipta prostrata	Asteraceae	Herb	NE	LC
Entada africana	Fabaceae	Tree	NE	LC
Ficus glumosa	Moraceae	Tree	NE	LC
Ficus sur	Moraceae	Tree	Green	LC
Ficus umbellata	Moraceae	Tree	Green	LC
Hyptis suaveolens	Lamiaceae	Herb	NE	NE
Indigofera hirsuta	Fabaceae	Shrub	NE	NE
Lannea acida	Anacardiaceae	Tree	NE	LC
Lannea kerstingii	Anacardiaceae	Tree	NE	LC
Musa sp.	Musaceae	Tree	NE	NE
Nauclea latifolia	Rubiaceae	Tree	NE	LC
Opilia amentacea	Opiliaceae	Climber	NE	NE
Parkia biglobosa	Fabaceae	Tree	NE	LC
Piliostigma thonningii	Fabaceae	Shrub	NE	NE
Sansevieria liberica	Dracaenaceae	Herb	Blue	NE
Scadoxus multiflorus	Amaryllidaceae	Herb	Green	NE
Sclerocarya birrea	Anacardiaceae	Tree	NE	NE
Sida acuta	Malvaceae	Herb	NE	NE
Solanum torvum	Solanaceae	Shrub	Green	NE
Spermacoce verticillata	Rubiaceae	Herb	NE	NE
Striga hermonthica	Orobanchaceae	Herb	NE	NE
Terminalia macroptera	Combretaceae	Tree	NE	LC
Triumfetta rhomboidea	Malvaceae	Shrub	NE	NE
Vitellaria paradoxa	Sapotaceae	Tree	NE	VU

Appendix 3: Fauna of the Dakrupe Subproject Area

Order	Name		Conservation Significance		Abundance Status
	Common	**Species**	**IUCN**	**National**	
Artiodactyla *(Even-toed ungulates)*	Bushbuck	*Tragelaphus scriptus*	LC	II	Rare
	Common Duiker	*Sylvicapra grimmia*	LC	II	Rare
	Oribi	*Ourebia ourebi*	LC	II	Rare
	Red River Hog	*Potamochoerus porcus*	LC	II	Rare
Canivora *(Carnivores)*	African Civet	*Civettictis civetta*	LC	II	Rare
	Common Slender Mongoose	Herpestes sanguineus	LC	II	Common
	Common Kusimanse	*Crossarchus obscurus*	LC	II	Common
	Marsh Mongoose	*Atilax paludinosus*	LC	II	Common
Lagomorpha	African Savanna Hare	*Lepus microtis*	LC	Not Listed	Common
Primata	Olive Baboon	*Papio anubis*	LC	II	Common
	Gambian Pouched Rat	*Cricetomys gambianus*	LC	Not Listed	Common
	Grasscutter	*Thryonomys swinderianus*	LC	Not Listed	Common
	Gambian sun squirrel	*Heliosciurus gambianus*	LC	Not Listed	
	Guinea multimammate mouse	*Mastomys erythroleucus*	LC	Not Listed	
	Stripped Ground Squirrel	*Euxerus erythropus*	LC	Not Listed	Abundant
	Common Frog	*Amnirana galamensis*	LC	Not listed	
Anura (Frogs and Toads)	Common Toad	*Sclerophrys regularis*	LC	Not listed	
	Crowned Bull Frog	*Hoplobatrachus occipitalis*	LC	Not listed	
Squamata	Agama Lizard	*Agama agama*	LC	Not listed	
(*Snakes and Lizards*)	African Rock Python	*Python sebae*	NT	II	
	Boomslang	*Dispholidus typus*	LC	Not listed	
	Forest Cobra	*Naja melanoleuca*	LC	Not listed	
	Gaboon Viper	*Bitis gabonica*	LC	Not listed	
	Hissing Sandsnake	*Psammophis sibilans*	LC	Not listed	
	Night Adder	Causus rhombeatus	LC	Not listed	
	Nile Monitor	*Varanus niloticus*	LC	I	
	Puff Adder	*Night Adder*	LC	Not listed	
	Savanna Monitor	Varanus exanthematicus	LC	Not listed	
	Spitting cobra	*Naja nigricollis*	LC	Not listed	
Accipitriformes	Black Kite	*Milvus migrans*	LC	I	
	Shikra	*Accipiter badius*	LC	I	
	Lizard Buzzard	*Kaupifalco monogrammicus*	LC	I	
Bucerotiformes	African Grey Hornbill	*Lophoceros nasutus*	LC	Not listed	

	West African Pied Hornbill	*Lophoceros semifasciatus*	LC	Not listed
	Spur-winged lapwing	*Vanellus spinosus*	LC	Not listed
Columbiformes	Laughing Dove	*Spilopelia senegalensis*	LC	II
	Red-Eyed Dove	*Streptopelia semitorquata*	LC	II
Cuculiformes	Levaillant's cuckoo	*Clamator levaillantii*	LC	Not listed
	Senegal Coucal	*Centropus senegalensis*	LC	Not listed
Galliformes	Double-spurred Spurfowl	*Pternistis bicalcaratus*	LC	II
	Stone Partridge	*Ptilopachus petrosus*	LC	II
Passeriformes	Western Grey Plantain-eater	*Crinifer piscator*	LC	Not listed
	African Blue Flycatcher	*Elminia longicauda*	LC	Not listed
	African Pied Wagtail	*Motacilla aguimp*	LC	Not listed
	Black-crowned Tchagra	*Tchagra senegalus*	LC	Not listed
	Bronze Mannikin	*Permestes cucullata*	LC	Not listed
	Common Bulbul	*Pycnonotus barbatus*	LC	Not listed
	Long-tailed Glossy Starling	*Lamprotornis caudatus*		
	Long-tailed nightjar	*Caprimulgus climacurus*	LC	Not listed
	Melodious Warbler	*Hippolais polyglotta*		
	Northern Grey-headed Sparrow	*Passer griseus*	LC	Not listed
	Orange-Cheeked Waxbill	*Estrilda melpoda*	LC	Not listed
	Red-breasted swallow	*Cecropis semirufa*	LC	Not listed
	Village Weaver	*Ploceus cucullatus*	LC	Not listed
	White-fronted Black Chat	*Oenanthe albifrons*	LC	Not listed
Pelecaniformes	Cattle Egret	*Bubulcus ibis*	LC	I

Annex 4-1: Stakeholder Engagement Results

Table 1: List of Persons Contacted and Key Issues Raised

No.	Location/ Venue	Person Contacted	Date Engaged	Issues/Concerns Raised	Responses Provided
1	Dakrupe	Committee Members Amoh yankey (Pit Owner) 0244415041 Stephen Amenu (Washer 0549358685 Abdurahman Abdulahi (P.T.A. Chairman) 0244776783 Ali 0556399880	09/08/2024	• Mining is the major economic activity, employing about 70% of the active adult population. • Farmers make up 25% and other workers such as artisans of various backgrounds like carpenters, masons, dressmakers and traders make up the remaining 5%. There are instances where some farmers double as miners. Yam, groundnut and maize are mostly cultivated in the area. • Concern about deplorable state of schools as most of them are at the brink of collapse, compelling parents to enroll their wards in the private school. • Truancy is on the rise, partly due to the deplorable nature of facilities in the school and the trappings of making money at the galamsey pit. • People from all walks of life are migrating into the community in search of gold. Many of such people include foreigners from Burkina Faso, Niger and Nigeria. • The government should attach a gold buying office to the center, so that taxes and revenue from gold buying will accrue to the government. Currently foreigners mostly Burkinabe's are the ones buying the gold. • Most pits are submerged in water, this makes mining tedious and expensive, they plead with government to assist them with pumps. • Would like to know if equipment to be installed at the center will have the capacity to extract the quantity of gold being mines at Dakrupe	Yes, the equipment will be able to process all the ore PIU will take on board some of the suggestions for consideration by the responsible authorities
2	Dakrupe	Group of Miners	09/08/2024	• Some of the community members are aware of the Project. They made reference to an earlier EPA visit to brief the community about the Project and also to educate them on the harmful effects of using mercury in the gold extraction process. • It was confirmed during the engagement that indeed the mercury they use was harmful to their health. Some miner's shared personal experiences where they had severe headaches and sleeplessness after they had used mercury. Others reported of hearing of other colleagues being diagnosed with Tuberculosis. • There are about 40 processing sites in the community, some are not operational. New ones are also springing up. • Requested for the process of setting up the demonstration center to be expedited.	Hopefully, more of such workshops will be organized to educate miners on environmental, safety and health issues

No.	Location/ Venue	Person Contacted	Date Engaged	Issues/Concerns Raised	Responses Provided
				• Others, however, expressed their apprehension. They claimed that similar exercises had been carried out in the past and nothing has been heard of it.	
3		Women in Mining • Ayisha salifu (0552334164) • Anane Matina • Alice Amatani • Tayfa Jakpa	09/08/2024	• Dakrupe women are an integral part of the mining process. There are roles typically reserved for women at the various sites. • The program was introduced to the community by officials from the EPA who briefed them about the effect of using mercury in mining, on women and the environment. • Informed that mercury could cause them to have pre-term babies and the could also give birth to babies with deformities. Mercury could also affect the environment by getting into water bodies. By inhaling the smoke during the extraction process they could also be seriously sick. • Happy about the program because it will guarantee their source of livelihood by keeping them employed all year round. • Concerned about the distance from the pit to the demonstration center because it might be too far for women to carry the gold ore to. • Would like to know if the center would pay women for the ore they carry to the center • Would also like to know what happens to the ore that is left after processing the ore.	More women should be encouraged to work in the mining sector
4	Bole/ Dakrupe	Ghana Health Service/Dakrupe CHPS Compound (Joana Ansuale(0542178716)	09/08/2024	• Catarrh is the most common especially among women due to the fact that had to be present all through the crushing process. • Top ailments in the community are malaria, diarrhea, urinary tract infection, upper respiratory tract infection, peptic ulcer and skin diseases as some of the most commonly reported diseases. • The health facility needs a facelift since referrals are in Bole which is several kilometers away.	Hopefully, the CMDC will be able to correct the health issues relating to the current mining operations
5	Bole	Ghana Education Service	08/08/2024	• Not only are the education facilities not well distributed, some of the structures are but run down. A number of primary school buildings in the District are three	The PIU may take up the community need on education for consideration by the responsible authorities

No.	Location/ Venue	Person Contacted	Date Engaged	Issues/Concerns Raised	Responses Provided
				unit classroom blocks. This necessitated the holding of multi-grade classes which affects quality of teaching and learning. • This state of affairs has two implications: firstly, pupils from communities without JHSs have to travel longer distances to other communities with JHSs and for a considerable number of them, it marks the end of their education; secondly, JHSs will be overcrowded since they serve many primary schools.. • The school building needs to be renovated to make learning attractive to children of school going age and deter them from galamsey.	
6	Bole	District Planning Officer (Edmund Zoure)	08/08/2024	• Settlement structure of the district is the Semi-Clustered type of settlement. The settlements vary in size and type; they range from hamlets to urban settlements. • There are five urban communities with population above 5000 which are classified as first level settlements. These are Bole, Bamboi, Tinga, Banda Nkwanta and Jama. The second level settlements are Mankuma, Maluwe, Mandari, Teslima and carpenter with populations of 2000 and above but not up to 5000. The rest are rural communities and hamlets. • The rural communities are basically bases of primary economic activities, whereas the urban settlements derive their life support from processing of agric produce, serve as marketing centres and provide other support services. • Major problems are non-adherence to planning regulations, encroachment on government lands and open spaces, non-enforcement of byelaws and unavailability of settlement plans and layouts. Open defecation is also a threat to healthy living in the communities. • Had knowledge of the project and expressed optimism about the success of the project in addressing the mercury menace in mining in the district. • Assured the readiness of the district to cooperate and assist in any way the assembly could. • Would like to know what becomes of the miners who derive their entire livelihood from mining in the community especially the women who do some sort of primary crushing at the various sites.	The assembly has a major role to play in the subproject and will be consulted regularly to ensure success of the subproject

No.	Location/ Venue	Person Contacted	Date Engaged	Issues/Concerns Raised	Responses Provided
7	Bole	District Directorate, Agriculture (Mr Sualey Abukari)	08/08/2024	• Farmers will only produce beyond subsistence when their products are assured of good market. Lack of access to markets and storage facilities can lead to post-harvest losses as far as perishable produce are concern. • The markets in the district are few and far apart. This increases transportation cost to and from the market and hence the cost of items in general. • Extension delivery to farmers is limited because of the few numbers of AEAs attending to several farmers. The number of AEAs required to deliver efficient and effective extension service is in sharp contrast to the number at post. • Though officers are few, most farmers had their fields and homes visited for extension delivery. • Environmental management is essential to sustain continuous farming. AEAs and farmers were trained on safety use of chemicals. • Does not seem to have any knowledge of such project happening in his catchment area. However after briefing him about the Project he was really excited that a project of such magnitude was going to be set up in the district. He asked how soon the project will take off. He observed that most farmers have abandoned farming and have become miners due to the continuous low yeild	There is need to ensure that mining does not thrive to the detriment of farming which may result in famine in the subproject area
7	Bole	Partners in Participatory Development (Eddie Telly-0244723498)	10/10/2024	❍ The NGO was established some 25 years ago. The organization is into advocacy of girl child education, reproductive health issues and environmental sustainability. ❍ Applauds the importance of such a program and underscored its importance at such a crucial time when environmental degradation is being attributed to mining. ❍ That the use of mercury is pervasive as a result of ignorance of its very toxic nature and the unavailability of an alternative to mercury. ❍ That with intensive sensitization and education, the miners will come to terms with the harmful attributes of mercury. ❍ That an alternative must be made easily accessible so as to forestall the use of mercury. ❍ Ensure the subproject implementation meets local and international standards	Hopefully, there will be more education of the miners on Environment, Health and Safety issues

No.	Location/ Venue	Person Contacted	Date Engaged	Issues/Concerns Raised	Responses Provided
8	Dakrupe	• Ronald Adu- Boahen- • Coordinator (0244205997) • Ali (0556399880) • Alhaji Seidu Saibu - Chairman (0244892025) • Abu Asiedu- (0246184157	28/02/2024	• We are aware of the mercury problem and have heard about it for several years. • Dr Ishmael from the University of Mines and Technology (UMAT) (as part of the project vision assignment) used to visit the community to educate miners on the use of mercury and how dangerous it is to our health. • It is very true that mercury is dangerous and needs to be eradicated. • There are currently two sites we are working on (Camp/ Waste Line and Sonyo Road). • We have heard about the proposed project to help get rid of mercury and are willing to embrace this opportunity.	• The proposed clean mine demonstration centre is funded by the World Bank and managed by EPA. • It is also being implemented as a pilot in the selected mine sites aimed at reducing or eliminating mercury use in small scale mining.

Photo Plate 1: Photos of Stakeholder Engagement Activities

Annex 7-1: Sample Code of Conduct Forms

Code of Conduct for Preventing Sexual Exploitation and Abuse and Sexual Harassment and Violence Against Children

A). Company Code of Conduct Preventing Sexual Exploitation and Abuse and Violence Against Children

The company is committed to creating and maintaining an environment in which gender-based violence (SEA/SH) and violence against children (VAC) have no place, and will not be tolerated by any employee, associate, or representative of the company. Therefore, in order to ensure that all those engaged in the project are aware of this commitment, and in order to prevent, be aware of, and respond to any allegations of SEA/SH and VAC, the company commits to the following core principles and minimum standards of behaviour that will apply to all company employees, associates, and representatives including sub-contractors, without exception:

1. The company — and therefore all employees, associates, and representatives — commit to treating women, children (persons under the age of 18), and men with respect regardless of race, colour, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status. Acts of SEA/SH and VAC are in violation of this commitment.
2. Demeaning, threatening, harassing, abusive, culturally inappropriate, or sexually provocative language and behaviour are prohibited among all company employees, associates, and its representatives.
3. Acts of SEA/SH or VAC constitute gross misconduct and are therefore grounds for sanctions, which may include penalties and/or termination of employment. All forms of SEA/SH and VAC, including grooming are unacceptable, regardless of whether they take place on the work site, the work site surroundings, at worker's camps or at worker's homes.
4. In addition to company sanctions, legal prosecution of those who commit acts of SEA/SH or VAC will be pursued if appropriate.
5. Sexual contact or activity with children under 18—including through digital media and use of children as construction labour —is prohibited. Mistaken belief regarding the age of a child is not a defines. Consent from the child is also not a defines or excuse.
6. Sexual favours—for instance, making promises or favourable treatment dependent on sexual acts—or other forms of humiliating, degrading or exploitative behaviour are prohibited.
7. Unless there is full consent[2] by all parties involved in the sexual act, sexual interactions between the company's employees (at any level) and members of the communities surrounding the work place are prohibited. This includes relationships involving the withholding/promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex—such sexual activity is considered "non-consensual" within the scope of this Code.
8. All employees, including volunteers and sub-contractors are highly encouraged to report suspected or actual acts of SEA/SH and/or VAC by a fellow worker, whether in the same company or not. Reports must be made in accordance with SEA/SH and VAC Allegation Procedures.
9. Managers are required to report suspected or actual acts of SEA/SH and/or VAC as they have a responsibility to uphold company commitments and hold their direct reports responsible.

To ensure that the above principles are implemented effectively the company commits to ensuring that:

10. All managers sign the 'Manager's Code of Conduct' detailing their responsibilities for implementing the company's commitments and enforcing the responsibilities in the 'Individual Code of Conduct'.

Consent is defined as the informed choice underlying an individual's free and voluntary intention, acceptance or agreement to do something. No consent can be found when such acceptance or agreement is obtained through the use of threats, force or other forms of coercion, abduction, fraud, deception, or misrepresentation. In accordance with the United Nations Convention on the Rights of the Child, the World Bank considers that consent cannot be given by children under the age of 18, even in the event that national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.

11. All employees sign the project's 'Individual Code of Conduct' confirming their agreement not to engage in activities resulting in SEA/SH or VAC.
12. Displaying the Company and Individual Codes of Conduct prominently and in clear view at workers' camps, offices, and in in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas, health clinics.
13. Ensure that posted and distributed copies of the Company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.
14. An appropriate person is nominated as the company's 'Focal Point' for addressing SEA/SH and VAC issues, including representing the company on the SEA/SH and VAC Compliance Team which is comprised of representatives from the client, contractor(s), the supervision consultant, and local service provider(s).
15. Ensuring that an effective Action Plan is developed in consultation with the Compliance Team which includes as a minimum:

    a. **SEA/SH and VAC Allegation Procedure** to report SEA/SH and VAC issues through the project Grievance Redress Mechanism (GRM);
    b. **Accountability Measures** to protect confidentiality of all involved; and,
    c. **Response Protocol** applicable to SEA/SH and VAC survivors and perpetrators.

16. That the company effectively implements the Action Plan, providing feedback to the SEA/SH and VAC Compliance Team for improvements and updates as appropriate.
17. All employees attend an induction training course prior to commencing work on site to ensure they are familiar with the company's commitments and the project's SEA/SH and VAC Codes of Conduct.
18. All employees attend a mandatory training course once a month for the duration of the contract starting from the first induction training prior to commencement of work to reinforce the understanding of the project's SEA/SH and VAC Code of Conduct.

I do hereby acknowledge that I have read the foregoing Company Code of Conduct, and on behalf of the company agree to comply with the standards contained therein. I understand my role and responsibilities to prevent and respond to SEA/SH and VAC. I understand that any action inconsistent with this Company Code of Conduct or failure to take action mandated by this Company Code of Conduct may result in disciplinary action.

Company name: _____
Signature: _____
Printed Name: _____
Title: _____
Date: _____

B). Manager's Code of Conduct Preventing Sexual Exploitation and Abuse, Sexual Harassment

Managers at all levels have particular responsibilities to uphold the company's commitment to preventing and addressing SEA/SH and Violence Against Children (VAC). This means that managers have an acute responsibility to create and maintain an environment that prevents SEA/SH and VAC. Managers need to support and promote the implementation of the Company Code of Conduct. To that end, managers must adhere to this Manager's Code of Conduct and also sign the Individual Code of Conduct. This commits them to supporting and developing systems that facilitate the implementation of the Action Plan and maintain a SEA/SH-free and VAC-free environment at the workplace and in the local community. These responsibilities include but are not limited to:

Implementation

1. To ensure maximum effectiveness of the Company and Individual Codes of Conduct:
    a. Prominently displaying the Company and Individual Codes of Conduct in clear view at workers' camps, offices, and in in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas, health clinics.
    b. Ensuring all posted and distributed copies of the Company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.
2. Verbally and in writing explain the Company and Individual Codes of Conduct to all staff.
3. Ensure that:
    a. All direct reports sign the 'Individual Code of Conduct', including acknowledgment that they have read and agree with the Code of Conduct.
    b. Staff lists and signed copies of the Individual Code of Conduct are provided to the client.
    c. Participate in training and ensure that staff also participate as outlined below.
    d. Staff are familiar with the Grievance Redress Mechanism (GRM) and that they can use it to anonymously report concerns of SEA/SH or VAC incidents.
    e. Staff are encouraged to report suspected or actual SEA/SH or VAC through the GRM by raising awareness about SEA/SH and VAC issues, emphasizing the staff's responsibility to the Company and the country hosting their employment, and emphasizing the respect for confidentiality.
4. In compliance with applicable laws and to the best of your abilities, prevent perpetrators of sexual exploitation and abuse from being hired, re-hired or deployed. Use background and criminal reference checks for all employees.
5. Ensure that when engaging in partnership, sub-contractor or similar agreements, these agreements:
    a. Incorporate the SEA/SH and VAC Codes of Conduct as an attachment.
    b. Include the appropriate language requiring such contracting entities and individuals, and their employees and volunteers, to comply with the Individual Codes of Conduct.
    c. expressly state that the failure of those entities or individuals, as appropriate, to take preventive measures against SEA/SH and VAC, to investigate allegations thereof, or to take corrective actions when SEA/SH or VAC has occurred, shall constitute grounds for sanctions and penalties in accordance with the Individual Codes of Conduct.
6. Provide support and resources to the SEA/SH and VAC Team to create and disseminate internal sensitization initiatives through the awareness-raising strategy under the Action Plan.
7. Ensure that any SEA/SH or VAC issue warranting police action is reported to the client and the World Bank immediately.

Training

8. All managers are required to attend an induction manager training course prior to commencing work on site to ensure that they are familiar with their roles and responsibilities in upholding the SEA/SH and VAC Codes of Conduct. This training will be separate from the induction training course required of all employees and will provide managers with the necessary understanding and technical support needed to begin to develop the Action Plan for addressing SEA/SH and VAC issues.

9. Ensure that time is provided during work hours and that staff attend the mandatory project facilitated induction training on SEA/SH and VAC required of all employees prior to commencing work on site.
10. Ensure that staff attend the monthly mandatory refresher training course required of all employees to combat increased risk of SEA/SH and VAC during civil works.
11. Managers are required to attend and assist with the project facilitated monthly training courses for all employees. Managers will be required to introduce the trainings and announce the self-evaluations.
12. Collect satisfaction surveys to evaluate training experiences and provide advice on improving the effectiveness of training.

Response

13. Managers will be required to provide input to the SEA/SH and VAC Allegation Procedures and Response Protocol developed by the SEA/SH and VAC Team as part of the final cleared Action Plan.
14. Once adopted by the Company, managers will uphold the Accountability Measures set forth in the Action Plan to maintain the confidentiality of all employees who report or (allegedly) perpetrate incidences of SEA/SH and VAC (unless a breach of confidentiality is required to protect persons or property from serious harm or where required by law).
15. If a manager develops concerns or suspicions regarding any form of SEA/SH or VAC by one of his/her direct reports, or by an employee working for another contractor on the same work site, s/he is required to report the case using the GRM.
16. Once a sanction has been determined, the relevant manager(s) is/are expected to be personally responsible for ensuring that the measure is effectively enforced, within a maximum timeframe of 14 days from the date on which the decision to sanction was made.
17. Managers failing to report or comply with such provision can in turn be subject to disciplinary measures, to be determined and enacted by the company's Chief Executive Officer, Managing Director or equivalent highest-ranking manager. Those measures may include:
    a. Informal warning.
    b. Formal warning.
    c. Additional Training.
    d. Loss of up to one week's salary.
    e. Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.
    f. Termination of employment.
18. Ultimately, failure to effectively respond to SEA/SH and VAC cases on the work site by the company's managers or Chief Executive Officer may provide grounds for legal actions by authorities.

I do hereby acknowledge that I have read the foregoing Manager's Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to SEA/SH and VAC. I understand that any action inconsistent with this Manager's Code of Conduct or failure to take action mandated by this Manager's Code of Conduct may result in disciplinary action.

Signature: _____
Printed Name: _____
Title: _____
Date: _____

C). Individual Code of Conduct Preventing Sexual Exploitation and Abuse and Sexual Harassment and Violence Against Children

I, _____, acknowledge that preventing gender-based violence (SEA/SH) and violence against children (VAC) is important. The company considers that SEA/SH or VAC activities constitute acts of gross misconduct and are therefore grounds for sanctions, penalties or potential termination of employment. All forms of SEA/SH or VAC are unacceptable be it on the work site, the work site surroundings, or at worker's camps. Prosecution of those who commit SEA/SH or VAC may be pursued if appropriate.

I agree that while working on the project I will:

- Consent to police background check.
- Treat women, children (persons under the age of 18), and men with respect regardless of race, colour, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status.
- Not use language or behaviour towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.
- Not participate in sexual contact or activity with children—including grooming, or contact through digital media. Mistaken belief regarding the age of a child is not a defence. Consent from the child is also not a defence or excuse.
- Not engage in sexual favours—for instance, making promises or favourable treatment dependent on sexual acts—or other forms of humiliating, degrading or exploitative behaviour.
- Unless there is the full consent[3] by all parties involved, I will not have sexual interactions with members of the surrounding communities. This includes relationships involving the withholding or promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex—such sexual activity is considered "non-consensual" within the scope of this Code.
- Attend and actively partake in training courses related to HIV/AIDS, SEA/SH and VAC as requested by my employer.
- Consider reporting through the GRM or to my manager any suspected or actual SEA/SH or VAC by a fellow worker, whether employed by my company or not, or any breaches of this Code of Conduct.

With regard to children under the age of 18:

- Wherever possible, ensure that another adult is present when working in the proximity of children.
- Not invite unaccompanied children unrelated to my family into my home, unless they are at immediate risk of injury or in physical danger.
- Not sleep close to unsupervised children unless absolutely necessary, in which case I must obtain my supervisor's permission, and ensure that another adult is present if possible.
- Use any computers, mobile phones, or video and digital cameras appropriately, and never to exploit or harass children or to access child pornography through any medium (see also "Use of children's images for work related purposes" below).
- Refrain from physical punishment or discipline of children.
- Refrain from hiring children for domestic or other labour which is inappropriate given their age or developmental stage, which interferes with their time available for education and recreational activities, or which places them at significant risk of injury.
- Comply with all relevant local legislation, including labour laws in relation to child labour.

Use of children's images for work related purposes

[3] **Consent** is defined as the informed choice underlying an individual's free and voluntary intention, acceptance or agreement to do something. No consent can be found when such acceptance or agreement is obtained through the use of threats, force or other forms of coercion, abduction, fraud, deception, or misrepresentation. In accordance with the United Nations Convention on the Rights of the Child, the World Bank considers that consent cannot be given by children under the age of 18, even in the event that national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.

When photographing or filming a child for work related purposes, I must:

- Before photographing or filming a child, assess and endeavour to comply with local traditions or restrictions for reproducing personal images.
- Before photographing or filming a child, obtain informed consent from the child and a parent or guardian of the child. As part of this I must explain how the photograph or film will be used.
- Ensure photographs, films, videos and DVDs present children in a dignified and respectful manner and not in a vulnerable or submissive manner. Children should be adequately clothed and not in poses that could be seen as sexually suggestive.
- Ensure images are honest representations of the context and the facts.
- Ensure file labels do not reveal identifying information about a child when sending images electronically.

Sanctions

I understand that if I breach this Individual Code of Conduct, my employer will take disciplinary action which could include:

- Informal warning.
- Formal warning.
- Additional Training.
- Loss of up to one week's salary.
- Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.
- Termination of employment.
- Report to the police if warranted.

I understand that it is my responsibility to avoid actions or behaviours that could be construed as SEA/SH or VAC or breach this Individual Code of Conduct. I do hereby acknowledge that I have read the foregoing Individual Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to SEA/SH and VAC. I understand that any action inconsistent with this Individual Code of Conduct or failure to take action mandated by this Individual Code of Conduct may result in disciplinary action and may affect my ongoing employment.

Signature: _____

Printed Name: _____

Title: _____

Date: _____

RAISING CONCERNS

If any person observes behaviours that he/she believes may represent a violation of this Code of Conduct, or that otherwise concerns him/her, he/she should raise the issue promptly. This can be done in either of the following ways:

1. Contact [*enter name of the Contractor's Social Expert with relevant experience in handling gender-based violence, or if such person is not required under the Contract, another individual designated by the Contractor to handle these matters*] in writing at this address [ ] or by telephone at [ ] or in person at [ ]; or
2. Call [ ] to reach the Contractor's hotline *(if any)* and leave a message.

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be submitted and will be given all due and appropriate consideration. We take seriously all reports of possible misconduct and will investigate and

take appropriate action. We will provide warm referrals to service providers that may help support the person who experienced the alleged incident, as appropriate.

There will be no retaliation against any person who raises a concern in good faith about any behaviour prohibited by this Code of Conduct. Such retaliation would be a violation of this Code of Conduct.

CONSEQUENCES OF VIOLATING THE CODE OF CONDUCT

Any violation of this Code of Conduct by Contractor's Personnel may result in serious consequences, up to and including termination and possible referral to legal authorities.

FOR CONTRACTOR'S PERSONNEL:

I have received a copy of this Code of Conduct written in a language that I comprehend. I understand that if I have any questions about this Code of Conduct, I can contact [*enter name of Contractor's contact person(s) with relevant experience]* requesting an explanation.

Name of Contractor's Personnel: [insert name]

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Contractor:

Signature: _____

Date: (day month year): _____

Behaviours constituting Sexual Exploitation and Abuse (SEA) and behaviours constituting Sexual Harassment (SH).

The following non-exhaustive list is intended to illustrate types of prohibited behaviours.

(1) **Examples of sexual exploitation and abuse** include, but are not limited to:

- A Contractor's Personnel tells a member of the community that he/she can get them jobs related to the work site (e.g. cooking and cleaning) in exchange for sex.
- A Contractor's Personnel that is connecting electricity input to households says that he can connect women headed households to the grid in exchange for sex.
- A Contractor's Personnel rapes, or otherwise sexually assaults a member of the community.
- A Contractor's Personnel denies a person access to the Site unless he/she performs a sexual favour.
- A Contractor's Personnel tells a person applying for employment under the Contract that he/she will only hire him/her if he/she has sex with him/her.

(2) **Examples of sexual harassment in a work context**

- Contractor's Personnel comment on the appearance of another Contractor's Personnel (either positive or negative) and sexual desirability.

- When a Contractor's Personnel complains about comments made by another Contractor's Personnel on his/her appearance, the other Contractor's Personnel comment that he/she is "asking for it" because of how he/she dresses.
- Unwelcome touching of a Contractor's or Employer's Personnel by another Contractor's Personnel.

A Contractor's Personnel tells another Contractor's Personnel that he/she will get him/her a salary raise, or promotion if he/she sends him/her naked photographs of himself/her