REPUBLIC OF GHANA

STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA) REPORT

ON THE DEVELOPMENT OF A PETROLEUM HUB IN GHANA

MAIN TECHNICAL REPORT

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STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA) ON THE DEVELOPMENT OF A PETROLEUM HUB IN GHANA

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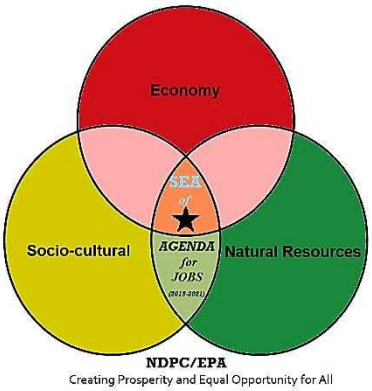

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Foreword

The Report summarises the entire process, findings, and recommendations of the Strategic Environmental Assessment (SEA) on the Development of a Petroleum Hub (PHub) in Ghana. The SEA has been conducted to understand and respond to the potential risks, as well as opportunities associated with the development of a Petroleum Hub.

Ghana is well positioned to develop its downstream petroleum sub-sector which will contribute immensely to the economy in terms of revenue generation, job creation, and improved access to petroleum and associated petrochemical products, among others. Upon completion, Ghana would possess enough storage capacity and infrastructure to supply the sub-region and transform the country into a major oil Hub for refined petroleum products in the West African sub-region and Africa.

The SEA has demonstrated the need to strike a balance among the various pillars of sustainability which will be essential to ensuring the sustainability of the downstream petroleum sub-sector. Current global issues such as climate change, health and safety, disaster, and emergency responses, among others in petroleum operations, have been broadly considered in the SEA. Several stakeholders including public and private sectors, Civil Society Organizations (CSOs), traditional authorities, affected communities, academia, etc. participated and contributed to the SEA process. These stakeholder engagements were crucial in the identification and determination of the key issues and concerns that must be addressed through leadership, effective collaboration, and coordination of all relevant stakeholders.

It is expected that all the recommendations and advisory notes will be implemented to ensure the successful development and operations of the Petroleum Hub.

We extend our deepest appreciation to the SEA Team, collaborating institutions, and other relevant stakeholders for their efforts in completing this task.

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Preface

The EPA commenced the SEA (PHub) at the request of the Ministry of Energy as required by the Environmental Protection Agency Act, 1994 (Act 490) and Environmental Assessment Regulations, 1999 (LI 1652).

The SEA Process involved a broad range of stakeholders. The Assessment was carried out in collaboration with the Ministry of Energy, the Ministry of Environment, Science, Technology and Innovation, and the National Development Planning Commission with technical support from the National Petroleum Authority (NPA), the Land Use and Spatial Planning Authority (LUSPA) and the Lands Commission. The heads of these organizations formed the Steering Committee that provided oversight for the SEA. The SEA covered the period from March – November 2021.

A key outcome of SEAs is the documentation of the process and findings to inform publicly accountable decision-making. Three (3) distinct reports covering this Process Report, Content Report and Executive Summary that highlights the main aspects of the SEA including the findings and recommendations are usually produced in the case of the Ghana SEA. However, in this SEA (PHub), all these aspects have been captured in one.

The SEA (PHub) Report has been structured into eight (8) Chapters with an Executive Summary. Chapter one is the Introduction, Chapter 2 provides an Overview of the Petroleum Hub Development, Chapter 3 examines the relevant Institutional, Policy and Legislative Framework, Chapter 4 outlines the Existing Conditions within and around the proposed area, Chapter 5 covers the Development of an Issues Register, Chapter 6 looks at the Assessment, Chapter 7 outlines the Recommendations and Advisory Notes for addressing the issues, and Chapter 8 concludes the Report with the Implementation and Monitoring Arrangements.

HON. HENRY K. KOKOFU (ESQ.)
EXECUTIVE DIRECTOR
ENVIRONMENTAL PROTECTION AGENCY

Acknowledgement

The SEA (PHub) Report was prepared by the Strategic Environmental Assessment (SEA) Team and under the direction and support of the Inter-ministerial Steering Committee.

The Environmental Protection Agency (EPA) is grateful to all stakeholders who participated and contributed to the processes that have led to the successful completion of the SEA. The names of all the participating stakeholder institutions are published and annexed to the SEA (PHub) Report.

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List of Acronyms

ACEP	Africa Centre for Energy Policy
AESL	Architectural and Engineering Services Limited
AfCFTA	African Continental Free Trade Agreement
AGI	Association of Ghana Industries
ATK	Aviation Turbine Kerosene
AU	African Union
BOST	Bulk Oil Storage and Transportation Company
CEDA	Centre for Extractives and Development Africa
COCOBOD	Ghana Cocoa Board
COPEC	Chamber of Petroleum Consumers Ghana
CREMA	Community Resource Management Area
CSIR	Council for Scientific and Industrial Research
CSOs	Civil Society Organizations
CSPOG	Civil Society Platform on Oil and Gas
CWSA	Community Water and Sanitation Agency
DA	District Assembly
DEM	Digital Elevation Model
DFI	Department of Factories Inspectorate
DISEC	District Security Committee
DMTDPs	District Medium-Term Development Plans
DoI	Duration of Impact
DPCU	District Planning Coordinating Unit
EAF	East Atlantic Flyway
EC	Energy Commission
EC	Economic Pillar
ECG	Electricity Company of Ghana
EIA	Environmental Impact Assessment
ENFALP	Enhancing Natural Forests and Agroforestry Landscapes Project
EPA	Environmental Protection Agency
EPFIs	Equator Principles Financial Institutions
EPs	Equator Principles
ESF	World Bank Environmental and Social Framework
ESSs	Environmental and Social Standards
FBOs	Faith-Based Organizations
FC	Forest Commission
FoC	Frequency of occurrence
GACL	Ghana Airports Company Limited
GCAA	Ghana Civil Aviation Authority
GCAA	Ghana Civil Aviation Authority
GCMC	Ghana Cylinder Manufacturing Company
GDP	Gross Domestic Product
GEA	Ghana Enterprises Agency
GEPA	Ghana Export Promotion Authority
GFZA	Ghana Free Zones Authority
GGSA	Ghana Geological Survey Authority

GHS	Ghana Health Service
GIDA	Ghana Irrigation Development Authority
GIE	Ghana Institution of Engineers
GIPC	Ghana Investment Promotion Centre
GIS	Geographic Information System
GIS	Ghana Immigration Service
GLSS	Ghana Living Standards Survey
GMA	Ghana Maritime Authority
GNFS	Ghana National Fire Service
GNPC	Ghana National Petroleum Corporation
GoG	Government of Ghana
GPHA	Ghana Ports and Harbours Authority
GRA	Ghana Revenue Authority
GRASS	Geographic Resources Analysis Support System
GRIDCo	Ghana Grid Company
GS	Geographical Scope
GSA	Ghana Standards Authority
GSGDA	Ghana Shared Growth and Development Agenda
GSS	Ghana Statistical Service
GVE	Gender, Vulnerable and Excluded
GWC	Ghana Water Company
HSD	Hydrological Services Department
HSSE	Health, Safety, Security and Environment
ICT	Information Communication Technology
IES	Institute for Energy Security
IFC	International Finance Corporation
ILO	International Labour Organisation
INS	Institutional Pillar
INSTEPR	Institute of Energy Policies and Research
IPIECA	International Petroleum Industry Environmental Conservation Association
OGP	International Association of Oil & Gas Producers
IBMP	Integrated Biodiversity Management Plan
ISODEC	Integrated Social Development Centre
IUCN	International Union of Conservation of Nature
JMA	Jomoro Municipal Assembly
LC	Land Commission
LGSS	Local Government Service Secretariat
LI	Legislative Instrument
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LUSPA	Land Use and Spatial Plan Authority
MARPOL	International Convention for the Prevention of Pollution from Ships
MDAs	Ministries, Departments and Agencies
MESTI	Ministry of Environment, Science, Technology and Innovation
MGCSP	Ministry of Gender, Children and Social Protection
MLNR	Ministry of Land and Natural Resources
MMDA	Metropolitan, Municipal and District Assemblies
MoEn	Ministry of Energy

MOFA	Ministry of Food and Agriculture
MoTI	Ministry of Trade and Industry
NADMO	National Disaster Management Organisation
NCA	National Communications Authority
NCCE	National Commission for Civic Education
NCCP	National Climate Change Policy
NDPC	National Development Planning Commission
NEAP	National Environmental Action Plan
NITA	National Information and Technology Agency
NPA	National Petroleum Authority
NPA	National Petroleum Authority
NR	Natural Resource Pillar
NRGI	Natural Resource Governance Institute
NSDF	National Spatial Development Framework
NVTI	National Vocational Technical Institute
PC	Petroleum Commission
PGA	Peak Ground Acceleration
PHDC	Petroleum Hub Development Corporation
PHub	Petroleum Hub
PIMP	Petroleum Infrastructure Master Plan
PNDCL	Provisional National Defense Council Law
PPP	Policy, Plan or Programme
PURC	Public Utilities Regulatory Commission
PWD	People with Disability
RBZP	Riparian Buffer Zone Policy
REGSEC	Regional Security Committee
RR	Regulatory regime
RTS	Relevance to the SEA
SC	Socio-Cultural Pillar
SDF	Spatial Development Framework
SDGs	Sustainable Development Goals
SEA	Strategic Environmental Assessment
TAs	Traditional Authorities
TOR	Tema Oil Refinery
UAV	Unmanned Aerial Vehicle
UNCLOS	United Nations Convention on the Law of the Sea
VRA	Volta River Authority
WRC	Water Resources Commission
WRCC	Western Regional Coordinating Council
WREGSEC	Western Regional Security Committee

Aerial photo of Kabelensuazo, *Credit EPA*

CHAPTER 1

INTRODUCTION

1.1 Background

The Government of Ghana seeks to expand the economy and has outlined several strategies to develop a modern, diversified, efficient and financially sustainable energy sector. One such measure is the Petroleum Infrastructure Master Plan (PIMP) which has led to the proposal to develop a Petroleum Hub.

The establishment of a Petroleum Hub is one of the Government's strategic anchor initiatives that would serve as a new pillar of growth in the Ghanaian economy. The project will accelerate the growth of Ghana's petroleum downstream sub-sector and make it a major player in the economy. The Petroleum Hub project will increase the presence of major international oil trading and storage companies, create regional trading champions, and encourage joint ventures between local and international companies for knowledge transfer and wealth creation, etc. It will also provide the country with LNG facilities for power production and drive the growth of various industries including petrochemicals. The Petroleum Hub project is expected to transform Ghana's economy and create over 780,000 direct and indirect jobs by 2030. This will also accelerate the growth of Ghana's petroleum downstream sub-sector.

The Petroleum Hub will house refineries, processing, storage, distribution and transportation facilities, jetties, etc. This will facilitate the trading of petroleum products within the West African sub-regional market and beyond.

The proposed area for the development of the Petroleum Hub is the Western Nzema Traditional Area which is in the Jomoro Municipality of the Western Region. This area was pre-selected based on specified criteria before the commencement of the SEA by the Ministry of Energy after considering two other alternative areas namely, the Anyinase-Atuabo area in the Ellembele District of Western Region, and the Saltpond area in the Mfantsiman West District of the Central Region.

1.2 Legal Framework for the SEA

The Strategic Environmental Assessment (SEA) process is aimed at determining the potential environmental risks and opportunities that are likely to be associated with the development of a Petroleum Hub. It is in line with existing legal frameworks for Environmental Assessment in Ghana including Environmental Protection Agency Act, 1994 (Act 490); Environmental Assessment Regulations, 1999 (LI 1652); Petroleum Hub Development Corporation Act, 2020 (Act 1053), the National Development Planning System Regulations, 2016 (LI 2232) and best industry practice guidelines. Relevant details of the institutional, policy and legal framework governing the SEA are presented in Chapter 3.

1.3 SEA Definitions and Concepts

There are various definitions for SEA, which include: The formalized, systematic, and comprehensive process of evaluating the environmental effects of a Policy, Plan or Programme (PPP) and its alternatives, including the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision-making (Brown &Therivel et al., 1992).

SEA is also defined as "a system by which the opportunities and risks of a Policy, Plan or Programme (PPPs) in relation to the environment are considered at the conceptual stage of decision making to ensure that the sustainability dimension i.e., natural resources, economic, socio-cultural and institutional are at par resulting in the documentation of the process and translating into implementation results" (Asare, 2017).

SEA is used to describe the whole assessment process with the results and findings documented in a 'SEA Report'[1]. SEA focuses on PPPs rather than projects. It is a process, which covers broad themes such as gender, or sectors such as oil and gas, and can be applied at national, regional or district levels. SEA is most effective when applied ex-ante i.e., at the PPPs are being developed and different approaches or alternatives can be proposed. It helps to identify obscure or hidden effects including their cumulative, induced, and transboundary effects and focuses on sustainability principles. SEA is, therefore, a tool for ensuring sustainability by considering natural resources, socio-cultural, economic, and institutional issues at the Policy, Plan and Programme (PPP) levels of decision-making.

[1] The Ghana 'SEA Report' is usually organized in three (3) Volumes: Process Report, Content Report and Executive Summary. However, in this SEA, all the three (3) volumes will be synthesized in one Report largely due to the scope of the assessment.

1.4 Purpose of this SEA

The main purpose of the SEA is to provide guidance on how to address the opportunities and risks associated with the development of a Petroleum Hub within the Jomoro Municipality, its adjoining districts, as well as the applicable laws and regulations. More particularly, there is the need to have a holistic view of the environmental[2] opportunities and risks that may arise because of the development of the Petroleum Hub.

The purpose of this SEA is therefore to ensure that environmental issues are considered in all key decisions at the earliest stage to achieve the following:

i. Enhance socio-economic opportunities for all including the vulnerable, excluded, women and children.
ii. Protect and enhance the natural resources (ecologically sensitive areas, etc.) on which communities depend for their livelihoods, as well as the survival of the entire ecosystem.
iii. Reduce risks associated with the establishment of the petroleum hub, particularly concerning potential conflicts, among others.
iv. Improve the health and well-being of inhabitants by eliminating pollution and reducing accidents.
v. Strengthen local content and participation.
vi. Create institutional systems that allow for broad participation in decision-making processes.
vii. Enhance the achievement of the African Union (AU) Agenda 2063 targets and related Sustainable Development Goals (SDGs).

The findings of the SEA would feed into the key elements at the project phase of the development as well as the preparation of land use and spatial plans, among others. The SEA will also influence the District Medium-Term Development Plans (DMTDPs) of the Jomoro Municipal Assembly and to some extent, other neighbouring District Assemblies.

[2] Environment is multi-dimensional, and it is necessary to refer to many geographic components and variables, which contribute to the 'environment' of Ghana. Therefore, the SEA has adopted a broad definition of 'environment'; embracing not only the biophysical environment but also the social, cultural, micro-economic and institutional conditions that constitute the human habitat

1.5 Specific Objectives of the SEA

The specific objectives of the SEA are to:

i. Integrate environmental and social considerations in the development of the petroleum hub to ensure sustainable development.
ii. Identify environmentally sensitive areas and provide guidance for protecting such resources as they coexist with the development of the Petroleum Hub.
iii. Determine the environmental opportunities and risks associated with various stages of development and present guidelines that will enhance opportunities and minimize risks.
iv. Outline mitigation and monitoring requirements and objectives that establish best practices and ensure effective management of the Hub.
v. Consider all potential environmental issues and concerns and ensure that they are addressed at the earliest stage of decision-making processes.
vi. Compile baseline information on the natural resource, socio-cultural, economic, and institutional conditions of the communities that are likely to be affected.
vii. Ensure wider stakeholder participation and involvement in decision-making.

1.6 Dimension of the Ghana SEA

The Ghana SEA in practice has two (2) main dimensions. The Process dimension focuses on all the processes and activities carried out in the SEA. These processes and activities are largely participatory to ensure understanding and ownership of the SEA amongst stakeholders. All activities of the SEA process are documented usually in a Process Report. The Content dimension documents all the outcomes of the processes and activities which include analyses of the information carried out at various stages of the assessment and recommendations proposed for effective environmental management. The Content dimension is also documented in a Content Report.

These two (2) dimensions are not mutually exclusive. It is thus recommended that both the Process and Content Reports are read together to get a full understanding of SEAs. In this SEA, however, both the process and content dimensions have been consolidated into one Report.

1.7 SEA Approach and Methodology

This SEA process generally follows the guidance in the report on the "Review of the Strategic Environmental Assessment (SEA) in Ghana". This SEA on the development of a Petroleum Hub followed the steps in Figure 1.0.

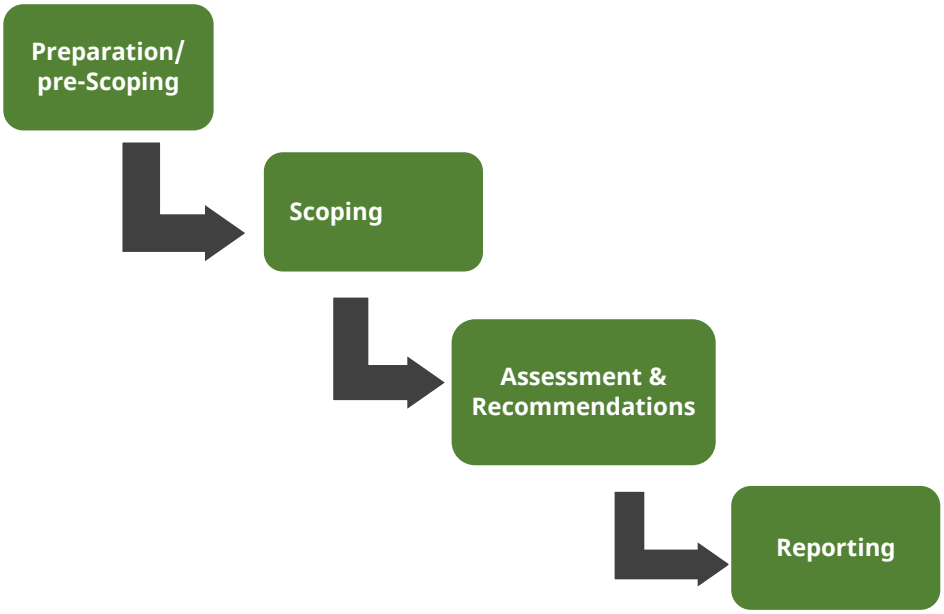


Figure 1.0: SEA Steps

As part of the steps, all stakeholders involved were equipped with basic information on the Petroleum Hub, through the development, evaluation, and communication of development scenarios, among others. Several stakeholders were drawn from relevant Ministries Departments and Agencies (MDAs), Metropolitan, Municipal and District Assemblies (MMDAs), private sectors, Traditional Authorities (TA), religious groups, academia, affected communities, opinion leaders, Civil Society Organizations (CSOs), etc.

1.7.1 Preparatory/Pre-scoping Phase

During the preparatory phase, some preliminary activities were undertaken by EPA to facilitate the conduct of the SEA. Activities that were carried out with the support of the Ministry of Energy include the following:

- Formation of SEA Team
- Preliminary Meeting of the SEA Team
- Capacity Building for SEA Team

1.7.1.1 Formation of SEA Team Meetings

The Ghana SEA Process is coordinated by a standing National Core Team which is made up of the Environmental Protection Agency (EPA) and the National Development Planning Commission (NDPC). However, personnel from other relevant institutions are usually co-opted to work with the Core Team during specific SEAs.

The SEA Team[3] constituted for this SEA included representatives of the following institutions:

1. Environmental Protection Agency (EPA)
2. National Development Planning Commission (NDPC)
3. Land Use and Spatial Planning Authority (LUSPA)
4. Lands Commission (LC)
5. Ministry of Energy (MoEn)
6. Ministry of Environment, Science, Technology, and Innovation (MESTI)*
7. National Petroleum Authority (NPA)

1.7.1.2 Preliminary SEA Team Meeting

The first meeting of the SEA Technical Committee was held on Wednesday, 3rd March 2021 at the Conference Room of the EPA. The meeting served as an introductory meeting for members to officially engage in the SEA process and the roles they would play in the SEA. Members of the Committee were briefed on the PIMP and the anticipated benefits of carrying out the SEA.

LUSPA had been commissioned by the Ministry of Energy to prepare local and structural plans for the PIMP, an activity that commenced in July 2020. The representative of the Land Use and Spatial Planning Authority (LUSPA) on the SEA Technical Committee then updated the SEA Team on the status of their work. LUSPA's presentation highlighted several issues (environmental, economy, health, socio-cultural, services and infrastructure, etc.) that were raised throughout their engagements with the communities and field data collection surveys. LUSPA also presented two (2) draft scenarios that were considered as well as the respective interventions with the structural and local plans to address the issues.

[3] The list of members of the SEA Technical Committee is provided in the preceding section of the Report

1.7.1.3 Capacity Building for SEA Technical Committee

Members of the SEA Technical Committee were trained and equipped with the requisite knowledge and skills for conducting SEA, particularly concerning the PIMP. The training took place from Thursday, 4th to Friday, 5th of March 2021 in the conference room of the EPA. The training covered tools for the conduct of SEA for PPPs, the application of SEA in the development planning process, and the need for decision-makers to consider the environment and other sustainability issues during decision-making.

1.7.3 Scoping Phase

The Scoping Phase of the SEA spanned the period from 17th March to 28th May 2021. All the issues and concerns i.e., both risks and opportunities that could arise from the development of the Petroleum Hub were identified.

The activities that were carried out during the scoping phase include:

- Engagements with the Western Regional Coordinating Council (WRCC), Sekondi-Takoradi
- Meeting with Traditional Authorities
- Municipal Consultations, Jomoro Municipal Assembly (JMA) – Half Assini
- Field Visit to the Western Nzema Enclave
- Community Consultations, Tenack Beach Resort & Hotel – Benyin
- SEA Launch & Kick-Off/Pre-scoping Stakeholders' workshop, Movenpick Ambassador Hotel - Accra

1.7.3.1 Engagements with the Western Regional Coordinating Council (WRCC)

The SEA Technical Committee met the Hon. Regional Minister of the Western Region and some officers of the WRCC on Wednesday, 17th March 2021. The meeting provided an opportunity for the Committee to inform the Regional Minister and the Coordinating Council about the official commencement of the SEA and to take on board their concerns and perspectives on the development of the Petroleum Hub.

1.7.3.2 Meeting with Traditional Authorities

The team also paid a courtesy call to the Paramount Chief of the Western Nzema Traditional Area (WNTA), Awulae Annor Adjei II on Wednesday, 17th March 2021. He expressed his optimism and satisfaction with the conduct of the SEA which he believed will address the environmental concerns and issues that are likely to emanate from the development of the Petroleum Hub. He also reiterated the commitment and support of the Western Nzema Traditional Council to facilitate the land acquisition and registration processes.

1.7.3.3 Municipal Consultations, Jomoro Municipal Assembly - Half Assini

Consultations at the municipal level were held on Thursday, 18th March 2021 at the Assembly Hall of the Jomoro Municipal Assembly, Half Assini. SEA Team engaged the Hon. Municipal Chief Executive on the purpose of the SEA and the objectives for the Municipal Consultations. In all, about forty (40) persons participated in the workshop.

Key municipal personnel who took part in the meeting included the Municipal Coordinating Director, the Municipal NADMO Officer, the Municipal Physical Planning Officer, the Municipal Development Planning Officer, the Municipal Works Engineer, the Municipal Agriculture Officer, the Municipal Transport Officer, the Municipal Fire Officer, the Municipal Health, Safety & Environment Officer, Western Regional Economic Planning Officer, and representatives from the Regional Lands Commission, Regional Wildlife Division of the Forestry Commission, District Security Committee (DISEC).

This engagement was critical in understanding the perspective and context of the Jomoro Municipal Assembly and the Regional Coordinating Council concerning the development of the Petroleum Hub. Several issues and concerns were raised during group discussions and plenary sessions for consideration by the SEA.

1.7.3.4 Field Visit to the Proposed Site

The SEA Team embarked on a field visit on Thursday, 18th March 2021 to the proposed site in Jomoro. The field visit provided an opportunity for the SEA Team to familiarize themselves with the situation on the ground. An Unmanned Aerial Vehicle (UAV) was used by the Team to collect data and information for further analysis.

Some observations made during the visit include interspersed communities, ecologically sensitive areas (mangroves, the Domunli lagoon, etc.), coconut trees, fishing activities along the coast, hamlets, pig farming activities, and burial sites, among others.

1.7.3.5 Community Consultations, Benyin

A consultative workshop was held on Friday, 19th March 2021 at the Tenack Beach Resort and Hotel, Benyin. The objective of the workshop was to identify the issues and concerns that the affected communities may have regarding the development of a Petroleum Hub. In all, about eighty-five (85) participants comprised of the SEA Team, Assembly Members, Unit Committee Members, sub-Chiefs, and other representatives of the affected communities took part in the workshop.

The development of the Petroleum Hub will potentially affect thirteen (13) communities within the Jomoro Municipality. These communities include Tikobo 1, Kabelensuazo, Allowule, Bonyere, Ezilembo, Ellenda, Ndumsuazo, Nawule, Takinta, Nuba, Allengenzule, Egbazo and Old Kabelensuazo.

1.7.3.6 SEA Launch & Kick-Off/Pre-scoping Stakeholders' Workshop, Accra

Although several activities had commenced, the official kick-off meeting of the SEA was held on Wednesday, 7th April 2020 at the Movenpick Ambassador Hotel, Accra. The meeting was attended by high and middle-level managers of the relevant Ministries, Department and Agencies (MDAs), Traditional Authorities, Academia, Civil Society Organizations (CSOs), and Media, among others. In all, a total of seventy (70) participants took part in the Workshop. Apart from the launch of the SEA, the workshop also discussed broad issues regarding the conduct of the SEA including the composition of the SEA Team, Interministerial Steering Committee, linkages of the SEA to the preparation of structural and local plans led by LUSPA, timelines, funding arrangements, among others.

1.7.4 Assessment Phase

Activities which took place during the assessment phase are discussed below.

1.7.4.1 SEA Team Retreat/Meetings, City Escape Hotel - Prampram

SEA Team meetings were held from 11th to 15th May and 25th to 28th May 2021 after the consultations. The issues and concerns gathered from the various processes including documents review, and expert inputs were consolidated and analyzed to determine the key issues that require further evaluation in the SEA. The consolidation and analyses of the issues were guided by the following criteria:

- The frequency of occurrence of the issue refers to the number of times the issue was raised or occurred at the respective engagements.
- Relevance[4] of the issue to the SEA which considers the strategic importance of the issue.

[4] High relevance issues are strategic, whereas Low relevance issues are project related and can be handled by Environmental Impact Assessment (EIA).

Baseline information was also compiled from several sources including primary and secondary data collected from a field reconnaissance survey, multi-hazard risk analysis, LUSPA Situational Report, District Medium-Term Development Plan (2018-2021) of Jomoro Municipal Assembly, Ghana Living Standards Survey (GLSS 7), among others.

CHAPTER 2

OVERVIEW OF THE PETROLEUM HUB DEVELOPMENT

2.1 Introduction

Ghana is a net importer of petroleum products. The quantities imported have increased over the years in response to increasing demand whiles local production has been inadequate. For instance, the demand for petroleum products in Ghana increased from 3.33 million metric tonnes in 2016 to 4.2 million metric tonnes in 2020. The existing infrastructure is however not adequate to meet the steady increase in demand in a manner that ensures efficiency in fuel supply and fuel security. This problem also affects other countries in the West African sub-region all of whom have inadequate infrastructural capacity to supply petroleum products to meet demand. The total consumption of petroleum products across the West African sub-region is estimated at 30 million metric tonnes. At a projected growth rate of about 7% per annum, it is estimated that total consumption would most likely double and peak at about 78 million metric tonnes by the year 2030.

This means the West African sub-region has the potential of becoming a huge market for refined petroleum products in the medium to long term. In addition to increasing consumption of petroleum products, there is also increased demand for Petrochemical products such as urea in the sub-region. The global annual production of urea is about 150 million tonnes. About 40 million tonnes of this is traded globally and the rest is locally consumed in the countries of production. The consumption of urea in sub-Saharan Africa is estimated to be 2.6 million tonnes of which the bulk is imported. The establishment of a petrochemical plant in Ghana with a capacity of about 1.3 million tonnes could supply about half of the demand of sub-Saharan African countries.

The rapid increase in demand for petrochemicals in the sub-region makes it important to consider establishing other petrochemical plants to produce ammonia, fertilizer, methanol, etc. to utilize the excess associated gas that will be available from the production of crude oil as many discoveries are made. There is an opportunity for the establishment of major infrastructure for refining and petrochemical processing, discharge, storage, distribution, transportation and trading of petroleum products using Ghana as a hub for the West African sub-region and the world at large. This requires the development of infrastructures such as refineries, port terminal facilities, storage facilities as well as petrochemical and Liquefied Natural Gas (LNG) terminals with a network of pipelines. With this kind of infrastructure and an enabling economic environment in place, Ghana would be able to create a Petroleum Hub that would supply petroleum products to meet the demands of domestic and West African sub-regional markets.

The country's production of natural gas in commercial quantities has also necessitated the drive to optimize the use of natural gas resources to industrialize. Though the priority use of natural gas in the past was to produce power, current developments in the gas industry dictate the need to diversify the use of natural gas. The strategic importance of developing a natural gas-based petrochemical industry as part of the proposed Petroleum Hub can therefore not be understated. These reasons and other future developments justify the need for the establishment of petrochemical, agrochemical, chemical, plastics and fertilizer plants in Ghana for export and local value addition.

2.2 Justification

The major advantages Ghana has are its central location in the sub-region, political stability, access to the sub-regional market, closeness to international shipping routes and macroeconomic stability. In terms of political stability, Ghana has had four successful political transitions where there has been a successful handing over of power from one political party to another. There is an independent judiciary as well as a democratically elected parliament that actively debates national issues, and a vibrant press and civil society. The nation is matured in terms of democratic governance and the rule of law which creates an atmosphere conducive to business enterprises thriving. This will serve as a good foundation for trading activities in a Petroleum Hub. Using the most common political and economic indicators such as peace and stability, democratic governance and the rule of law, corruption, macroeconomic stability, poverty reduction and social contract, Ghana has been highly successful in its political and economic development, relative to other developing countries or countries in sub-Saharan Africa.

Currently, it takes a minimum of two weeks to ship petroleum products from Petroleum Hubs in Europe, Asia, and the Americas into the sub-region and in case of a crisis, the sub-region would have no security of supply. From Ghana, a vessel can easily reach any of the countries in the sub-region within forty-eight (48) hours. This situation makes Ghana an ideal destination for the development of a Petroleum Hub. Ghana can provide the platform required for making a trading Hub for petroleum products successful. This includes a network of traders, human capital, financial and trading platform, legal, regulatory and tax framework, infrastructure for physical delivery of products, and a generally conducive business environment. Upon completion, Ghana would possess enough storage capacity and infrastructure to supply the sub-region (including land-locked countries) and transform the country into a major oil Hub for refined petroleum products in the West African sub-region and Africa.

2.3 Description of the Petroleum Hub

The Petroleum Hub is to be situated within Western Nzema Traditional Area in the Jomoro Municipality of the Western Region of Ghana. The Hub will require a total land size of about 20,000 acres to accommodate the various types of infrastructure necessary for its operations.

The Ministry of Energy in collaboration with the Land Use and Spatial Planning Authority (LUSPA) has prepared a spatial plan for the area.

New infrastructure will be developed within and around the Hub to facilitate operations. The infrastructure has been categorized into four namely:

i. Key Infrastructure - Jetties, Storage tanks, Refineries, LNG Facility, Hub transmission infrastructure, Power plant, Petrochemical plant, Lube blending plant, and Transmission and Storage Infrastructure for the land-locked countries.
ii. Infrastructure for Offshore Activities to support Nautical Services, Repair and Maintenance, Exploration and Rig Equipment Servicing, and would also include facilities such as Off-Dock Yard and Dry-Dock Facilities for Vessel Repair, Engineering and Decommissioning.
iii. Ancillary Infrastructure. This includes Water treatment facilities, Waste Management Centre, Commercial Services, Residential Area (with Social Amenities), Security and Emergency Response Centre, Solid Logistics, Transportation Network, Laboratory, and a Light to Medium industrial area.
iv. Social Infrastructure including Health, Educational and Training facilities among others to provide various services for the Hub.

The key infrastructure has been detailed in the Petroleum Infrastructure Master Plan which would be implemented over 12 years (2018-2030) and would be executed in three (3) phases. This will be preceded by preparatory activities such as land acquisition, the establishment of the Petroleum Hub Development Corporation (PHDC), and the preparation of requisite legal and regulatory frameworks, among others.

Currently, the Petroleum Hub Development Corporation (PHDC) has been established by an act of parliament herein referred to as the Petroleum Hub Development Corporation Act, 2020 (Act 1053) to oversee the development, implementation, and management of the Hub. The Corporation will facilitate the acquisition of all the necessary licenses and permits to enable developments to commence. The Hub area will be designated as a Free Zone enclave.

Project level Environmental Impact Assessments (EIA) will be carried out during the construction, operation, and decommissioning stages of the Petroleum Hub after the Strategic Environmental Assessment.

2.4 Objectives of the Petroleum Hub

The development of the Petroleum Hub is premised on the following objectives:

- Create an enabling environment to attract domestic and foreign investments into the oil and gas industry through fiscal and non-fiscal measures.
- Achieve competitive pricing of petrochemical products and services within the African sub-region by developing oil and gas infrastructure.
- Provide safe and well-secured infrastructure systems for the petroleum and petrochemical hub.
- Establish sustainable safety protocols and frameworks to guide effective and safe operation within the Petroleum Hub.
- Develop highly skilled human resources to participate in the petroleum downstream sub-sector.

CHAPTER 3

INSTITUTIONAL, POLICY AND LEGAL FRAMEWORK

3.1 Introduction

This chapter outlines the institutional, legal and regulatory framework which governs the scope within which the SEA of the proposed Petroleum Hub at Jomoro Municipality in the Western Region of Ghana was carried out. It presents relevant institutions involved in the regulation of the petroleum sector as well as aspects of domestic laws, regulations and international treaties that Ghana has ratified, signed or acceded to. It further details the policies, standards and guidelines that apply to oil and gas development.

3.2 Institutional Framework

The Ministry of Energy has oversight responsibility of the Petroleum Hub. Other ministries including the Ministries of Finance, Trade and Industry, Transport and the Ministry of Environment Science, Technology and Innovation play key collaborative roles in the installation of facilities and other activities in the hub. The National Development Planning Commission (NDPC) formulates comprehensive national development planning policies and strategies; and ensures that the strategies including consequential policies and programmes such as the development of Ghana's Petroleum Hub are effectively implemented.

The main agencies with regulatory responsibilities in the Petroleum Hub include the National Petroleum Authority (NPA), Petroleum Commission (PC) Ghana, Environmental Protection Agency (EPA), Ghana Ports and Harbours Authority (GPHA), Ghana Maritime Authority (GMA), Ghana National Fire Services (GNFS), Land Use and Spatial Planning Authority (LUSPA), Lands Commission, Ghana Standards Authority (GSA), Department of Factories Inspectorate (DFI), Ghana Investment Promotion Centre (GIPC) and the Jomoro Municipal Assembly (JMA). The Petroleum Hub Development Corporation (PHDC) is responsible for the promotion and coordination of activities in the Petroleum Hub.

An overview of Ministries and Administrative Bodies (i.e., Authorities, Agencies and Commissions) with responsibilities related to the Petroleum Hub development are listed and described in Table 3.1.

Table 3.1: Overview of Ministries and Administrative Bodies relevant to the Petroleum Hub

No	Ministry	Responsibilities	Agencies
1.	Ministry of Energy	• Policy formulation, monitoring, and evaluation • Responsible for developing and implementingenergy sector policies in Ghana and for supervising the operations of energy sector agencies. • The Ministry provides policy direction for thedevelopment of the Petroleum Hub	• Petroleum Hub Development Corporation • National Petroleum Authority • Petroleum Commission • Energy Commission • Electricity Company of Ghana • Ghana National Gas Company • Ghana National Petroleum Corporation • Volta River Authority • Bulk Oil Storage and Transportation Company • Tema Oil Refinery • Ghana Cylinder Manufacturing Company (GCMC) • GRIDCo
2.	Ministry of Trade and Industry	• Policy formulation, monitoring, and evaluation • The lead policy advisor to the government on trade, industrial and private sector development with responsibility for the formulation and implementation of policies forthe promotion, growth and development of domestic and international trade and industry.	• Ghana Free Zones Authority • Ghana Standards Authority • Ghana Export Promotion Authority (GEPA) • Ghana Enterprise Agency (GEA)
3.	Ministry of Environment,Science, Technology, and Innovation (MESTI)	• Policy formulation, monitoring and evaluation • Responsible for the promotion of sustainable development by deepening and strengthening market-driven Research and Development (R&D) for sound Environmental Governance,Science, Technology and Innovation through awareness creation, collaboration, and partnership.	• Environmental Protection Agency • Land Use and Spatial Planning Authority • Council for Scientific and Industrial Research (CSIR)

No	Ministry	Responsibilities	Agencies
4.	Ministry of Finance	• Policy formulation, monitoring and evaluation • Ensures macroeconomic stability for the promotion of sustainable economic growthand development in Ghana	• Ghana Revenue Authority (GRA)
5.	Ministry of Interior	• Policy formulation, monitoring and evaluation • Responsible for the formulation of internalsecurity policies	• Ghana Police Service • Marine Police • Ghana National Fire Service • Ghana Immigration Service • National Disaster Management Organization(NADMO)
6.	Ministry of Transport	• Responsible for the development of transport policies and infrastructure and service deliveryfor Ghana's transport sector • Policy formulation, monitoring and evaluation	• Ghana Maritime Authority • Ghana Ports and Harbours Authority • Ghana Civil Aviation Authority
7.	Ministry of Food and Agriculture	• Policy formulation, monitoring and evaluation • Responsible for developing and executingpolicies and strategies for the agriculture sector within the context of a coordinatednational socio-economic growth and development agenda.	• Ghana Irrigation Development Authority • COCOBOD • Ghana Seed Company • Ghana National Buffer Stock Company
8.	Ministry of Fisheries and Aquaculture Development	• Responsible for policy formulation and implementation, management, and control ofthe fishing industry.	• Fisheries Commission • Regional Departments of Fisheries

No	Ministry	Responsibilities	Agencies
9.	Ministry of Defence	• Policy formulation, monitoring and evaluation • Responsible for defending the Republic of Ghana from internal and external military threats and promoting Ghanaian national defence interests	• Ghana Navy • Ghana Air Force
10.	Ministry of Local Government, Decentralization, and Rural Development	• Policy formulation, monitoring and evaluation • Responsible for ensuring good governance andbalanced development of Metropolitan / Municipal / District Assemblies.	• Western Regional Coordinating Council • Jomoro Municipal Assembly - District Planning • Coordinating Unit (DPCU) Agric, PhysicalPlanning, Disaster Prevention Department
11.	Ministry of Sanitation and Water Resources	• Policy formulation, monitoring and evaluation • Initiate and formulate water, environmental health and sanitation policies and undertakes water and environmental sanitation sub-sectors development planning in consultation with the National Development Planning Commission (NDPC)	• Water Resources Commission • Ghana Water Company • Community Water and Sanitation Agency
12.	Ministry of Works and Housing	• Policy formulation, monitoring and evaluation • Initiate and formulate policies for the Worksand Housing sector, as well as coordinate, monitor and evaluate the implementation of plans, programmes, and performance of the sector	• Hydrological Services Division • Architectural and Engineering Services Limited(AESL)
13.	Ministry of Employment and Labour Relations	• Responsible for the formulation and implementation of policies aimed at creatingand promoting decent jobs, as well as for developing strategies that promote industrial peace and harmony	• Department of Factories Inspectorate • Labour Commission

No	Ministry	Responsibilities	Agencies
14.	Ministry of Lands and NaturalResources	• Ensure the sustainable management and utilization of the nation's lands, forests, andwildlife resources as well as the efficient management of the mineral resources for socio-economic growth and development	• Ghana Geological Survey Authority • Forestry Commission • Lands Commission • Office of the Administrator of Stool Lands
15.	Ministry of Communication and Digitalization	• Responsibility for initiating and developing national policies aimed at achieving cost-effective information and communicationsinfrastructure and services, for the enhancement and promotion of economic competitiveness	• National Communications Authority • National Information and Technology Agency
16.	Ministry of Gender and SocialProtection	• Responsible for policy formulation, coordination and monitoring and evaluation ofGender, Children and Social Protection issues within the context of the national development agenda	• Livelihood Empowerment Against Poverty (LEAP) Secretariat • Non-Profit Organization Secretariat
17.	Ministry of Chieftaincy and Religious Affairs	• Have oversight responsibility for chieftaincy and religious institutions for peacefulcoexistence for national development	• National House of Chiefs • Western Nzema Traditional Council
18.	Office of the President		• Coastal Development Authority • Ghana Investment Promotion Centre

3.4 Legal and Regulatory Framework

This section describes the relevant laws and regulations for the development of the Petroleum Hub.

3.4.1 The 1992 Constitution of the Republic of Ghana

The 1992 Constitution, under Article 36, charges the State to take all necessary action to ensure that the national economy is managed in such a manner as to maximize the rate of economic development including the encouragement of foreign investment, subject to the existing laws.

On environmental protection, the Constitution, in Article 36(9) requires the State to take appropriate measures needed to protect and safeguard the national environment for posterity; and shall seek cooperation with other states and bodies for purposes of protecting the wider international environment for mankind". Article 41(k) also imposes a duty on every citizen to protect and safeguard the environment.

3.4.2 Energy/Petroleum Legislations

The relevant energy/petroleum legislations include the following:

3.4.2.1 Petroleum Hub Development Corporation Act, 2020 (Act 1053)

The Petroleum Hub Development Corporation Act, 2020 (Act 1053) established the Petroleum Hub Development Corporation as a corporate body with the object to promote and develop a Petroleum and Petrochemicals Hub in the country. The Corporation is mandated to perform the following functions:

1. Plan and implement strategies for the development of the Hub in the country.
2. Undertake preparatory works for the promotion and development of the Petroleum Hub.
3. Facilitate the provision of basic utilities for companies and service providers for the development of the Petroleum Hub.
4. Assist companies that seek to operate in the Hub to acquire all relevant licenses and permits from the relevant regulatory bodies to develop and operate the facilities within the Hub.
5. Coordinate and facilitate investment activities in the Hub.
6. Collaborate with investors to develop the Hub.
7. Monitor and evaluate the development of the Hub to ensure value retention for the country.
8. Facilitate the availability of an industry-ready workforce to drive the growth of the Hub.

9. Ensure the participation of Ghanaians in technical and managerial functions of the companies operating within the Hub.
10. Compile, keep and maintain a register of companies and service providers operating within the Hub.
11. Maintain and preserve records of the Corporation and publish the records in the medium that the Board considers appropriate.

Consequently, the Petroleum Hub Development Corporation is responsible for the development of Ghana's Petroleum and Petrochemicals Hub under the direction of the Ministry of Energy.

3.4.2.2 National Petroleum Authority Act, 2005 (Act 691)

The National Petroleum Authority Act, 2005 (Act 691) established the National Petroleum Authority (NPA) to regulate, oversee and monitor activities in the petroleum downstream industry. The Act mandates the NPA to perform various functions including the following:

1. Monitor ceilings on the price of petroleum products following the prescribed petroleum pricing formula.
2. Grant licenses and keeps records and data on licenses, petroleum products and petroleum service providers.
3. Provide guidelines for petroleum marketing operations.
4. Monitor standards of performance and quality of the provision of petroleum services.
5. Initiate and conduct investigations into standards of quality of petroleum products offered to consumers.
6. Investigate regularly the operations of petroleum service providers to ensure conformity with best practices and protocols in the petroleum downstream industry.
7. Promote fair competition amongst petroleum service providers.
8. Conduct studies relating to the economy, efficiency, and effectiveness of the petroleum downstream industry.
9. Periodically review in consultation with petroleum service providers the prescribed petroleum pricing formula and publish in the gazette the respective formula.
10. Monitor daily the import parity price of refined petroleum products and publish the price periodically in the gazette.
11. Collaborate with relevant institutions for purposes of the Act.
12. Oversee open and transparent international competitive bidding for the procurement of petroleum products and crude oil.

13. Approve charges for the provision of petroleum services within the downstream industry.
14. Publish in the gazette user fees for monopoly infrastructure.
15. Protect the interest of consumers and petroleum service providers

The National Petroleum Authority is the regulator for Ghana's petroleum downstream sub-sector and will regulate all downstream activities of the Petroleum and Petrochemicals Hub. The Act specifies the requirements for obtaining a license to engage in business in the petroleum downstream industry. The NPA applies the National Petroleum Authority (Prescribed Petroleum Pricing Formula) Regulations, 2012 (L.I. 2186) and the National Petroleum Authority (Petroleum Product Marking) Regulations, 2012 (L.I. 2187) in carrying out its mandate. The Authority has also developed various manuals and guidelines including the Petroleum Products Loading, Transportation, Unloading and Loss Control Manual as well as the Health, Safety, Security and Environment (HSSE) Manual for Energy Sector Organizations.

Currently, the NPA is developing a Draft Petroleum Downstream (Ghanaian Content and Participation) Regulation which seeks to consolidate the gains of indigenous companies in the petroleum downstream sector and promote and build the capacities of local companies.

3.4.2.3 Petroleum Commission Act, 2011 (Act 821)

The Petroleum Commission Act, 2011 (Act 821) established the Petroleum Commission for the regulation and management of the utilization of petroleum resources and to provide for related purposes. Specifically, the Commission is mandated to undertake the following functions:

1. Promote petroleum activities for the benefit of Ghana.
2. Recommend national policies related to petroleum activities.
3. Monitor compliance with national policies, laws, regulations, and agreements on health, safety, and environmental standards in petroleum activities.
4. Monitor and carry out inspections and audits of petroleum facilities.
5. Promote local content and local participation.
6. Receive and store petroleum data.
7. Receive applications and issue permits for specific petroleum activities.
8. Issue an annual report on petroleum resources and activities.
9. Analyze economic information related to petroleum activities and submit forecasts to the Ministry; and
10. Perform any other function related to the object of the commission.

The Commission will regulate activities in the Hub that pertains to the petroleum upstream sector, particularly, the provision of services for offshore companies.

3.4.2.4 Energy Commission Act, 1997 (Act 541)

The Energy Commission Act, 1997 (Act 541) established the Energy Commission (EC) with the object to regulate and manage the utilization of energy resources in the Republic and coordinate policies. The functions of the Energy Commission relating to petroleum include:

1. Recommend national policies for the development and utilization of indigenous energy resources.
2. Advise the Minister on national policies for the efficient, economical, and safe supply of electricity, natural gas, and petroleum products having due regard to the national economy.
3. Secure a comprehensive database for national decision-making on the extent of development and utilization of energy resources available to the nation.
4. Receive and assess applications and grant licenses under Act 541 to public utilities for the transmission, wholesale supply, distribution, and sale of electricity and natural gas.
5. Establish and enforce, in consultation with the Public Utilities Regulatory Commission, standards of performance for public utilities engaged in the transmission, wholesale supply, distribution and sale of electricity and natural gas.
6. Promote and ensure uniform rules of practice for the transmission, wholesale supply, distribution and sale of electricity and natural gas.

3.4.2.5 Ghana National Petroleum Corporation Act, 1983 (PNDCL 64)

The Ghana National Petroleum Corporation Act, 1983 (PNDCL No. 64) established the Ghana National Petroleum Corporation (GNPC) with the object to undertake the exploration, development, production, and disposal of petroleum. The Corporation is further mandated to:

1. Obtain the effective transfer to the Republic of appropriate technology relating to petroleum operations.
2. Ensure the training of citizens and the development of national capabilities in all aspects of petroleum operations; and
3. Ensure that petroleum operations are conducted in such a manner as to prevent adverse effects on the environment, resources, and people of Ghana.

In addition to the above functions, the Corporation may also advise the Minister and the National Energy Board on matters relating to petroleum operations; engage in petroleum operations, alone or in association with others; enter into any petroleum contracts providing for the assistance, participation or co-operation of contractors in connection with petroleum operations; engage in research and development programme related to petroleum; and engage in any other activities, alone or association with others, as may be necessary or desirable for the carrying out of petroleum operations. PNDCL 64 defines Petroleum operations as the exploration, development, production, transportation, and disposal of petroleum.

3.4.3 Environment/Pollution Control Legislation

The relevant environmental/pollution control legislations include the following:

3.4.3.1 Environmental Protection Agency Act, 1994 (Act 490)

The Environmental Protection Agency Act, 1994 (Act 490) established the Environmental Protection Agency (EPA) as the leading public body responsible for the protection and improvement of the environment in Ghana. Act 490 mandates the EPA to implement environmental policies, issue environmental permits and pollution abatement notices for controlling waste discharges, emissions, deposits or other sources of pollutants and issue directives, procedures, or warnings to control noise.

The EPA is also mandated to prescribe standards and guidelines, inspect, and regulate businesses and respond to emergency incidents. It provides for the establishment of a hazardous chemicals committee, comprising representatives from key government organizations with an interest in chemical management, to monitor and advise the EPA on the importation, exportation, manufacture, distribution, use and disposal of hazardous chemicals.

The EPA requires an Environmental Assessment (EA) for proposed undertakings, such as oil and Gas developments. It is responsible for ensuring compliance with Environmental Impact Assessment (EIA) procedures and is the lead EIA decision-maker. The relevant EPA laws that apply to the Petroleum Hub are discussed below. These include the Environmental Assessment Regulations, 1999 (LI 1652), Hazardous and Electronic Waste Control and Management Act, 2016 (Act 917), and Waste (Classification, Control and Management) Regulations, 2016 (LI 2250).

3.4.3.2 Environmental Assessment Regulations, 1999 (LI 1652)

The Environmental Assessment Regulations,1999(LI 1652) legislates the Environmental Impact Assessment (EIA) process. LI 1652 requires that all activities likely to harm the environment must be subject to environmental assessment and issuance of a permit before the commencement of the activity.

The EPA law mandates the Agency to require an environmental assessment from any undertaking that has, or is likely to have, an adverse effect on the environment. The development of the Petroleum Hub is one such undertaking contemplated by the LI 1652. Schedules 1 and 2 of the Environmental Assessment Regulations provide lists of activities for which an environmental permit is required, and EIA is mandatory, respectively. These include the construction of offshore and onshore pipelines, the construction of oil and gas separation, processing, handling and storage facilities and the construction of oil refineries. Schedule 5 provides a list of environmentally sensitive areas, any proposed undertaking within these areas will require EIA.

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

Act 917 provides for the control, management and disposal of hazardous waste, electrical and electronic waste and related purposes. The Act gives powers to the Minister responsible for the Environment to grant authorizations for imports and export of hazardous waste into and out of the country respectively. The law also mandates the EPA to issue permits, give notices, control imports and exports, and ensure appropriate management of hazardous waste in the country.

3.4.3.4 Hazardous, Electronic and Other Wastes (Classification), Control and Management Regulations, 2016 (LI 2250)

This Legislation seeks to regulate, classify, control, and manage waste in the country. Specifically, the purpose of LI 2250 is to:

a. regulate the classification and management of waste in a manner which supports and implements the provisions of Act 917.
b. establish a mechanism and procedure for the listing of waste management activities that do not require a Waste Management Permit.
c. prescribe requirements for the establishment of take-back systems.
d. prescribe requirements and timeframes for the management of wastes listed in the First Schedule.
e. prescribe general duties of waste generators, waste transporters and waste managers; and
f. prescribe requirements for the disposal of waste.

The EPA applies Act 917 and LI 2250 to regulate hazardous wastes such as waste oil, sludge, etc. which may be generated by activities of the Petroleum Hub.

3.4.3.5 Maritime Pollution Act, 2016 (Act 932)

Act 932 provides for the prevention, regulation, and control of pollution, arising from maritime activities in areas within Ghana's maritime jurisdiction and for other related matters. Section 2 of the Act requires the Ghana Maritime Authority (GMA) to collaborate with the Environmental Protection Agency and other relevant agencies in executing the provisions of the Act, particularly in areas of notification of imminent damage by pollution to the marine environment. The Act makes provisions for the prevention of marine pollution by dumping of wastes and other matter at sea; prevention of pollution from ships including from sewage and garbage from ships; prevention of pollution by oil and by noxious liquid substances carried in bulk and the prevention of air pollution from ships. The law further provides for oil pollution preparedness, response, and cooperation as well as liability and compensation for pollution damage.

3.4.4 Planning Legislations

The relevant planning legislations considered include the following:

3.4.4.1 National Development Planning Commission

The National Development Planning Commission (NDPC) was established under Article 86, whiles its functions are prescribed under Article 87 of the 1992 Constitution as part of the Executive Arm of Government. The National Development Planning Commission Act, 1994 (Act 479) and the National Development Planning (System) Act, 1994 (Act 480), provide the enabling legal framework for the establishment of the Commission and the performance of its functions.

The core function of the Commission is to "advise the President on development planning policy and strategy" and, "at the request of the President or Parliament, or on its initiative," do the following:

1. Study and make strategic analyses of macroeconomic and structural reform options.
2. Make proposals for the development of multi-year rolling plans taking into consideration the resource potential and comparative advantage of the different districts of Ghana.
3. Make proposals for the protection of the natural and physical environment.
4. Make proposals for ensuring the even development of the districts of Ghana by the effective utilization of available resources; and
5. Monitor and evaluate the implementation of development policies, programmes, and projects.

The Commission, according to the Constitution, "shall also perform such other functions relating to development planning as the President may direct". Act 479 operationalizes these broad functions and charges the Commission with the following additional functions:

1. Make proposals to ensure the even development of the districts by the effective utilization of available resources.
2. Monitor, evaluate and coordinate development policies, programmes, and projects.
3. Undertake studies and make recommendations on development and socio-economic issues.
4. Formulate comprehensive national development planning strategies and ensure that the strategies including consequential policies and programmes are effectively carried out; and
5. Prepare broad national development plans and keep them keep under constant review in the light of prevailing domestic and international economic, social, and political conditions and make recommendations for the revision of existing policies and programmes where necessary.

Additionally, Act 480 provided for the decentralized planning system, while the National Development Planning (System) Regulations, 2016 (LI 2232) gives legal backing to planning systems, including the use of SEA at the national, regional, district and unit levels.

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

The Land Use and Spatial Planning Act, 2016 (Act 925) integrated various legislations on land use and spatial planning into a coherent law. Act 925 established the Land Use and Spatial Planning Authority (LUSPA) with the objectives of providing for sustainable development of land and human settlements through a decentralized planning system; ensuring judicious use of land, and enhancing the attainment of Ghana's decentralization programme and creating an enabling environment for District Assemblies to better perform the spatial planning and human settlements management functions. LUSPA is structured around the National and Regional levels. It performs spatial land use and human settlement planning functions of the National Development Planning System Act 1994, Act 480.

The passage of this law enables planning authorities at the different levels of governance to control and direct physical development in an orderly and harmonious manner. The law provides for the transformation of the TCPD into the Physical Planning Department of the district assembly to provide technical services to the district spatial planning committee in regulating, monitoring and advising on spatial development planning and human settlement issues. This is to ensure conformity and compliance with spatial plans, zoning regulations and planning standards at the national, regional and district levels. The Local Governance Act, 2016 (Act 936) mandate the District Assemblies to perform their spatial planning functions under Act 925.

The Land Use and Spatial Planning Regulations, 2019 (L.I 2384) specify the procedures for the issuance of development permits by the District Assemblies. In furtherance to the above laws, LUSPA has prepared the Structure Plan and Local Plan for the development of the Petroleum Hub.

3.4.5 Fisheries Legislations

This section discusses the laws governing the fisheries sector.

3.4.5.1 Fisheries Act, 2002 (Act 625)

The Fisheries Act, 2002 (Act 625) established the Fisheries Commission to regulate and manage the development and utilization of fishery resources and coordinate the related policies. The Commission advises the Minister on all matters about the fishery industry. The Commission's functions among other things are to ensure the proper conservation of the fishery resources through the prevention of overfishing; ensure the monitoring, control and surveillance of the fishery waters; and promote subregional, regional and international cooperation in fisheries management.

The Commission is also mandated to prepare fishery plans for the management and development of fisheries for various water bodies. Act 625 established the Monitoring, Control and Surveillance Division with clearly defined legal powers to regulate fishing operations. The Commission carries out its regulatory mandate through various regulations and guidelines including the Fisheries Regulations, 2010, (L.I 1968) which sets up specific rules and regulations for the implementation of the Fisheries Act. Regulation 11(2) of LI 1968 specifically prohibits fishing activity within areas designated as oil and gas exploration installations as may be prescribed by the competent authority. Similar restrictions on fishing activities shall be required in areas around the Petroleum Hub installations.

3.4.6 Water Resources Legislation

This section discusses the legislation governing water resources management.

3.4.6.1 The Water Resources Commission Act, 1996 (Act 522)

The Water Resources Commission Act, 1996 (Act 522) established the Water Resources Commission to regulate and manage the water resources of the Republic of Ghana. The Commission is tasked with establishing comprehensive plans for the use, conservation, protection, development and improvement of Ghana's water resources and to grant rights for the exploitation of water resources. Act 522 prohibits all persons from abstracting water (surface or ground) without obtaining a water rights permit from the Commission. The Act lays out the requirements and process for the application and subsequent transfer of such rights. The impact of the Petroleum Hub activities on the water resources would be regulated through stringent compliance with the Act.

3.4.7 Maritime Legislations

Maritime legislations discussed include the following:

3.4.7.1 Ghana Maritime Authority Act 2002, (Act 630)

The Maritime Authority Act, 2002 (Act 630) established the Ghana Maritime Authority (GMA) to be responsible for monitoring, regulating and coordinating all maritime activities for the Republic of Ghana. The purpose of the GMA is to ensure the provision of safe, secure and efficient shipping operations and protection of the marine environment from pollution from ships. The role of GMA in the Petroleum Hub Area would be to coordinate the activities of vessels that would be arriving and departing in the hub area. One other key activity of their role would be to ensure maritime security in coordination with security services such as the Marine Police and Navy.

3.4.7.2 Ghana Shipping Act, 2003 (Act 645)

The Ghana Shipping Act, 2003 (Act 645) consolidates and amends the law on the regulation of ships and the maritime industry. The Act requires a foreign ship that intends to engage in local trade from the coast of Ghana to an offshore installation located within Ghana's maritime jurisdiction to do so only if the foreign ship has a permit issued by the Ghana Maritime Authority.

3.4.7.3 Ghana Ports and Harbours Authority Act, 1986 (P.N.D.C.L 160)

The GPHA is responsible for planning, managing, building, and operating Ghana's seaports. It manages Ghana's two main seaports (Takoradi and Tema) and has the following functions regarding their operation, maintenance, and control:

1. Regulate the use of ports and port facilities.
2. Provide, maintain, extend, and enlarge port facilities as required for the efficient and proper operation of the port.
3. Maintain and deepen the approaches to, and the navigable waters within and outside the limits of any port.
4. Maintain lighthouses and beacons and other navigational services, and aids as necessary.
5. Provide facilities for the transport, storage, warehousing, loading, unloading, and sorting of goods passing through the ports, and operate or provide access to road haulage service providers; and
6. Provide stevedoring and porterage services.

3.4.8 Lands and Natural Resources Legislations

The relevant lands and natural resources legislations include the following:

3.4.8.1 Forestry Commission Act, 1999 (Act 571)

The Forestry Commission Act established the Forestry Commission (FC) under the provisions of Article 269(1) of the 1992 Constitution. The Commission is responsible for the regulation of the utilization of forest and wildlife resources, the conservation and management of those resources and the coordination of policies related to them. The FC has two divisions (Wildlife, and Forestry Services) whose works relate to the protection of wildlife and forest reserves. The development of the hub may impact wildlife and other forest resources. Consultation with the FC is key to ensuring the successful implementation of the Petroleum Hub.

3.4.8.2 Land Act, 2020 (Act 1036)

Ghana's Land Act, 2020 (Act 1036) is to revise, harmonize and consolidate the laws on the land to ensure sustainable land administration and management, effective and efficient land tenure and to provide for related matters. The implementation of the Petroleum Hub is expected to follow the administrative framework of land registration, security, and governance in Ghana. The Law provides for the compulsory acquisition of land and prompt payment of fair and adequate compensation, which will apply to the Petroleum Hub Development.

3.4.8.3 Lands Commission Act, 2008 (Act 767)

The Lands Commission Act, 2008 (Act 767) established the Lands Commission (LC) under Articles 258 – 265 of the 1992 Constitution and provided the legal basis for four land sector agencies to be merged into one institution with four Divisions. These include the Land Valuation Division, Land Registration Division, Survey and Mapping Division and the Public and Vested Land Management Division.

The LC is to ensure effective and efficient land administration and to provide for related matters. Among others is also to ensure guaranteed tenure, property valuation, surveying and mapping through teamwork and modern technology to stakeholders. The commission will play a role in the surveying and mapping, acquisition of land (Publication of the EI, and Assessment of compensation to landowners), and registration of interests to operators within the hub.

3.4.9 Trade/Labour Legislation

The trade and labour legislations relevant to the development of the petroleum hub include the following:

3.4.9.1 Companies Act, 2019 (Act 992)

Act 992 amends and consolidates the law relating to companies, establishes the Office of the Registrar of Companies and provides for related matters. Operators within the Petroleum Hub must register their companies and conduct the affairs of their companies under the Companies Act, 2019 (Act 992).

3.4.9.2 Ghana Investment Promotion Centre Act, 2013 (Act 865)

The Act provides for the establishment of the Ghana Investment Promotion Centre as the Agency of Government responsible for the encouragement and promotion of investments in Ghana and the creation of an attractive incentive framework and a transparent, predictable, and facilitating environment for investments in Ghana. The specific functions of the Centre include:

1. Formulate investment promotion policies and plans, promotional incentives and
2. marketing strategies to attract foreign and local investments in advanced technology.
3. 3. industries and skill-intensive services which enjoy good export market prospects.
4. Initiate and support measures that will enhance the investment climate in Ghana for both Ghanaian and non-Ghanaian enterprises.
5. Initiate, organize and participate in promotional activities such as exhibitions, conferences, and seminars for the stimulation of investments, to present Ghana as an ideal investment destination.
6. Collect, collate, analyze, and disseminate information about investment opportunities and sources of investment capital, incentives available to investors, and the investment climate and advise upon request on the availability, choice, or suitability of partners in joint venture projects.
7. Register, monitor and keep records of all enterprises in Ghana.
8. Register and keep records of all technology transfer agreements.
9. Identify specific projects and prepare project profiles on investments and joint ventures.
10. Opportunities in Ghana and attract interested investors for participation in those projects.
11. Bring about harmonization in investment policy formulation through coordination of the activities of all other institutions and agencies; and
12. Perform any other functions that are necessary for the attainment of the objects of this Act.

GIPC will be required to formulate investment plans and policies to attract investments to the Petroleum Hub.

3.4.9.3 Free Zones Act 1995, (Act 504)

The Act establishes the Free Zones Authority with the functions of the Board to grant licenses to applicants under the Act; assist applicants for licenses under the Act by providing services for obtaining other relevant licenses, permits and facilities; examine and recommend for approval agreements and treaties relating to the development and activities of the free zones; monitor the activities, performance and development of free zone developers and enterprises; ensure compliance by free zone developers and enterprises of this Act and any other laws relevant to free zone activities; register and keep records and data on the programmes of developers, operators and enterprises in free zones; and perform such other functions as are incidental to the foregoing.

Act 504 provides for the declaration of an area of land or a building as a free zone and an airport, a river port, seaport, or lake port as a free port by the President on the recommendation of the Free Zones Board.

Such a declaration shall specify the area and the scope of activities in the free zone concerned. The law specifies the rights and responsibilities of a free zone enterprise which includes the right to produce any type of goods and services for export but shall not produce environmentally hazardous goods.

The Free Zones Act provides for the non-application of import laws to the free zones area and grants tax concessions to free zone developers and enterprises for ten years subject to article 174 of the Constitution. A shareholder also is exempted from the payment of withholding taxes on dividends arising out of free zone investments. A foreign investor may take and hold a maximum of one hundred percent of the shares in a free zone enterprise. Foreign and domestic investors have equal status within the export-free zones. An enterprise in a free zone is guaranteed unconditional transfer of dividends or net profits attributable to the investment, payments in respect of loan servicing where a foreign loan has been obtained, fees in respect of a technology transfer agreement, and the remittance of proceeds net of the taxes and any other obligations, in the event of the sale or liquidation of the enterprise or interest attributable to the investment.

Act 504 also provides a guarantee against the nationalization or expropriation of free zones enterprises or their capital. The operation of the Petroleum Hub as a free zone area will provide tax benefits and protects the investments of the developers in the hub.

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

Act 328 provides for the registration of factories, the health, welfare, and safety of persons employed in factories, offices, shops, and other places, and for related matters. It provides for the appointment of Inspectors who are to ensure that occupational health and safety issues at workplaces including the Petroleum Hub are addressed.

3.4.9.5 Labour Act, 2003 (Act 651)

The Labour Act, 2003 (Act 651) consolidates and updates various pieces of former Labour legislation and introduces provisions to reflect International Labour Organization (ILO) Conventions ratified by Ghana. The Labour Act covers all employers and employees except those in strategic positions such as the armed forces, police service, prisons service and security intelligence agencies. The labour Act addresses all labour issues including the protection of the employment relationship; general conditions of employment; employment of persons with disabilities, young persons, and women; fair and unfair termination of employment; protection of remuneration; temporary and casual employees; unions, employer organizations and collective agreements; strikes and forced labour.

The Labour Act establishes the National Labour Commission which coordinates the implementation of the provisions of the law. Act 651 contains provisions relating specifically to occupational health, safety, and the working environment. These include general health and safety conditions, exposure to imminent hazards, employer occupational accidents and disease reporting. The activities of both employees and employers at the Petroleum Hub will be regulated by this law to ensure the fairness and safety of workers.

3.4.9.6 Children's Act 1998 (Act 560)

The Act reforms and consolidates the laws relating to children, to provide for the rights of the child, maintenance, and adoption, regulate child labour and apprenticeship and ancillary matters concerning children generally and provides for related matters such as child prostitution and early-child marriage.

The Children's Act 1998 (Act 560) defines a child as a person below the age of eighteen (18) years. It prohibits engaging a child in exploitative labour, defined to mean labour depriving the child of its health, education, or development. The Children's Act has domesticated the United Nations Convention of the Right of the Child that prohibits the engagement of children in any form of work especially hazardous jobs that jeopardizes the 'best interest of the child'. The operations of the Petroleum Hub must adhere to the tenets of the Children's Act including the provision of vocational and skills training for children.

3.4.9.7 National Vocational Training Act, 1970 (Act 351)

The National Vocational Training Act, of 1970 (Act 351) established the National Vocational Training Institute to coordinate at the national level all aspects of vocational training including apprenticeship, and to provide for related matters. The specific functions of the Institute include organizing apprenticeship, in-plant training and training programmes for industrial and clerical workers, and training the instructors and training officers required for that purpose; provide for vocational guidance and career development in the industry; developing training standards and trade testing; initiate a continuing study of the country's manpower requirements at the skilled worker level, and establish and maintain technical and cultural relations with international organizations and any other foreign institutions engaged in activities connected with vocational training.

The law obliges employers to provide training for their employees for the attainment of the level of competence required for the performance of their duties and to enhance their careers. The Petroleum Hub Development Corporation, as part of its functions to facilitate the availability of an industry-ready workforce to drive the growth of the Hub, must facilitate the establishment of

vocational training centres in line with Act 351 around the Petroleum Hub to cater for skills and manpower needs of the operators of the hub.

3.4.10 Transport Legislations

The relevant transport legislations include:

3.4.10.1 Ghana Civil Aviation Act, 2004 (Act 678)

The Ghana Civil Aviation Act, 2004 (Act 678) established the Ghana Civil Aviation Authority as a body corporate to develop opportunities for domestic and international travel and trade and provide facilities to improve access to remote regions, enhance mobility and develop opportunities for travel within the Republic, among others.

The core functions of the Authority are to regulate aviation safety and security; provide Air Navigation Services; regulate air transport, and advise the government on aviation matters. The Civil Aviation Authority was restructured into the Ghana Civil Aviation Authority (GCAA) and the Ghana Airports Company Limited (GACL) in 2007. Other functions of GCAA include licensing and certification of air transport operators, and the construction and operation of aerodromes; maintenance and management of navigation sites; provision of air navigation services (air space management) within the Accra flight information region; regulation of air transport services; promoting the development of civil air transport industry in Ghana; advising the government on all matters concerning civil aviation, among other functions; and provision of oversight for all activities related to civil aviation. The GCAA may develop Airstrips close to the Petroleum Hub to facilitate movement to/from the Hub. It will also be responsible for ensuring the operational safety of flights within the enclave.

3.4.11 Security Legislations

The following security legislations are discussed.

3.4.11.1 Ghana Maritime Security Act, 2004 (Act 675)

The Ghana Maritime Security Act, 2004 (Act 675) gives effect to Chapter XI-2 of the International Convention for the Safety of Life at Sea, 1974 (SOLAS) and is aimed at enhancing maritime safety and security. The Act applies to ships on international voyages including cargo ships, including the high-speed craft of 500 gross tonnages or more; mobile offshore drilling units that are located within Ghana's maritime jurisdiction; port facilities within Ghana's maritime jurisdiction and other offshore marine installations designated by the Minister.

3.4.11.2 Ghana National Fire Service Act, 1997 (Act 537)

Act 537 re-established the Ghana National Fire Service (GNFS) under Article 190 of the Constitution, 1992; provides for the management of undesired fires and makes provisions for related matters. The specific functions of the GNFS include:

1. organize public fire education programmes to create and sustain awareness of the hazards of fire and heighten the role of the individual in the prevention of fire.
2. provide technical advice for building plans in respect of machinery and structural layouts to facilitate escape from fire, rescue operations and fire management.
3. inspect and offer technical advice on fire extinguishers.
4. co-ordinate and advise on the training of personnel in firefighting departments of institutions in the country.
5. train and organize fire volunteer squads at the community level, and
6. offer rescue and evacuation services to those trapped by fire or in any other emergencies.

The GNFS have a very significant role in ensuring the prevention and management of undesired fires in the Petroleum Hub.

3.4.11.3 Immigration Service Act, 2016 (Act 908)

Act 908 provides for the organization and administration of the Immigration Service and for related matters to ensure the effective administration and management of migration in the country; and contribute to national security. To achieve the above objectives, the Immigration Service undertakes the following functions:

1. Examines travel documents of persons entering or leaving the country through the
1. Borders, subject to existing laws.
2. Ensure the application and enforcement of laws relating to the immigration and employment of non-Ghanaians in the country.
3. Advise on and implement international cooperation agreements with other countries and international organizations on matters relating to migration.
4. Manage and patrol the borders of the country.
5. The comptroller-general or the duly authorized representative of the comptroller-general issues visas for entry into the country and permits for residence or work in the country.

Foreign workers, investors and operators in the Petroleum Hub must comply with the provisions of Act 908 and its subsidiary legislations in all immigration issues.

3.4.11.4 Ghana Revenue Authority Act, 2009 (Act 791)

The Ghana Revenue Authority Act, 2009 (Act 791) established the Ghana Revenue Authority to replace the Internal Revenue Service, the Customs, Excise and Preventive Service and the Value Added Tax Service for the administration of taxes and to provide for related purposes. Some of the specific functions of the GRA include:

1. Administer and give effect to the laws or relevant provisions of the laws set out in the First Schedule and use optimum efficiency in assessing, collecting, and accounting for all revenue to which those laws apply.
2. Pay the amounts collected into the Consolidated Fund unless otherwise provided by this Act and other Acts.
3. Promote tax compliance and tax education.
4. Combat tax fraud and evasion and cooperate to that effect with other competent law enforcement agencies and revenue agencies in other countries.
5. Advise District Assemblies on the assessment and collection of their revenue; and
6. Prepare and publish reports and statistics related to revenue collection.

3.4.11.5 Revenue Administration Act, 2016 (Act 915)

Act 915 provides for the administration and collection of revenue by the Ghana Revenue Authority and related matters. The defines "tax" to mean a duty, levy, charge, rate, fee, interest, penalty or any other amount imposed by tax law or to be collected by, or paid to, the Commissioner-General under a tax law. It also defines a taxpayer as a person liable to pay taxes. Operators of the Petroleum Hub will be taxpayers under Act 915.

3.4.11.6 Chieftaincy Act, 2008 (Act 759)

Act 751 establishes the national and regional house of chiefs as well as the traditional and divisional councils. The functions of the national house of chiefs include:

1. Advise a person or an authority charged with responsibility under the Constitution or any other law for any matter related to or affecting chieftaincy,
2. Undertake the progressive study, interpretation, and codification of the customary law to evolve, in appropriate cases, a unified system of rules of customary law, and compiling the customary laws and lines of succession applicable to each stool or skin, and
3. Undertake an evaluation of traditional custom and usage to eliminate custom and usage that is outmoded and socially harmful.

3.5 Policies and Plans

The Operation of the Petroleum Hub will be in-line with existing Policies, Plans and Strategies at both sub-national and national levels. This is to ensure compliance and conformity with national laws, policies, and strategies. The following policies, plans and strategies are relevant to the development of the Petroleum Hub and are discussed below:

3.5.1 Ghana Beyond Aid

Ghana Beyond Aid is a national agenda comprising a vision of the Ghana we want and the mindset and behavioural changes that are geared towards unleashing the embedded potential of the nation and the people in transforming the country from mainly production and exports of raw materials to one based on manufacturing and high-value services; an economy that provides opportunities, jobs, and prosperity to all Ghanaians.

It is inspired by a prosperous and self-confident Ghana that takes charge of her economic destiny; a transformed Ghana that is prosperous enough to be beyond needing aid, and that engages competitively with the rest of the world through trade and investment.

Ghana Beyond Aid has six Strategic Pillars comprising (1) Agricultural Modernization; (2) Industrialization; (3) Infrastructure; (4) Private Sector and Entrepreneurship Development; (5) Social Interventions; and (6) Domestic Resource Mobilization and Protecting the Public Purse. The development of the Petroleum Hub is therefore anchored under the Industrialization Pillar.

3.5.2 National Long-Term Development Plan (Ghana at 100 Long-Term Development Plan)

The plan is founded on four key pillars, namely, Economic, Social, Environment, Governance, Peace and Security, with 10 drivers which will catalyze the achievement of national development goals. Two out of the ten key drivers of transformation in the plan were identified as related to the development of the Petroleum Hub. These include Efficient and effective land administration and land use will be critical to achieving the vision, and the pursuit of accelerated socio-economic growth and a diversified economy coupled with rapid urbanization requires modern infrastructure development to support growth in industrial and commercial activities.

3.5.3 Medium-Term National Development Policy Framework (MTNDPF, 2018-2021)

As part of NDPC's mandate, it is expected to develop and coordinate the implementation of the Medium-Term National Development Policy Framework (MTNDPF, 2018-2021), also known as "An Agenda for Jobs: Creating Prosperity and Equal Opportunity for All". The National Development Planning Commission has in every four-year, set in motion the process of developing a successor policy framework per its mandate, which is to keep under constant review of national

development plans in the light of prevailing domestic and international economic, social and political conditions and make recommendations for the revision of existing policies and programmes where necessary; and formulate comprehensive national development planning strategies and ensure that the strategies which include consequential policies and programmes are effectively carried out.

3.5.4 National Spatial Development Framework (NSDF)

The National Spatial Development Framework (NSDF) is a long-term, 20-year strategy for the spatial development of Ghana prepared in 2015. It is at the apex of the spatial planning system in Ghana as stipulated by Act 925. The main objectives of the NSDF are the following:

i. Strengthen national development planning, including in the medium and long term, by articulating the spatial dimensions of social, economic, environmental, and other policies at the national level.
ii. Establish a national spatial framework that gives policy direction to land use planning and management at the national level, to guide the preparation of other lower hierarchy plans, such as regional, sub-regional and district spatial development frameworks, structure plans and local plans.
iii. Make explicit the spatial information from sectoral agencies—including their plans, projects, resources, and assets—to enable coordinated decisions and aligned policies as well as reduced duplications, conflicts and overlaps.
iv. Provide spatial policies to help ensure sustainable development as well as mitigate and adapt the natural environment and human settlements to climate change.

The NSDF plays a key role in guiding local authorities in preparing regional, sub-regional and district-level spatial development frameworks and lower-level plans. Since each part of the country must use its strengths to build a prosperous, healthy, and sustainable future with optimal impact on the livelihoods of people and their surroundings, the NSDF seeks to harness these strengths, foster collaboration and ensure spatially integrated development throughout Ghana. The NSDF influences orderly development plans across the country and guides spatial development. The NSDF is aligned with existing development policies and trajectories. It makes proposals for sustainable economic growth, a transition to a low-carbon economy and the development of infrastructure for the oil and gas sector.

3.5.5 The National Energy Policy, 2020

The Policy is intended to guide the development and management of Ghana's energy sector, including the emerging oil and gas sector. It provides Policy direction for energy production and

utilization in an environmentally sound manner. This National Energy Policy outlines the energy sector goals, objectives, and issues and their respective policy directions. The Policy covers the broad spectrum of issues relating to the following areas: Power Generation, Transmission and Distribution; Renewable Energy; Nuclear Power; Coal Power; Petroleum Upstream; Petroleum Downstream; and Cross-Cutting Areas (Health Safety Security and Environment, Gender, Local Content and Local Participation, Security, and Research and Development).

Policy direction concerning the development of the Petroleum Hub includes Promoting infrastructure for Hub-based development and production; Developing a downstream infrastructure financing policy; and Developing petroleum infrastructure in designated areas to support Ghana becoming a Petroleum Hub for the West African region.

3.5.6 Ghanaian Content and Ghanaian Participation Policy for the Downstream Petroleum Industry, 2019

The Ghanaian Content and Ghanaian Participation Policy for the Downstream Petroleum Industry serves as a platform for achieving the goals for the downstream petroleum industry with participation by Ghanaians in all roles, at all levels and in all activities relating to the petroleum downstream value chain. Activities contemplated by the Policy include petroleum licenses and permits for importation, re-exportation, shipment, transportation, processing, refining, storage, distribution, marketing, and sale in Ghana, as well as provision of supplies and services to the petroleum service providers.

It is the vision of the policy that within ten years from the commencement of activities of a petroleum service provider (PSP), the level of Ghanaian Content will target 100% for such supplies and services that are identified by the regulator as being of priority to Ghana. The Regulator shall set appropriate targets for all other supplies and services.

The objectives of the policy are:

1. achieve 100% equity participation by Ghanaian petroleum companies and their suppliers in petroleum downstream-related activities.
2. maximize value additions and job creation using local expertise, goods and services, businesses and financing in petroleum downstream activities and the retention of benefits within Ghana.
3. Develop Ghanaian capacity in all aspects of the petroleum value chain through education, skills and expertise development, transfer of technological know-how and active research and development.

4. Achieve at least 98% Ghanaian employment in all aspects of petroleum downstream-related activities within 5 years from the commencement of operations, other than exceptional cases.
5. Increase capabilities and international competitiveness of domestic businesses and industries.
6. Provide rigorous and transparent monitoring and reporting system to ensure delivery of policy goals.
7. Outline strategies for small and medium-scale enterprises to increase their participation.
8. Ensure compliance with national and internationally accepted standards and safety regulations within the industry.

The policy is coordinated, implemented, and monitored by the Ministry of Energy, the National Petroleum Authority (NPA) and the Ghanaian Content Committee established under the NPA. The policy provides for the legislation of the policy directives to provide the regulator with the necessary legal backing to ensure full implementation of the policy.

3.5.7 The National Environment Policy, 2014.

The National Environment Policy gives directions on the constitutional mandate of Ghana to protect and safeguard the environment by detailing, among others, various strategic goals and objectives on sustainable resource use and impact management and holistic integrated planning.

The Policy sets out the National Environmental Action Plan (NEAP) which seeks to redirect national development into more environmentally sustainable programmes and practices through: the protection and preservation of the resource base; prior assessment of the potential environmental impacts of development projects; alternative or multi-purpose uses of land and water resources; and the promotion of popular participation in planning, evaluation, and implementation of environmental and development strategies.

3.5.8 Ghana National Climate Change Policy, 2012

The National Climate Change Policy (NCCP) is Ghana's integrated response to climate change. The Policy aims to ensure a climate-resilient and climate-compatible economy while achieving sustainable development through equitable low-carbon economic growth for Ghana. The Policy provides strategic direction and coordinates issues of climate change in three Policy objectives which are (1) effective adaptation, (2) social development and (3) mitigation. To address the adaptation issues in Ghana, four thematic areas have been identified. These are (1) energy and infrastructure, (2) natural resources management, (3) agriculture and food security and (4)

disaster preparedness and response. These policy objectives are of relevance to Ghana's Petroleum Hub.

3.5.9 National Land Policy, 1999

This policy seeks to promote the judicious use of the nation's land and all its natural resources by all sectors of Ghanaian society in support of various socioeconomic activities undertaken following sustainable resource use and maintenance of viable ecosystems. The policy indicates that land for private use must be accessed either through negotiation or compulsory acquisition.

3.5.10 Forest and Wildlife Conservation Policy, 2012

This policy is aimed at the conservation and sustainable development of the nation's forest and wildlife resources for the maintenance of environmental quality and the perpetual flow of optimum benefits to all segments of society. The policy provides for an additional basis to develop a national forest estate and a timber industry that provides the full range of benefits required by society in a manner that is ecologically sustainable and that conserves the environmental and cultural heritage.

One of the strategic goals of this policy is collaborative resource management. The Ministry of Lands and Natural Resources is operationalizing this strategic goal through one of the projects of the Ghana Forest Investment Programme "Enhancing Natural Forests and Agroforestry Landscapes" (ENFALP). Under this project, the Government of Ghana is piloting the Community Resource Management Area (CREMA) concept as a strategy to devolve management powers of natural resources to groups of communities who come together with a common goal and objective.

The Petroleum Hub Area has one such proposed Community Resource Management Area (CREMA) i.e., the Ankasa-Tano CREMA. The CREMAs link Protected Areas and Forest Reserves and create an ecological corridor for both flora and fauna and also create incentives for farmers by allowing them to benefit from the use of natural resources which in turn encourages them to manage these resources sustainably.

The CREMA is regulated through the development of a constitution, bylaws and natural resource management plan which are created by the CREMA committees composed of elected community members, who work with the Wildlife Division and District Assembly to formulate the CREMA constitution, bylaws, and natural resource management plan for each area.

3.5.11 Riparian Buffer Zone Policy, 2011

The Buffer Zone Policy is intended to protect, regenerate and maintain the native /established vegetation in riparian buffer zones to improve water quality by instituting proper procedures for managing and controlling the above activities along riverbanks and generally in catchments of surface water bodies. The policy, among others, serves to clarify the requirements for water quality and quantity and outline a national policy on buffer zones as part of managing Ghana's river basins in an integrated manner and to harmonize traditional and existing public institutional standards on buffer zones in Ghana.

3.5.12 National Wetlands Policy, 1993

The policy promotes the conservation of wetlands included on the Ramsar List and the use of wetlands to ensure their sustainable utilization for the benefit of humankind in a way compatible with the maintenance of natural properties of the ecosystem. The policy recognizes wetlands as environmental conservation areas and precludes certain activities within its boundaries (e.g., mining, waste disposal and infrastructure development).

3.5.13 Water Policy, 2007

The overall goal of the National Water Policy is to "achieve sustainable development, management and use of Ghana's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations". This will be achieved by addressing relevant issues of underwater resources management, urban water supply and community water and sanitation.

3.5.14 Ghana Infrastructure Development Plan

The GIP is a companion document of the long-term national development plan and provides the physical expression of the social and economic aspirations outlined in the long-term plan. The objective of the GIP is to chart a new vision and strategic direction for Ghana's infrastructure in a coordinated and integrated manner and develop a financing plan for implementation to attain a high-income status within 40 years. The plan covers energy, transport water, Information Communication Technology (ICT) infrastructure, human settlements and housing, social, civic, and commercial Infrastructure, human resource and skills planning, among other sectors.

3.5.15 Petroleum Infrastructure Master Plan 2018

The Ministry of Energy in the year 2017 formed a Task Force do prepare a Petroleum Infrastructure Master Plan for the development of Ghana into a Petroleum Hub. The Master Plan was finalized in the year 2018 and obtained Cabinet approval for implementation. The report identifies an opportunity for the establishment of major infrastructure for refining and processing, discharge, storage, distribution, transportation, and trading of petroleum products using Ghana as a hub for the West African sub-region and the world at large. This requires the development of infrastructures such as refineries, port terminal facilities, storage facilities as well as petrochemical and Liquefied Natural Gas (LNG) terminals with a network of pipelines. With this kind of infrastructure and an enabling economic environment in place, Ghana would be able to create a Petroleum Hub, which could supply petroleum products to meet the
domestic and West African sub-regional markets.

The establishment of a Petroleum Hub is one of the Government's strategic anchor initiatives that would serve as a new pillar of growth in the Ghanaian economy. The project will accelerate the growth of Ghana's petroleum downstream sub-sector and make it a major player in the economy. The Petroleum Hub project will increase the presence of major international oil trading and storage companies, create regional trading champions, and encourage joint ventures between local and international companies for knowledge transfer and wealth creation, etc. It will also provide the country with LNG facilities for power production and drive the growth of various industries including petrochemicals. The Petroleum Hub project is expected to transform Ghana into a high-income earner from the export of petroleum products thereby increasing Ghana's GDP by 70% and creating over 780,000 direct and indirect jobs by 2030. The Master Plan provides an initial study of Ghana's petroleum downstream sub-sector, existing infrastructure and new infrastructure required to achieve the vision of making Ghana a hub for refined petroleum products and petrochemicals.

3.5.15 Spatial Development Framework for Jomoro Municipal Assembly

This Spatial Development Framework (SDF) is a comprehensive spatial vision designed to ensure coordinated future land use patterns to accelerate socio-economic growth in the Jomoro Municipal Assembly (JDA) for the next 20 years.

The objectives of the SDF include:

i. Provide the Assembly with Implementable tools to help control and direct the physical development in the area.
ii. Formulate and prioritize holistic implementable development strategies and projects.

iii. Set the spark which triggers the investment drive for plan implementation to provide a monitoring mechanism for the implementation of the plan.

The JMA SDF is also designed to maximize the opportunities presented by the promising oil industry while at the same time taking steps to mitigate the potential negative impacts associated with these new opportunities and the potential influx of people into the district. It also strategically positions the Jomoro Municipal Assembly to attract oil and gas investments. The JMA SDF proposes the location of most of the petrochemical industries be established in support of the exploration of oil and gas in the area. This will serve as a major catalyst for the spatial growth and development of the district.

3.5.16 The National Biodiversity Strategy and Action Plan, 2018

Ghana signed (1992) and ratified (1994) the Convention on Biological Diversity and developed a National Biodiversity Strategy and action plan in 2002 (which is being revised) for the sustainable use of its biological resources. Forest reserves, national parks and other wildlife reserves including various traditional forms of conservation have been established to protect biological conservation. These areas occupy approximately 16% of Ghana's land surface. It is recognized that there is a lack of information on biological resources in Ghana and there is a need to address these data gaps. It is further recognized that for sustainable development there is a need to integrate biodiversity issues into national development planning programmes. The strategy recommends the establishment of a National Biodiversity Commission to coordinate policy and the implementation of the strategy among the relevant agencies under the Ministries as well as NGOs, CBOs, and local communities.

Other relevant plans include:

1. The Coastal Zone Management Indicative Plan (1990).
2. The National Environmental Action Plan (1994).
3. The Integrated Tourism Development Plan (1996-2010).
4. The Draft Integrated Coastal Zone Plan (1998).
5. The National Oil Spill Contingency Plan (2002, Revised Draft 2009)
6. Jomoro District Medium-Term Development Plan (2018-2021)
7. National Disaster Management Plan 2010

3.6 Relevant International Agreements and Conventions

Ghana has also ratified the following international conventions and treaties, which may apply to the Petroleum Hub in the context of the SEA.

1. Africa Convention on the Conservation of Nature and Natural Resources.
2. African Charter on Human and Peoples' Rights.
3. African Continental Free Trade Agreement (AfCFTA)
4. Convention Concerning the Protection of World Cultural and Natural Heritage.
5. Convention on Biological Diversity.
6. Convention on the Conservation of Migratory Species of Wild Animals.
7. Convention on Wetlands of International Importance, especially as Waterfowl Habitats.
8. United Nations Framework Convention on Climate Change.
9. International Convention for the Prevention of Pollution from Ships (MARPOL).
10. International Convention on Civil Liability for Oil Pollution Damage.
11. International Convention on the Establishment of an International Fund for Compensation of Oil Pollution Damage.
12. United Nations Convention on the Law of the Sea (UNCLOS)
13. International Covenant on Economic, Social and Cultural Rights.
14. Montreal Protocol on Substances that Deplete the Ozone Layer.
15. International Labour Organization Conventions including:

    i. ILO Convention 29 on Forced Labour.
    ii. ILO Convention 87 on Freedom of Association and Protection of the Right to Organize.
    iii. ILO Convention 98 on the Right to Organize and Collective Bargaining.
    iv. ILO Convention 100 on Equal Remuneration.
    v. ILO Convention 105 Concerning the Abolition of Forced Labour.
    vi. ILO Convention 111 on Discrimination (Employment and Occupation).
    vii. ILO Convention 148 on Working Environment (Air Pollution, Noise and Vibration) Convention, 1977.
    viii. Convention on hours of work in Industry, weekly rest, minimum wage fixing, labour inspection, employment service, night work by women, social policy, working environment, child labour, and labour administration.

3.7 Sustainable Development Goals (SDGs)

There is a strong linkage among the seventeen (17) SDGs. This means that the contribution of one SDG is likely to impact other SDGs. This interrelated nature of the SDGs highlights the importance of multi-stakeholder engagement, collaboration and complementary partnerships across government, civil society, traditional authorities, private sector, among others.

The development of a Petroleum Hub and its operations will potentially have positive and negative impacts on a range of areas covered by the SDGs, including on communities, ecosystems, and the economy. The Petroleum Infrastructure Master Plan (PIMP) will contribute to sustainable development in several ways including the creation of direct and indirect jobs; access to energy that will enable economic activity and social development; generation of substantial taxes and other forms of revenue; development of advanced technologies and products; investments in the long-term social and economic success of surrounding communities, and the management of the impacts through environmental protection, health and safety, etc.

In contrast, however, the SDGs also highlight several sustainability challenges that need to be adequately considered to mitigate the adverse impacts of the Petroleum Hub development. Key among these challenges are the environmental footprint on biodiversity, and climate change and its associated impacts on communities, among others.

3.8 Standards, Guidelines and Good Practice

There are several industry standards, guidelines and good practices for onshore oil and gas developments. This section describes relevant standards, the Environmental Assessment Guidelines, the World Bank Environmental and Social Framework (ESF), the International Finance Corporation (IFC) Performance Standards, the International Petroleum Industry Environmental Conservation Association (IPIECA), International Association of Oil & Gas Producers (OGP) and other relevant best practice guidelines.

3.8.1 Environmental Assessment Guidelines and Standards

The EPA has issued several guidelines and standards on the EIA process and pollution control. These include:

1. Guidelines for Environmental Assessment and Management in the Offshore Oil and Gas Development (2011) guide integrating environmental, health, safety and community requirements into offshore oil and gas operations. The guidelines cover effluent limitations for discharges from offshore oil and gas operations.

2. Draft Guidelines for Environmental Assessment and Management in the Offshore Oil and Gas Development (2014) guide integrating environmental, health, safety and community requirements into onshore oil and gas operations.
3. Environmental Assessment in Ghana, a Guide (1996) to Environmental Impact Assessment Procedures (1995) is an EPA guidance document, which outlines procedures to be adhered to when undertaking an EIA.
4. Ghana Standard for Environmental Protection-Requirements for Effluent Discharge (GS 1212:2019),
5. Ghana Standard for Environment and Health Protection-Requirements for Ambient Air Quality and Point Source/Stack Emissions (GS 1236:2019)
6. Ghana Standard for Health Protection-Requirements for Ambient Noise Control (GS 1222:2018).

3.8.2 World Bank Environmental and Social Framework (ESF)

The ESF for investment project financing sets out the mandatory requirements of the Bank for the projects it supports through investment project financing. The Bank commits to supporting Borrowers in the development and implementation of projects that are environmentally and socially sustainable and to enhance the capacity of Borrowers' environmental and social frameworks to assess and manage the environmental and social risks and impacts of projects. The Bank has defined specific Environmental and Social Standards (ESS), designed to avoid, minimize, reduce, or mitigate the adverse environmental and social risks and impacts of projects. There are ten (10) standards[5] within the ESF which include the following:

1. ESS1: Assessment and Management of Environmental and Social Risks and Impacts
2. ESS2: Labour and Working Conditions
3. ESS3: Resource Efficiency and Pollution Prevention
4. ESS4: Community Health and Safety enjoins
5. ESS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement
6. ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
7. ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities.
8. ESS8: Cultural Heritage
9. ESS9: Financial Intermediaries
10. ESS10: Stakeholder Engagement and Information Disclosure

[5] Further details on specific requirements for each ESS is available at https://www.worldbank.org/en/projects-operations/environmental-and-social-framework/brief/environmental-and-social-standards

3.8.3 International Finance Corporation (IFC) Performance Standards[6]

The IFC Performance Standards (PS) guide the management of environmental, and social risks and impacts of IFC-financed projects. The PS indicated that the party responsible for implementing and operating the project must comply with the applicable national laws, including those laws implementing host country obligations under international law.

The project operator is also required to meet the requirements of the standards of IFC or other relevant financial institutions throughout the life of an investment. The IFC PS6 include the following:

1. Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
2. Performance Standard 2: Labour and Working Conditions
3. Performance Standard 3: Resource Efficiency and Pollution Prevention
4. Performance Standard 4: Community Health, Safety, and Security
5. Performance Standard 5: Land Acquisition and Involuntary Resettlement
6. Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
7. Performance Standard 7: Indigenous Peoples.
8. Performance Standard 8: Cultural Heritage

3.8.4 The Equator Principle[7]

The Equator Principles (EPs) is a risk management framework adopted by financial institutions, for determining, assessing, and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence and monitoring to support responsible risk decision-making. The EPs apply globally to all sectors and four financial products namely.

1. Project Finance Advisory Services.
2. Project Finance.
3. Project-Related Corporate Loans and
4. Bridge Loans

[6] Further details on applicability and scope of the IFC Performance Standards are available at www.ifc.org/performancestandards.

[7] More information on the Equator Principles (EPs) is available at https://equator-principles.com

Currently, ninety-two (92) Equator Principles Financial Institutions (EPFIs) in 37 countries have officially adopted the EPs, covering the majority of international project finance debt within developed and emerging markets. EPFIs commit to implementing the EPs in their internal environmental and social policies, procedures and standards for financing projects and will not provide Project Finance or Project-Related Corporate Loans to projects where the client will not, or is unable to, comply with the EPs. While the EPs are not intended to be applied retroactively, EPFIs apply them to the expansion or upgrade of an existing project where changes in scale or scope may create significant environmental and social risks and impacts, or significantly change the nature or degree of an existing impact.

3.9 Non-State Actors

Various Civil Society Organizations (CSO) whose work focuses on issues in the oil and gas sector are available to be consulted and engaged on a wide range of petroleum development issues. Some key CSO in the oil and gas sector include.

1. Africa Center for Energy Policy (ACEP)
2. Integrated Social Development Center (ISODEC)
3. Centre for Extractives and Development Africa (CEDA)
4. IMANI Centre for Policy and Education
5. Natural Resource Governance Institute (NRGI)
6. Chamber of Petroleum Consumers Ghana (COPEC)
7. Oil Watch Ghana
8. Open Licensing Monitoring Group
9. Institute of Energy Policies and Research (INSTEPR)
10. Institute for Energy Security (IES)
11. Civil Society Platform on Oil and Gas (CSPOG), among others

Table 3.2: SEA Observations and Recommendations regarding Some Laws and Institutional Mandates

Institution	Issues	Remarks
BOST	BOST is mandated as the National Gas Transmission utility and Ghana National Gas Company to construct a network of gas pipelines.	BOST has a monopoly over the laying of pipelines. There is a need to review BOST's monopoly to allow companies to construct the gas pipelines.
Ghana Ports and Harbours Authority Act, 1986 (Section 5)	It is the sole mandate of the Ghana Ports and Harbours Authority to plan, build, manage, maintain, operate, and control ports in the country.	The law may be reviewed to enable private investors to enter joint ventures with the GPHA to build and operate port facilities at the hub.
Fisheries Regulations, 2010 (L.I 1968)	Regulation 11(2) Prohibiting fishing activities within areas designated as oil and gas exploration installations	Should be expanded to include oil and gas downstream installations
Free Zones Act, 1995 (Act 504)	S13. Rights and responsibilities of a free zone enterprise (1) A free zone enterprise has the right to produce any type of goods and services for export but shall not produce environmentally hazardous goods.	The law should be amended to make specific provisions for hazardous goods in petroleum and petrochemical products that will be refined and produced in the Petroleum Hub which will be gazetted as a Free Zones Area

CHAPTER 4

EXISTING CONDITIONS

4.1 Introduction

The oil and gas industry presents enormous opportunities for the country's accelerated economic development. It has the potential of generating multiple impacts on the economy particularly in the manufacturing and services sector when properly planned and managed. It is an impetus for contributing to the industrialization agenda of the government. The Coordinated Programme of Economic and Social Development Policy termed "Agenda for Jobs: Creating Prosperity and Equal Opportunity for All" has leveraged this opportunity as a catalyst for economic development. It has outlined several strategies to develop a modern, diversified, efficient and financially sustainable energy economy. Paramount to these strategies is the goal to create an enabling environment through fiscal and non-fiscal measures to attract domestic and foreign investment into the oil and gas industry. One such measure is the development of a Petroleum Hub.

To achieve the Government's vision of the Energy Economy and to facilitate universal access to adequate reliable, cost-effective petroleum products, the Government intends to increase the national crude oil refining capacity, through public and private sector investment. The private investment will expand the national refining capacity to create a Petroleum Hub made up of refining and processing facilities, port discharge, storage, distribution, and transportation facilities as well as trading of petroleum products in Ghana for the West African sub-regional market and beyond. It will also contribute to the achievements of SDGs 7, 8, 9 and 11.

Three potential sites were considered, using criteria such as land availability, land suitability, environment, and proximity to the sea for the siting of the Hub among other things. Based on the outcomes of extensive stakeholder engagements, the MoEn selected the Domunli enclave, located in the Western Nzema Traditional Area in the Jomoro Municipal Assembly to site the Petroleum Hub. This is in line with the District Spatial Development Framework (SDF) which seeks to strategically position the Jomoro Municipal Area to attract Oil and Gas Investments.

The Jomoro SDF takes cognizance of national policies and plans which include the Ghana Shared Growth and Development Agenda 2014-2017 (GSGDA II), the Western Region Spatial Development Framework and the District's Medium-Term Development Plans (MTDPs).

Following the preparation of the Jomoro SDF, it is imperative to develop Structure Plans of broad land use as the next logical sequence in the spatial planning process to guide the future development and land use patterns, the layout of trunk infrastructure and main transportation networks, conservation and protected areas and natural drainage system, and other key features to manage the direction of development (LUSPA, 2021).

4.2 Objective of the Baseline Study and Survey

The study and survey generally assessed the baseline conditions of the Petroleum Hub area and its environs in the Jomoro District in the Western Region of Ghana. The objectives are to:

i. Provide information on the current status quo in terms of demographics, social amenities and infrastructure, climate characteristics, economic conditions, security, and the services sector amongst others
ii. Determine the current state of aspects of flora and fauna within the proposed area
iii. Assess the ecological importance of the elements of biodiversity.
iv. Assess the current land use and land cover status within the proposed area.

4.3 Jomoro Municipal Assembly

The Jomoro Municipal Assembly is one of the 14 districts in the Western Region of Ghana. The Jomoro District was upgraded to Municipal Status in 2017 by Legislative Instrument 2285. The capital town of the Municipality is Half Assini and has a population of 199,725 according to the 2020 GSS Projected Population. The major occupations of the people in the municipality are farming, fishing, and petty trading. The Jomoro Municipality is in the Southwestern part of the Western Region and covers an area of 1,344 square kilometres, which is about 5.6% of the total land area of the Western Region. It is bounded to the south by the Gulf of Guinea, to the west by the Ellembele District, to the east by Cote D'Ivoire and to the north by Aowin and Wassa Amenfi Districts. It lies between latitudes 4°58' N & 5°25'N and between longitudes 2°28'W & 3°7'W.

The proposed Petroleum Hub would be situated in the Western Nzema Traditional Area of the Jomoro Municipality as shown in Figure 4.1. The project area can be located between latitude 04°59' 45" N to 05°07'15" N and longitude 02°48'30" W to 02° 38 30" W. The total estimated land size for the Petroleum Hub intervention area is estimated to cover 20,000 acres.

Source: EPA, 2021

Figure 4.1: Location Map of the Petroleum Hub within JMA

4.4 Climatic Conditions

4.4.1 Rainfall, Temperature and Humidity

The Petroleum Hub area and its environs experience two wet seasons with year-round rainfall that has double maxima rainfall pattern just like the Jomoro Municipality. The highest monthly mean rainfall occurs between May and June. Rainfall peaks in July and October followed by short spells of the relatively dry season. Rainfall in the Petroleum Hub area and its environs all in the Jomoro municipality averages about 1380 mm with maximum amounts of about 1700 mm occurring during March and July.

The Jomoro District is believed to be the wettest part of the country, with its average rainfall exceeding 1,732 millimetres. The rainfall records a double maximum, usually registered from April to July and from September to November. It has a short dry period in August and a much longer dry period from December through January (JMA, 2021[8]).

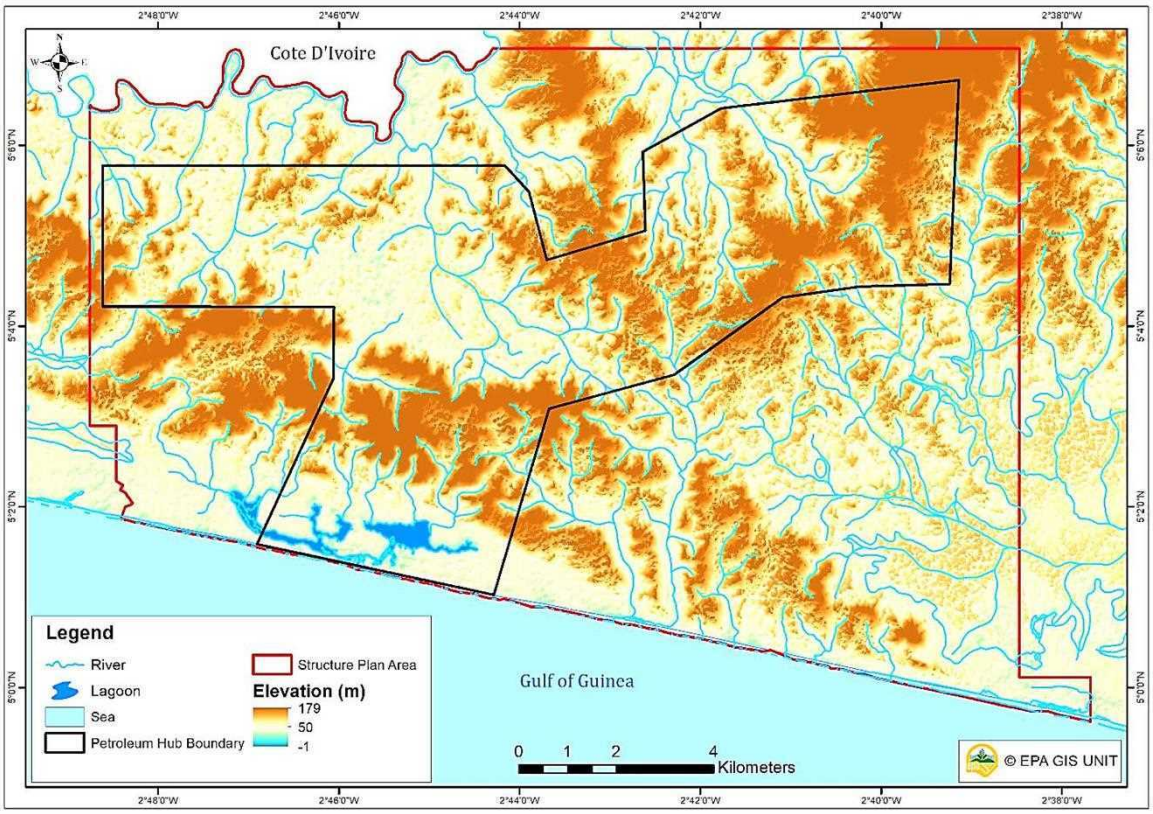
[8] JMA (2021). About Jomoro Municipal Assembly. Available at: http://jma.gov.gh/about-jma. Assessed on 20th May 2021

The district has a monthly mean temperature of 26°C with relative humidity throughout the district being very high at about 90% during the night and falls to about 75% when the temperature rises in the afternoon. The area is characterized by a high rainfall pattern which falls in two wet seasons, the district is also characterized by uniformly high temperatures. The temperature conditions in the area readily support the cultivation of tropical crops such as cassava, oil palm and maize. Farmers take advantage of the double rainfall seasons to increase the production of crops. Maize, for instance, can be grown and harvested in both the major and lean seasons. The climatic conditions also favour fishing.

4.4.2 Relief and Drainage

The south-central part of the district including the Ankasa Forest Reserve is an area of undulating granite topography consisting of frequent steep-sided small round hills rising to 61 - 183m above sea level. Around the coastal area, the relief is lower consisting of flat upland areas and steep valleys. A minor relief feature is the one formed by a ridge of highland running northwest to southeast from the Tano to Western Nzema area that terminates on its northern side in the Nawule scarp.

The Tano, Ankasa, Suhwen, Elloyin and Amanzulle Rivers and their tributaries drain the municipality. There are several lagoons in the Jomoro Municipality and the largest ones such as the Domunli, the Amanzulle and the Dwenye Lagoons are located within the Petroleum Hub area. These water bodies provide immense support systems to the residents as sources of livelihood (through fishing), irrigation, transportation, and other ecosystem services. Figure 4.2 presents the relief and drainage of the enclave.



Source: EPA, 2021

Figure 4.2: Relief & Drainage Map

4.5 Vegetation

The Jomoro Municipality lies within the tropical forest belt of Ghana, with coastal vegetation being largely mangrove swamps. The original vegetation in the interior parts of the district was the Tropical Rain Forest type characterized by its evergreen scenery with a vast variety of plant species. The Municipality is currently made up of forest vegetation and houses the Ankasa Conservation Area, which is characterized by high forest. There are designated areas of fallow land and tree crops and farms/plantations.

There are also major areas of swampy forest, which have not seen much cultivation because of their waterlogged nature for most times of the year (JMA MTDP, 2014[9]). The vegetation is evergreen, which has influenced edaphic and physiographic factors to create conditions suitable for the growth of various plant species, as well as the cultivation of crops in the area. Two distinct vegetation types corresponding to the terrestrial and coastal habitats were identified in the Hub area and its environs namely the Coastal Grassland and the Terrestrial vegetation.

[9] JMA (2014). Annual Progress Report on The District Medium Term Development Plan [MTDP]

4.5.1 Coastal Grassland

The coastal vegetation consists of grassland mixed with mangrove stands i.e., Avicennia Germanus, Rhizophora racemose and Laguncularia racemose), coconut (Cocos nucifera), Raphia vinifera, and scattered populations of Chrysobalanus icaco, Ipomoea pes-Capra and Button mangrove (Conocarpus erectus). Other associates of mangroves such as the India tulip tree (Thespesia populnea) and Golden leather fern (Achrostichum aurem), which are indicators of coastal habitat degradation were also identified. Dominant grasses species found include beach star (Remirea Maritima) and (Congon grass) Imperata cylindrical with Chrysobalanus icaco as the most common shrub.

Plate 4.1: *Chrysobalanus icaco*

Plate 4.2: Grassland (mostly *Imperata cylindrical*)

Plate 4.3: *Remirea Maritima* and distribution

Plate 4.4: Distribution of *Achrostichum aurem* in the coastal environment

4.5.2 Terrestrial Vegetation

The terrestrial vegetation falls within the wet evergreen zone of Ghana, dominated by trees like Anthocleista Nobilis and Cussonia bancoensis. Other common trees identified include Cassia siamea, Ceiba pentandra, Elaeis guineensis, Khaya senegalensis, Lophira alata, Mangifera indica, Musanga cecropioides, Raphia vinifera and Terminalia catappa. A significant cover of Cocos nucifera plantations was also identified, largely cultivated. The common forbes and shrubs in the terrestrial habitats were Panicum maximum, Alchornea cordifolia, Bignonia capreolata Centrosema pubescens Chromolaena ordorata, Cissus quadrangularis, Commelina diffusa, Dieffenbachia, Ipomoea purpurea, Lantana camara, Dryopteris, Helitropium indicum, Bambusa vulgaris, Musa paradisiaca, Manihot esculenta, Mimosa pudica, Paspalum scrobiculatum, Sesuvium portulacastrum, Spondias mombin and Sporobolus pyramidalis.

4.5.2.1 Useful Plants for Habitat Management and Ecosystem Services

A component of this survey involved interactions with inhabitants within the project area on the use of the vegetation. Trees and herbaceous plants provide vital ecosystem services including the provision of food from plant products, medicine, timber, soil cover and other useful services like fodder for livestock of the inhabitants as well as non-human requirements and habitats for the refuge of the animals. Hence any activity likely to impact negatively on them would affect the livelihood of the inhabitants. Cultivated plants included maize, cassava, plantain, mango, coconut palm, cocoa, and rubber tree. Below are images of some ecosystem services encountered within the project area:

Source: EPA Field Survey, 2021

Plate 4.4: *Anthocleista nobilis*, *Cussonia bancoensis* and other plants in the habitat

Plate 4.5: *Baphia nitida* surrounded by some grass species

Plate 4.6: Coconut Trees in a habitat

Plate 4.7: Fishing activity in the estuary

Plate 4.8: A fishing boat along the coast

Plate 4.9: Birds in the estuary

Plate 4.10: Sheep grazing at the habitat

Plate 4.11: Butterfly at habitat close to the estuary

Plate 4.12: Grasshopper at habitat close to the estuary

4.5.3 Summary of Protected and Threatened Species Vulnerable Species

Cussonia bancoensis, *Entandrophragma cylindricum*, Heritiera utilis, Khaya senegalensis, Lophira alata, Terminalia ivorensis and Khaya senegalensis is shown to be vulnerable on the International Union of Conservation of Nature (IUCN) red list rating.

4.5.3.1 Near-Threatened Species

Albizia ferruginea and Milicia excelsa are listed as near threatened on the IUCN red list. This shows that these species are close to being vulnerable. The listed plants are highly exploited for timber, medicine and other purposes by inhabitants which is destructive. The presence of these vulnerable and near-threatened species in the project area raises issues of international concern due to the possibility of extinction.

The species of conservation concern in Ghana, according to the Star Rating system are mostly exploited for timber, medicine, and other purposes. Antiaris toxicaria and Elaeis guineensis are starred pink on the Ghana database. This means their distributions are common and moderately exploited. In addition, they are non-abundant species of high potential value.

Terminalia ivorensis, Albizia ferruginea, Triplochiton scleroxylon, and Milicia excelsa (starred scarlet) are under serious pressure from heavy exploitation and Terminalia catappa (starred red) is under pressure from exploitation.

Cussonia bancoensis is starred gold on the Ghana Star Rating which means it is Fairly Rare internationally and/or locally. This shows the high ecological importance of these plants both locally and internationally, hence the need to put in place pragmatic measures to ensure the conservation of these plant species Cussonia bancoensis, Entandrophragma cylindricum, Heritiera utilis, Khaya senegalensis, Lophira alata, Terminalia ivorensis, Triplochiton scleroxylon, Khaya senegalensis, Albizia ferruginea and Milicia excelsa.

Table 4.1: Life forms and Conservation Statuses of Plants

No.	Plant Name	Family	Life Form	IUCN Rating	Status InHabitat	Star Rating	Uses
1.	Abbrus precatorius L.	Fabaceae	Climber	Not assessed	Least common		
2.	Acrostichum aureum L.	Pteridaceae	Fern	Least concern	Common		Food, wounds, ulcers, boils
3.	Albizia ferruginea (Guill. & Perr.) Benth.	Fabaceae	Tree	Near threatened	Least common	Scarlet	Timber, Furniture, Treatment offever, sores, and pimples
4.	Albizia saman or Samanea saman (Jacq.) Merr	Fabaceae	Tree	Least concern	Least common		Treatment of diarrhoea, stomachpain, and sore throat
5.	Albizia zygia (DC.) JFMacbride	Fabaceae	Tree	Least concern	Least common		Bronchial disease, fever, femalesterility
6.	Alchornea cordifolia (Schum. & Thonn.) Mull. -Arg	Euphorbiaceae	Shrub	Least concern	Common	Green	Treatment of ulcers, bronchitis, wound, cough, anaemia
7.	Alstonia boonei De. Wild.	Apocynaceae	Tree	Least concern	Least common	Green	Treatment of fractures and dislocation, jaundice, and inducingbreast milk
8.	Anthocleista nobilis G. Don	Loganiaceae	Tree	Least concern	Common		Treat constipation, leprosy, scrotal elephantiasis, regulate menstruation
9.	Antiaris toxicaria Lesch.	Moraceae	Tree	Least concern	Least common	Pink	Antidysenteric, anodyne, dye
10.	Aspilia africana (Pers.) C.D. Adams	Asteraceae	Herb	Least concern	Least common		Treatment of wounds, sores,and rheumatic pains
11.	Avicennia germinans(L.) L.	Acanthaceae	Tree	Least concern	Dominant		
12.	Azadirachta indica A.Juss.	Meliceae	Tree	Least concern	Least common		
13.	Bambusa vulgaris Schrad.ex J. C. Wendl.	Poaceae	Grass	Not assessed	Dominant	Green	Furniture, food, biofuel, fabrics, cloth, paper
14.	Baphia nitida Lodd.	Fabaceae	Tree	Least concern	Least common	Green	Mortars, pestles, farm implement
15.	Bignonia capreolata L.	Bignoniaceae	Climber	Not assessed	Common		Treatment of diphtheria, rheumatism, oedema and

No.	Plant Name	Family	Life Form	IUCN Rating	Status InHabitat	Star Rating	Uses
							headaches
16.	Blighia sapida	Sapidaceae	Tree	Least concern	Least common	Green	Treatment of epilepsy, and yellowfever
17.	Borassus aethiopum Mart.	Arecaceae	Tree	Least concern	Least common		Basketry, mat, Telegraphic poles
18.	Canavalia rosea (Sw.) DC.	Fabaceae	Creeper	Not assessed	Common		Treatment of boils, wounds andrheumatism
19.	Cassia siamea or Senna siamea (Lam.) Irwin et Barneby	Fabaceae	Tree	Least concern	Common	Green	Treatment of malaria, windbreaks,shelterbelts
20.	Calotropis procera (Aiton) W.T.Aiton	Apocynaceae	Tree	Not assessed	Least common		Treatment of diarrhoea, constipation, and stomach ulcers
21.	Caripa papaya Linn.	Caricaceae	Tree	Data Deficient	Least common	Green	Treatment of nerve pains, and intestinal parasite infections, sedative
22.	Crotalaria retusa L	Fabaceae	Shrub	Not assessed	Least common		Forage, treatment of epidermal infections, thrush, and haemoptysis
23.	Ceiba pentandra (L.)Gaertn.	Malvaceae	Tree	Least concern	Common	Green	Diuretic, aphrodisiac, treat headache, stuff mattresses, pillows, cushions
24.	Centrosema pubescensBenth.	Fabaceae	Herb	Not assessed	Common	Green	Forage, soil improvement
25.	Chromolaena ordorata (L.) R.M.King & H.Rob.	Asteraceae	Shrub	Not assessed	Common	Green	Treatment of wounds, burns andskin infections
26.	Chrysobalanus icaco(L.) L.	Chrsobalanaceae	Shrub	Least concern	Dominant		Treatment of dysentery, dyspepsia, diarrhoea, fruit used for food, jam, and jellies
27.	Cissus quadrangularis L.	Vitaceae	Climber	Not assessed	Common		Treatment of haemorrhoids, bone loss, allergies, asthma, anddiabetes

No.	Plant Name	Family	Life Form	IUCN Rating	Status InHabitat	Star Rating	Uses
28.	Citrus aurantiifolia (Christm.) Swingle	Rutaceae	Tree	Not assessed	Least common		Antibacterial, anticancer, antidiabetic, antifungal, antioxidant
29.	Cocos nucifera L.	Arecaceae	Tree	Not assessed	Dominant		Construction, sugar vinegar, alcohol, mats, cooking oil, treatment of diarrhoea
30.	Colocasia esculenta (L.)Schott.	Araceae	Herb	Not assessed	Common		Treatment of asthma, arthritis, diarrhoea, neurological and skin disorders
31.	Commelina diffusa Burm.f.	Commelinaceae	Herb	Least concern	Common		Treatment of urinary and respiratory tract infections, diarrhoea, enteritis and haemorrhoid
32.	Conocarpus erectus L.	Combretaceae	Shrub	Not assessed	Least common		Barges, boats, maritime construction, fences, turnery
33.	Corchorus olitorius	Malvaceae	Shrub	Not assessed	Least common		Treatment of piles, ascites, pain,fever, gonorrhoea, and tumours
34.	Cussonia bancoensisAubrev. & Pellergr.	Araliaceae	Tree	Vulnerable	Common	Gold	Wood, potash, management of pain and infectious diseases
35.	Cyperus articulatus L.	Cyperaceae	Grass	Least concern	Common		
36.	*Desmodium sp.*	Fabaceae	Herb	Not assessed	Least common		Treatment of rheumatism pyrexia,dysentery, cough, malaria
37.	Dieffenbachia spp. Schott	Araceae	Herb	Not assessed	Common		Food, stimulants, inflict punishment
38.	Distemonanthus benthamianus	Fabaceae	Tree	Least concern	Least common		Cabinetwork, joinery, flooring, decorative veneers
39.	Dracaena trifasciata (Prain) Mabb. Or Sansevieria	Asparagaceae	Herb	Not assessed	Least common		Landscape designs, remove toxicpollutants

No.	Plant Name	Family	Life Form	IUCN Rating	Status InHabitat	Star Rating	Uses
	trifasciata Prain						
40.	Dryopteris spp. Adans.	Dryopteridaceae	Fern	Not assessed	Dominant		Treatment of inflammation, rheumatoid arthritis, wounds, ulcers
41.	Drypetes parvifolia (Muell. Arg.) Pax & K. Hoffm.	Euphorbiaceae	Shrub	Not assessed	Least common	Green	Treatment of sinusitis, swelling, boils, gonorrhoea and dysentery
42.	Entandrophragma cylindricum Harms	Meliaceae	Tree	Vulnerable	Least Common		Flooring, panelling, stairs, furniture, musical instrument, carvings
43.	Elaeis guineensisJacq.	Arecaceae	Tree	Least Concern	Common	Pink	Cooking oil, food, treatment of gonorrhoea, menorrhagia, cancer,asthma
44.	Euphorbia hirta L.	Euphorbiaceae	Herb	Not assessed	Least Common		Treatment of female disorders, respiratory ailments, dysentery, jaundice, pimples
45.	Ficus capensis Thunb. orFicus sur Forssk	Moraceae	Tree	Not assessed	Least Common	Green	Improve male fertility, dysentery,leprosy, epilepsy
46.	Ficus exasperate Vahl.	Moraceae	Tree	Not assessed	Least Common	Green	Sandpaper, anti-ulcer, hypotensive, lipid-lowering
47.	Flacourtia flavescens Willd.	Flacourtiaceae	Shrub/Small tree	Not assessed	Least Common		Purgative, treatment of diarrhoeic conditions
48.	Gloriosa superba L.	Colchicaceae	Herb	Not assessed	Least common		Treatment of gout, infertility,impotence, open wound, snakebite, cancer
49.	Gmelia arborea Roxb.	Lamiaceae	Tree	Not assessed	Least common		Particle board, plywood, matches,carvings
50.	Griffonia simplicifolia	Fabaceae	Climbingshrub	Not assessed	Least common	Green	Treatment of depression, anxiety,headaches

No.	Plant Name	Family	Life Form	IUCN Rating	Status InHabitat	Star Rating	Uses
51.	Helitropium indicum L.	Boraginaceae	Herb	Not assessed	Common		Treatment of inflammation, tumours, analgesic, diuretic
52.	Heritiera utilis (Sprague) Sprague	Malvaceae	Tree	Vulnerable	Least common		Panelling, flooring, moulding, cabinetwork
53.	Hevea brasiliensisMüll.Arg.	Euphorbiaceae	Tree	Least common	Common		Rubber
54.	Hippocratea apocynoides Welw. ex Oliv.	Celastraceae	Tree	Not assessed	Least common		Tying, woven stretchers, woven pot covers
55.	Ipomoea pes-caprae (L.)R.Br.	Convolvulaceae	Creepingvine	Not assessed	Common		Treatment of boils, rheumatism, gonorrhoea, syphilis, cold and flu
56.	Ipomoea purpurea (L.)Roth	Convolvulaceae	Herb	Not assessed	Common		Anthelmintic, diuretic, laxative, oedema, oliguria
57.	Khaya senegalensis (Desr.) A.Juss.	Meliaceae	Tree	Vulnerable	Common	Green	Treatment of fever, headache, leprosy, mental illness, syphilis
58.	Lantana camara L.	Verbenaceae	Shrub	Not assessed	Common	Green	Treating cancers, chicken pox, measles, asthma, tetanus
59.	Leucaena leucocephala(Lam.) de Wit	Fabaceae	Tree	Unspecified	Least common		Firewood, timber, forage, paper,treating stomach-ache, contraception, abortifacient
60.	Conocarpus erectusL.	Combretaceae	Tree	Least concern	Least common		
61.	Lonchocarpus sericeus(Poir.) HB & K.	Fabaceae	Tree	Least concern	Least common		
62.	Lophira alata Banks ex Gaertn.	Ochnceae	Tree	Vulnerable	Common		
63.	Mangifera indica L.	Anacaridiaceae	Tree	Unspecified	Common		
64.	Manihot esculenta Crantz	Euphorbiaceae	Shrub	Not assessed	Common		
65.	Margaritaria discoidea(Baill.) G.L.Webster	Phyllantaceae	Tree	Least concern	Least common		

No.	Plant Name	Family	Life Form	IUCN Rating	Status InHabitat	Star Rating	Uses
66.	Milicia excelsa (Welw.) C.C. Berg	Moraceae	Tree	Near Threatened	Least common	Scarlet	
67.	Mimosa pudica L.	Fabaceae	Herb	Least concern	Common	Green	
68.	Momordica foetidaSchmach.	Cucurbitaceae	Climber	Least concern	Least common		
69.	Morinda lucida Benth.	Rubiaceae	Tree	Not assessed	Least common	Green	
70.	Musa × paradisiacaL.	Musaceae	Herb	Not assessed	Common	Green	
71.	Musanga cecropioides R.Br.& Tedlie	Urticaceae	Tree	Least concern	Dominant	Green	
72.	Nephrolepis biserrata (Sw.) Schott	Nephrolepidaceae	Fern	Not assessed	Common		
73.	Nicotiana tabacum L.	Solanaceae	Shrub	Not assessed	Least common		
74.	Panicum maximum Jacq.	Poaceae	Grass	Not assessed	Dominant		
75.	Paspalum scrobiculatum L.	Poaceae	Grass	Least concern	Common		
76.	Paspalum vaginatum Sw.	Poeceae	Grass	Least concern	Least common		
77.	Paullina pinnata L.	Sapindaceae	Climber	Least concern	Least common	Green	
78.	Pentaclethra macrophylla Benth.	Fabaceae	Tree	Least concern	Least common	Green	
79.	Persea americana Mill.	Lauraceae	Tree	Not assessed	Least common		
80.	Petersianthus macrocarpus (P Beauv.)	Lecythidaceae	Tree	Least concern	Least common		
81.	Piper guinense Schumach. & Thonn.	Piperaceae	Climber	Least concern	Least common	Green	
82.	Platycerium sp. Desv	Polypodiaceae	Climber	Least concern	Least common		

No.	Plant Name	Family	Life Form	IUCN Rating	Status InHabitat	Star Rating	Uses
83.	Psidium guajava L.	Myrtaceae	Shrub	Not assessed	Least common		
84.	Pycnanthus angolensis (Welw.) Warb.	Myristicaceae	Tree	Least concern	Least common	Green	
85.	Raphia vinifera P. Beauv.	Arecaceae	Tree	Least concern	Dominant		
86.	Rauvolfia vomitoria Afzel.	Apocynaceae	Shrub	Least concern	Common	Green	
87.	Remirea maritima Aubl.	Cyperaceae	Sedge	Not assessed	Common		
88.	Rhizophora racemoseG.Mey.	Rhizophoraceae	Tree	Least concern	Common		
89.	Ricinus communis L.	Euphorbiaceae	Shrub	Not assessed	Least common		
90.	Securinega virosa (Roxb.) Baill,	Euphorbiaceae	Shrub/small Tree	Not assessed	Common		
91.	Selaginella sp. P. Beauv	Selaginellaceae	Herb	Not assessed	Least common		
92.	Sesuvium portulacastrum(L.) L.	Aizoaceae	Creeper	Not assessed	Common		
93.	Sida acuta Burm. Fil.	Malvaceae	Shrub	Not assessed	Least common	Green	
94.	Spathodea campanulata P. Beauv.	Bignoniaceae	Tree	Least concern	Least common		
95.	Spondias mombin Linn.	Anacaridiaceae	Tree	Not assessed	Least common		
96.	Sporobolus pyramidalisBeauv.	Poaceae	Grass	Not assessed	Common		
97.	Sterculia tragacantha Lindl.	Sterculiaceae	Tree	Least concern	Least common		
98.	Tectona grandis L.F.	Lamiaceae	Tree	Not evaluated	Least common	Green	
99.	Terminalia catappa L.	Combretaceae	Tree	Least concern	Common	Red	

No.	Plant Name	Family	Life Form	IUCN Rating	Status InHabitat	Star Rating	Uses
100.	Terminalia ivorensis A. Chev.	Combretaceae	Tree	Vulnerable	Least common	Scarlet	
101.	Terminalia mantaly H.Perrier	Combretaceae	Tree	Least concern	Least common		
102.	Terminalia superba Engl. & Diels	Combretaceae	Tree	Not assessed	Least common		
103.	Thaumatococcus daniellii (Benn.) Benth.	Marantaceae	Herb	Not assessed	Least common		
104.	Theobroma cacao L.	Malvaceae	Tree	Not evaluated	Least common	Green	
105.	Thespesia populnea (L.) Sol. ex Corrêa	Malvaceae	Tree	Least concern	Least common		
106.	Trichilia monadelpha (Thonn.) J.J.de Wilde	Meliaceae	Tree	Least concern	Least common	Green	
107.	Triclisia angustifolia Diels	Menispermaceae	Climbingshrub	Not assessed	Least common		
108.	Triplochiton scleroxylon K.Schum.	Malvaceae	Tree	Least concern	Least common	Scarlet	
109.	Uapaca guineensis Müll.Arg.	Phyllanthaceae	Tree	Least concern	Least common		
110.	Vernonia amygdalina or Gymnanthemum amygdalina Delile	Asteraceae	Shrub	Not assessed	Common	Green	
111.	Vernonia cinerea (L.) Less.	Asteraceae	Herb	Not assessed	Common		
112.	Waltheria indica L.	Malvaceae	Shrub	Not assessed	Least common		
113.	Ximenia americana L.	Olacaceae	Tree	Not assessed	Least common		
114.	Zea mays L.	Poaceae	Grass	Least concern	Least common		

4.5.3.2 Issues of Concern

Azadirachta indica (neem) is noted to be a problematic exotic hence their presence shouldn't be overlooked as it spreads fast within a short while. *Chromolaena ordorata* and Centrosema pubescens are the common invasive species in the project zone. For this reason, any construction efforts should consider their distribution to control the spread of these two invasive plants.

4.5.4 Survey on General Fauna Mammals

A total of 43 mammal species have been recorded within the proposed project area and its immediate surroundings (Table 4.2). Of these, 13 are reported to be of international conservation importance according to the IUCN red list while 27 are listed as Least Concern. Of the species that have international conservation importance, 4 are Endangered, 2 are Vulnerable, 3 are Critically Endangered, and 4 are Near Threatened.

4.5.4.1 Herpetofauna

Surveys in the project area and its surroundings have reported a total of 65 species of herpetofauna (Table 4.3). Of the species of reptiles and amphibians recorded for the immediate surroundings of the project area, 11 are reported to be of international conservation importance according to the IUCN red list while the remaining 41 are listed as Least Concern with the status of 1 species not assessed. Of the species that are of international conservation importance, 3 are Vulnerable, 2 are critically Endangered, and 6 are Near Threatened.

4.5.4.2 Fish and Crustaceans

The lagoon is an important nursery site for marine species that spawn at sea but have their juvenile forms washed into the lagoon. This includes for instance the fish Mugil sp. Gerres melanopterus and the shrimps Penaeus duorarum and Penaeus atlantica. The fish fauna includes true lagoon species such as the cichlid Sarotherodon melanotheron and the mudskipper Priopthalmus kaelruti, freshwater species like the cichlids Oreochromis niloticus and Tilapia zillii and marine species like Albula vulpes and Lutjanus fulgens.

4.5.4.3 Sea Turtles

The sandy beaches of Ghana support the breeding of a significant population of different species of turtles. Five species, Leatherback (Dermochelys coriacea), Green (Chelonia mydas), Olive Ridley (Lepidochelys olivecea), Loggerhead (Caretta caretta), and Hawksbill (Eretmochelys imbricate),

are all documented to utilize the coastal areas for foraging and nesting (Armah & Amlalo, 1998[10]; Agyekumhene et al., 2014[11]).

In the proposed project area, the Olive Ridley is the most common species to nest, but Leatherback and Green turtles also utilize the area for nesting (Armah et al, 2009[12]). Loggerhead and Hawksbill turtles have been reported in fishery by-catch in the survey area. Nesting by turtles in Ghana occurs primarily between October and March (Table 4.4) with peak nesting in November-December (Agyekumhene, 2009; Agyekumhene et al., 2014). However, there are early and late nesters who sometimes deposit eggs outside these months (Agyekumhene, 2009). The green turtle was previously documented to nest from June to August, but recent field surveys have reported the species also nesting actively during the October-March period.

4.5.4.4 Avifauna

The proposed project site is in the Western Region of Ghana and falls within the Greater Amanzule wetland. The Amanzule wetland and associated forests and sandy beaches have a diverse bird (avifauna) community which consists of both resident and migrant species. Within this area, 165 bird species belonging to 15 orders and 53 families have been recorded in previous studies (Ntiamoa-Baidu et al., 2001[13]; Owusu, 2007[14]), constituting 24.2% of the 680 avifauna species recorded in Ghana.

The resident birds of the wetland constitute 17.4% of Ghana's 494 resident bird species (Borrow & Demey, 2020[15]). A total of 100 bird species have been recorded to breed within the Amanzule wetland. A total of 44 bird species recorded within the site are seasonal migrants including 30 Paleoarctic species and one Neoarctic species (Ntiamoa-Baidu et al., 2001; Owusu, 2007; BirdLife International, 2019).

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[10] Armah A. K. & Amlalo D. S., (1998). Coastal zone profile of Ghana. Accra: Ministry of Environment, Science and Technology.

[11] Agyekumhene A., J. Akwoviah & P. Allman (2014). Perception of fishing communities on seat turtle status and conservation in central Ghana. M. Tiwari (Eds.) African Sea Turtle Newsletter. No. 2 / 2014. 52 pp.

[12] Armah A. K., Adomako JK, Agyeman DY, & Agyekumhene A. (2009). Reforested mangrove evaluation: a case study from Ada, Ghana. Resource and Environmental Development Organisation (REDDR 17O).

[13] Ntiamoa-Baidu, Yaa & Owusu, Erasmus & Daramani, D. & Nuoh, A (2001). Important Bird Areas of Ghana.

[14] Owusu, Francis. (2007). Conceptualizing Livelihood Strategies in African Cities. Journal of Planning Education and Research - J PLAN EDUC RES. 26. 450-465. DOI:10.1177/0739456X06298818

[15] Borrow, N., & Demey, R. (2020). Field guide to the birds of Ghana. Bloomsbury Publishing.

The Amanzule wetland is the only site along the Ghana coast where the Eurasian oystercatcher (Haematopus ostralaegus) is observed with any degree of frequency (Ntiamoa-Baidu, 1991[16]; Ntiamoa- Baidu et al., 2001). The entire Ghana coast supports between 3-4% of the sanderling (Calidris alba) population of the East Atlantic Flyway (EAF). Out of this proportion, the stretch of beach between the Ankobra and Amansuri estuaries supports between 40-70% of the EAF sanderling population (Reneerkens et al., 2009[17]; Ntiamoa-Baidu et al., 2014[18]).

The Amanzule wetland is important for several bird species of conservation concern according to the IUCN red list. At the national level, the Ghana Wildlife Conservation Regulations (WCR) L.I. 685, 1357 and 1452 wholly protect all birds of prey and some egrets listed under 'Schedule 1' of the document. Table 4.5 provides a list of birds that are of conservation concern at the international and national levels, occurring within the proposed project area and its immediate environs.

[16] Ntiamoa-Baidu (1991), Conservation of coastal lagoons in Ghana: the traditional approach, Landscape and Urban Planning, Volume 20, Issues 1–3, 1991, ISSN 0169-2046, https://doi.org/10.1016/0169-2046(91)90089-5.

[17] Reneerkens, Jeroen & Benhoussa, Abdelaziz & Boland, Helen & Collier, Mark & Grond, Kirsten & Gunther, Klaus & Hallgrimsson, Gunnar Thor & Hansen, Jannik & Meissner, Włodzimierz & Meulenaer, Brecht & Ntiamoa-Baidu, Yaa & Piersma, Theunis & Poot, Martin & Roomen, Marc & Summers, Ron & Tomkovich, Pavel & Underhill, Leslie. (2009). Sanderlings using African-Eurasian flyways: A review of current knowledge. Wader Study Group Bulletin. 116. 2-20.

[18] Ntiamoa-Baidu Y., Nuoh A.A., Reneerkens J. & Piersma T. 2014. Population increases in non-breeding Sanderlings in Ghana indicate site preference. Ardea 102: 131–137. doi:10.5253/arde.v102i2.a3

Table 4.2: Mammal Species Identified within and around the Proposed Area

Species	Common Name	Yeboah & Deikumah (2008)	Wildlife Division-FC (2010)	Hen Mpoano (2016)	Bempah et al., (2019)	ESL (2019)	IUCN Status
Order Proboscidea							
Loxodonta africana	African Forest Elephant	+					Critically Endangered
Order Primata							
Cercopithecus diana	Diana monkey	+	+				Endangered
Colobus vellerosus	White-thighed B/Wcolobus	+	+				Critically Endangered
Pan troglodytes	Chimpanzee	+	+				Endangered
Galago senegalensis	Bushbaby				+		Least Concern
Cercocebus torquatus	Red-capped Mangabey				+		Endangered
Cercopithecus lowei	Lowe's mona monkey		+		+		Vulnerable
Galagoides demidovii	Demidoff's Dwarf Galago				+	+	Least Concern
Perodicticus potto	Bosman’s potto		+		+		Near
Order Pholidota							
Phataginus Tricuspis	Tree Pangolin				+	+	Endangered

Species	Common Name	Yeboah & Deikumah (2008)	Wildlife Division-FC (2010)	Hen Mpoano (2016)	Bempah et al., (2019)	ESL (2019)	IUCN Status
Order Hyracoidea							
Dendrohyrax dorsalis	Western tree hyrax				+	+	Least Concern
Order carnivora							
Leopard	Panthera pardus		+				Vulnerable
Civettictis civetta	African civet		+		+	+	Least Concern
Herpestes sanguineus	Common Slender Mongoose		+			+	Least Concern
Crossarchus obscurus	Common Cusimanse		+			+	Least Concern
Nandinia binotata	*African Palm Civet*		+				Least Concern
Genetta johnstoni	Johnston's genet	+					Near Threatened
Mellivora capensis	Honey badger/ ratel	+					Least Concern
Aonyx capensis	African clawless otter	+					Near Threatened
Order rodentia							
Anomalurus peli	Pel's flying squirrel	+			+		Data Deficient
Idiurus zenkeri	Pygmy Scaly-tailed Flying Squirrel	+					Least Concern

Species	Common Name	Yeboah & Deikumah (2008)	Wildlife Division-FC (2010)	Hen Mpoano (2016)	Bempah et al., (2019)	ESL (2019)	IUCN Status
Anomalurus derbianus	Lord Derby's Scaly tailed Squirrel	+					Least Concern
Atherurus africanus	African brushtail porcupine				+		Least Concern
Cricetomys gambianus	Gambian Rat		+	+	+	+	Least Concern
Funisciurus pyrropus	Fire-footed rope squirrel			+	+	+	Least Concern
Protoxerus stangeri	Forest giant squirrel				+		Least Concern
Thryonomys swinderianus	Greater bane rat		+		+	+	Least Concern
Paraxerus poensis	Green bush squirrel				+		Least Concern
Xerus erythropus	striped ground squirrel		+		+	+	Least Concern
Genetta johnstoni	Johnston’s Genet			+			Near Threatened
Order Artiodactyla							
Cephalophus maxwelli	Maxwell duiker			+	+		Least Concern
Cephalophus niger	Black duiker			+	+		Least Concern
Sylvicapra grimmia	Common duiker					+	Least Concern
Neotragus pygmaeus	Royal Antelope				+		Least Concern
Tragelaphus scriptus	Harnessed bushbuck			+	+		Least Concern

Species	Common Name	Yeboah & Deikumah (2008)	Wildlife Division-FC (2010)	Hen Mpoano (2016)	Bempah et al., (2019)	ESL (2019)	IUCN Status
Hyemoschus aquaticus	Water chevrotain				+		Least Concern
Hylochoerus meinertzhageni	Forest hog				+		Least Concern
Potamochoerus porcus	Red River Hog			+			Least Concern
Tragelaphus euryceros	Bongo				+		Critically Endangered
Order chiroptera							
Eidolon helvum	African Straw-coloured Fruit-bat				+		Near Threatened
Glauconycteris superba	Pied bat	+					
Epomops buettikoferi	Buettikofer's Epauletted Fruit Bat	+					Least Concern
Atherurus africanus	African Brush-tailed Porcupine						Least Concern
Number of species		**12**	**13**	**7**	**24**	**11**	

Table 4.3: Herpetofauna species recorded within and around the proposed area

Species	Common Name	Rödel et al., (2003)	Hen Mpoano (2016)	Bempah et al., (2019)	ESL (2019)	IUCN Status
Order reptilia						
Osteolaemus tetraspis African	Dwarf Crocodile		+			Vulnerable
Crocodylus cataphractus	Slender snouted crocodile		+			Critically Endangered
Crocodylus niloticus	Nile crocodile		+		+	Least Concern
A. agama	Agama lizard			+	+	Least Concern
Lampropholis guichenoti	Pale-flecked Garden sun skink				+	Least Concern
Kinixys homeana	Home's Hinged back tortoise		+			Vulnerable
Kinixys erosa	Forest Hinged Tortoise		+			Data Deficient
Polemedusa subrufa	African helmeted turtle		+			
Python sebae natalensis	African rock python		+			
Python regius	Royal Python		+			Least Concern
Naja nigricollis	Black-necked spitting cobra		+			
Bitis gabonica					+	
Bitis rhinoceros	Rhinoceros viper		+			Least Concern
Naja melanoleuca	Forest cobra			+		Least Concern
Trachylepis polytropis				+		Least Concern
Varanus niloticus	Nile monitor		+	+		

Species	Common Name	Rödel et al., (2003)	Hen Mpoano (2016)	Bempah et al., (2019)	ESL (2019)	IUCN Status
Dendroaspis viridis	Western green mamba			+		Least Concern
Dendroaspis polylepis	Black mamba				+	Least Concern
Order amphibia						
Sclerophrys regularis	Common African toad		+		+	Least Concern
Discoglossus pictus	Painted frog				+	Least Concern
Sclerophrys maculata	Hallowell's toad				+	Least Concern
Silurana tropicalis	Tropical clawed frog	+	+			Least Concern
Sclerophrys regularis	square-marked toad	+				Least Concern
Amnirana albolabris	white-lipped frog	+	+			Least Concern
Amnirana occidentalis	Ivory Coast frog	+				Least Concern
Aubria subsigillata	brown ball frog	+	+			Least Concern
Hoplobatrachus occipitalis	African Groove crown frog	+	+			Least Concern
Ptychadena aequiplicata	Victoria grassland frog	+				Least Concern
Ptychadena longirostris		+				Least Concern
Ptychadena mascareniensis	Mascarene grass frog	+	+			Least Concern
Ptychadena oxyrhynchus	Sharp-nosed frog	+				Least Concern
Ptychadena superciliaris	Sierra Leone Grassland Frog	+				Least Concern

Species	Common Name	Rödel et al., (2003)	Hen Mpoano (2016)	Bempah et al., (2019)	ESL (2019)	IUCN Status
Phrynobatrachus latifrons	Ahl's river frog	+				Least Concern
Phrynobatrachus alleni	Allen's River Frog	+				Least Concern
Phrynobatrachus annulatus	Ringed River Frog	+				Least Concern
Phrynobatrachus calcaratus	Boutry river frog	+				Least Concern
Phrynobatrachus ghanensis	Ghana river frog	+	+			Near Threatened
Phrynobatrachus gutturosus	Chabanaud's river frog	+	+			Least Concern
Phrynobatrachus liberiensis	Liberia River Frog	+	+			Least Concern
Phrynobatrachus plicatus	Coast River Frog	+				Least Concern
Phrynobatrachus tokba		+	+			Least Concern
Cardioglossa leucomystax	Silver long-fingered frog	+				Least Concern
Astylosternus laticephalus		+				Near Threatened
Acanthixalus sonjae	Ivory Coast Wart Frog	+				Vulnerable
Afrixalus dorsalis	brown banana frog	+				Least Concern
Acanthixalus fulvovittatus		+				
Hyperolius bobirensis	Bobiri Reed Frog	+				Vulnerable
Hyperolius concolor	variable reed frog	+				
Hyperolius fusciventris	Lime Reed Frog	+	+			Least Concern
Hyperolius lamtoensis		+				

Species	Common Name	Rödel et al., (2003)	Hen Mpoano (2016)	Bempah et al., (2019)	ESL (2019)	IUCN Status
Hyperolius guttulatus	Dotted reed frog	+	+			Least Concern
Hyperolius laurenti	Schiotz's Reed Frog	+				Near Threatened
Hyperolius picturatus	Tanzania reed frog	+				Least Concern
Hyperolius sylvaticus	Bobiri reed frog	+				Least Concern
Hyperolius viridigulosus	Stream Reed Frog	+				Near Threatened
Leptopelis viridis	rusty forest treefrog	+				Least Concern
Leptopelis macrotis	Big-eyed Forest Treefrog	+				Near Threatened
Leptopelis occidentalis	Tai Forest Treefrog	+				Near Threatened
Phlyctimantis boulengeri		+				Least Concern
Chiromantis rufescens	African Foam-nest Treefrog	+				Least Concern
Leptopelis spiritusnoctis			+			Least Concern
Morerella cf. cyanophthalma			+			
Number of Species		**42**	**26**	**5**	**8**	

Table 4.4: Turtles Species recorded in the Proposed Area

Biodiversity feature		IUCN Status	WCR	Status and Occurrence area
Lepidochelys olivacea	Olive Ridley	Vulnerable	Completely Protected	Nesting Confirmed in the study area
Dermochelys coriacea	Leatherback	Vulnerable	Completely Protected	Nesting Confirmed in the study area
Chelonia mydas	Green turtle	Endangered	Completely Protected	Nesting Confirmed in the study area
Caretta caretta	Loggerhead	Vulnerable	CompletelyProtected	No nesting recorded over several years; Last sightedin 2019 offshore areas, captured in a fishing net
Eretmochelys imbricate	Hawksbill	Critically Endangered	Completely Protected	No nesting recorded over several years

Table 4.5. List of Birds of Global Conservation Significance within and around the Proposed Area

Common name	Scientific name	Conservation Status	
		IUCN	WCR
African Skimmer	Rynchops flavirostis	Near Threatened	
Bar-tailed godwit	Limosa lapponica	Near Threatened	
Cattle egret	Bubulcus ibis		Wholly Protected
Copper-tailed starling	Hylopsar cupreocauda	Near Threatened	
Crown hawk-eagle	Stephanoaetus coronatus	Near Threatened	Wholly Protected

Common name	Scientific name	Conservation Status	
		IUCN	WCR
Curlew sandpiper	Calidris ferruginea	Near Threatened	
Eurasian curlew	Numenius arquata	Near Threatened	
Eurasian oystercatcher	Haematopus ostralaegus	Near Threatened	
Goliath heron	Ardea goliath		Wholly Protected
Great white egret	Ardea alba		Wholly Protected
Harrier hawk	Polybroides radiatus		Wholly Protected
Hooded vulture	Necrosyrtes monachus	Critically Endangered	Wholly Protected
Little egret	Egretta garzetta		Wholly Protected
Red knot	Calidris canutus	Near Threatened	
Red-tailed buzzard	Buteo augularis		Wholly Protected
West African Goshawk	Accipiter toussenelii		Wholly Protected
Yellow-billed kite	Milvus migrans (parasitus)		Wholly Protected

4.6 Coastline Profile

The Jomoro Municipal District has a 61km stretch of coastline which forms about 11% of Ghana's total coastline (550km). The 61km stretch of the coastline consists of 28 settlements including Half Assini, the district capital with most of the settlements being rural. It is characterized by a 50 km stretch of relatively flat sandy beaches: and dune systems with an elevation below 10 meters. The Petroleum Hub area covers approximately 5km, representing 8% of the Jomoro District's 61km coastline. The coastline is linked to rivers, estuaries, and the greater part of the vast ecologically significant Amanzule wetland and Domunli lagoon complex that provides habitats for diverse flora and fauna which are worth preserving. These provide essential ecosystem services and are also critical for maintaining a healthy fishery. Most of these ecosystems are of national and international significance and hence more efforts are needed to preserve these ecosystems due to their irreplaceability and strong linkage to the livelihoods of the residents.

The rich and largely undisturbed wetlands, estuaries, lagoons and nationally identified ecologically sensitive areas that are in the district have the potential of diversifying the economy via tourism development if properly developed. Due to the action of wind, waves, current and rising sea levels in recent decades, most barrier beaches in Ghana are retreating at a rate of about 1m per year and in the Western region, are estimated to be retreating at 2m per year on average. Erosion, sea level rise, and sand winning from the beach can all result in land loss and the inland movement of the shoreline. (Coastal Resources Centre, 2013).

4.6.1 Coastal Dynamics

Due to the action of wind, waves, current and rising sea levels in recent decades, most barrier beaches in Ghana are retreating at a rate of about 1m per year. Within the Petroleum Hub Area, it is estimated to be retreating at 2m per year on average. Erosion, sea level rise, and sand winning from the beach result in land loss and the inland movement of the shoreline. While the rate of erosion slightly varies from one coastal community to the other, sections of the shoreline within the Municipality are noted to have eroded by approximately 50 meters over the past 2 decades, causing the disappearance of buildings, farmlands, and other properties (Coastal Resources Centre, 2013). Communities experiencing major coastal erosion include Old Kabenlansuazo, Western Nzema, Ezinlibo, Agyeza, Allengenzule, Egbazo and Twenen.

4.7 Wind

A synoptic wind speed record from Axim (a nearby weather station of the proposed site) from 1986 - 2020, ranged from 0.4 - 5 m/s. This range together with air temperature variations over the area largely falls under Pasquil atmospheric stability classes of Class A, Class B, and Class F (Class A – Extremely unstable, Class B – Moderately unstable, Class F – Moderately stable).

4.8 Mapping of the Bonyere Enclave

A total of 9,607.3 acres was mapped out of the 20,818.33 acres using drones which represents 46.15% of the total area earmarked for the development of the petroleum hub. Primary data on existing environmental conditions were also gathered.

4.8.1 The Domunli Lagoon

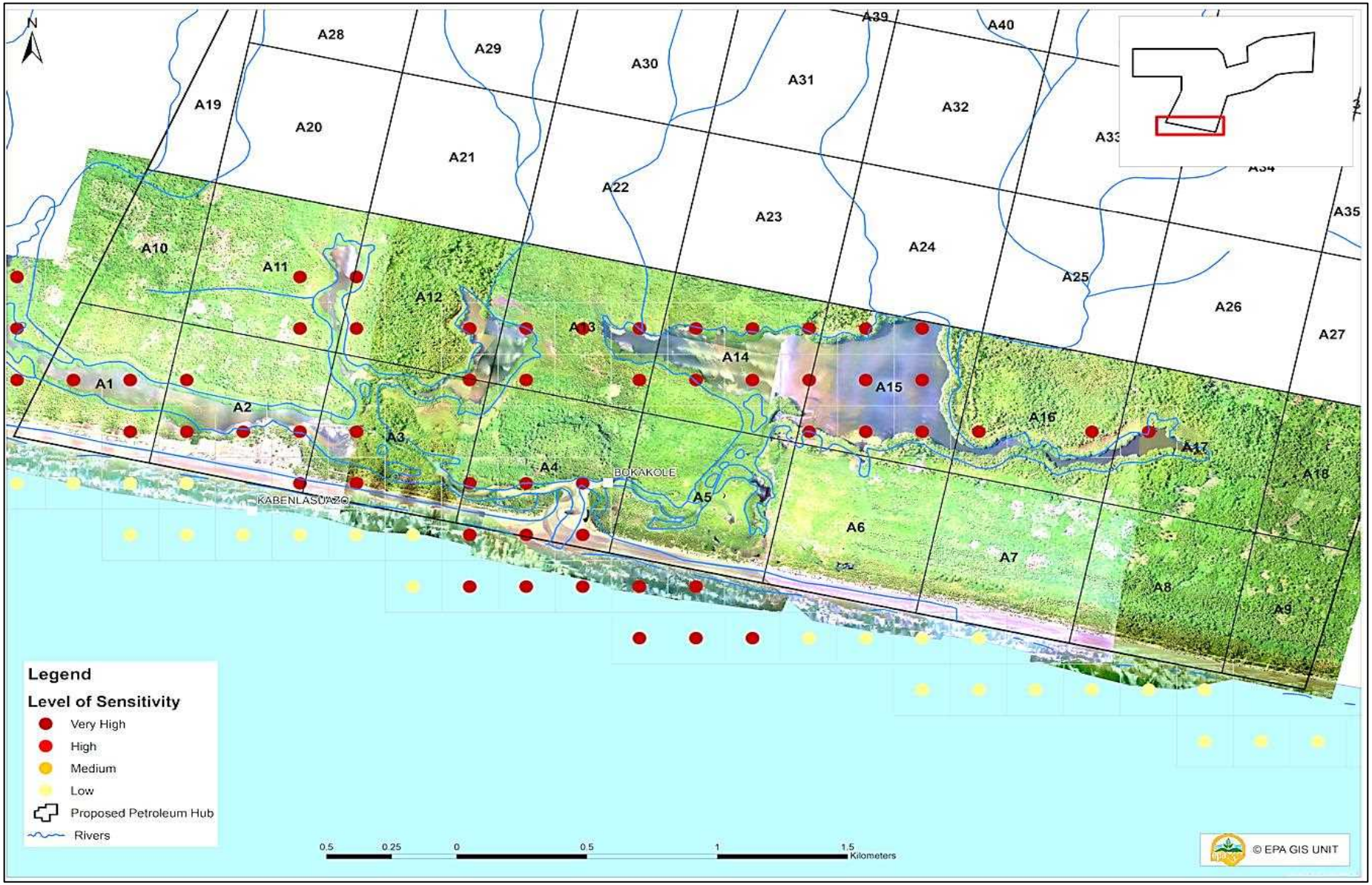
The Domunli lagoon is open and permanently connected to the sea. It stretches over an area of approximately 1,560 km2. The beach area in front of the lagoon is predominantly fine-grained sand with a low slope. The lagoon is an important bird site, providing feeding, roosting, and nesting sites for migratory and resident birds. The lagoon is an important and vulnerable ecosystem, housing a wide variety of fish, shrimps, crabs, and mollusc species. They are important nursery areas for juveniles of marine fish and shrimps.

4.8.1.1 Ecological Sensitivity of the Domunli Lagoon

The lagoon ranks very high in terms of ecological sensitivity based on the ecosystem services it provides presented in Figure 4.3.

4.9 The Ankasa Conservation Area

The Ankasa Conservation Area, located in the Jomoro District of the Western Region of southwestern Ghana near the border with Côte d'Ivoire is an ancient rainforest and the most biodiverse in Ghana as shown in Figure 4.4. It incorporates the Nini Suhien National Park in the North and the Ankasa Forest Reserve in the South. It represents the only wet evergreen protected area in an almost pristine state. The importance of this area for scientific study, environmental stability and educational and recreational purposes cannot be over-emphasized. It is home to over 800 vascular plant species, forest elephants, leopards, bongo, chimpanzees, and most of the West African forest primates. It has an impressive avifauna and six hundred butterfly species. The Ankasa, Nini, and Suhien rivers all pass through the conservation area and are known for their rapids and waterfalls. Its network of streams is an important breeding ground for many of the fish species in the Eburneo-Ghanaian ichthyofauna region as well as being of immense importance for the biotic integrity of waters west and south of the Protected Area.



Source: EPA Field Survey, 2021

Figure 4.3: Ecological Sensitivity Map of the Domunli Lagoon

4.10 Ankasa – Tano Community Resource Management Area (CREMA)[19]

The Community Resource Management Area (CREMA) is a concept developed by the Wildlife Division of the Forestry Commission of Ghana aimed at promoting collaborative and participatory wildlife management in the country. The concept generally involves a group of communities agreeing on the management regime of a common area. This works as a community-based organization with an executive structure, a constitution and relevant bylaws that guide and regulate natural resource governance and management activities in the respective constituent communities.

CREMAs usually link protected areas and forest reserves and create an ecological corridor for both flora and fauna. The CREMA mechanism creates incentives for farmers by allowing them to benefit from the use of natural resources which in turn encourages them to manage these resources sustainably. CREMAs aim to conserve wildlife for future generations, conserve wetland areas for sustainable ecological, social, and economic benefits, protect all natural resources in general, generate income for community development, improve the livelihoods of people in the community, provide employment for people, and promote ecotourism.

Portions of the Kwabre Rainforest lie within the Ankasa-Tano CREMA. The Kwabre Rainforest is a 2,550-hectare corridor of community-owned virgin rainforest which lies along the Tano River, directly opposite the Tanoé Forest in Côte d'Ivoire in Western Ghana. Situated within the Upper Guinean Rainforest, it is home to some endangered primates including the white-naped mangabey (*Cercocebus lunulatus*), and the Critically Endangered Geoffrey's black & white colobus (*Colobus vellerosus*) and Roloway monkey. The Ankasa – Tano CREMA spans twenty- three (23) communities namely, Edu, Akyenenu, Kramosuago, Ebolobo, Kojokyisuazo, Takinta, Nawule, Medina, Nzelenu, Akeyemenu, Ellekobabo, Allumille, Ellenda – Waife, Ellena, Nuba, Anwiafutu Town, Nserewaso, Kwabre, Mansa Nkwanta, Allaboare, Amakuakro, Kotinase, Tobotobo.

4.11 Socio-demography

4.11.1 Population

The Jomoro Municipality has an estimated population of 214,438 which represents 7.4% of the total population of the Western Region (LUSPA 2020 based on GSS 2010) It is a 1.05 percentage point increase from the previous census year of 150,107 in 2010. The Municipality has a population density of 96 persons per square kilometer (Ghana Statistical Service, PHC 2010).

[19] During the baseline survey, it was discovered that although some communities and businesses were benefiting from the ecosystem services provided by the Resource, the official map, byelaws, and geographical boundaries of the Ankasa-Tano CREMA were yet to be gazetted.

The Jomoro Municipality constitutes about 6.3% of the size of the Western Regions population. (Composite Budget for 2019-2022, Programme Based Budget Estimates for 2019, Jomoro Municipal Assembly). The current estimated population of the Petroleum Hub area is 61,663 and is projected to reach 71, 125 by 2025 and 82,410 by 2030 at a growth rate of 15%.

4.11.2 Age-Sex Structure

According to Ghana Statistical Service (2020), the projected population of the Jomoro Municipality is estimated at 199,725. Details are provided in Table 4.6 below.

Table 4.6: 2020 Projected Population of JMA

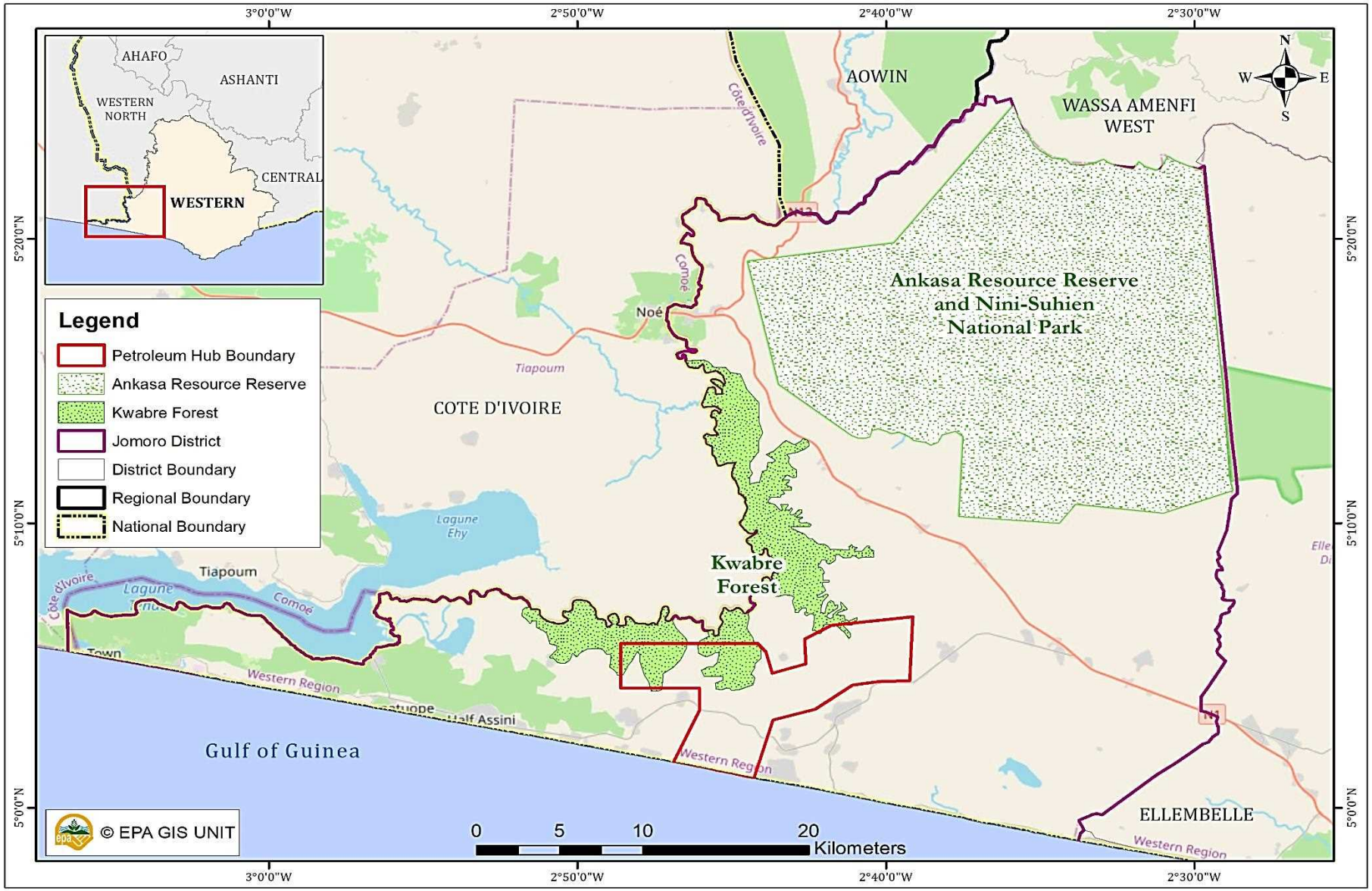
Sex	Age Groups (Years)		Total	Percentage (%)
	Below 18	18 & above		
Male	45,448	50,180	95,628	49
Female	47,304	56,793	104,097	51
Total	**92,752**	**106,973**	**199,725**	**100**

4.11.3 Settlement Distribution

Various factors including vegetation, type of economic activity, infrastructure, and cultural and administrative policies account for uneven population distribution in the district. The 20 largest settlements in the Jomoro District happen to be outside the area designated for the Petroleum Hub. The Hub however hosts two smaller settlements, namely, Old Kabenla-Suazo and Bokakole Nkwanta, with Nyamenli Kwame and Ohiamadwen found along the border of the Hub shown in Figure 4.5. None of these settlements is urban, as their population is below 5000.

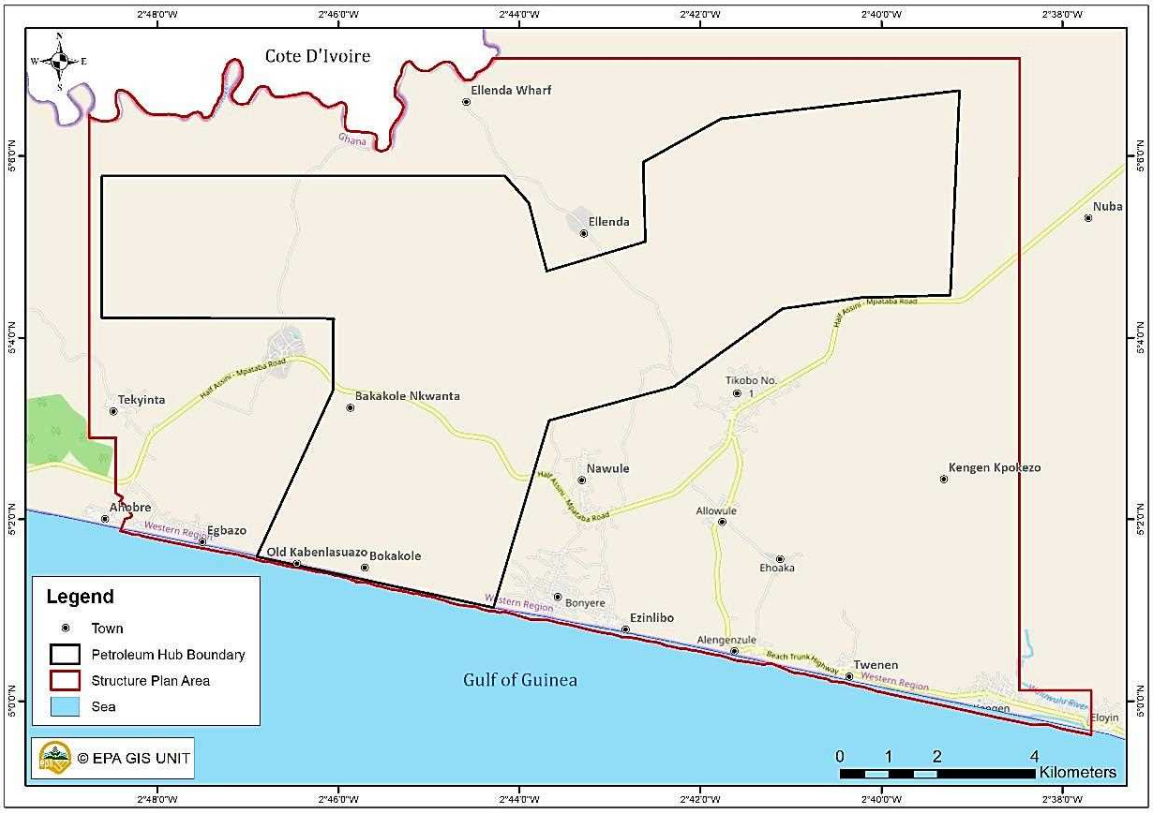
4.11.4 Economy

The Municipality has 22% of its population in extreme poverty compared with 7.6% for the Western Region. The unemployment rate for the Municipality equals that of the Western Region at 4%. The agricultural sector employs 40% of the population, with manufacturing, wholesale/retail and other sectors employing 18%, 16% and 26% respectively. The major food crops grown in the Municipality include cassava, plantain, rice, cocoyam, yam and maize, with cassava having the highest production at 57,608 tonnes/annum and yam being the lowest at 110 tonnes/annum. Coconut and oil palm are the dominant cash crops cultivated in both the municipality and the Petroleum Hub area.



Source: EPA, 2021

Figure 4.4: Ankasa Conservation Area



Source EPA, 2021

Figure 4.5: Settlement Distribution Map

About 37,000 tonnes/annum of coconuts are produced, whilst oil palm accounts for 987 tonnes/annum. Coconut production has a very significant impact on the local economy as it has important value-chain linkages. Coconuts are used in the production of coconut oil, pig feed, charcoal production, door-mat production, and brush production to name a few.

4.11.5 Livestock production

Pigs and sheep are the most reared livestock in the Petroleum Hub area. As of 2020; pigs, sheep, goats, and cattle number 6437, 5935, 347 and 115 respectively. Poultry production is a relatively new entrant in the agriculture economy of the Petroleum Hub area. The steady increase in poultry rearing can be attributed to the dwindling fish catch over the years. A total of 85,550 birds were reared in 2017, to supplement the protein requirement.

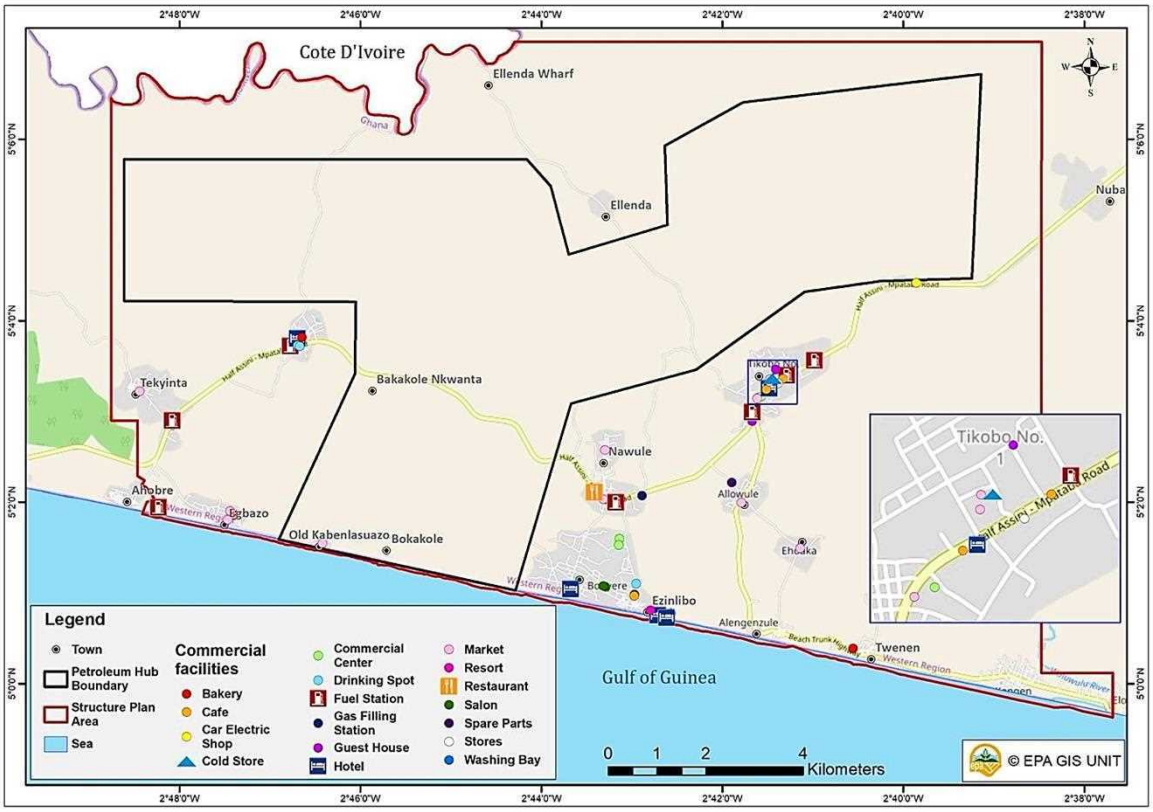
4.11.6 Services sector

The services sector engages 40.81% of the economically active populace in the Petroleum Hub area and its environs. The services sector is highly concentrated in the most urbanized areas which is the eastern part of the Petroleum Hub area and its environs in towns like Tikobo No.1, Western Nzema, Ndumsuazo and New Kabenlensuazo.

There are no commercial and investment banks within the area. The only rural bank located at Tikobo No. 1 with two credit unions located in Tikobo No.1 and Ndumsuazo. There is an even spread of three hotels in the Petroleum Hub area. Two guest houses, a resort and two restaurants are also located in the eastern part of the Hub area. Key services within the Assembly are presented in Table 4.7 and Figure 4.6 below.

Table 4.7: Key Services within the Assembly

Service	Number	Location
Bank	1	Tikobo No. 1
Credit union	2	Tikobo No. 1
Fuel station	7	Takinta, New Kabenla-suazo, Ahobre No. 1, Ndumsuazo and Tikobo No. 1
Gas filling station	1	Ndumsuazo
Guest house	2	Ndumsuazo and Tikobo No. 1
Hotel	3	New Kabenla-suazo, Tikobo No. 1 and Bonyere
Resort	1	Ezinlibo
Restaurant	2	Bonyere and Ndumsuazo
Market	12	Takinta, New Kabenla-suazo, Ahobre No. 1, Ndumsuazo,Egbazo, Old Kabenla-suazo, Nawuli, Allowulle, Ehoaka, Bonyere and Tikobo No. 1
Mechanic's shop	5	Tikobo No. 1, Nyamenli Kwame and Sosuazo
Cold store	1	Tikobo No. 1



Source EPA, 2021

Figure 4.6: Services Map

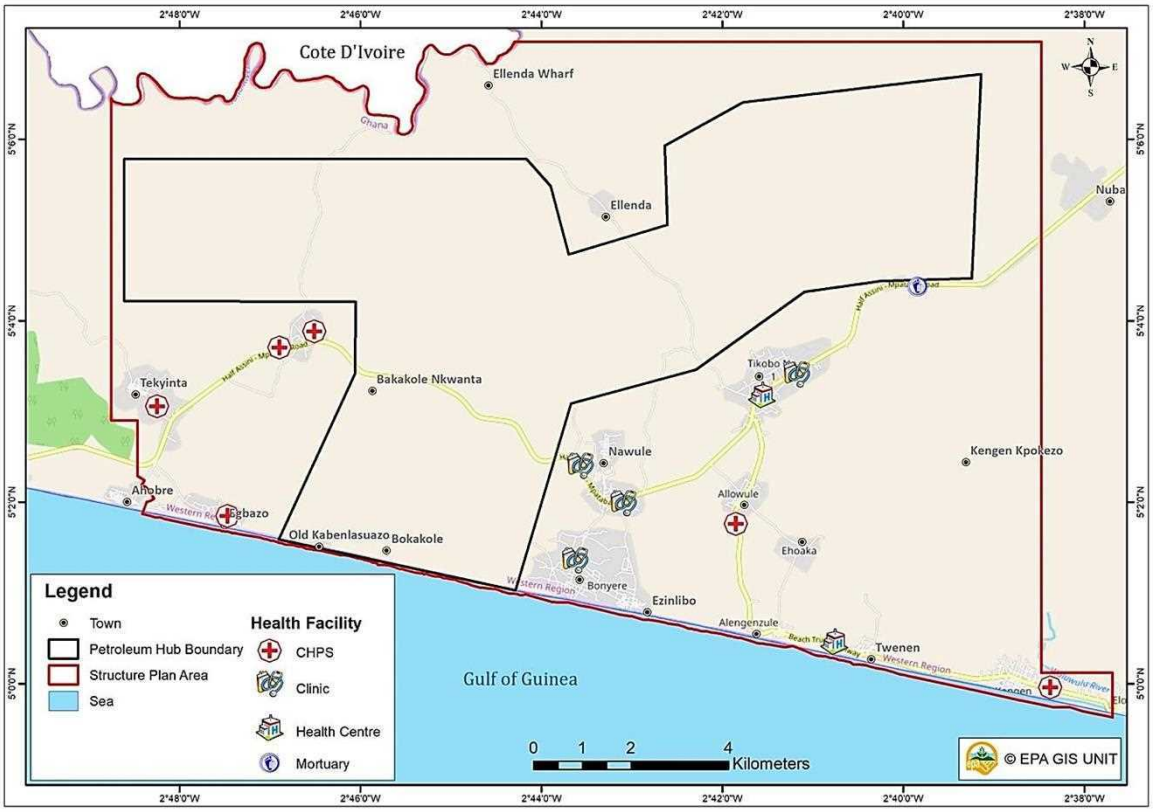
4.11.7 Social Services

4.11.7.1 Health

The Hub area and its environs enjoy both orthodox and traditional healthcare facilities as presented in Table 4.8. There is no hospital or ambulance service within the Hub environs. However, there is one district hospital located in Half Assini, which is about 12.8 km from the proposed Hub area.

Table 4.8: Health Facilities

Health Facility	Number	Location
CHIPs compound	5	New Kabenla-suazo, Takinda, Egbazo, Allowulle, Kengen
Eye clinic	1	Nawule
Clinic	2	Bonyere, Nawuli
Health Centre	2	Tikobo No.1, Twenen
Herbal clinic	1	Tikobo No. 1
Mortuary	1	Ohiamadwen



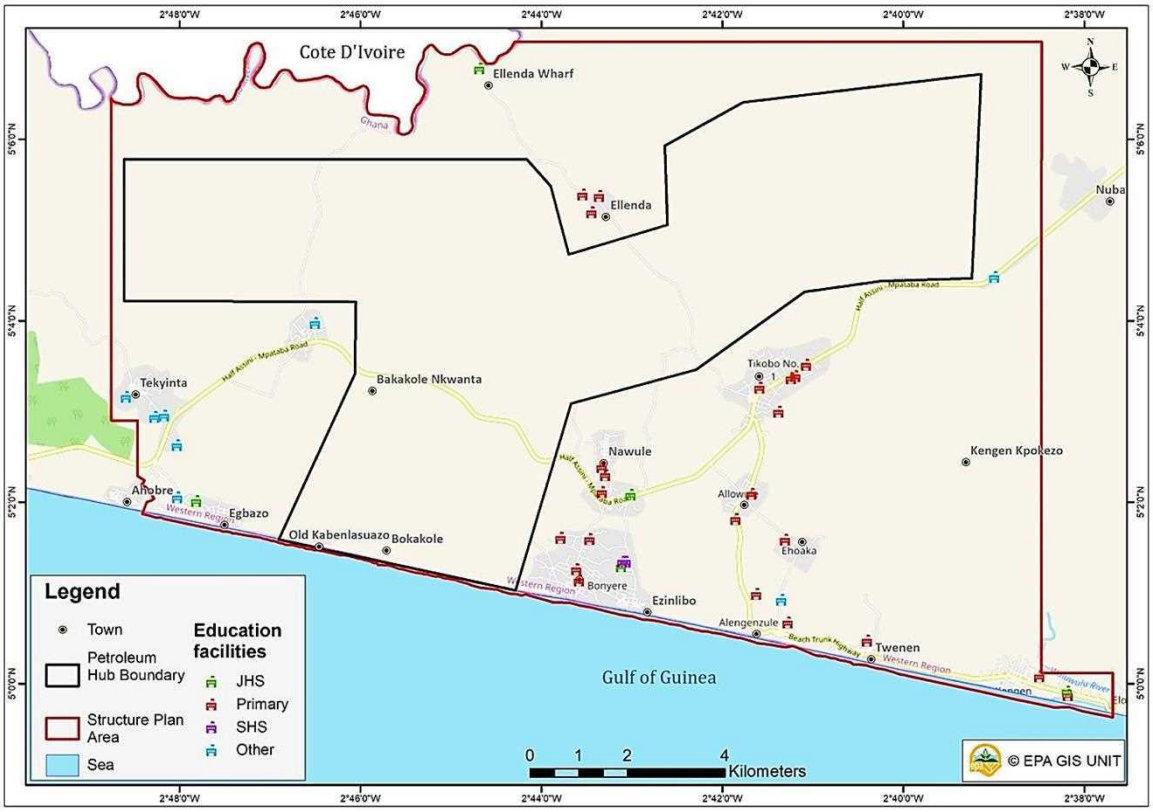
Source: EPA, 2021

Figure 4.7: Health Facilities within and around the Proposed Area

4.11.7.2 Education

There are two levels of education in the hub area: basic and secondary. In total, there are forty-three (43) basic schools with twenty-six (26) and seventeen (17) being private and public schools respectively. These are in sixteen (16) out of twenty-five (25) communities in the Hub area (Education directorate, Jomoro Municipal, 2020). The Annor Agjaye Senior High School (SHS) is the only secondary school in the Hub environs and is located to the east in Ezinlibo. There are no technical/ vocational or tertiary institutions in the area.

The Pupil Teacher Ratio (PTR) of KG, Primary and JHS are 19, 26 and 22 respectively. This compares with the national targets of 35, 35 and 18 respectively showing that the PTR for JHS in the Hub area is higher than the national target.



Source: EPA, 2021

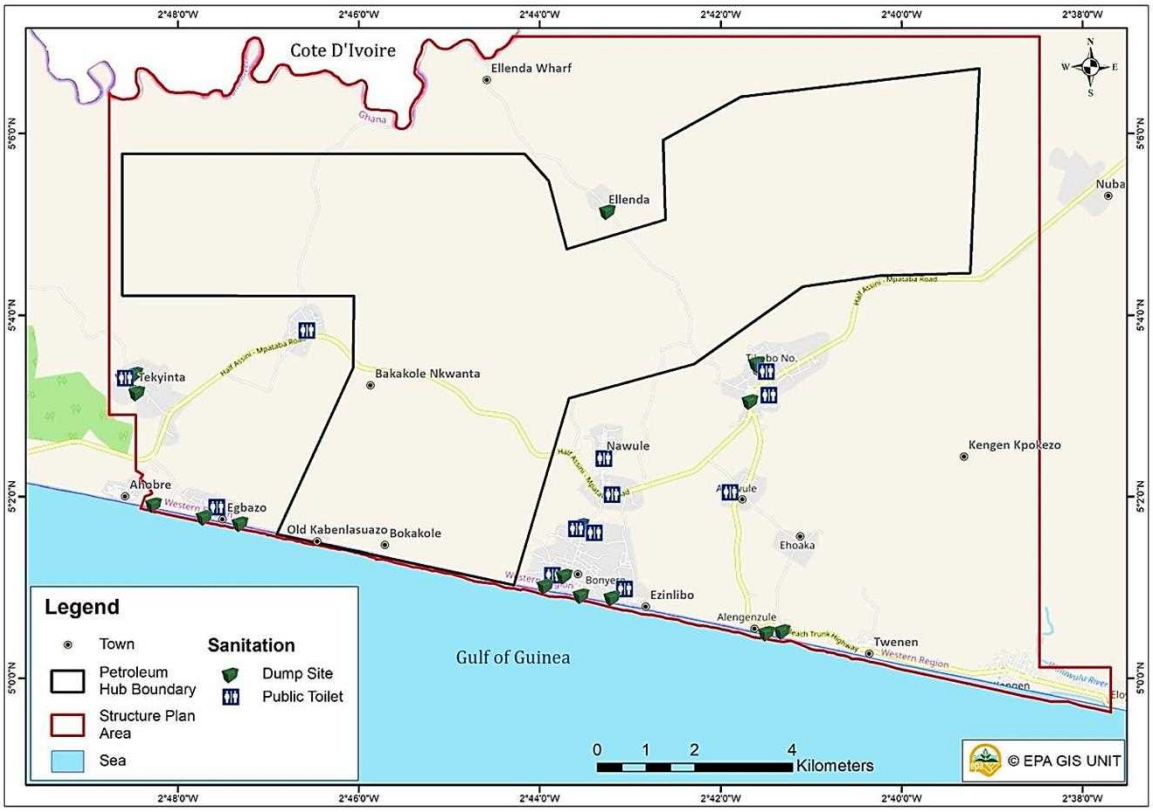
Figure 4.8: Educational Facilities within and around the Proposed Area

4.11.7.3 Water and Sanitation

About 32% of households have access to treated drinking water but from different sources. Piped water within the Hub area is scarce, with only 4% of households having access, with most households getting their supply from pipes outside the house (27.6 %), public taps (27%), or tube wells (11.6%). Other sources of drinking water in the municipality are boreholes (manual/mechanized), standpipes, overhead tanks, wells, streams, and small water town systems. The Community Water and Sanitation Agency (CWSA) and the Municipal Assembly supply and distribute water within the Jomoro municipality.

Jomoro municipality has the highest percentage (36.5%) of households without toilet facilities in the region. (Coastal Resources Centre, 2013 & GSS: 2000 Population Census). The mode of liquid waste disposal is by open surface and cesspits tanks. Liquid waste within the Hub area and its environs are not treated. It is normally sprayed quarterly on large-scale farms while others are disposed-off at Half Assini. The Municipality has no cesspit tank emptiers and hence employs the services of Zoomlion in disposing of liquid waste. Open defecation is an issue within the Hub area and its environs. Also, there is an absence of public toilets.

More than 60% of households in the municipality dump solid and liquid waste into open spaces. Generally, in rural communities, there are no refuse collection or waste bins, and the locals indiscriminately dispose-off waste.



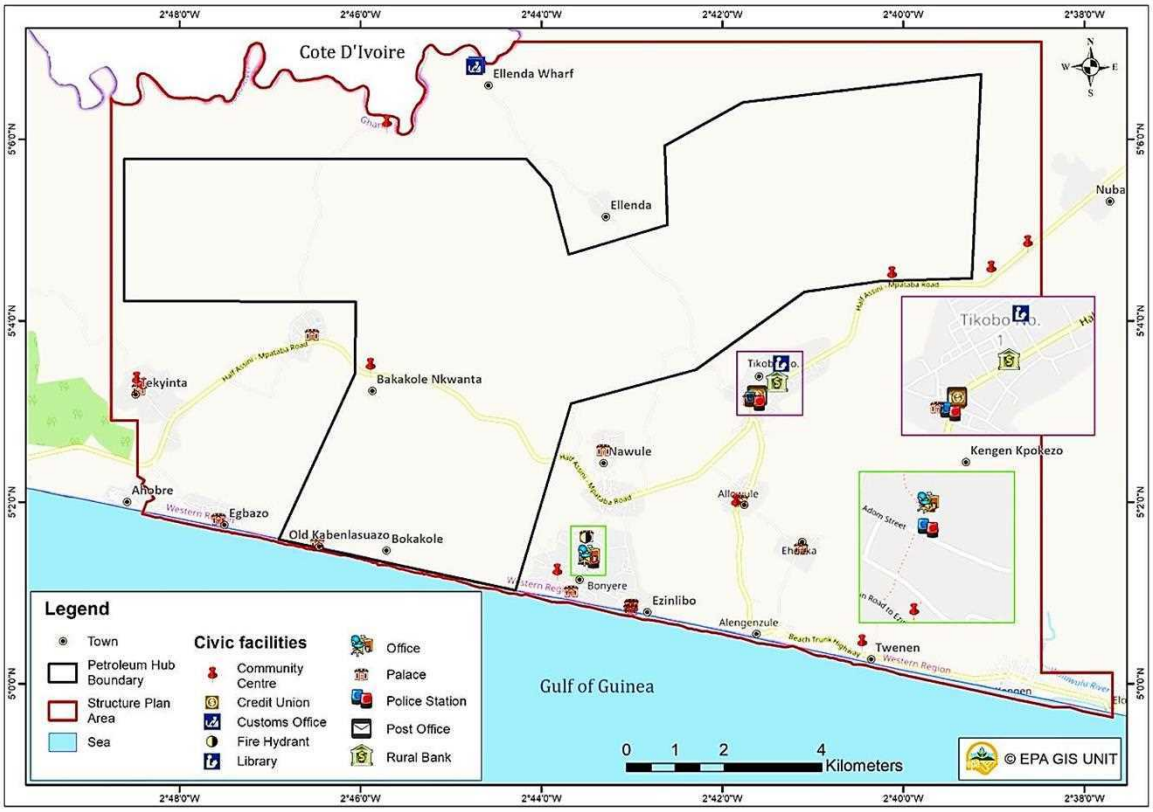
Source: EPA, 2021

Figure 4.9: Sanitation Map

4.11.7.4 Safety and Security

Coconut theft is the major crime reported in the Hub area and its environs. Other minor crimes include motorbike theft, assault, and chieftaincy-related assault, with Western Nzema being the hotspot for chieftaincy disputes. These crimes prevalent in the Hub area and its environs are also predominant in the Jomoro Municipality (LUSPA, 2020[20]). There is an existing police station in Tikobo No.1 and a police post at Western Nzema. Communities that do not have police stations or posts have neighbourhood watch groups. The police also augment the security of these communities by providing patrol services. The Ghana Immigration Service has surveillance posts at Newtown and Ellenda Wharf respectively. The rate of piracy increased from 16 in 2017 to 46 in 2018 with Ghana recording five incidents. The Ghana Navy has established two (2) posts in the Municipality comprising the Jawey Wharf and the Newtown posts.

[20] Land Use and Spatial Planning Authority (2020). Situational Analysis Report. Structure Plan For Ghana's Petroleum Hub. October 2020. Accra.



Source: EPA, 2021

Figure 4.10: Civic Facilities Map

4.12 Historical Oil and Gas Production/Abandoned Old Wells

According to the "Ghana Geological Survey Bulletin No. 40" (exploration for oil and gas in Ghana started in 1896 in the onshore Tano basin (Western Region). This was due to the presence of onshore oil and gas seepages found by early explorers in that area. During that period early wells were drilled without geological understanding and the benefit of seismic data. These wells were capped, however, oil seepages into the environment persist in these areas as observed by field visits[21]. The images below throw more light on the state of the oil wells. These have been categorized into three (3); capped oil wells, uncapped oil wells and areas with oil seepage.

Figure 4.11 shows a capped well in good shape. Figure 4.12 also indicates a capped well with water dripping from it. Figure 4.13 displays an uncapped oil well with oil deposits. The oil well is located at Bonyere and is 1km away from the coast stretching inland. Notably, the well is in proximity to the Domunli Lagoon (60m approx.). Figure 4.14 shows oil seepage on land in the forest. The oil was thicker than the one in the uncapped well in figure 4.13. Figure 4.15 indicates oil seepage on the prop roots of the mangrove stand along the Domunli Lagoon. Figure 4.16 shows a sheen of oil on the Lagoon

[21] https://www.ghanapetroleumregister.com/phase-1.

4.12.1 Capped Oil Wells

Figure 4.11: Capped oil wells in good condition at New Kabenlasuazo

Figure 4.12: Capped oil wells with water leakage at Bonyere.

4.12.2 Uncapped Oil Wells

Figure 4.13: Uncapped Oil well with oil deposits

4.12: Areas with oil seepage

Figure 4.14: Oil seepage on land

Figure 4.15: Oil seepage on the prop roots of a mangrove stand

Figure 4.16: Sheen of oil on the Donmuli Lagoon

4.13 Limitations & Ethical Considerations

One of the limitations of the baseline study was the issue of data gaps, particularly in terms of the various reference dates for key data and information considered. The reference year for most of the data sources was 2015, with a few outliers from 2013 and 2020 respectively. Accordingly, reference was made to each reference year and will be monitored.

In terms of ethical considerations, the baseline study ensured the voluntary participation of all stakeholders, particularly at the national, district and community levels. They were also assured of confidentiality and anonymity as per the Data Protection Act.

CHAPTER 5

DEVELOPMENT OF ISSUES REGISTER

5.1 Introduction

The development of issues for the SEA was compiled through a systematic process guided by the four (4) pillars of sustainability (i.e., natural resources, socio-cultural, economic, and institutional). All the issues generated relate to the implementation of the Petroleum Infrastructure Masterplan (PIMP). These issues were gathered from various activities including desktop reviews, expert judgement, scenario development and analysis, and stakeholder consultations.

The chapter presents information on the nature of the issues generated from these activities and the development of an Issues Register. Figure 5.1 shows the framework for the development of the Issues Register for the SEA of the PIMP.

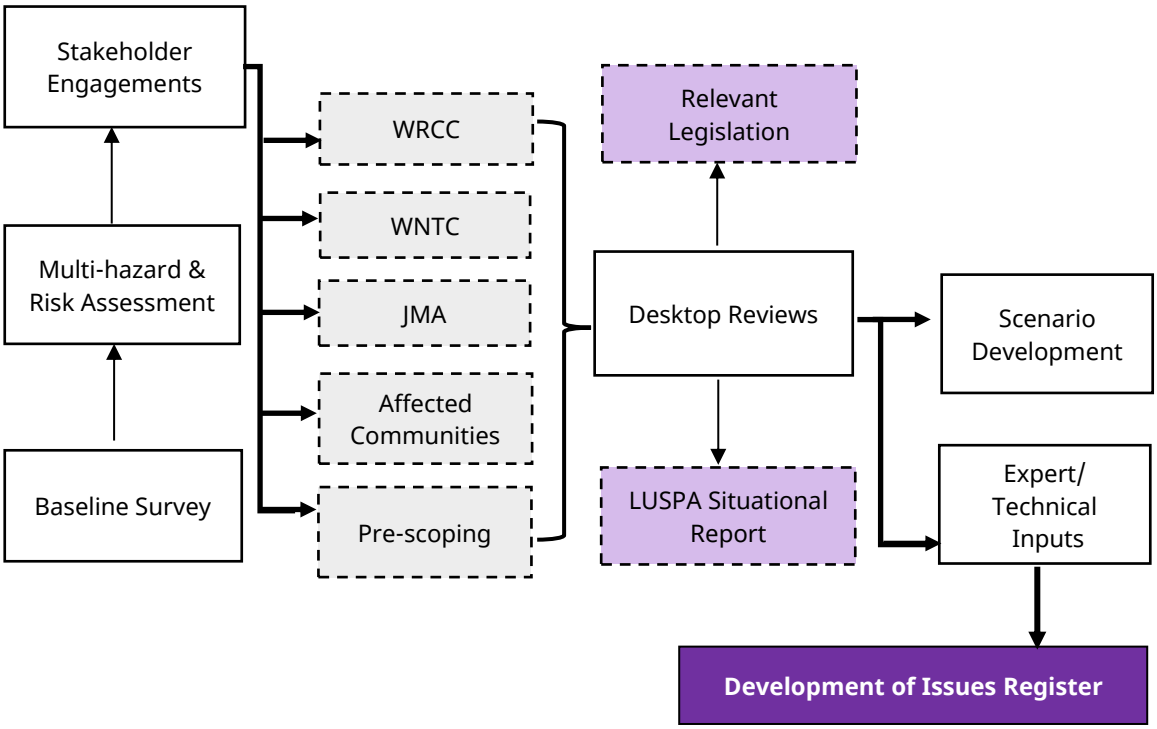


Figure 5.1: Framework for the development of the Issues Register

5.2 Stakeholder Engagements

Several issues were identified during engagements held with relevant stakeholders of the Petroleum Hub development. These engagements include the municipal consultations, held at the Jomoro Municipal Assembly (JMA), community consultations which took place at the Tenack Beach Hotel, Benyin and the SEA Kick–Off/Pre-scoping Workshop held at the Movenpick Ambassador Hotel in Accra.

Various issues and concerns expressed at these stakeholder engagements and review of the LUSPA Situational Report are provided in Table 5.1, 5.2, 5.3 and 5.4.

Table 5.1: Issues from Municipal Consultations, Half Assini

Natural Resources	Socio-cultural	Economic	Institutional
1. Mineral Deposits: The possibility of over-concentrating on the PHub to the disadvantage of the mineral deposits and its related activities in areas such as Nawule to Kabenlansuazo 2. Biodiversity Loss Habitat and Ecosystem Services Loss (oil spill, reclamation of wetlands, flooding) 3. Interruption in the management of surface water resources in the planned area 4. Groundwater pollution. 5. Waste Management Issues (because of pressure on the existing community waste disposal system	1. In-Migration & Migration 2. Increase in social-vices due to in-migration (e.g., prostitution, cultural adulteration, pressure on existing health facilities, inadequate basic infrastructure 3. Likelihood of haphazard and uncontrolled development 4. Health and safety issues (public and occupational health and safety) 5. Traffic Impact/Management (road congestion, accidents, and dust pollution) 6. High expectations of locals regarding social infrastructure development and employment opportunities 7. Challenges with	1. Impact on fishing activities (due to limited access) 2. Conflict in land use priorities (impact on the activities of the coconut industry) 3. Inadequate capacity (skills and knowledge) of the youth 4. Likelihood of abandonment of current livelihoods (farming) for Hub activities (Dutch Disease). 5. Increased/High cost of living 6. Limited alternative livelihood support and compensation schemes 7. Increased revenue generation for the government 8. Poverty Reduction (through job creation) 9. Partial implementation of the Local Content	1. Pressure on existing socio-economic institutions. 2. Low institutional capacity to deal with land conflicts and possible litigation (due to weak land tenure and land acquisition systems). 3. Weak Institutional Coordination and Collaboration (amongst institutions, the community, local & national security apparatus, GPHA and the PHub Port and the Assembly controlling haphazard development). 4. Inadequate capacity of institutions to regulate the

Natural Resources	Socio-cultural	Economic	Institutional
due to in-migration-community waste and commercial waste). 6. Climate Change Issues: (Increased GHG emissions and acid rain could cause soil infertility, displacement of people due to rising sea levels, and weather patterns negatively impacting farms. 7. Land degradation (sand winning, compacting of soil, accidental spills, and erosion due to removal of vegetation). 8. Impact on the aesthetic view of the area.	land acquisition processes 8. Worsening access to education (basic school and technical university, establishment of universities) 9. Resettlement Issues (resistance to resettlement due to impact on socio-cultural activities (e.g., relocation of existing shrines) 10. Traffic Management: Provision of tarred roads within the PHub area 11. Gender and Disability (PWD & vulnerable groups not engaged adequately and potential gender bias)	Law	industry and the public (social vices, piracy). 5. Spatial and Land use Issues (impact on the structural plan of the Jomoro Municipality/Bonyere Enclave). 6. A threat to the existence of NGOs and their activities in the conservation of plants and animals

Table 5.2: Issues from Community Consultations, Tenack Beach Hotel – Benyin.

Natural Resources	Socio-cultural	Economic	Institutional
1. Land degradation from the destruction of farms and fertile lands, cutting down of trees, and coastal erosion. 2. Loss of Biodiversity 3. Pollution of Water resource 4. Air pollution from the dusty untarred roads and the	1. Health and Safety 2. Increased population because of migration to the Hub could put pressure on existing health facilities. 3. Accidents from the movement of heavy equipment to the petroleum hub area. 4. Land Ownership and acquisition.	1. Local Economy will be affected including the increase in rent and land price 2. Inadequate technical capacity of locals to obtain employment in the hub project. 3. Loss of livelihoods 4. Participation of indigenes 5. Possible increase	1. National and public security – crime rates would increase. Both communities do not have a police station to handle the increasing crime rates 2. Institutional coordination and capacity – inadequate coordination

Natural Resources	Socio-cultural	Economic	Institutional
generation of dust from heavy-duty trucks and the movement of equipment 5. Climate change (Possible flooding, rise in sea level, Changes in rainfall pattern and microclimate would be affected) 6. Integrated Waste Management: The use of the shores/beaches as places of convenience due to inadequate toilet facilities 7. Increased waste generation coupled with open dumping of solid waste	5. Possible land conflicts between government, chiefs, original landowners, and communities. 6. Access to electricity, health, potable water, and other social amenities. 7. Poor road infrastructures will increase traffic because of the increase in more people coming into the area. 8. Gender and Disability	in poverty and inequality due to inappropriate compensation and lack of alternative livelihoods 6. Increase in Cost of Living 7. Reduction in Agriculture production (cash crops such as coconut, cocoa, palm, rubber plantation and medicinal herbs, fish).	between the various institutions regulating activities within the enclave 3. Spatial and land-use planning – some portions of the land to be acquired for the PHub would affect the existing layout of the area 4. Inadequate training programmes to support locals, especially the youth to obtain jobs within the petroleum hub enclave 5. Education and Awareness creation on the project

Table 5.3: Issues from Kick Off/Pre-scoping workshop, Movenpick Hotel – Accra

Natural Resources	Socio-cultural	Economic	Institutional
1. Pollution of water bodies 2. Destruction of aquatic life in the wetlands and rivers (freshwater ecosystem, etc.) 3. Destruction of Biodiversity-flora and fauna (i.e., mangroves, lagoons, coconuts, loss of	1. Loss of cultural heritage sites (graves, fetish grooves, etc.) 2. Loss of current livelihood opportunities (i.e., fishing, farming, etc.) 3. Increase in social vices (i.e., teenage pregnancy, etc.)	1. Creation of Jobs 2. Job losses (i.e., loss of some traditional economic activities of the indigenous people, etc.) 3. Impact on the national and local economy (i.e., cultivation of food crops may be affected	1. Potential civil unrest that can disrupt and delay planned activities due to unresolved community/ local concerns including payment of compensations 2. Lack of institutional collaboration

Natural Resources	Socio-cultural	Economic	Institutional
ecosystem services, marine turtles, marine habitats, migratory & resident birds, medicinal plants) 4. Air pollution (Particulate Matter, Gaseous emissions, etc.) 5. Noise pollution 6. Climate change-related issues (sea level rise, flood risks, gaseous	4. Rapid urbanization 5. Preparedness and acceptance of alternatives livelihoods by local people 6. Safeguarding the livelihoods of local people as the influx of migrants for work 7. The influx of foreign culture, i.e., cultural dilution	leading to low production in the local economy, increase in government revenue, foreign direct investments, increased in local trade volumes, etc.) 4. Increase in property and land values 5. Improvement in social infrastructure (i.e., communication, roads, schools, etc.	(i.e., GPHA and other Port facilities) 3. Improved access by local communities to sub-contracts, employment, scholarships, transfer of knowledge, etc. 4. Improvement in the downstream petroleum sub-sector

Table 5.4: Issues from the LUSPA Situational Report

Natural Resources	Socio-cultural	Economic	Institutional
1. Coastal erosion 2. Flooding 3. Threat to livelihoods of artisanal coastal settlements such as fishing and coconut farming in the SPA 4. Coastal vulnerability to climate-related hazards such as the sea-level rise and shoreline erosion in the coastal settlements in the SPA. 5. Threatens coastal nesting habitats for marine turtles. 6. Risk tourism /hospitality industry	1. Inadequate logistics (medical supplies) 2. Seasonal increase (fishing season) in the population due to migration puts pressure on the health facilities 3. OPD attendance decreases 4. Inadequate health personnel. 5. No access to Health facilities in their area 6. Indiscriminate disposal of waste 7. Bad condition of health facilities	1. Limited job opportunities 2. Lack of supervision by the circuit supervisors due to inadequate funding and motorbikes	1. Inadequate personnel, logistics, accommodation, and incentives have affected the effective delivery of safety and security services in the SPA. 2. Marine surveillance through the establishment of the FOB in the SPA will consolidate the security of

Natural Resources	Socio-cultural	Economic	Institutional
in the SPA.	and staff quarters 8. Inadequate health infrastructure in the health facilities 9. Absence of ambulance stations in the Structure Plan Area 10. Lack of ICT laboratories in 13 out of 17 public basic schools 11. Lack of 12. accommodation for teachers in some communities 13. Inadequate trained teachers at the JHS level 14. Inadequate toilet and water facilities in the basic schools. 15. Inadequate logistics and office space for administrative work 16. Inadequate access to potable water 17. Nonfunctioning regular breakdown of some water facilities 18. Lack of management of the water facilities 19. Irregular flow of water supply		investment and development in the Ghana Petroleum Hub enclave. 3. Inadequate office space for Security Personnel in the SPA. 4. Lack of accommodatio n for Security Personnel in the SPA

Natural Resources	Socio-cultural	Economic	Institutional
	(Water scarcity in some of the communities) 20. Pollution of water bodies (River Tano) by the activities of illegal mining upstream 21. Poor drainage in the community due to its hilly nature 22. Encroachment of land earmarked for dumping sites 23. Inadequate toilet facilities in institutions like education and health facilities 24. Limited access to household toilet facilities 25. Indiscriminate disposal of waste 26. High rate of open defecation in some of the communities 27. Limited behavioural change, communication, and education on sanitation 28. Increase in the generation of waste due to increasing population in urban areas and market centres 29. Poor mobile network connectivity in the rural communities		

Natural Resources	Socio-cultural	Economic	Institutional
	30. Low access to computers in the SPA 31. Low internet patronage in the SPA 32. Non-functioning important civic facilities such as the post office and library in the SPA 33. Lack of Durbar Grounds cultural activities 34. The peaceful co-existence of religious groups in the SPA fosters a stable environment for investment 35. Lack of local sports facilities in 18 out of the 23 settlements in the SPA 36. Underdeveloped existing sports and recreational facilities in the SPA 37. The presence of cemeteries along the beaches in the SPA 38. Population influx and the propensity for informal settlement development 39. Poor quality of existing housing stock 40. Insanitary Housing		

Natural Resources	Socio-cultural	Economic	Institutional
	Conditions in most rural and urban communities 41. The poor condition of roads e.g., Tikobo No 1. 42. The transport system within this predominantly rural SPA is geared towards vehicular traffic at the expense of other modes of transport like motorcycles, bicycles, and walking. 43. An underdeveloped water transport system		

5.3 Scenario Development

The development of scenarios is used to facilitate discussions leading to the identification of issues related to the potential risks and opportunities associated with the development of the Petroleum Hub. The scenarios describe planned developments within the Hub based on parameters derived from available information. Several assumptions were made in the development of scenarios. The assumptions were categorized into favourable and unfavourable in Table 5.5.

Table 5.5: Assumptions underlying the Development of Scenarios

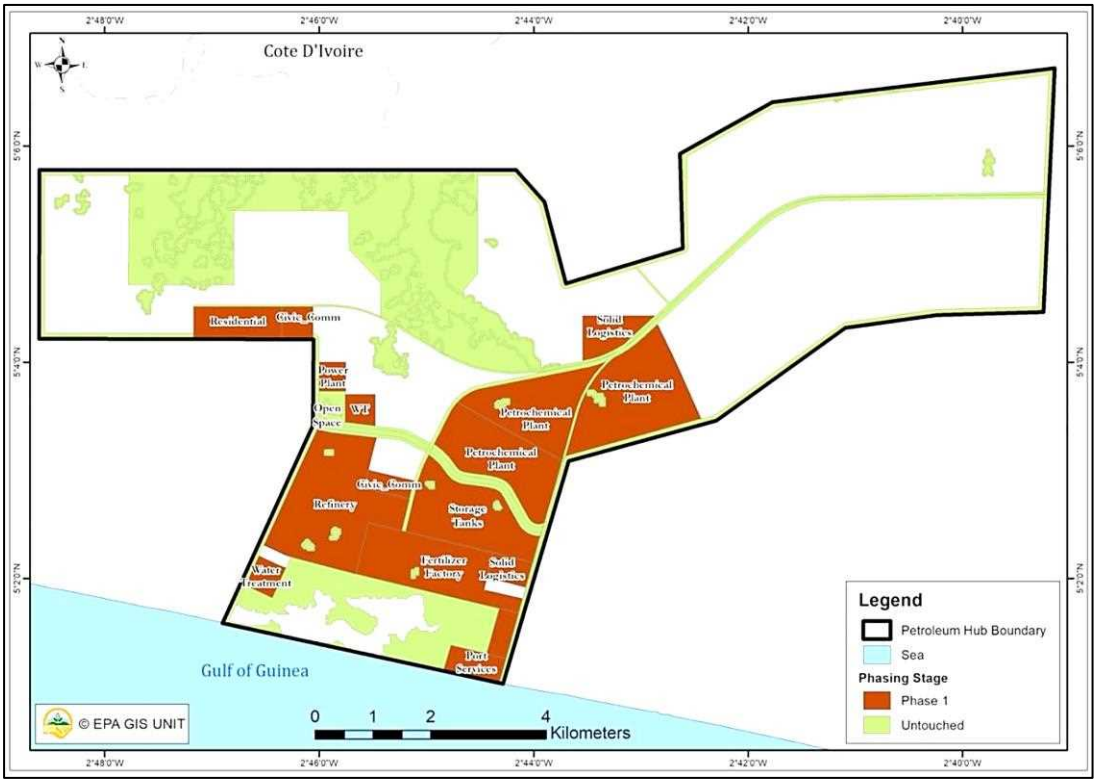
Favourable Assumptions	Unfavourable Assumptions
• Political stability • Favourable/preferred investment destination • Adequate and well-defined legal and regulatory framework • Independent judicial system • Availability of litigation-free land • Availability of labour force • Adequate Security	• Shifting investments from hydrocarbons to renewal energies • Low oil and gas prices • Potential transboundary conflicts • The risk of flooding, fire, and explosion • Potential regional threats (terrorism, civil strife, etc.) • Global health threats (COVID-19 Pandemic, HIV, etc.)

5.3.1 Scenario 1 – Low Development ("Breaking Grounds")

This scenario focuses on initial infrastructure development which captures the initial phase of the Petroleum Hub development. Key infrastructure considered in scenario 1 includes the following:

- Storage Tanks
- Oil Refinery
- Petrochemical Plants
- Jetty and Port Infrastructure

Jetty and port facilities with multiple berths will be constructed in Scenario 1. It will connect supply vessels to transmission pipelines which will feed into an initial storage facility with 1,000,000 m^3 capacity and a 300,000 bpsd capacity refinery. The pipelines will also supply three (3) petrochemical plants with a feedstock of 450, 155 and 434 mmscfd of natural gas respectively. Other key activities considered in this scenario also include the construction of a fertilizer factory, the development of transmission and storage infrastructure for sub-region, realignment of high-tension lines, utility facilities, and other infrastructure including roads, residential, commercial, waste, power, and other facilities. Scenario 1 is illustrated in Figure 5.1. The potential opportunities and risks associated with Scenario 1 are presented in Table 5.6.



Source: EPA, 2021

Figure 5.1: Scenario 1 - Low Development ("Breaking Grounds")

Table 5.6: Opportunities and Risk Analysis for Scenario 1

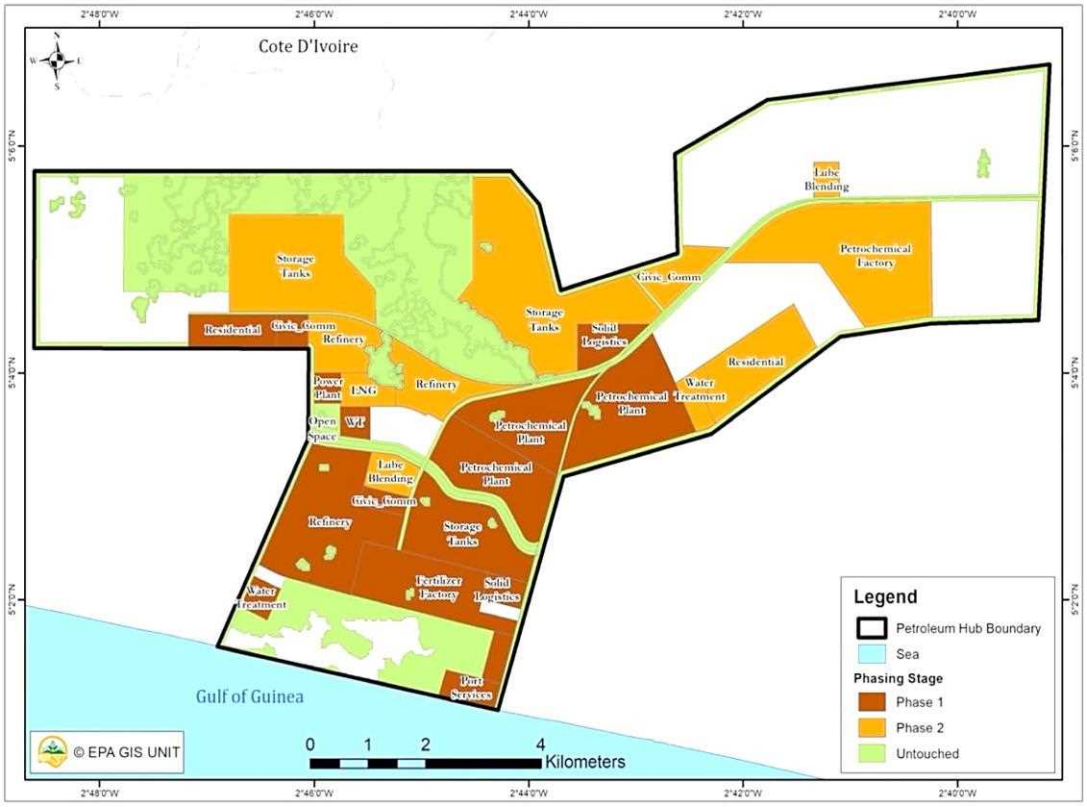
Natural Resource	Economic	Socio-cultural	Institutional
1. Loss of biodiversity 2. Deterioration of air quality 3. Pollution (noise,water, and land) 4. Visual intrusion 5. Hazard risks (Flooding, fire, andexplosion) 6. Oil spills andleakages 7. Discharges i.e.,ballast water 8. Invasive Alienspecies, etc.	1. Job creation 2. Revenue to GoG 3. Economic displacement 4. Compensation challenges	1. Improved infrastructure 2. In-migration 3. Transmission of communicable diseases 4. Food insecurity 5. Land use conflict 6. Management of expectations	1. Skills and technology transfer 2. Security 3. Waste management

5.3.2 Scenario 2 – Medium Development ("Home Stretch")

This scenario focuses on the 2nd phase of the Petroleum Hub development and further incorporates the assumptions of Scenario 1. Key infrastructure in this scenario includes:

- LNG (Onshore) Infrastructure
- Lube Blending Plant

Scenario 2 - Medium Development consists of the construction of an additional 300,000bpsd capacity refinery, a petrochemical plant with a processing capacity of 1 million tonnes per year (MTPY), and storage tanks of 4,000,000m3 capacity. Jetty and port facilities will also be constructed to link the supply vessels to these facilities. Additionally, an LNG (onshore) infrastructure, a lube blending plant, and other infrastructure including roads, residential, commercial, and other facilities. Scenario 2 is illustrated in Figure 5.2. Table 5.7 presents the potential opportunities and risks associated with Scenario 2.



Source: EPA, 2021

Figure 5.2: Scenario 2 – Medium Development ("Home Stretch")

Table 5.7: Opportunities and Risk Analysis for Scenario 2

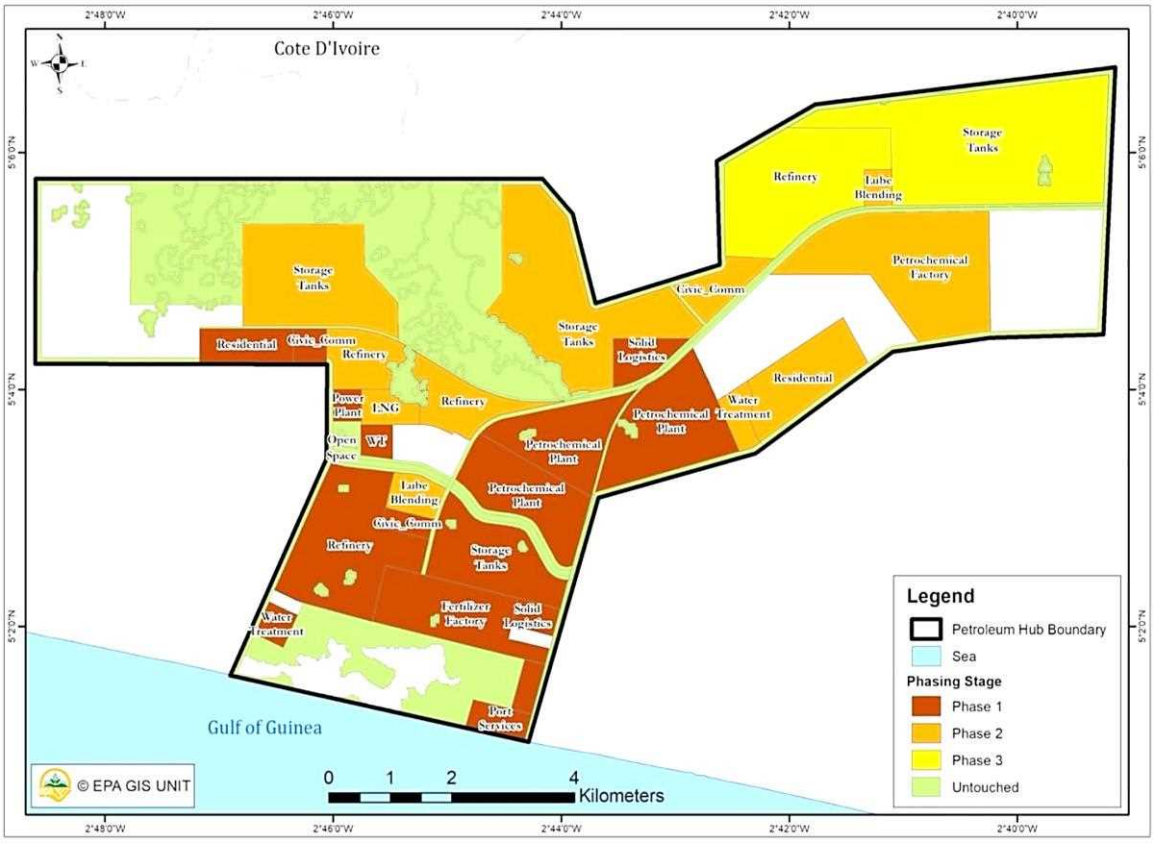
Natural Resource	Economic	Socio-cultural	Institutional
1. Loss of biodiversity 2. Deterioration of air quality 3. Pollution (noise, water, and land) 4. Visual intrusion 5. Hazard risks (Flooding, fire, and explosion) 6. Oil spills and leakages 7. Discharges i.e., ballast water 8. Invasive Alien species, etc.	1. Job creation 2. Revenue to GOG 3. Improved Intra regional trade 4. Economic displacement 5. Compensation challenges	1. Improved infrastructure 2. In-migration 3. Transmission of communicable diseases 4. Food insecurity 5. Land use conflict 6. Management of expectations	1. Skills and technology transfer 2. Security 3. Waste management

5.3.3 Scenario 3 – High Development ("Crossing the Finish Line")

This scenario focuses on the 3rd phase of the Petroleum Hub development and further incorporates the assumptions of Scenarios 1 and 2. Key infrastructure that characterizes scenario 3 includes:

- Oil Refinery - 300,000 bpsd capacity
- Storage Tanks - 5,000,000 m^3 capacity
- Other infrastructure including roads, residential, commercial, and other facilities

Scenario 3 – High case development involves the construction of one (1) more refinery of 300,000bpsd and further storage infrastructure of 5,000,000 m^3 bringing the total storage infrastructure in the Hub to 10,000,000 m^3. Other auxiliary infrastructure such as a new power plant as may be required following the needs of the Hub enclave. Scenario 3 is illustrated in Figure 5.3. Table 5.8 presents the potential opportunities and risks associated with Scenario 3.



Source: EPA, 2021

Figure 5.3: Scenario 3 – High Development ("Crossing the Finish Line")

Table 5.8: Opportunities and Risk Analysis for Scenario 3

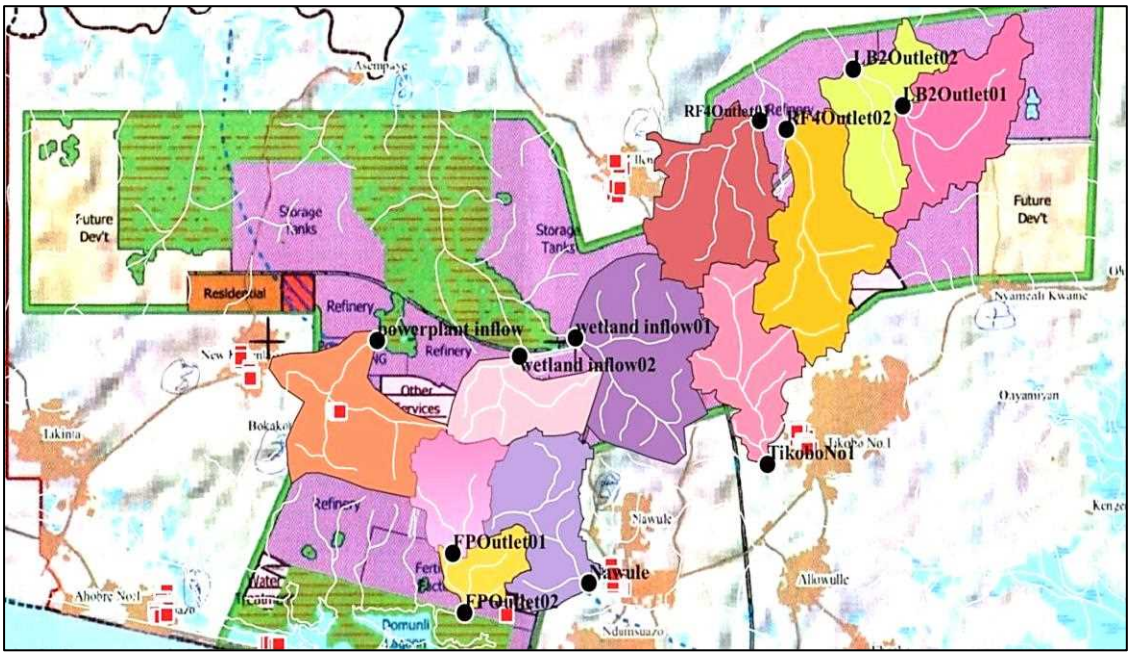
Natural Resource	Economic	Socio-cultural	Institutional
1. Loss of biodiversity 2. Deterioration of airquality 3. Pollution (noise, water, and land) 4. Visual intrusion 5. Hazard risks (Flooding, fire, andexplosion) 6. Oil spills and leakages 7. Discharges i.e., ballastwater, 8. Invasive Alien species, etc.	1. Job creation 2. Revenue to GoG 3. Improved Intra-regional trade 4. Economic displacement 5. Compensation challenges 6. Risk to the local economy (i.e., fishing, livestock, and coconut industry)	1. Improved infrastructure 2. In-migration 3. Transmission of communicable diseases 4. Food insecurity 5. Land use conflict 6. Management of expectations	1. Skills and technology transfer 2. Security 3. Transboundary conflicts 4. Maritime traffic 5. Waste management

5.4 Multi-Hazard Implications of Scenarios

The multi-hazard analysis of the proposed area includes flood hazard assessment, the impact of a sea level rise, earthquakes, fire, and the cumulative impacts of air pollution.

5.4.1 Flood Hazard Assessment

The proposed site for the development of the Petroleum Hub is drained by several streams (Figure 5.4). Eleven (11) outlets of the various streams were created based on the proposed land use base map developed by the Land Use and Spatial Planning Authority (LUSPA).



Source: EPA, 2021

Figure 5.4: Extracted drainage network of the site with outlets (black dots) at potential flood zone areas

A small catchment with an area of 1.89 square kilometres and a longest flow path length of 2. 258 kilometres (Figure 5.5) which drains an area near the proposed site for the fertilizer factory was extracted for detailed hydrologic and hydraulic modelling. Runoffs from a 50-year return period rain depth of 245.31 mm of the catchment were modelled under three development scenarios: Existing Conditions (EC)/No development with zero impervious surfaces, Partial Development (PD) with 30% impervious surface, and Fully Developed (FD) with 72% impervious surface (Figure 5.6).

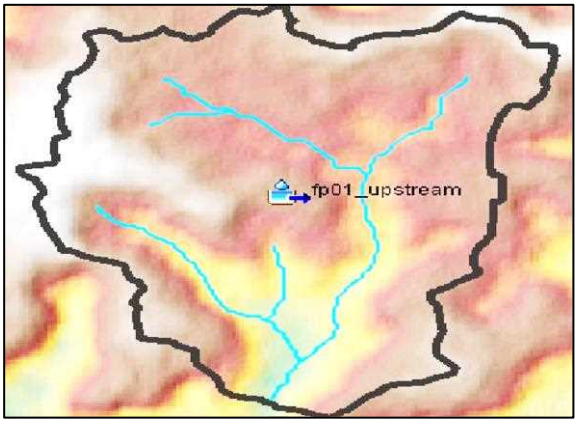
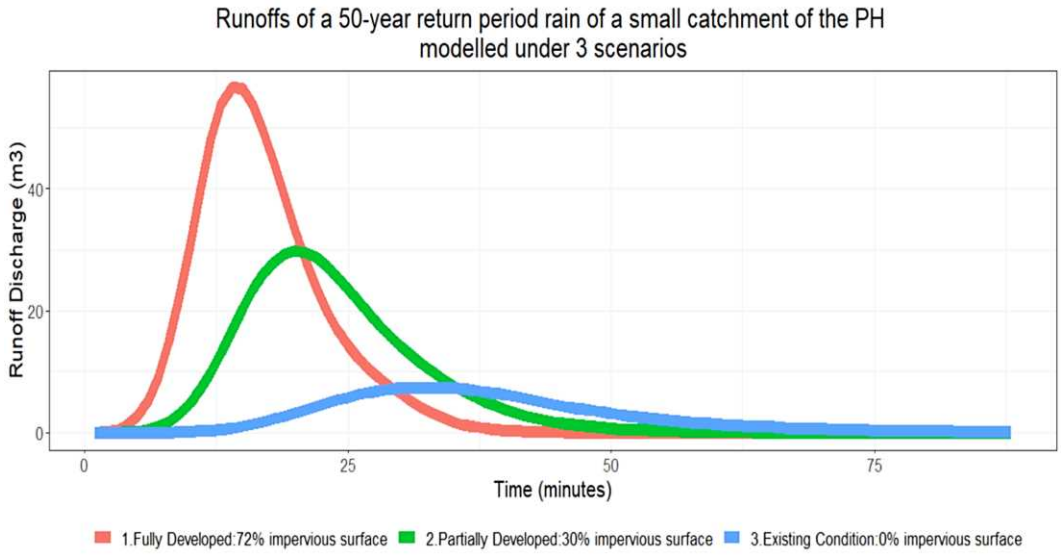


Figure 5.5: A small catchment which drains an area near the proposed site for the fertilizer factory

The runoffs generated from a 50-year return period rain depth of 245.31 mm peaked at 7.4 m3/sec for scenario 1, 29.8 m^3/sec for scenario 2, and 56.5 m3/sec for scenario 3, at 31. 20 and 14 minutes for a 3-hour storm (Table 5.1). There is a significant increase in runoff discharge when the catchment is developed with a more impervious surface, which can lead to flooding downstream. The 3 scenarios considered above were used in a hydraulic modelling system to assess the potential impact of flood hazards. The areas that can be impacted under the 3 scenarios of development are delineated by the outputs of the hydraulic models (Figures 5.7 – 5.9).



Source: EPA, 2021

Figure 5.6: Runoffs generated from simulation of a 50-year return period Rainfall Depth of 245.31 mm of the Scenarios

Table 5.1: Runoffs peaks and time of the Development Scenarios

Parameter	Scenario 1	Scenario 2	Scenario 3
Peak flow (m^3)	7.4	29.8	56.5
Time of peak flow (minutes)	31	20	14

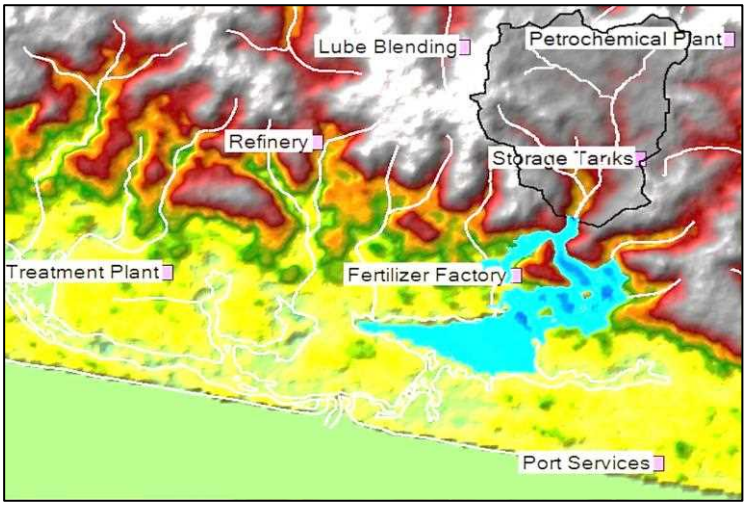


Figure 5.7: Flood Hazard Map of a 50-year return period rainfall depth of 245.31 of the No Development Scenario

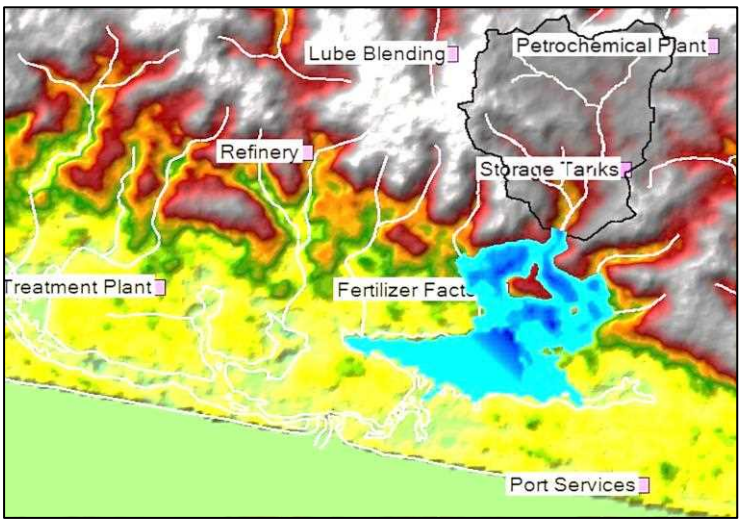


Figure 5.8: Flood Hazard Map of a 50-year return period rainfall depth of 245.31 of the Partial Development (30% Impervious Surface) Scenario

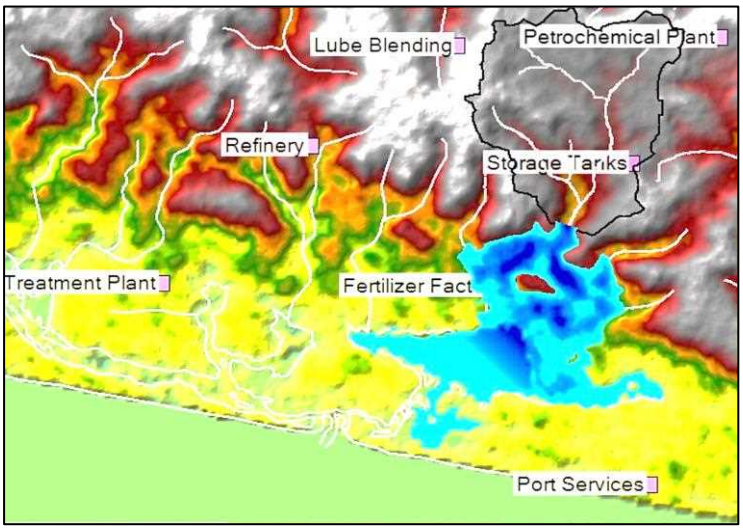


Figure 5.9: Flood Hazard Map of a 50-year return period rainfall depth of 245.31 mm of the Full Development (72% Impervious Surface) Scenario

5.4.2 Assessment of Impact of Sea Level rise

Participatory GIS hazard mapping was conducted in eight (8) communities in the area to elicit from them their experiences with the environmental hazards being assessed. The communities surveyed included: New Kabenla Suazo, Ellenda, Old Kabenla Suazo (coastal community), Western Nzema, Tikobo No. 1, Egbazo (coastal community), Ndumsuazo, and Bokakole Nkwanta (Table 5.2). A total of One Hundred and Twenty-Five (125) respondents were asked if they have had flooding in their communities, the extent of flooding, level of flooding, percentage damage caused, threats of tidal waves, conflicts, and other hazards in their communities. This was undertaken to validate the output of the hydrologic and hydraulic models.

Table 5.2: Distribution of Respondents among the Eight (8) Communities which participated in the GIZ Hazard mapping Survey

ID	Community	Respondents	Recent flood	Other floods	Tidal Waves	Other hazards	Conflicts
1	New Kabenla Suazo	19	14	12	0	4	0
2	Ellenda	19	9	8	0	10	0
3	Old Kabenla Suazo	16	6	5	8	1	0
4	Bonyere	15	0	8	0	4	0
5	Tikobo No. 1	20	4	6	0	6	0
6	Egbazo	18	7	6	6	11	0
7	Ndumsuazo	11	2	2	0	2	0
8	Bokakole Nkwanta	7	0	0	0	1	0

Tidal waves appear not to be a major problem in the proposed site based on the interaction with the coastal communities and the site visit of the team during high tide. A digital terrain model of ground resolution 12 m by 12 m obtained from the GIS unit of the Agency was used to simulate potential areas of the proposed site which will be threatened by floods under extreme events such as a tsunami or very strong storm surge. One scenario of these events is triggered by a tsunami or extreme storm where the sea level could rise to 8 m, The areas of the site which will be affected under the above scenario were modelled using Geographic Resources Analysis Support System (GRASS) GIS software.

Running the algorithm, the system searches for areas which will be inundated based on the background digital elevation model (DEM) data. The areas that are vulnerable under the scenario were delineated and overlaid on the shaded relief map of the proposed site (Figure 5.10).

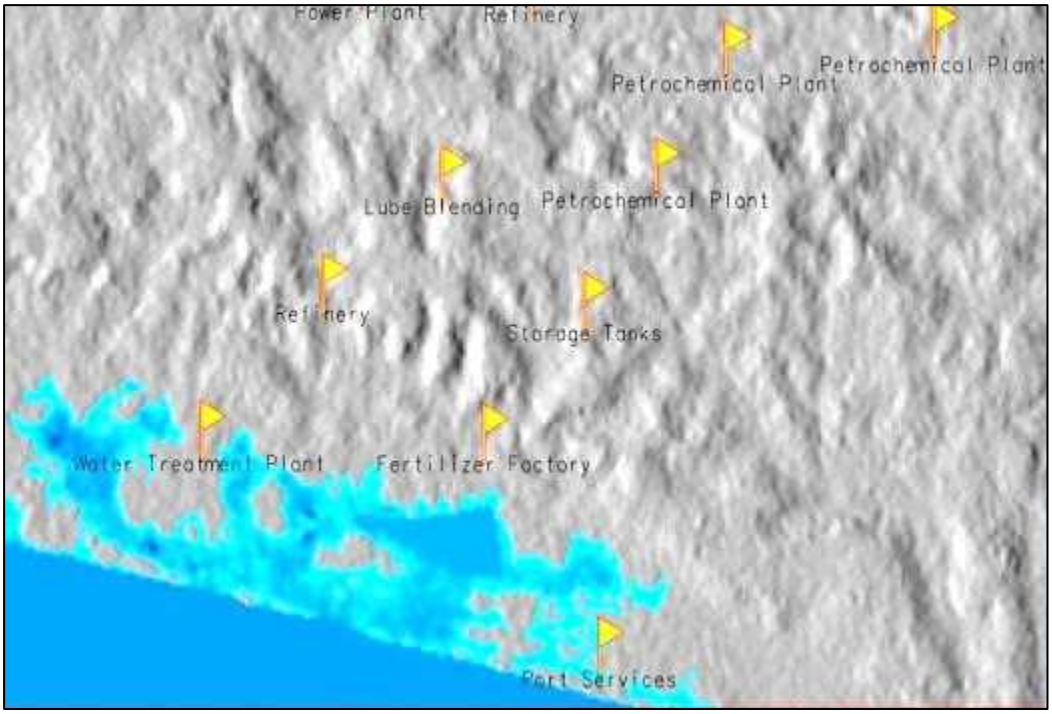


Figure 5.10: Areas which could be flooded under very high sea level rise generated by causes such as a tsunami or strong storm surge

5.4.3 Assessment of Earthquake Hazard

Three Hundred and Eighty-Six (386) years' record of seismic activities in the entire country was obtained from Ghana Geological Survey Authority (GGSA) and was used in the Earthquake hazard assessment of the proposed site. The first record of seismic event occurred on 18th December 1635 at Axim near the proposed site with a magnitude of 5.7 on the Richter scale to the current event which occurred on 12th June 2021 offshore of Bortianor with a magnitude of 3.7 on the Richter Scale. Peak Ground Acceleration (PGA) of the seismic activities was computed by GGSA and presented as a seismic zonation map of the proposed site (Figure 5.11).

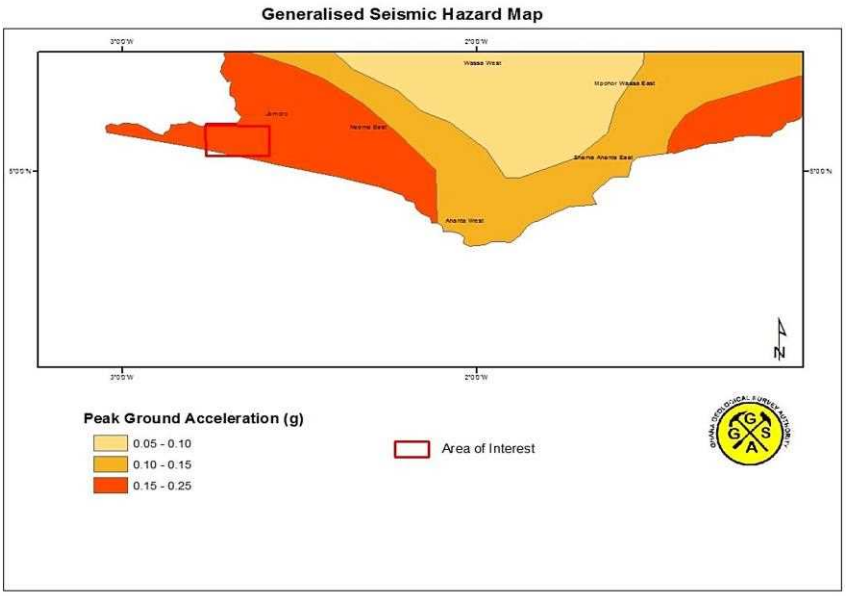


Figure 5.11: Earthquake Peak Ground Acceleration Zonation Map

5.4.4 Fire Hazard Assessment

Radiant heat flux to a target is defined as the amount of heat radiation received by a target located at a distance from the source of the fire. The high value of heat flux could damage the target or trigger another fire. Locations of flammable materials in respect of each other are therefore crucial in fire management. Two fire scenarios (pool fire, which could occur due to accidental spillage) and the explosion of a storage facility of Liquified Petroleum Gas with combustion heat energy of 46, 000 kJ/kg were assessed.

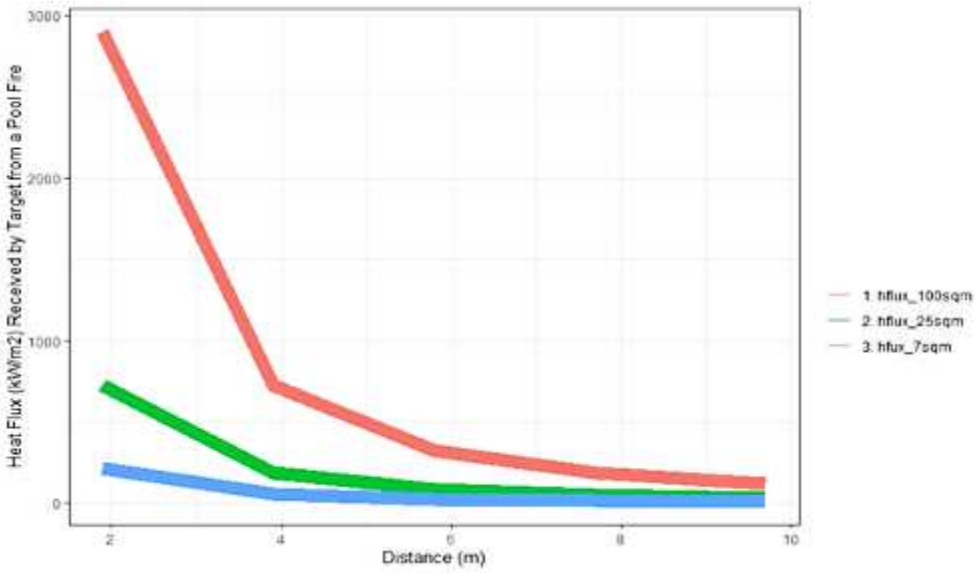


Figure 5.12: Heat flux received by a target at a distance from the source of pool fire from a Liquified Petroleum Gas (LPG)

In the case of the pool fire scenario, three sub-scenarios namely: pool fire areas of 10, 25, and 100 square meters were modelled. Outputs of the pool fire scenarios suggest that a huge amount of heat energy is released from a pool fire source but decays abruptly with distance (Figure 5.12).

Approximately 3000 kW/m2 of heat energy is received by a target located at the source of fire for a pool fire scenario covering an area of 100 square meters but decreases to less than a 1000 kW/m2 for a target located just 4 meters away from the source of fire

For the case of the LPG explosion scenario, three sub-scenarios were drawn from the proposal of the Petroleum Hub final document. In that document various volumes of eight petroleum products (Crude, LPG, LNG, Naphtha, Gasoline, Gasoil, Kerosene, ATK), were targeted for the various phases of development at the proposed hub. A worst-case scenario of all the stored products being an LPG was assumed for the explosion hazard assessment:

Phase 1

Storage facility of 1000000 m3 = 1000000*1.808 = 180, 8000 kg

Phase 2

Storage facility of 5000000 m3 = 5000000*1.808 = 9040000 kg

Phase 3

Storage facility of 10000000 m3 = 10000000*1.808 = 18, 080, 000 kg

These estimated values of LPG were used to model potential fire hazards associated with the explosion of the LPG storage facility with the assumption that all estimated values at each phase will be stored at one location. For each scenario, in the event of an explosion, the duration of the fire, flame height, fireball diameter, and heat flux at 2-metre intervals from the centerline of the fire were calculated.

Scenario 1 – Development

Storage facility of 1000000 m^3 = 1000000*1.808 = 180, 8000 kg

Explosion analysis for this scenario in the worst-case scenario where all the 1000000 m3 is an LPG. In the event of an explosion, the characteristics of the fireball will be as follows:

Duration of fire = 33 minutes,

Maximum diameter of the fire = 706.58 m, Height of the fireball = 529.9343,

Maximum emitted thermal flux = 2, 754, 827 kW

Scenario 2 – Development

Storage facility of 5000000 m3 = 5000000*1.808 = 9040000 kg

Explosion analysis for this scenario in the worst-case scenario where all the 5000000 m3 is an LPG.

In the event of an explosion, the characteristics of the fireball will be as follows:

Duration of fire = 49.35 minutes,

Maximum diameter of the fire = 1208.233 m, Height of the fireball = 906.175,

Maximum emitted thermal flux = 6, 159, 981 kW

Scenario 3 – Development

Storage facility of 10000000 m3 = 10000000*1.808 = 18, 080, 000 kg

Explosion analysis for this scenario in the worst-case scenario where all the 5000000 m3 is an LPG.

In the event of an explosion, the characteristics of the fireball will be as follows:

Duration of fire = 58.69 minutes,

Maximum diameter of the fire = 1522.279 m, Height of the fireball = 1141.709,

Maximum emitted thermal flux = 8,711,529 kW

In the three scenarios, heat flux from the source of the explosion travels quite far compared to the pool fire scenario. For scenario 1, the heat flux could reach 12.5 kW/m3 at 750 m from source explosion, for scenario 2, at 1000 m, the heat flux could reach 12.5 kW/m3, and for scenario 3, heat flux could reach 12.5 kW/m3 even at 1500 m (Figure 5.13).

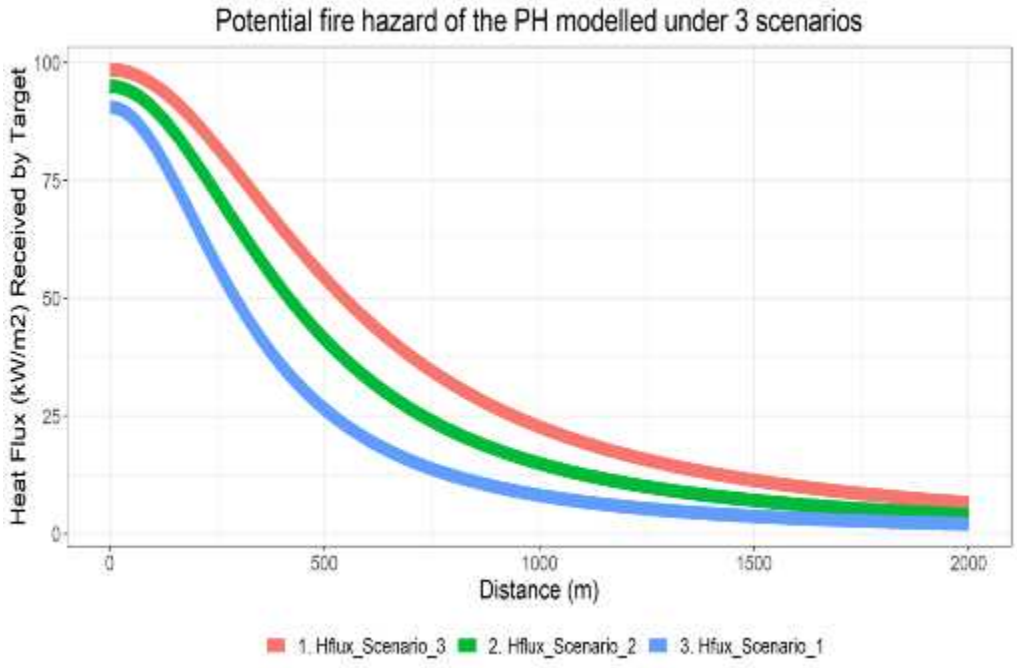


Figure 5.13: Heat flux received by a target at a distance from the explosion source of Liquified Petroleum Gas (LPG) storage facility of various quantities

5.4.5 Modelling of Cumulative Air Pollution Impact

Air pollution impacts from the operation of the proposed Petroleum Hub on the site and its surrounding communities can be very significant considering the number of facilities proposed to be established on the selected site. To have a fair idea of how cumulatively the operation of the factories could be impacting the air and the surrounding communities, the Gaussian Plume Atmospheric dispersal model (GPM) was used to simulate the areas which will be affected by the operation of the Petroleum Hub. Due to the limited time for the study, seven of the proposed facilities (Port services, 1 Fertilizer plant, 2 Refineries, 2 Petrochemical plants, and 1 Power plant) were used in the model development.

Assumption: One air pollution scenario was assumed for each selected facility.

1. Emission rate of 2200 g/s of PM10, an effective stack height of 94.31 m, under all the six atmospheric classes,

For the Gaussian plume atmospheric dispersal model, a centerline from the windward direction is required to estimate land fall concentration of emitted pollutants at specific locations both along downwind and crosswind from the pollution source. To simulate the landfall of the pollutants at several locations along the centerline and across the crosswind, 20-metre interval points were created along a downwind from the location of the selected proposed factories (centerline) and 20-meter intervals along the crosswind of 2-kilometre distance on both sides of the centerline. Estimates of the concentration of landfall of PM_{10} at all the sampling locations were calculated for the six (6) atmospheric classes for all seven selected facilities.

The cumulative impact of all the seven selected proposed facilities in the area was generated by interpolating the output of each simulation over a common interpolation grid of resolution 20 m by 20 using an inverse distance weighted interpolation algorithm. The seven interpolated outputs were summed into one raster map to represent the cumulative impacts of the proposed factories. The outputs of the scenarios are presented in two formats: PM_{10} concentration in microgram per cubic meter plotted against distance (which is a distance from the centerline, in other words, downwind distance from the location of the stack of the factory), and a cumulative map which is a summation of all the seven stack emissions of four of the Pasquil atmospheric classes: Class A, Class B, Class C, and Class E; (Figures 5.14 and 5.15).

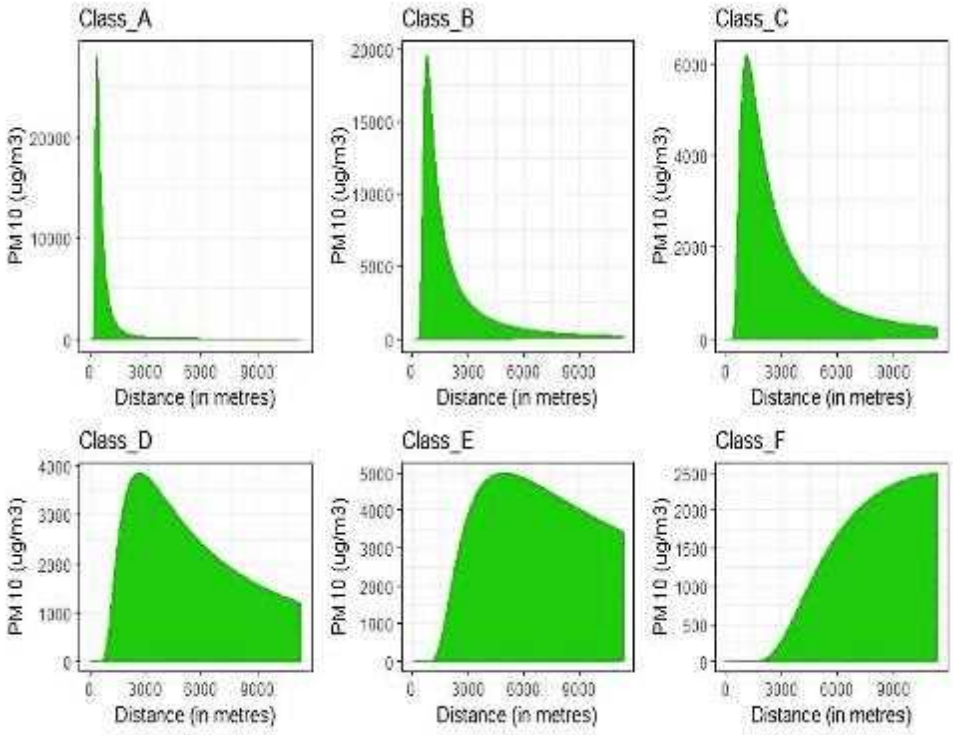


Figure 5.14: Plot of PM_{10} concentration in microgram per cubic meter against downwind distance from a hypothetical stack of a factory for all the six Pasquil atmospheric stability classes with an effective stack height of 94.31 meters, the emission rate of 2200 g/s of PM_{10}

a b

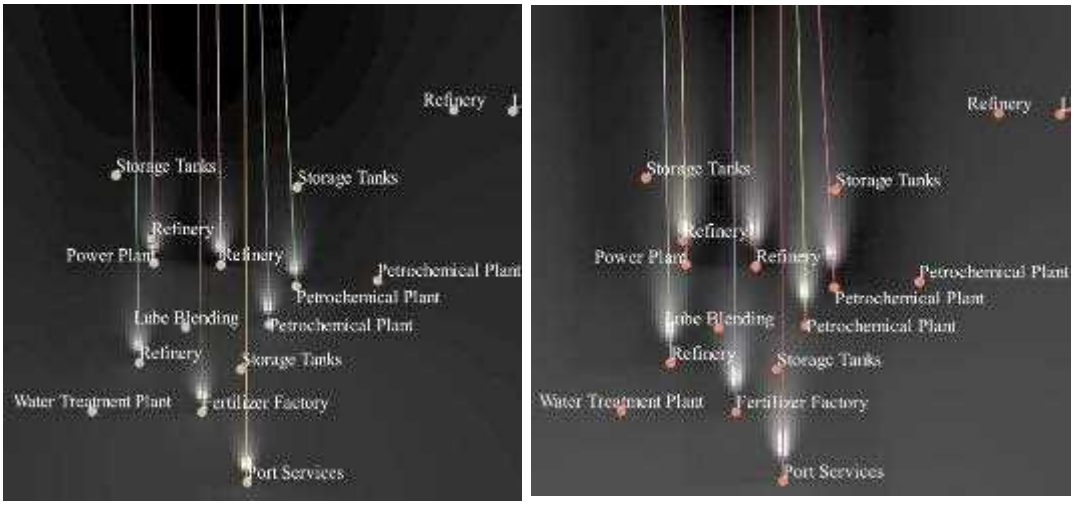
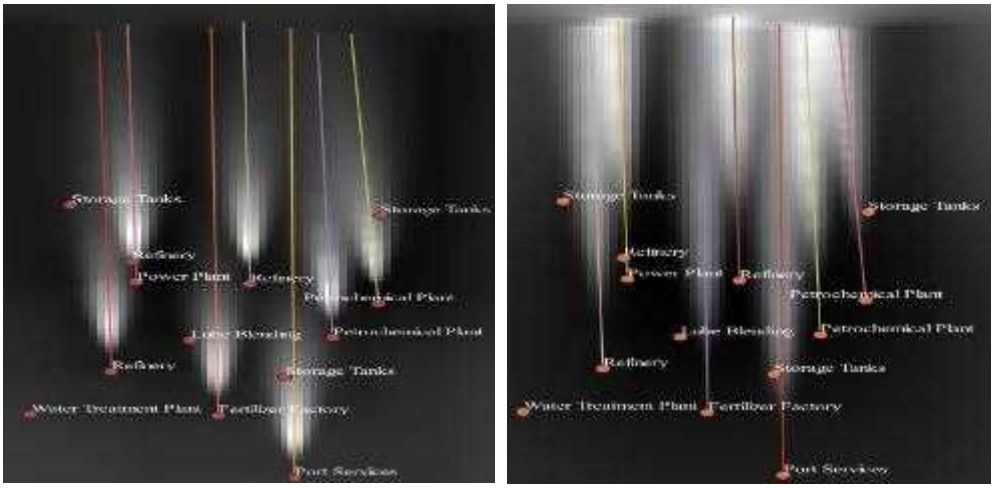


Figure 5.15: Cumulative impact of Gaussian Plume Model output of all the seven stack emissions under a: Class A and b: Class B of Pasquil atmospheric classes of weather condition



a b

Figure 5.16: Cumulative impact of Gaussian Plume Model output of all the seven stack emissions under a: Class C and b: Class E of Pasquil atmospheric classes of weather condition

From the graphical plots, it is obvious that the landfall of pollutants from a point source is highest near the vicinity of the emission source for atmospheric stability Class A, followed by Class B (Figure 5.14). Areas within 2000 m (2 km) from the factory are impacted most under stability Classes A and B, whereas under stability Classes C and D, facilities or settlements located 2500 m (2.5 km) downwind, and crosswind of the factory are the severest hit (Figure 5.14). In the case of stability Classes E and F, facilities or settlements located far away from the factory (5 km for stability Class E) and (10 km for stability Class F) are the severest impacted (Figure 5.14). These characteristics of air pollution plumes from a factory can severely impact nearby facilities if the pollution coming from the operation of a factory is not regulated.

If a facility or community is located close to a factory that is polluting the air, the concentration of pollutant impact the community of the facility will vary depending on the weather condition. For instance, if the proposed fertilizer plant becomes operational, emission from the plant will be impacting on the proposed lube blending facility located within 2 km of the fertilizer plant when the weather condition falls under Class A, when the weather condition changes to Class C, D, E or F, the distant facilities will rather be impacted most. When the proposed oil hub is fully operational communities which are located far away (5 – 20 km) from the hub but are within the downwind direction of the hub will be impacted most by the cumulative impacts of the factories or plants that will be emitting pollutants into the atmosphere. This will occur when the weather condition changes to Class C, Class D, Class E and Class F.

On the other hand, when the weather condition changes to Class A or Class B, facilities or communities located within 3 km away and downwind of the proposed hu will be significantly impacted by the cumulative impact of activities at the hub.

5.5 Cumulative and Transboundary Impacts

Cumulative impacts may arise because of incremental effects of similar and related activities within a particular area. The presence of oil refineries, petrochemical industries and storage tanks will result in some cumulative impacts which may exceed prescribed thresholds. The main cumulative impacts of concern and recommendations are discussed below.

Air Emissions: Cumulatively, the hub will have three (3) refineries of 300,000 bpd and five (5) petrochemical industries. All these activities will result in emissions into the atmosphere. This will affect the ambient air quality with the attendant health implications within the enclave and beyond. It is recommended that a central monitoring system is put in place within the enclave to monitor emissions and ensure that they are kept within the approved Ghana Standards for Environment and Health-Requirements for Ambient Air Quality and Point Source/Stack Emissions (GS 1236:2019).

Waste Management: Waste generation will be associated with all activities within the enclave. This may include, both domestic and industrial waste. The major waste materials from oil storage tanks and refineries are sludge, which is classified as hazardous waste. The necessary treatment and disposal facilities must be put in place to handle these waste streams.

Oil Spill: There is the potential for oil spills which may lead to pollution of land and water bodies with the potential for fire outbreaks. The southern section of the enclave is an environmentally sensitive area. Any spillage may affect these sensitive natural resources. It is therefore important to put in place spill containment measures to prevent the spread beyond the source.

Fire and Explosion: The individual facilities within the enclave have the potential for fire outbreaks and explosions. The aggregation of these industries and facilities increases the likelihood of a spread within the enclave from one facility to the other. Siting these facilities must consider fire prevention and control measures.

Water Pollution: The enclave is drained by many rivers and streams. The Domunli lagoon receives water from many of these water bodies. There is the potential for pollution of these water bodies because of effluent discharges, spillages and improper solid waste disposal. There is a need to observe **the riparian buffer zone distances**. It Is also important to put in place appropriate waste management infrastructure and practices.

5.6 Transboundary Impacts

The distance of the enclave to the Ivorian border is approximately 500m. This proximity to the Ivorian border introduces a high likelihood of transboundary issues related to the following:

- Air Emissions
- Oil Spill
- Fire and Explosion
- Water Pollution
- Invasive Alien Species
- Security threats

There is a need for increased bilateral cooperation in this regard to deal with any potential conflicts that may arise from the hub activities.

5.7 Compilation of Issues Register

Several issues and concerns generated from the scenario development and analysis, document review as well as stakeholder engagement processes were similar. These issues were evaluated, consolidated, and compiled to arrive at the Issues Register. A total of twenty-eight (28) issues were compiled based on the four (4) pillars of sustainability. Table 5.3 presents a summary of these issues. The Issues Register is presented below in Tables 5.4, 5.5, 5.6 and 5.7.

Table 5.3: Summary of Issues

No.	Pillar of Sustainability	Issues
1.	Natural Resources	7
2.	Socio-Cultural	9
3.	Economics	5
4.	Institutional	7
	Total	**28**

Table 5.4: Natural Resource Issues

No.	Natural Resource Issues
1	Loss of Biodiversity
2	Pollution (water, land, air and noise)
3	Climate Change Issues
4	Coastal erosion
5	Oil spills and leakages
6	Hazard risks (Flooding, fire and explosion)
7	Discharges of ballast water and associated Invasive Alien species, etc.

Table 5.5: Socio-cultural Issues

No.	Socio-cultural Issues
1.	Migration, in-migration and associated social vices
2.	Impacts on Eco-tourism
3.	Health and Safety Issues
4.	Resettlement and compensation including land ownership, acquisition, and conflicts
5.	High expectations of locals
6.	Alternative livelihood opportunities
7.	Inadequate infrastructure (Schools, water, electricity, hospitals, etc.)
8.	Food insecurity
9.	Cultural/Religious Issues (cultural heritage, chance finds, festivals, cemeteries, etc.)

Table 5.6: Economic Issues

No.	Economic Issues
1.	Limited diversity of jobs (due to the loss of some traditional economic activities such as farming, fishing, etc.)
2.	Inadequate capacity of Locals to participate in the development and implementation of Petroleum activities.
3.	Creation of Jobs and job losses
4.	High Cost of Living
5.	Gender marginalization especially women, children, the vulnerable and excluded

Table 5.7: Institutional Issues

No.	Institutional Issues
1	Weak institutional coordination and collaboration
2	Inadequate capacity of institutions to enforce existing laws
3	Haphazard physical development of adjoining communities
4	Lack of waste management infrastructure (hazardous and non-hazardous waste)
5	Skills and technology transfer
6	Transboundary conflicts
7	Increased maritime traffic

CHAPTER 6

DETERMINATION OF KEY ISSUES

6.1 Introduction

The issues gathered from the different processes including document review, scenario analysis by expert inputs and stakeholder consultations were compiled into an Issues Register of twenty-eight (28) issues. Further analysis was carried out to determine the most significant issues that require attention in the SEA.

6.2 Determination of the level of significance

The level of significance of each issue was determined based on the following criteria:

- Frequency of occurrence (FoC) refers to the number of times the issue was raised
- Relevance to the SEA (RTS) refers to the strategic importance of the issue (High relevance issues are strategic, whereas Low relevance issues are project related and can be handled by EIA)
- Geographical Scope (GS) refers to the coverage of the issue i.e., international, national, regional, district or local. NB: International is the highest geographical scope in the evaluation
- Duration of Impact (DoI) refers to the time duration that the impact arising from the issue will persist. Extended duration is more than 5 years, and Short is less than 5 years
- Impact Evaluation refers to the perceived magnitude (intensity, severity, etc.) of the impact, which is classified as high, medium, or low
- Regulatory regime (RR) refers to the priority of the issue to conventions, laws, customary laws (taboos, values, and norms) and regulations

The level of significance for the different issues was finally determined by the consideration of all the above criteria. The results were classified as High (Red), Medium (Yellow), or Low (Green). A total of fourteen (14) out of the twenty-eight (28) issues were determined to be of high significance (key issues). Details of the evaluation are presented below.

Table 6.1: Determination of Significance of Issues

No.	Issues	Source of Issue			FoC	RTS	GS	DoI	Impact Evaluation			RR	LS
		LUSPA	Scenario	Stakeholder Engagements					H	M	L		
Natural Resources													
1.	Loss of Biodiversity	x	x	x	39	x	I	E	x			x	High
2.	Pollution (water, land, air, and noise)	x	x	x	36	x	I	E	x			x	High
3.	Climate Change Issues	x		x	12	x	I	E	x			x	High
4.	Coastal erosion	x		x	3	x	N	E		x		x	Medium
5.	Oil spills and leakages			x	4	x	I	E	x			x	High
6.	Hazard risks (Flooding, fire, and explosion)	x		x	6	x	I	E	x			x	High
7.	Discharges of ballast water and associatedInvasive Alien species, etc.			x	6	x	I	E		x		x	Medium
Socio-cultural													
1.	Migration, in-migration and associated socialvices	x	x	x	35	x	I	E	x			X	High
2.	Impacts on Eco-tourism	x		x	16	x	I	E		x		X	Low
3.	Health and Safety Issues	x	x	x	45	x	I	E	x			X	High

No.	Issues	Source of Issue			FoC	RTS	GS	DoI	Impact Evaluation			RR	LS
		LUSPA	Scenario	Stakeholder Engagements					H	M	L		
4.	Resettlement and compensation includingland ownership, acquisition, and conflicts		x	x	34	x	L	S		x		X	High
5.	High expectations of locals		x	x	7	x	R	E	x				High
6.	Alternative livelihood opportunities	x	x	x	7	x	L	S		x			Medium
7.	Inadequate infrastructure (Schools, water,electricity, hospitals, etc.)	x	x	x	41	x	D	E		x		X	Medium
8.	Food insecurity		x	x	16	x	D	S		x		X	Medium
9.	Cultural/Religious Issues (cultural heritage,chance finds, festivals, cemeteries, etc.)	x			6	x	L	S			x	X	Low
Economic													
1.	Limited diversity of jobs (due to the loss of some traditional economic activities such as farming, fishing, etc.)	x		x	20	x	D	E		x			Medium
2.	Inadequate capacity of Locals to participate in the development and implementation of the Petroleum activities.			x	13	x	N	E	x			x	High
3.	Creation of Jobs and job losses		x	x	10	x	N	E	x			x	High

No.	Issues	Source of Issue			FoC	RTS	GS	DoI	Impact Evaluation			RR	LS
		LUSPA	Scenario	Stakeholder Engagements					H	M	L		
4.	High Cost of Living			x	18	x	R	E		x			Medium
5.	Gender marginalization especially women, children,the vulnerable and excluded			x	7	x	L	E		x		x	High
Institutional													
1.	Weak institutional coordination and collaboration			x	15	x	N	E		x		x	Medium
2.	Inadequate capacity of institutions to enforce existing laws	x		x	16	x	I	E		x		x	Medium
3.	Haphazard physical development of adjoining communities			x	8	x	D	E		x		x	Medium
4.	Lack of waste management infrastructure (Hazardous and non-hazardous waste)	x	x	x	12	x	I	E	x			x	High
5.	Skills and technology transfer		x		3	x	I	E		x		x	Medium
6.	Transboundary conflicts		x		1	x	I	E	x			x	High
7.	Increased maritime traffic		x		1	x	I	E		x		x	Medium

Table 6.2: Summary - Issues of Significance

No.	Pillar	Low	Medium	High	Total Issues
1	Natural resources	-	2	5	7
2	Socio-cultural	2	3	4	9
3	Economic	-	2	3	5
4	Institutional	-	5	2	7
	Total	**2**	**12**	**14**	**28**

6.2.1 Key Issues

Twenty-eight (28) issues were raised from stakeholder engagements, as well as the technical expert and desktop reviews. These issues were grouped under the four (4) pillars of sustainability per the Ghana SEA approach i.e., natural resources, socio-cultural, economic, and institutional pillars. Further analysis and consolidation of these issues resulted in fourteen (14) key issues presented in Table 6.3.

Table 6.3: Key Issues

No.	Pillar of Sustainability	Key Issues
1.	Natural Resources	Loss of Biodiversity
2.		Pollution (Water, Land, Air, and Noise)
3.		Climate Change Issues
4.		Oil spills and leakages
5.		Hazard risks (Flooding, fire, and explosions)
6.	Socio-cultural	Migration, in-migration and associated social vices
7.		Health and Safety Issues
8.		Resettlement and compensation including land ownership,acquisition, and conflicts
9.		High expectations of locals
10.	Economic	Inadequate capacity of locals to participate in the development and implementation of the Petroleum activities
11.		Creation of Jobs and job losses
12.		Gender marginalization including women and othervulnerable groups
13.	Institutional	Lack of waste management infrastructure
14.		Transboundary conflicts

CHAPTER 7

RECOMMENDATIONS AND ADVISORY NOTES

7.1 Introduction

This Chapter documents the set of recommendations and advisory notes proposed to respond to the key issues. The Chapter provides a preamble on the key issues under the four (4) pillars of sustainability (natural resources, socio-cultural, economic and institutions). A total of forty-two (42) recommendations and nine (9) advisory notes were proposed to guide the development of the Petroleum Hub. The final matrix of key issues, recommendations, and responsible institutions is discussed below.

7.2 Natural Resources (NR)

The key issues identified under the natural resource pillar include loss of biodiversity, pollution (water, land, air, and noise), climate change, oil spills and leakages, and hazard risks including flooding, fire, and explosions.

7.2.1 Loss of Biodiversity

Biodiversity is the variability among living organisms from all sources including inter-alia terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part.

The proposed area for the Petroleum Hub is a highly rich biodiversity area. The Domunli lagoon and other ecosystems are in this area particularly as it falls within the Greater Amanzule wetlands area. Various species within the ecosystem have been classified under international conservation status as vulnerable, threatened, and endangered. The activities of the Petroleum Hub will impact these ecosystems negatively.

7.2.1.1 Recommendations

1. Implement the Riparian Buffer Zone Policy for the management of water bodies and wetlands within the Petroleum Hub.

   Lead: PHDC
   Collaborator: Water Resource Commission (WRC), EPA, FC, JMA, TAs, Local Communities, Forestry Commission, NADMO, MOFA, CREMA Committee.

2. Develop and implement an Integrated Biodiversity Management Plan (IBMP) with consideration for Gender, the Vulnerable and Excluded (GVE).

   Lead: PHDC
   Collaborators: MESTI, NDPC, EPA, MLNR, MGCSP, FC, TAs, JMA, CSOs, Local Communities, Department of Social Welfare & Community Development, CREMA Committee.

3. Ensure compliance with industrial pollution control limits.

   Lead: EPA
   Collaborators: PHDC, WRC, National Petroleum Authority (NPA), Local Communities, Petroleum Commission, Energy Commission, Ghana Maritime Authority (GMA), CREMA Committee.

4. Monitor and evaluate emissions levels.

   Lead: PHDC
   Collaborators: EPA, WRC, JMA, TAs, CSOs

5. Establish a Biodiversity Offsetting System (BOS) for Petroleum Hub activities with special consideration for women, children and the vulnerable.

   Lead: EPA
   Collaborators: PHDC, NDPC, MESTI, MLNR, MGCSP, FC, TAs, JMA, CSOs, Local Communities, CREMA Committee.

6. Ensure coordination and collaboration among all stakeholders within the Petroleum Hub.

   Lead: PHDC
   Collaborators: EPA, JMA, NPA, Women Groups, Identifiable Groups, TAs, CSOs.

7. Explore options for sustaining various uses of resources and benefits obtained from the ecosystems with consideration for gender, the vulnerable and the excluded.

   Lead: PHDC
   Collaborators: WRC, NPA, MESTI, EPA, Forestry Commission, Women Groups, Identifiable Groups, CSOs, Ministry of Gender, Children and Social Protection (MGCSP).

7.2.2 Pollution (Air, water, land, etc.)

Pollution can occur in different forms and can affect various media such as air, water, and land. Pollution, if not controlled can affect land, aquatic, and terrestrial life. The proposed site for the Hub has several water bodies including streams, lagoons and rivers which must be protected from pollution. The Hub will host oil refineries, petrochemical industries, and power plants, among others. All these facilities release pollutants into the environment which can affect its quality and by extension the quality of human lives. It must also be noted that the proximity of the Hub to the Ghana-Cote d'Ivoire international border is less than 10km and therefore, any impact on air, freshwater and marine quality can go beyond our border. Such incidents can create conflicts.

7.2.2.1 Recommendations

1. Implement the Riparian Buffer Zone Policy for the management of water bodies and wetlands within the Petroleum Hub.

   Lead: PHDC
   Collaborators: WRC, EPA, JMA

2. Ensure compliance with maritime, and industrial pollution control limits.

   Lead: PHDC
   Collaborators: EPA, WRC, NPA, GMA

3. Ensure compliance with developed land use and zoning plans to protect or conserve ecological or biological sensitivity areas within and outside the boundaries of the Hub.

   Lead: PHDC
   Collaborators: LUSPA, EPA, WRC, JMA, FC, CSOs

4. Monitor cumulative impacts of all emissions and effluent from all industries within the Hub enclave.

   Lead: PHDC
   Collaborators: EPA, WRC, NPA, FC, CSOs

5. Ensure compliance with Ghana Standard for Environmental Protection – Requirements for Effluent Discharge (GS 1212, 2019).

   Lead: PHDC
   Collaborators: EPA, WRC, NPA, and Ghana Standards Authority (GSA)

6. Ensure compliance with Ghana Standard for Environment and Health Protection - Requirements for Ambient Air Quality and Point Source/Stack Emissions (GS 1236, 2019).

   Lead: PHDC
   Collaborators: EPA, WRC, NPA, GSA

7. Ensure compliance with Ghana Standard for Health Protection – Requirements for Ambient Noise Control (GS 1222, 2018)

   Lead: PHDC
   Collaborators: EPA, WRC, NPA, GSA

8. Ensure collaboration with neighbouring countries that may be affected by activities of the Petroleum Hub.

   Lead: PHDC
   Collaborators: NPA, EPA, Ministry of Foreign Affairs and Regional Integration, GMA

7.2.3 Climate Change

Climate change and climate variabilities have become serious global challenges because of their devastating impacts on countries and human lives. It has negatively affected rainfall patterns, sea levels rise, coastal erosion and increased temperatures, among others. The operations of the Petroleum Hub can contribute to the worsening effects of climate change and threatens the sustainability of the Hub's operations. Emissions from the operations of oil refineries, petrochemical industries and the power plant will certainly contribute to the effects of climate change.

It is therefore important to ensure that the design and distribution of the infrastructure are done in a manner that will minimize climate change impacts. Other concerns include the issue of "stranded assets" as there appear to be gradual shifts in investments into renewable energy alternatives on the global front.

7.2.3.1 Recommendations

1. Adopt and implement a low carbon growth strategy including afforestation for operations in the Petroleum Hub with consideration for Gender, the Vulnerable and the Excluded (GVE).

   Lead: PHDC
   Collaborators: MESTI, EPA, Ministry of Finance (National Designated Authority).

2. Mainstream climate change issues into all activities within the enclave with consideration for Gender, the vulnerable and the excluded.

   Lead: PHDC
   Collaborators: NDPC, MESTI, EPA, MGCSP, Ministry of Finance (National Designated Authority).

7.2.4 Hazards and Risks (Oil spills and leakages[22] , flooding, fire, explosions, sea erosion, etc.)

The risk of oil spills, leakages, fire, and explosions in the operations of the Petroleum Hub is quite high. The current landscape and topography of the Western Nzema area are quite susceptible to flooding. The construction of petroleum infrastructure could further exacerbate this problem if not addressed.

In terms of hazards from earthquakes and tremors, the enclave has a Peak Ground Acceleration (PGA) of 0.25 and could pose serious challenges for the different facilities earmarked for the area. The nature of proposed activities within the Petroleum Hub poses the risk of fire and explosions which could spread beyond the hub to neighbouring areas. Operations involving the discharge of petroleum products could also lead to oil spills which may traverse beyond Ghana's territorial waters.

7.2.4.1 Recommendations

1. Put measures in place to minimize the impact of coastal erosion and potential sea-level rise.

   Lead: PHDC
   Collaborators: Hydrological Services Division (HSD), GGSA, EPA, JMA, LUSPA, NADMO and Fisheries Commission

2. Ensure robust, resilient, and green infrastructure to withstand potential floods, earthquakes, and tremors.

   Lead: PHDC
   Collaborators: GGSA, NADMO, Ghana Highways Authority, Department of Urban Roads, NDPC, JMA, AESL, GPHA, Ghana Railway Development Authority, NPA, LUSPA, Ghana Civil Aviation Authority (GCAA), Ghana Institution of Engineers, Hydrological Services Division, and other relevant bodies.

[22] The key issue, "Oil spills and leakages" was addressed under Hazard risks.

3. Minimize the risks from fire and explosions.

   Lead: PHDC
   Collaborators: NPA, EPA, Ghana National Fire Service, NADMO, JMA, Ghana Police Service

4. Develop a system to minimize the impact of emissions on nearby local communities and areas beyond our national borders.

   Lead: PHDC
   Collaborators: EPA, GSA, NPA, JMA

5. Develop an Ecosystem-based Disaster Management Plan for the Petroleum Hub enclave.

   Lead: PHDC
   Collaborators: NADMO, JMA, EPA, NPA, GNFS, Ghana Ambulance Service, Ghana Police Service, Ghana Armed Forces, FC, WRC.

7.3 Socio-cultural

The key issues identified under this pillar include migration, in-migration and associated social vices; health and safety; resettlement and compensation including land ownership, acquisition, and conflicts; and high expectations of locals.

7.3.1 Migration, in-migration and associated social vices

Migration generally implies the movement of people in and outside a country. In-migration is the phenomenon where there is the movement of people into a particular area or community with the hope of getting jobs, better means of livelihood and security. The establishment of the Petroleum Hub in the Jomoro Municipality will pull people into the community in search of jobs and better livelihoods. Some of the migrants may gain employment while others may be involved in all kinds of social vices such as robbery, prostitution and so on. The increase in population may also put pressure on the existing social infrastructure beyond their threshold. Measures must therefore be put in place to mitigate this trend.

7.3.1.1 Recommendations

1. Investments must be made in the provision of social infrastructure such as water supply, toilet facilities, hospitals, schools, and waste treatment facilities (such as incinerators, and engineered landfill sites) among others with consideration for GVE.

Lead: Jomoro Municipal Assembly (JMA)

Collaborators: Community Water and Sanitation, Ghana Health Service, Ghana Education Service, PHDC, Investors, NDPC, Ministry of Gender, Children and Social Protection (MGCSP).

2. Affordable housing schemes should be provided within the Petroleum Hub enclave and surrounding communities with consideration for GVE, and PWD.

Lead: PHDC

Collaborators: JMA, State Housing Corporation, Department of Rural Housing and Cottage Industries, CSOs, TAs, Workers in the Hub, Ministry of Gender, Children and Social Protection, Real Estate Developers.

7.3.2 Health and Safety

Operations of the Hub are likely to impact negatively on the health and safety of the workers and the people living in the nearby communities.

The International Finance Corporation (IFC) Performance Standard 4 and the World Bank Environment and Social Performance Standards (ESS 4) both recognize that project activities can increase communities' exposure to risks and impacts, including climate change impacts. It acknowledges the public authorities' role in promoting the health, safety and security of the public, through the avoidance and minimization of risks and impacts to community health, safety and security that may arise from project-related activities. The Factories Offices and Shops Act, 1970 (Act 328) enjoins factories, offices, and shops to indicate welfare facilities provided, notification of operational accidents and illnesses, health and welfare standards, safety measures, complaints related to dangerous conditions and practices and related matters in Ghana.

It is also crucial to consider the potential threat from piracy as activities such as bunkering, ship-to-ship transfer and discharge or loading of petroleum products and materials could be targeted. This poses security threats which becomes not just an issue but a risk that will drive away investors. Notwithstanding the above, the following recommendations should be implemented to ensure the safety of workers and the public.

7.3.2.1 Recommendations

1. Environmental Assessment Regulation, 1999 (LI 1652), Regulations 5 and 6 on Health and Safety must be fully complied with during project planning and implementation.

   Lead: Environmental Protection Agency (EPA)

   Collaborators: Department of Factories Inspectorate, National Petroleum Authority, Petroleum Hub Development Corporation, Ghana Health Service, Ghana National Fire Service, Ghana Standards Authority.

2. The provisions of the Factories Offices and Shops Act, 1970 (Act 328) must be fully complied with in all undertakings.

   Lead: Department of Factories Inspectorate

   Collaborators: Petroleum Hub Development Corporation, Environmental Protection Agency, National Petroleum Authority, District Assemblies, Ghana Health Service, Ghana National Fire Service.

3. The Petroleum Hub Development Corporation (PHDC) must develop specific health and safety guidelines for the Petroleum Hub.

   Lead: Petroleum Hub Development Corporation (PHDC)

   Collaborators: Environmental Protection Agency, National Petroleum Authority, Ghana Health Service, Ghana National Fire Service, JMA, DFI.

7.3.3 Resettlement and compensation including land ownership, acquisition, and conflicts

The land for the development of the Petroleum Hub covers an area of approximately 20, 000 acres and belongs to families and the Traditional Authorities of the Western Nzema Traditional Area. Currently, the land is predominantly being used for agriculture. The use of the land for the Petroleum Hub will deprive the people of their livelihoods.

The landowners and the occupants must be adequately compensated. There have been instances where the Government has taken community lands and has either failed to compensate or provided inadequate compensation.

7.3.3.1 Recommendations

1. Ensure the implementation of a sustainable compensation mechanism that spans the lifetime of the Petroleum Hub. Options such as using the lands as equity, providing pension benefits for the aged, etc. could be considered for the compensation of affected persons especially women, the vulnerable and the excluded.

   Lead: Lands Commission
   Collaborators: PHDC, JMA, CSOs, Ministry of Gender, Children and Social Protection, Tas

2. Compensation must be adequate and timely.

   Lead: PHDC
   Collaborators: Ministry of Energy, Ministry of Finance, Lands Commission, Ministry of Lands and Natural Resources

3. Alternative Livelihood and Support Schemes such as the Livelihood Empowerment Against Poverty (LEAP) must be extended to cover affected groups and individuals who cannot be trained in alternative livelihood schemes especially the aged, women, the vulnerable and the excluded/marginalized.

   Lead: PHDC
   Collaborators: CSOs, Private Investors, JMA, NDPC, Ministry of Gender, Children and Social Protection, TAs.

4. Groups or persons whose lands will be affected in the development of the Petroleum Hub and who are employable may be given priority for appropriate employment opportunities within the Hub especially women and the vulnerable.

   Lead: Investors
   Collaborators: PHDC, NDPC, JMA, Ministry of Gender, Children and Social Protection.

7.3.4 High expectations of locals

The proposal to establish the Petroleum Hub within JM and its environs has brought much hope to the locals for a better life. Because of this, some of the locals have high expectations of social infrastructure development, employment opportunities and better livelihoods. These high expectations if not well managed may degenerate into community agitations, conflicts, apathy, vandalism, and sabotage.

7.3.4.1 Recommendations

1. Awareness creation programmes should be instituted to manage the expectations of the locals.

   Lead: PHDC

   Collaborators: JMA, NCCE, CSOs, Ministry of Gender, Children and Social Protection, TAs

2. Grievance and conflict resolution programmes should be instituted

   Lead: PHDC

   Collaborators: JMA, NCCE, CSOs, Ministry of Gender, Children and Social Protection, TAs, and Local Communities.

7.4 Economic

The establishment of the Petroleum Hub will have significant economic benefits for Ghana. The key issues identified under the economic pillar include the inadequate capacity of locals to participate in the development of the Petroleum Hub and the creation of jobs and the prevention of job losses.

7.4.1 Inadequate capacity of locals to participate in the development and implementation of the Petroleum Hub activities

The development of the Petroleum Hub in Jomoro will accelerate the growth of the petroleum downstream sub-sector and make it a major player in the economy. The Petroleum Hub development will increase the presence of major international oil trading and storage companies, create regional trading champions, and encourage joint ventures between local and international companies for knowledge transfer and wealth creation, etc. It will also provide the country with Liquefied Natural Gas (LNG) facilities for power production and drive the growth of various industries including petrochemicals.

Generally, it is expected that Ghanaians would have the requisite capacity to participate in the provision of goods and services, management of businesses, and financing of petroleum-related activities. Although some capacity has been built in the country's oil and gas sector, the development of a petroleum infrastructure on this scale will require additional capacity both at the national and local levels.

7.4.1.1 Recommendations

1. Develop and implement capacity-building programmes including relevant technical and vocational skills for the locals, CSOs, academia, Traditional Authorities (TAs), and Association of Ghana Industries (AGI), among others with consideration for GVE.

Lead: PHDC

Collaborators: JMA, NVTI, NCCE, Traditional Authorities, CSOs, Community, Ministry of Gender, Children and Social Protection, AGI.

7.4.2 Creation of Jobs and prevention of job losses

The development of the Petroleum Hub is expected to transform Ghana's economy and is projected to create over 780,000 direct and indirect jobs by 2030. It is also the case that this will also lead to job losses in some other sectors like agriculture and trade in the local economy. Many of the current jobs linked to coconut farming, organic coconut oil, shea butter production, fishing, and coconut charcoal production, among others may be negatively impacted. Some sustainable business investments, green value chain development and biodiversity conservation linked to the Ankasa-Tano Community Resource Management Area (CREMA) may be gravely affected.

7.4.2.1 Recommendations

1. Develop and implement strategies that will empower micro, small, and medium-scale enterprises within Jomoro Municipality to effectively participate in the opportunities presented by the Petroleum Hub with consideration for GVE and PWD.

   Lead: PHDC

   Collaborators: Ghana Enterprises Agency (GEA), JMA, Ministry of Trade, MGCSP, Business Advisory Center (BAC)

2. Strategies that ensure coexistence with national and community conservation areas and other eco-tourism-related activities in the area should be implemented during the development of the Petroleum Hub.

   Lead: PHDC

   Collaborators: EPA, Ghana Tourism Authority (GTA), JMA, CSOs, Traditional Authorities, FC.

7.4.3 Gender marginalization especially women, children, the vulnerable and excluded

Generally, women, children, the vulnerable and excluded are marginalized concerning economic opportunities and improved livelihoods. The Petroleum Hub and related developments will result in job creation and economic empowerment within the Jomoro Municipality and its adjoining districts. There is a need to ensure that women, children, the vulnerable and excluded are given due consideration in the economic value chain.

The development will also have some adverse impacts on existing jobs and livelihoods due to the loss of farmlands, access to some community resource assets, etc. therefore, efforts must be made to minimize this impact on women, the vulnerable and excluded.

7.4.3.1 Recommendations

1. Strategies must be developed to ensure that women, the vulnerable and the excluded as well as persons with disability benefit from all the programmes aimed at empowering the community members to enable them to participate in the economic value chain.

   Lead: PHDC

   Collaborators: MGCSP, Jomoro Municipal Assembly, GEA, NDPC, adjoining District Assemblies, etc.

2. Women, the vulnerable and the excluded, as well as persons with disability who will be economically disadvantaged because of the development of the Petroleum Hub, should be given priority in various economic empowerment initiatives.

   Lead: PHDC

   Collaborators: MGCSP, Jomoro Municipal Assembly, GEA, NDPC, adjoining District Assemblies, etc.

7.5 Institutional

The key issues identified under the institutional pillar include the lack of waste management infrastructure (hazardous and non-hazardous waste) and transboundary conflicts.

7.5.1 Lack of Waste Management Infrastructure

The general concern relates to inadequate waste management infrastructure within the entire Jomoro Municipality which therefore provides an opportunity for planning and establishing appropriate waste management facilities (e.g., engineered landfill sites, etc.), particularly for the management of oil and gas-related wastes including chemicals and other hazardous wastes.

7.5.1.1 Recommendations

1. Establish an integrated waste management system within the JMA and the Petroleum Hub under a framework for zero impact philosophy and maximizing local content.

   Lead: PHDC

   Collaborators: EPA, Jomoro Municipal Assembly, NPA, NDPC.

2. Adhere to strict planning and environmental regulations to prevent the siting of waste management infrastructure in sensitive ecological locations.

   Lead: PHDC

   Collaborators: LUSPA, NDPC, JMA, EPA, NPA

7.5.2 Transboundary Conflicts

With regards to potential transboundary effects, the location of the Petroleum Hub is 10 km from the Republic of Cote d'Ivoire's border. This makes the management of cumulative and transboundary impacts from the Petroleum Hub developments very crucial. Transboundary effects particularly from air emissions, and oil spillages, among others, are potential externalities of concern in addition to other security threats.

7.5.2.1 Recommendations

1. Ensure continuous transboundary dialogue to prevent any potential security threats and conflicts.

   Lead: PHDC

   Collaborators: Ministry of Foreign Affairs and Regional Integration, Ghana Immigration Service (GIS), GMA, Ghana Armed Forces, Western Regional Security Committee (WREGSEC), TAs.

2. Engineer the facilities in the Petroleum Hub to minimize its cumulative and transboundary impacts.

   Lead: PHDC

   Collaborators: EPA, NPA, JMA, GSA, Department of Factories Inspectorate (DFI), NDPC

7.6 Advisory Notes

A. PHDC Environment and Sustainability Unit

To ensure that the development and operation of the PHub conform to the highest standards of sustainability, it is advised that an Environment and Sustainability Unit be established as part of the organizational structure of PHDC. This Unit will be initially responsible for ensuring the implementation of the SEA Recommendations and subsequently all matters concerning environmental sustainability (The VRA operates a similar model that serves as a point of reference).

Lead: PHDC

Collaborator: EPA

B. Project Implementation Standards

The plan has various undertakings i.e., construction, operations, decommissioning, etc. which must conform to existing standards and safeguards that are enshrined in relevant legislative provisions. It is advised that these standards should be harmonized into a single composite document (Project Implementation Standards Document) and made available to all stakeholders i.e., permitting institutions, developers, inspectors, development partners, investors, etc.

Lead: Petroleum Hub Development Corporation (PHDC)

Collaborator: EPA, NPA, WRC, Forestry Commission, Energy Commission

C. Local Content

The Petroleum Hub activities form part of the downstream sub-sector. Currently, the local content law does not cover downstream activities. It is advised that the ongoing development of the local content legislation for the downstream sub-sector be accelerated.

Lead: Ministry of Energy

Collaborator: Ministry of Justice and Attorney General

D. Institutional Coordination and Collaboration

To give effect to the functions of the PHDC as stipulated in the Petroleum Hub Development Corporation Act, 2020 (Act 1053), there is a need to establish an Intersectoral Committee to support the PHDC.

Lead: PHDC

Collaborators: Ministry of Energy, EPA, NPA, LUSPA, JMA, Forestry Commission, WRC

E. Completion of Baseline Survey

Due to inadequate resources, a baseline survey on fauna and flora within the Petroleum Hub conducted by the EPA was incomplete. It is advised that the PHDC provide funding to the EPA to complete the baseline studies which will be useful to guide other developments in the enclave.

Lead: PHDC

Collaborator: EPA

F. Emergency Response and Risk Management Plan

The individual processing/storage facilities within the enclave have the potential for fire outbreaks and explosions. The aggregation of these facilities increases the likelihood of a spread within the enclave from one facility to the other. Significant volumes of petroleum products (Crude, LPG, LNG, Naphtha, Gasoline, Gasoil, Kerosene, ATK) will be handled for the various stages of the operations of the Hub. The total estimated volume will range from 1,000,000 m^3 to 10,000,000 m^3 from the initial phase to the full production phase respectively.

The risks of fire/explosion will be very high. It is advised that a comprehensive Emergency Response and Risk Management Plan should be prepared and operationalized before the commencement of operational activities.

Lead: PHDC

Collaborators: NADMO, JMA, AESL, GPHA, NPA, EPA, Ghana National Fire Service (GNFS), GPS, Ghana Ambulance Service

G. Security

The nature of activities which will take place at the Hub, the high levels of investments, the migration and associated social vices including terrorism will pose a high-security risk to the Petroleum Hub. It is advised that security and intelligence systems must be put in place. In addition, there is a need to strengthen security agencies to be efficient in patrolling and securing the area.

Lead: Ministry of Interior

Collaborators: PHDC, Ministry of National Security, Ministry of Defense, WREGSEC, District Security Committee, Ghana Police Service.

H. Coexistence with Cultural Heritage

The location of Petroleum Hub is within a rural community with a rich cultural heritage which must be protected. During the consultative processes, it became obvious that the communities have significant concerns about the implications of the phub activities on their cultural heritage. This includes cultural adulteration, language loss, intrusion of cultural sites such as sacred groves, burial grounds, taboos, norms, and values, etc.

Cultural heritage issues are held in high esteem within the communities and could lead to conflicts if not properly managed. It is advised that the PHDC should work with TAs and local communities to develop unambiguous guidelines on cultural heritage issues to inform potential investors. It is proposed that the PHDC should consider the formulation of relevant regulations consistent with the PHDC Act 2020 (Act 1053) to give effect to the protection of cultural heritage.

Lead: Ministry of Chieftaincy & Religious Affairs
Collaborators: PHDC, TAs, Local communities, JMA

I. Decommissioning

The lifecycle of the Petroleum Hub is estimated at 50 years. At the end of this period, it is expected that the Hub will be decommissioned. The issues involved include site restoration, transfer of landed properties in line with government regulations, post-decommissioning monitoring, etc. It is advised that a decommissioning plan which assigns roles and responsibilities, especially to relevant stakeholders including investors be put in place. It is also important to take cognizance of the potential shift from fossil fuels to renewable energy sources which could lead to a reduction in the lifespan of the Hub, thus triggering early decommissioning.

Lead: PHDC
Collaborators: EPA, JMA, Investors, TAs.

CHAPTER 8

IMPLEMENTATION AND MONITORING ARRANGEMENTS

8.1 Introduction

This chapter presents the implementation and monitoring arrangements of the SEA recommendations and advisory. The recommendations have been captured in Table 8.1 together with appropriate indicators and details of the lead and collaborating institutions that will guide their implementations. A remarks column has also been provided to further clarify some of the indicators.

8.2 Implementation and Monitoring Arrangements

The development of the Petroleum Hub is a government initiative through the Ministry of Energy which is expected to be driven by private investors. The Petroleum Development Hub Corporation Act, 2020 (Act 1053) incorporates the Petroleum Development Hub Corporation (PHDC) to be the government agency mandated to plan and implement strategies for the development of the Hub; undertake preparatory works; coordinate and facilitate investment activities; collaborate with investors; monitor and evaluate the development of the Hub; among others.

The implementation of each of the recommendations and advisory notes involves several relevant institutions. To ensure effective coordination and management of the process, the Lead has been assigned to the institution that has the ultimate responsibility for ensuring the achievement of the desired outcome. Collaborators have also been assigned the responsibility of providing implementation support to the Lead. The Lead can assign certain roles and responsibilities to the Collaborators to achieve the set objective.

The PHDC therefore will be responsible for the coordination of the implementation of the SEA recommendations. This will involve coordinating a wide range of stakeholders at all levels i.e., national, regional and district through the adoption of participatory monitoring and evaluation approaches. The Jomoro Municipal Assembly and adjoining districts i.e., Ellembele, Aowin and Wassa Amenfi West District Assemblies will have to incorporate relevant aspects of the recommendations into their respective DMTDPs for implementation.

Table 8.1: Monitoring Plan

Issues	Recommendation	Indicators	Responsible Institution	Remarks
Natural Resource				
Loss of Biodiversity	1. Implement the Riparian Buffer Zone Policy for the management of water bodies and wetlands within the Petroleum Hub.	• Level of compliance withall the prescribed buffer allowances in the Spatial Plans for the Hub • Number of projects thathave complied with theprescribed buffer allowances	**Lead:** PHDC **Collaborators:** Water Resource Commission (WRC), EPA, FC, JMA, TAs, Local Communities, Forestry Commission, NADMO, MOFA, CREMA Committee	The compliance should be based on the buffer widthsof the RBZP
	2. Develop and implement an Integrated Biodiversity Management Plan (IBMP) with consideration for Gender, the Vulnerable and Excluded (GVE).	• Integrated Biodiversity Management Plan developed • Level/ extent of Implementation • Extent of the role of women in the implementation	**Lead**: PHDC **Collaborators:** MESTI, NDPC, EPA, MLNR, MGCSP, FC, TAs, JMA, CSOs, Local Communities, Department of Social Welfare & Community Development, CREMA Committee.	Percentage of implementation
	3. Ensure compliance with industrial pollution control limits	• The level of compliance with industrial pollution	**Lead:** EPA **Collaborators:** PHDC, WRC, National Petroleum Authority (NPA), Local Communities, Petroleum Commission, Energy Commission, Ghana Maritime Authority (GMA), CREMA Committee	The pollution limit control will be measured by the standards of the Ghana Standards Authority (i.e., GS1236, 2019 etc.).
	4. Monitor and evaluate emissions levels.	• Frequency of monitoring emission levels • Number of evaluations conducted • Impacts of levels of emissions	**Lead:** PHDC **Collaborators:** EPA, WRC, JMA, TAs, CSOs	Levels of measurement within the permissible limit

Issues	Recommendation	Indicators	Responsible Institution	Remarks
	5. Establish a Biodiversity Offsetting System (BOS) for Petroleum Hub activities with special consideration for women, children and the vulnerable	• Biodiversity Offsetting System with a focus on the vulnerable established	**Lead:** EPA **Collaborators:** PHDC, NDPC, MESTI, MLNR, MGCSP, FC, TAs, JMA, CSOs, Local Communities, CREMA Committee	Several segments of the system might take a while to establish. The key ones such as the biodiversity offsetting plan can be measured from the onset
	6. Ensure coordination andcollaboration among all stakeholders within the Petroleum Hub	• Level of collaboration and extent of coordination	**Lead:** PHDC **Collaborators:** EPA, JMA, NPA, Women Groups, Identifiable Groups, TAs, CSOs	Criteria such as the number of meetings, MOUs signed, etc. can be used. Efforts should be made to include women representatives and the vulnerable in allengagements
	7. Explore options for sustaining various uses of resources and benefits obtained from the ecosystems with consideration for gender, thevulnerable and the excluded	• Number of sustained resource use and benefits from ecosystem services	**Lead:** PHDC **Collaborators:** WRC, NPA, MESTI, EPA, Forestry Commission, Women Groups, CSOs, Ministry of Gender, Children and SocialProtection (MGCSP)	Several sustainable resource use/benefit activities linked to the existing CREMA should co-exist with the Hub i.e., organic coconut virgin oil production, coconut charcoal, livestock farming,etc. Efforts should be made to disaggregate results for the various groups as measured by the indicators
Pollution (Water, Land, Air, and Noise)	8. Implement the Riparian Buffer Zone Policy for the management of water bodieswithin the Petroleum Hub	• Level of compliance withall the prescribed buffer allowances in the spatial plans for the Hub • Number of projects that have complied with the prescribed buffer allowances	**Lead:** PHDC, **Collaborators:** EPA, WRC, JMA	The compliance should be based on the buffer widthsof the RBZP. The focus is on pollution.

Issues	Recommendation	Indicators	Responsible Institution	Remarks
	9. Ensure compliance with maritime, and industrial pollution control limits	• Level of compliance with industrial pollution control limits	**Lead:** PHDC **Collaborators:** EPA, WRC, NPA, GMA`	The pollution limit controlwill be measured by the standards of the Ghana Standards Authority (GS 1236, 2019; GS 1222, 2018; GS 1212, 2019) Levels of measurement within the permissible limit
	10. Ensure compliance with developed land use and zoning plans to protect or conserve ecological or biological sensitivity areas within and outside the boundaries of the Hub.	• Level of compliance with Spatial Plans	**Lead:** PHDC **Collaborators:** LUSPA, EPA, WRC, JMA, FC, CSOs	
	11. Monitor cumulative impacts of all emissions and effluent from all industries within the Hub enclave	• Frequency of monitoring cumulative impacts	**Lead:** PHDC **Collaborators:** EPA, WRC, NPA, FC, CSOs	
	12. Ensure compliance with Ghana Standard for Environmental Protection – Requirements for Effluent Discharge (GS 1212, 2019).	• Level of compliance with Requirements for Effluent Discharge (GS 1212, 2019)	**Lead:** PHDC **Collaborators:** EPA, WRC, NPA, and Ghana Standards Authority (GSA)	

Issues	Recommendation	Indicators	Responsible Institution	Remarks
	13. Ensure compliance with Ghana Standard for Environment and Health Protection -Requirements for Ambient Air Quality and Point Source/Stack Emissions (GS 1236, 2019).	• Level of compliance with Requirements for Ambient Air Quality and Point Source/Stack Emissions (GS 1236, 2019)	**Lead:** PHDC **Collaborators:** EPA, WRC,NPA, GSA	
	14. Ensure compliance with Ghana Standard for HealthProtection – Requirements for Ambient Noise Control (GS 1222, 2018)	• Level of compliance with Requirements for Ambient Noise Control (GS 1222, 2018)	**Lead:** PHDC **Collaborators:** EPA, WRC,NPA, GSA	
	15. Ensure collaboration with neighbouring countries that may be affected by activities of the Petroleum Hub.	• Extent of collaboration	**Lead:** PHDC **Collaborators:** NPA, EPA, Ministry of Foreign Affairs and Regional Integration, GMA	Some of the parameters /Criteria will be protocol, agreement, MOU, etc.
Climate Change Issues	16. Adopt and implement a low carbon growth strategy including afforestation for operations in the Petroleum Hub with consideration for Gender, the Vulnerable and the Excluded (GVE).	• Low carbon growth strategy adopted	**Lead:** PHDC **Collaborators:** MESTI, EPA, Ministry of Finance (National Designated Authority).	This should be supportedby documentation. Efforts must be made tointegrate GVE considerations
	17. Mainstream climate change issues into all activities within the enclave with consideration for Gender, the vulnerable and the excluded.	• Extent/level of climate change issues mainstreamed	**Lead:** PHDC **Collaborators:** NDPC, MESTI, EPA, MGCSP, Ministry of Finance (National Designated Authority).	Mainstreaming has several segments that are evident in policy framework, planning, budget and implementation, monitoring and evaluation

Issues	Recommendation	Indicators	Responsible Institution	Remarks
Hazard risks (Flooding, fire, and explosions)	18. Put measures in place to minimize the impact of coastal erosion and potential sea-level rise	• Number of measures in place to minimize the impact of coastal erosion and potential sea-level rise	**Lead:** PHDC **Collaborators:** Hydrological Services Division (HSD), GGSA, EPA, JMA, LUSPA, NADMO and Fisheries Commission	The measures to be developed should consider GVE
	19. Ensure robust, resilient, and green infrastructure to withstand potential floods, earthquakes, and tremors	• Approval and certification of the infrastructure designs • Intensity of supervisions • Extent to which infrastructure conforms to Codes and Standards	**Lead:** PHDC **Collaborators:** GGSA, NADMO, Ghana Highways Authority, Department of Urban Roads, NDPC, JMA, AESL, GPHA, Ghana Railway Development Authority, NPA, LUSPA, Ghana Civil Aviation Authority (GCAA), Ghana Institution of Engineers and other relevant bodies,	Ghana Building Code Shorelines should be reinforced The structure should withstand the PGA 0.25 concerning earthquake The human factor should be critically looked at.
	20. Minimize the risks from fire and explosions	• Robust operations and integrity management systems established for theHub • Number of events/incidents related to fire and explosion emergencies	**Lead:** PHDC **Collaborators:** NPA, EPA, Ghana National Fire Service, NADMO, JMA, Ghana Police Service	Developing strategies to manage the risks must take into consideration GVEs
	21. Develop a system to minimize the impact of emissions on nearby local communities and areas beyond our national borders	• System to minimize the impact of emissions developed • Level of compliance with emissions requirements	**Lead:** PHDC **Collaborators:** EPA, GSA,NPA, JMA	System to include stack designs, etc.

Issues	Recommendation	Indicators	Responsible Institution	Remarks
	22. Develop an Ecosystem-based Disaster Management Plan for the Petroleum Hub	• Ecosystem-based Disaster Management Plan developed and operationalized	**Lead:** PHDC **Collaborators:** NADMO, JMA, EPA, NPA, GNFS, Ghana Ambulance Service, Ghana Police Service, Ghana Armed Forces, FC, WRC	
Socio-cultural				
Migration, in-migration and associatedsocial vices	23. Investments must be made inthe provision of social infrastructure such as water supply, toilet facilities, hospitals, schools, and waste treatment facilities (such as incinerators, and engineered landfill sites) among others with consideration for GVE	• Quantum of investments into the provision of social infrastructure • Level of investments into the provision of social infrastructure • Number of women, children and the vulnerable benefiting from the investment	**Lead:** Jomoro Municipal Assembly (JMA) **Collaborators:** Community Water and Sanitation (CWSA), Ghana Health Service, Ghana Education Service, PHDC, Investors, NDPC, Ministry of Gender, Children and Social Protection (MGCSP)	The investments should be prioritized within the District Medium-Term Development Plan (DMTDP) and Budgets and the Strategic Plan of the PHDC. The total cost of the social infrastructure is estimated at USD 6 Billion.
	24. Affordable housing schemes should be provided within the Petroleum Hub enclave and surrounding communities with consideration for GVE, and PWD	• Number of affordable housing schemes provided within and outside the Hub • Number of Affordable Houses being used • Number of women, children and the vulnerable benefiting from the affordable housing schemes	**Lead:** PHDC, Jomoro Municipal Assembly **Collaborators:** JMA, State Housing Corporation, Department of Rural Housing and Cottage Industries, CSOs, TAs, Workers in the Hub, Ministry of Gender, Children and Social Protection, Real Estate Developers	In the Hub, workers' involvement in the M&E is key regarding participatory monitoring In the Municipality, communities' involvement in the M&E is key regarding participatory monitoring Housing designs should be Disability friendly.

Issues	Recommendation	Indicators	Responsible Institution	Remarks
Health and Safety Issues	25. Environmental Assessment Regulation, 1999 (LI 1652), Regulations 5 and 6 on Health and Safety must be fully complied with during project planning and implementation	• Level of compliance of Regulations 5 and 6 of Environmental Assessment Regulation, 1999, LI 1652	**Lead:** EPA **Collaborators:** DFI, National Petroleum Authority, PHDC, Ghana Health Service, Ghana National Fire Service, GSA	
	26. The provisions of the Factories, Offices and ShopsAct, 1970 (Act 328) must befully complied with in all undertakings.	• Level of compliance with the provisions of the Factories, Offices and Shops Act, 1970(Act 328)	**Lead:** DFI **Collaborators:** PHDC, EPA, National Petroleum Authority, DistrictAssemblies, Ghana Health Service, Ghana National FireService	Emphasis is on Occupational Health and Safety
	27. The Petroleum Hub Development Corporation (PHDC) must develop specific health and safety guidelines for the Petroleum Hub.	• Number of guidelines developed	**Lead:** PHDC **Collaborators:** EPA, National Petroleum Authority, Ghana Health Service, Ghana National Fire Service, JMA	

Issues	Recommendation	Indicators	Responsible Institution	Remarks
Resettlement and compensation including land ownership, acquisition,and conflicts	28. Ensure the implementation of a sustainable compensation mechanism that spans the lifetime of the Petroleum Hub. Options such as using the lands as equity, providing pension benefits for the aged, etc. could be considered for the compensation of affected persons especially women, the vulnerable and the excluded	• Level/extent of implementation of a sustainable compensation mechanism for affected persons especially women, the vulnerable and the excluded/marginalized.	**Lead:** Lands Commission **Collaborators:** PHDC, JMA, CSOs, Ministry of Gender, Children and Social Protection, TAs	Compensations should focus on intergenerational benefits to the affected persons.
	29. Compensation must beadequate and timely	• Quantum of compensation • Value of the land/property • Turn-around time for administration of compensation	**Lead:** PHDC **Collaborators:** Ministry of Energy, Ministry of Finance, Lands Commission, Ministry of Lands and Natural Resources	Timely payment of compensation is in line with the two (2) year payment period stipulated in section 240 subsection 2of the Lands Act 2020, Act1036.
	30. Alternative Livelihood and Support Schemes such as the Livelihood Empowerment Against Poverty (LEAP) must be extended to cover affected groups and individuals who cannot be trained in alternative livelihood schemes especially the aged, women, the vulnerable and the excluded/marginalized.	• Number of Livelihood Support Schemes made available • Number of gender-disaggregated beneficiaries of the Livelihood Support Scheme	**Lead:** PHDC **Collaborators:** CSOs, Private Investors, JMA, NDPC, Ministry of Gender, Children and Social Protection, TAs.	

Issues	Recommendation	Indicators	Responsible Institution	Remarks
	31. Groups or persons whose lands will be affected in the development of the Petroleum Hub and who are employable may be given priority for appropriate employment opportunities within the Hub especially women and the vulnerable.	• Number of affected persons employed	**Lead:** Investors **Collaborators:** PHDC, NDPC, JMA, Ministry of Gender, Children and Social Protection.	Those employed are prioritized affected locals The indicator should be disaggregated by GVE,PWD, etc.
High expectations of locals	32. Awareness creation programsshould be instituted to manage the expectations of the locals	• Number of awareness programmes created to manage the expectations ofthe locals • Level of awareness createdto manage the expectationsof the locals	**Lead:** PHDC **Collaborators:** JMA, NCCE, CSOs, Ministry of Gender, Children and Social Protection, TAs	Perception surveys may be used to assess the level of awareness among both men and women.
	33. Grievance and conflict resolution programmes should be instituted	• Number of grievance and conflict resolution programmes instituted • Level of understanding and cooperation among locals • Use of available GRM and Conflict Resolution systems	**Lead:** PHDC **Collaborators:** JMA, NCCE, CSOs, Ministry of Gender, Children and Social Protection, TAs, Local Communities	Perception surveys may be used to assess the level of understanding among men and women as well as the use of available GRM and Conflict Resolution systems
Economic				
Inadequate capacity of locals to participate in the development and implementation of the Petroleum activities	34. Develop and implement capacity-building programmes including relevant technical and vocational skills for the locals, CSOs, academia, Traditional	• Number of capacity-building programmesdeveloped • Level of implementationof capacity-building programmes • Number of disaggregated beneficiaries of the capacity building programmes including the vulnerable and excluded	**Lead:** PHDC **Collaborators:** JMA, NVTI, NCCE, Traditional Authorities, CSOs, Community, Ministry of Gender, Children and Social Protection, AGI.	These indicators should be disaggregated by GVE, PWD, etc.

Issues	Recommendation	Indicators	Responsible Institution	Remarks
	Authorities (TAs), and Association of Ghana Industries (AGI), among others with consideration for GVE.			
Creation of Jobs and Prevention of Joblosses	35. Develop and implement strategies that will empower micro, small, and medium-scale enterprises within Jomoro Municipality to effectively participate in the opportunities presented by the Petroleum Hub with consideration for GVE and PWD.	• Number of the strategies developed to empower micro, small, and medium-scale enterprises within Jomoro Municipality • Level of implementationof the strategy that will empower micro, small, and medium-scale enterprises within Jomoro Municipality	**Lead:** PHDC **Collaborators:** Ghana Enterprises Agency (GEA), JMA, Ministry of Trade, MGCSP, Business Advisory Center (BAC)	The indicators should be disaggregated by GVE, PWD, etc.
	36. Strategies that ensure coexistence with national and community conservation areas and other eco-tourism-related activities in the area should be implemented during the development of the Petroleum Hub.	• Level of implementation ofthe strategies that ensure coexistence with national and community conservation areas and other eco-tourism-related activities in the area	**Lead:** PHDC **Collaborators:** EPA, Ghana Tourism Authority, JMA, CSOs, Traditional Authorities, Forestry Commission (FC)	

Issues	Recommendation	Indicators	Responsible Institution	Remarks
Gender marginalization especially women, children, the vulnerable andexcluded	37. Strategies must be developed to ensure that women, the vulnerable and the excluded as well as persons with disability benefit from all the programmes aimed at empowering the community members to enable them to participate in the economic value chain.	• Strategies to empower women, the vulnerable andexcluded (WVE) and PWDdeveloped and operationalized • Number of WVE/PWD beneficiaries of the programmes	**Lead:** PHDC **Collaborators:** MGCSP, Jomoro Municipal Assembly, GEA, NDPC, adjoining District Assemblies, etc.	The indicator should disaggregate the numberof WVE and PWD participating in each initiative
	38. Women, the vulnerable and the excluded, as well as persons with disability who will be economically disadvantaged because of the development of the Petroleum Hub, should be given priority in various economic empowerment initiatives.	• Number of economic empowerment initiatives provided. • Number of WVE and PWDgiven priority in various economic empowerment initiatives	**Lead:** PHDC **Collaborators:** MGCSP, Jomoro Municipal Assembly, GEA, NDPC, adjoining District Assemblies, etc.	The indicator should disaggregate the numberof WVE and PWD participating in each initiative
Institutional				
Lack of waste management infrastructure	39. Establish an integrated waste management system within the JMA and the Petroleum Hub under a framework for zero impact philosophy and maximizing local content.	• Integrated Waste Management Plan for the Hub and the Jomoro Municipality developed	**Lead:** PHDC **Collaborators:** EPA, Jomoro Municipal Assembly, NPA, NDPC.	The emphasis of the SEA is the IWMP. Other components of the IWMS should be covered by project EIA processes The role of women is critical in preparing the Plan

Issues	Recommendation	Indicators	Responsible Institution	Remarks
	40. Adhere to strict planning and environmental regulations to prevent the siting of waste management infrastructure in sensitive ecological locations	• Conformity to Spatial Plan in siting waste management infrastructure for the Hub	**Lead:** PHDC **Collaborators:** LUSPA, NDPC, JMA, EPA, NPA	
Transboundary conflicts	41. Ensure continuous transboundary dialogue to prevent any potential security threats and conflicts.	• Reports on transboundary dialogues/ meetings held	**Lead:** PHDC **Collaborators**: Ministry of Foreign Affairs and Regional Integration, Ghana Immigration Service (GIS), GMA, Ghana Armed Forces, Western Regional Security Committee (WREGSEC), TAs.	
	42. Engineer the facilities in the Petroleum Hub to minimize its cumulative and transboundary impacts	• Approval and certificationof the design • Quality Supervision • Extent to which the facilities conform to Codesand Standards	**Lead:** PHDC **Collaborators:** EPA, NPA, JMA, GSA, Department of Factories Inspectorate (DFI), NDPC	Supervisors should ensure compliance with standards, etc. The design should take into consideration the needs of women

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