**PROJECT**: ACCESS LNG FLOATING STORAGE AND REGASIFICATION PROJECTS (FSU/FRU) -

**COUNTRY**: GHANA

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**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) SUMMARY**

*April 2019*

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<th>Role</th>
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<td><strong>Team Leaders</strong></td>
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<td></td>
<td>Charles Wole LAWUYI</td>
<td>Principal Investment Officer</td>
<td>PESR2</td>
<td>4631</td>
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<td></td>
<td>Kweku KORANTENG</td>
<td>Principal Investment Officer</td>
<td>PESR2</td>
<td>4308</td>
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<tr>
<td><strong>E &amp; S Team Members</strong></td>
<td>Bakia MBIANYOR</td>
<td>Chief E &amp; S Safeguards Compliance Officer</td>
<td>SNSC</td>
<td>4212</td>
</tr>
<tr>
<td></td>
<td>Osric Tening FORTON</td>
<td>Principal E &amp; S Safeguards Officer</td>
<td>SNSC</td>
<td>5078</td>
</tr>
<tr>
<td></td>
<td>Bedilu Amare RETA</td>
<td>Environmental and Social Safeguards-Consultant</td>
<td>SNSC</td>
<td>4926</td>
</tr>
<tr>
<td><strong>Division Manager</strong></td>
<td>Ngom AIDA</td>
<td></td>
<td>PESR.2</td>
<td>2542</td>
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<tr>
<td><strong>Sector Director</strong></td>
<td>Wale SHONIBARE</td>
<td></td>
<td>PESR.0</td>
<td>4030</td>
</tr>
<tr>
<td><strong>Regional Director General</strong></td>
<td>Mme Marie-Laure AKIN OLUGBADE</td>
<td></td>
<td>RDGW</td>
<td>4018</td>
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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) SUMMARY

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| Code SAP     | P-GH-FD0-007                                          |
| Category     | 1                                                      |
| Division     | PESD.1                                                 |

1. INTRODUCTION

Power is currently the single largest constraint on Ghana’s ambition to achieve sustained high levels of Gross Domestic Product (GDP) growth to consolidate its middle-income status. The current natural gas demand in Ghana is not being met by indigenous gas production due to supply constraints and unreliability of the West African Gas Pipeline (WAGP). Around Tema (located to the east of the country) which established itself as a hub for thermal generation power plants in Ghana, housing installed generation capacity of 2,126MW, sub-optimal pipeline gas supply received from Nigeria, via WAGP, has meant that Tema’s thermal plants have relied heavily on expensive Heavy Fuel Oils (HFO) and diesel imports to meet their fuel requirements with impacts including increased cost of electricity generation and higher end user tariffs.

To address its domestic gas supply requirements, Ghana National Petroleum Company (GNPC) has signed an agreement with Rosneft Trading SA (RTSA) for the supply of 1.7 million metric tonnes per annum (mmtpa) of gas to the Tema region. Under the contract terms, GNPC will procure LNG from RTSA under a 12-year Gas Supply Agreement (GSA), which will be regasified for onward delivery to onshore thermal Independent Power Producers (IPPs) and industrial customers in the Tema area. RTSA will require an LNG import terminal and adjoining regasification facility to meet its obligations under the GSA, and has entered into a series of agreements with the Tema LNG Terminal Company (TLTC) to develop a 240 million standard cubic feet per day (mmscf/d) LNG import terminal with an adjoining Floating Storage Unit (FSU) and Floating Regasification Unit (FRU) which it will utilise under a 12-year Terminal Use Agreement (TUA). Development of the facilities will eliminate the requirement for liquid fuels, resulting in lower cost of electricity generation for Ghana’s thermal IPPs and an anticipated reduction in end user tariffs.

As part of the development, the African Development Bank (AfDB) is proposing to exclusively finance the construction of the floating storage (FSU) and floating regasification (FRU) units for the exclusive use of TLTC, the developer of the terminal infrastructure. The FRU will regasify imported LNG from RTSA, stored in the FSU, which will later be transmitted to shore via pipeline as natural gas for the generation of power by thermal plants and for industrial/commercial customers. Other components of the TLTC project are therefore associated facilities of the FSU/FRU project which will not be financed by the AfDB.

This ESIA Summary illuminates the Project, including its location and context, justification for the project, potential environmental and social impacts as well as the associated mitigation and monitoring measures for the identified impacts. The ESIA Summary is based on the review of the Project environmental and social impact assessment (ESIA) study report which has been prepared in accordance with Ghanaian regulations as well as lenders’ safeguard requirements, including the African Development Bank’s Integrated Safeguards System (ISS) and Environmental and Social assessment Procedures (ESAP).
The construction of the associated facilities linked to the FSU/FRU project the AFDB is funding, does not result in significant physical and economic displacement of Project Affected Persons (PAPs). However, the gas transport pipeline, an associated facility will result in the economic displacement of 15 Project Affected Persons (PAPs). As such this document also includes a brief summary of the livelihood improvement plan prepared for the identified PAPs.

2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The ESIA for the proposed FSU/FRU project has been undertaken in accordance with applicable environmental and social policies, legislations, regulations, and standards of the Republic of Ghana. The ESIA study was also informed by international conventions and treaties to which Ghana is a signatory. The institutional and legal frameworks guiding ESIA in the sector are presented in the sections below.

2.1 Legislative and Institutional Frameworks in Ghana

2.1.1 National and Sector Policies and Plans

The national and sector policies, legal frameworks and plans applicable to the project are summarized below:

- **Environmental Protection Agency (EPA) Act 1994 (Act 490)** which established the EPA as the leading public body responsible for the protection and improvement of the environment in Ghana. It is responsible for enforcing environmental policy and legislation, prescribing standards and guidelines, inspecting and regulating businesses and responding to emergency incidents.

- **The National Land Policy (1999)** which provides strategic guidance for the protection of water bodies and the environment in the long-term national interest under any form of land usage be for human settlements, industry and commerce, agriculture, forestry and mining.

- **The National Energy Policy (2010)** which aims to guide the development and management of Ghana’s energy sector. The overall aim of the policy is to make energy services universally accessible and readily available in an environmentally sustainable manner.

- **The National Environmental Policy (2012)** with a vision for ensuring the sustainable management of the environment to benefit the citizens of Ghana.

- **The Energy sector Health, Safety, and Environmental Policy (2016)** which defines the elements necessary to develop, implement, and maintain a high level of safety in all energy sector activities.

- **Ghana Shared Growth and Development Agenda (GSDAII) (2015)** which is a transformative agenda to be aided by the development of the oil and gas industry with effective linkage to the rest of the economy.

- **Ghana Gas Master Plan (2016)** which sets out the elements necessary to develop, implement and maintain a high level of safety in all energy sector activities.

- **The Strategic National Energy Plan (2006-2020)** which reiterates the sector Ministry’s vision to develop an ‘Energy Economy’ that would ensure sustainable production, supply and distribution of high-quality energy services to all sectors of the economy in an environmentally friendly manner for Ghana’s future while making significant contribution to the country’s export earnings.
2.1.2 Legislative framework applicable to the energy sector in Ghana

The applicable legal framework related to the energy sector in Ghana is depicted in the following legislative instruments:

- **Energy Commission Act 1997 (Act 541)** provides for its functions relating to the regulations, management, development and utilization of energy resources, provide for the granting of licenses for the transmission, wholesale supply, distribution and sale of electricity and natural gas, refining, storage bulk distribution marketing and sale of petroleum products and to provide for related matters.

- **National Petroleum Authority (NPA) Act 2005 (Act 691)** empowers the authority to regulate, oversee, and monitor activities in the petroleum downstream community; to establish a unified petroleum price fund taking cognizance of the prescribed petroleum pricing formula; and to provide for related purposes.

- **Natural Gas Pipeline Safety (Construction, Operation, and Maintenance) Regulations, 2012 (LI 2189)** provides consistent, uniform standards and procedures for the safe construction, operation, and maintenance of natural gas facilities throughout the country.

2.1.3 Administrative and Institutional Framework

The environmental and social management of the project will involve several institutions, national, regional and local structures as set out below.

- **Ministry of Energy.** The proposed Access LNG Floating Storage and Regasification Unit (Team LNG) Ghana project falls directly under the jurisdiction of the Ministry of Energy. The key ministerial departments and agencies with interest in the development and implementation of the project are the Energy Commission, Ghana National Petroleum Corporation (GNPC), National Petroleum Authority and the Bulk Oil Storage and Transport (BOST) departments.

- **Ministry of Transport** and its specialized departments such as Ghana Maritime Authority, Ghana Ports and Harbours Authority (GPHA), Ghana Shippers Authority (GSA), Department of Urban Roads (DUR) and Ghana Railway Authority (GRA).

- **Ministry of Environment, Science, Technology and Innovation (MESTI)** which hosts the Environmental Protection Agency (EPA) and the Land Use and Spatial Planning Authority.

- **Ministry of Works and Housing** hosting the Tema Development Corporation (TDC).

- **Ministry of Employment and Labour Relations** with the Department of Factories Inspectorate and Labour Department.

- **Ministry of Water Res. and Sanitation** with the Water Resources Commission.

- **Ministry of Planning** with the National Development Planning Commission (NDPC).

- **Ministry of Fisheries** and Aquaculture with the Fisheries Commission.

- **Ministry of Local Government** including the Tema Metropolitan Assembly and the Kpone Katamanso District Assembly.

2.2 African Development Bank Operational Safeguards

This section summarizes AfDB’s operational safeguard requirements and how each OS is triggered:

- **Operational Safeguard 1: Environmental and Social Assessment.** This operational safeguard is triggered because the project activities have the potential to generate significant environmental and
social impacts to the identified receptors in the project area of influence. In accordance with the ISS, the Project has been validated as Category 1.

- **Operational Safeguard 2: Involuntary Resettlement: Land Acquisition, Displacement and Compensation.** This operational safeguard is triggered because it will result in the economic displacement of PAPs as well as loss of capitals upon which they depend to construct their livelihoods.

- **Operational Safeguard 3: Biodiversity, Renewable Resources and Ecosystem Services.** This operational safeguard is triggered because the Project could impact on marine biodiversity and associated ecosystem services.

- **Operational Safeguard 4: Pollution prevention and control, hazardous materials.** This operational safeguard is triggered because project activities during the preparation, construction and operation phases are sources of pollution and various nuisances.

- **Operational Safeguard 5: Labour conditions, health and safety.** This operational safeguard is triggered due to the fact that the construction phase will involve the recruitment of a significant number of construction workers and there will also be potential risks related to health and safety of the workers and the community.

Other relevant policies and guidelines of the African Development Bank which are also triggered in parallel with the Operational Safeguards of the ISS include the following: Environmental and Social Assessment Procedures for Bank Operations (2015); the Climate Risk Management and Adaptation Strategy (CRMA, 2016-2020); the Integrated Safeguard Policy (2013); the Bank's Gender Policy (2001); the Disclosure and Access to Information Policy (2012); the Framework for Enhanced Engagement with Civil Society Organizations (2012); the Bank's Policy on Population and Strategies for Implementation (2002); Population Policy and Implementation Strategy (2002); the Bank's Handbook on Stakeholder Consultation and Participation (2001); Policy on Poverty Reduction (2001); and the Bank's Integrated Water Resources Management Policy (2000).

### 2.3 International conventions on environmental and social aspects

Applicable international conventions to which Ghana is a signatory in relation to specific environmental and social aspects are set out below.


- **Air Quality and Climate Change.** The United Nations Framework Convention on Climate Change (UNFCCC)


- **Human Rights.** The International Code of Safety for Ships using Gases or other Low-Flashpoints Fuels (IGF Code); Convention on Civil Liability for Oil Pollution Damage (CLC); ILO Convention 138 (1973)


### 2.4 Benchmarking the legislative framework in Ghana with the ISS

The Republic of Ghana’s national legal framework in relation to environmental and social management is presented below in alignment with the applicable operational safeguards (OS) of the African Development Bank’s Integrated Safeguards System, notably OS1, OS2, OS3, OS4 and OS5.

- **Environmental and Social Assessment (OS1).** Environmental and Social Impact Assessment (ESIA) in the country is governed by the following policies, regulations, guidelines and decrees, which are consistent with the Bank’s OS 1 and provide overall guidance on the requirements for an ESIA. These include: Environmental Impact Assessment Procedures (1995); Environmental Assessment Regulations 1999 (LI 1652); the Fees and Charges (Amendment) Instrument 2015 (LI 2228); Ghana Meteorological Agency Act 2004 (Act 687); The Ghana Investment Promotion Centre Act 1994 (Act 478); The Beaches Obstructions Ordinance of 1897 (Cap. 240).

- **Involuntary Resettlement: land acquisition, population displacement, and compensation (OS2).** The country has set out the following guidelines on involuntary resettlement to ensure project affected communities and populations are not adversely impacted by project design and implementation: The Constitution of the Republic of Ghana (1992); the Lands Commission Act 2008 (Act 767); the State Lands Act 1962 (Act 125 and Amendments); the Survey Act 1962 (Act 127), the Lands (Statutory Wayleaves) Act (1963), the Land Title Registration Act 1986 (PNDCL 152 and Regulations 1986 LI 1341) and the Office of the Administrator of Stool Lands Act 1994 (Act 481). In addition to these legislative instruments, the AfDB OS2 has a requirement to ensuring that the livelihoods of the project-affected persons are improved because of any development.

- **Biodiversity, renewable resources and ecosystem services (OS3).** Consistent with OS 3, the country has the following legislative frameworks and guidelines: Fisheries Act 2002 (Act 625); Water Use Regulations 2001 (LI 1692); Ghana Maritime Authority Act (2002), and Water Resources Commission Act 1996 (Act 522). These regulations have been put in place to prevent a net loss of biodiversity and impacts on ecosystems and its services (provisioning, regulating, cultural, and supporting).

• **Labor conditions, health, and safety (OS5)** The guiding principles for workers’ Health and Safety, working conditions and collective bargaining rights are consistent with OS 5 of the ISS include: Factories, Offices and Shops Act 1970 (Act 328), the Labour Act 2003 (Act 651), the Children’s Act 1998 (Act 560), Workmen’s Compensation Law 1987, Ghana National Fire Service Act 1997, the Fire Precaution (Premises) Regulations 2003 (LI 1724)

### 3 PROJECT JUSTIFICATION AND DESCRIPTION

#### 3.1 Project Location

The proposed Tema LNG Terminal Ghana Project falls mainly within the Tema Metropolis in the Greater Accra Region. The floating infrastructure of the project will be sited just outside of the entrance to the Port of Tema to the southeast of the existing outer breakwater of the main port (Figure 3.1 and Figure 3.2). The infrastructure will be protected by an extended breakwater of approximately 800m in length, which connects to the tip of the existing outer breakwater. The indicative location of other infrastructure associated with the project, including the pipeline route is presented in Figure 3.2.

![Figure 3.1. Project Location site (showing the location of the FSU/FRU)](image-url)
Figure 3.2. Indicate location of the pipeline associated with the project.

3.2 Project Justification
Power is currently the single largest constraint on Ghana’s ambition to achieve sustained high levels of Gross Domestic Product (GDP) growth to consolidate its middle-income status. The current natural gas demand in Ghana is not being met by indigenous gas production nor sufficiently or reliably served by the West African Gas Pipeline (WAGP). Adequate gas supply will facilitate the ongoing Electricity Grid Expansion Programme and provide an adequate reserve margin.

An LNG facility that ties into the existing pipeline grid is the most feasible and reliable source of natural gas and provides stability of supply which could help drive Ghana’s journey towards a country of middle-income status.

3.3 Project Description
The main infrastructure for the proposed Tema LNG Terminal Ghana Project are the Floating Regasification Unit (FRU), the Floating Storage Unit (FSU) and the Natural Gas Pipeline. Other key ancillary structures are the mooring facilities and the ship to shore transfer system. Project activities include the following:

- **Dredging**: To assure enough under keel clearance during the approach and berthing of the LNG Carrier. Within the Tema port area, the channel and turning circle will be dredged to depths between -15 m Chart Datum (m CD) or -16m mCD.
- **Breakwater construction**: Extension of the existing outer breakwater by about 800 m;
- **Mooring facilities**: To provide safe and permanent mooring of the Floating Liquefied Natural Gas (LNG) infrastructure, 7 mooring and breasting dolphins will be constructed in the protected waters.
behind the breakwater. In November 2018, TLTC commenced the construction of a breakwater and mooring facility that can anchor an FSU/FRU;

- **Floating infrastructure**: Installation and operation of the floating storage unit (FSU) and floating regasification unit (FRU) with a combined storage capacity of about 145,000 m³ to 160,000 m³. The nominal gas send out capacity of the project will be 1.7 million tons per annum (MTPA) of Liquefied Natural Gas (LNG) about 230 MMSCFD (million standard cubic feet per day of natural gas);

- **Natural Gas Pipeline**: Construction and operation of a 8 km pipeline, submerged across the main port channel and connecting into the existing Volta River Authority header station, approximately 5km north-east of the Tema port, via an onshore pipeline along the existing oil and Liquefied Petroleum Gas (LPG) pipeline right of ways as well as Ghana Grid Company Ltd (GRIDCo) right of ways on the Volta Aluminum Company Limited (VALCO) property.

The LNG supplier will deliver LNG in standard sized LNG carriers to the FSU, which acts as the primary LNG storage. The LNG is then periodically transferred to the FRU, which has secondary LNG storage, from where it is regasified and delivered to GNPC at the tie-in point at the existing Volta River Authority (VRA) header station (Figure 3.2).

### 3.4 Project Component to be funded by the AfDB and the Project Company

The AfDB is proposing to finance the construction of the floating storage and floating regasification units (FSU/FRU) only for the exclusive use of Tema LNG Terminal Company (TLTC), the developer of the terminal infrastructure. The FRU will regasify imported LNG from RTSA, stored in the FSU, which will later be transmitted to shore via pipeline as natural gas for the generation of power by thermal plants and for industrial/commercial customers. Other components of the TLTC project are therefore associated facilities of the FSU/FRU project which will not be financed by the African Development Bank (AfDB).

A typical layout of the FSU/FRU and the LNG carrier is shown in Figure 3.4.

A Special Purpose Vehicle (Access LNG BV Ghana) has been established to finance, own and lease a Floating Storage Unit (FSU) and Floating Regasification Unit (FRU) to the

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Figure 3.3. Schematic of the Tema LNG Project with the specific component to be funded by the AfDB in red
Tema LNG Terminal Company (TLTC) under 12-year bareboat charters.

**Figure 3.4. Typical FSU and FRU arrangements**

### 3.5 Brief description of the Floating Regasification Unit (FRU)

The FRU is a new built unit with a storage capacity of 20,000 m³ and with multiple regasification trains to efficiently cover the required send out. The FRU will be permanently installed onsite using a mooring system, which is able to withstand loads corresponding to environmental data and rule requirements. The unit is designed as a self-sufficient system, providing its own utilities and can remain onsite for the project duration without the need for dry-docking. On a scheduled basis, the FSU transfers LNG to the buffer storage on the FRU where the LNG is temporarily stored before being regasified and sent to the buyers via the pipeline. This solution uses flexible aerial hoses to load LNG into the buffer storage system from the FSU and a flexible high-pressure connection to link the FRU send out with the pipeline.

### 3.6 Brief description of the Floating Storage Unit (FSU)

The FSU will be a carrier out of the existing fleet of LNG carriers (LNGCs) and will be finally selected during the post-FID development phase. The final size of the carrier will be a result of the underlying supply logistics and is envisaged to be in the range of 125,000 m³ to 145,000 m³. Together with the 20,000 m³ storage of the FRU, this will enable the full unloading of modern LNGCs without demurrage. The FSU will remain continuously moored alongside the FRU using a piled mooring dolphin system. Detailed wave simulation studies carried out have confirmed that the mooring configuration of the FSU is adequate to protect it from extreme weather conditions and that it will not have to leave the berth.

The calling LNGCs will berth against the FSU in a side-to-side (STS) mooring configuration and discharge the LNG into the FSU by means of cryogenic flexible hoses.
Marine facilities will be installed comprising the mooring system for the FSU and the FRU and an STS LNG transfer system using cryogenic flexible hoses. A flexible non-cryogenic pipe will be used for connecting the FRU send out flange with the tie-in point of the onshore natural gas pipeline.

3.7 Project Alternatives Considered

As part of the ESIA process, several alternatives, including the no project alternative were considered and assessed in detail. Alternatives considered were related to location of the LNG Terminal, layout options, breakwater type options and pipeline route options. Alternatives were also considered for pipeline routes (onshore and subsea) and pipeline construction methods.

A summary of the outcome of the alternative analysis for some of the objectives directly linked to the FSU/FRU components of the wider project is presented below.

- **No Action Option**: The no action option was not selected because it will mean no benefits will be derived from the proposed Project; loss of significant contribution to the national energy policy’s objective to secure future fuel supplies and efforts to increase and diversify the fuel mix in power generation at a cheaper cost.
- **Location for LNG Terminal**: The location selected because Port infrastructure could potentially limit the capital expenditure for the facility and the environmental/social risk and impacts can be effectively managed.
- **Site Selection within the Tema Port**: The alternative selected had the highest operational availability; was at a safe location with no impact on the public and industry, and port operations. The location also maximizes benefits of an industrial zone and port services, demand short subsea pipeline to access existing pipeline right of ways to the tie-in Facility is the selected option.
- **Site Layout within the Tema Port**. The alternative selected was based on berth availability (i.e. the marine facilities providing adequate tranquil conditions for the floating infrastructure to be able to operate 100% of the time).

Based on the project alternative analysis, the Access LNG project, part of the wider development of marine infrastructure within the Tema part area will help Ghana to address the current issues related to unreliability of fuel supply for the IPP projects in the Tema area.

4 DESCRIPTION OF THE PROJECT ENVIRONMENT

4.1 Project Area of Influence

The ESIA study addresses the Project Area of Influence (AoI) which encompasses all areas directly and indirectly affected by the Project components such as the FSU, FRU, the mooring system, the offshore and onshore gas pipelines, VRA header station as well as sites for related and associated facilities and their corridors. This ESIA refer to the:

- **Project Affected Area (PAA)**: the area where sea or land is required for construction of any component of the Project and the actual Project footprint; and
4.2 Description of the Physical Environment

Climate. Tema is characterised by a dry equatorial climate. The highest mean monthly daytime temperature of about 31.1°C occurs between February and April and the lowest of about 21.70°C in August. The average annual rainfall is about 713 mm.

Topography: The topography of the Port is generally flat with a gentle slope towards seaward of the Gulf of Guinea.

Geology and hydrogeology: The Tema Harbour area is underlain by the Dahomeyan System of rocks consisting of heterogeneous assemblage of sericitic, bioitic or chloritic quartz schist. In some areas, many small amphibolite dikes occur in the rocks. Primary porosity as well as fracturing of the massive paragneiss is very low. The groundwater potential is poor.

Hydrology and Drainage: The streams in the Metropolis are seasonal in nature. A number of streams however flow through depressions into the sea during the rainy season. Notable among them are the Gynakorgyor (flow into the Gao Lagoon between Manhean and Kpone). Water from the industrial area and the Eastern part of the township ends up in the Chemu Lagoon located between the harbour area and Tema Manhean.

Ambient air quality and noise: The dust level measurements for PM$_{10}$ along the pipeline route generally exceeded the EPA permissible limit of 70 µg/m$^3$ and all the sampling areas were non-compliant with WHO guideline level of 50 µg/m$^3$. The results of the noise assessment indicate that the baseline noise data at Abonkor Community and VALCO hospital were however above EPA guideline value of 65 dB(A) and 55 dB(A) respectively.

Marine water depth: Bathymetric survey carried out in the project area shows that water depth ranges from approximately 8.4m to 17.9m below Chart Datum (CD)

Coastal Stability: The coastline is mainly covered by sand, partially with exposed rock. Revetment made of gneiss block can be found along the coastline.

Seismicity: The Accra-Tema corridor of the Accra-Ho seismic region is the most active and most susceptible earthquake area in Ghana. Available records indicate that Seismic activity in southern Ghana is believed to be caused by movement along two active fault systems; the Akwapim Fault and the Coastal Boundary Fault. As the Tema lies between these two faults zones, precaution measures shall be considered during design phase of the proposed project.

Marine water and sediment quality: The result for the marine water quality show that all measured parameters are within the associated guideline levels. Whereas, the results for the sediment quality show that all the samples in the port area are above the Canadian Environmental Quality Guidelines (CEQGs) permissible levels for Mercury (0.13 mg/kg).

Water quality: The water conditions at the port are generally normal for survival of fauna and flora. Both temperature and salinity increased with depth at both sampling stations. The water quality results for all sampling sites show that higher value from the expected 35 ppt.

Chemu Stream Water Quality: The Chemu stream was sampled in October 2017 and the result shows that lead and Zinc were within guideline levels for both Chemu upstream and downstream samples. However, in comparison with Ghana TWQR for Agriculture (irrigation) TDS, chloride, Fecal Coliform (Chemu upstream)
and TSS (Chemu Downstream) were above guideline levels. The high levels of BOD, oil/grease and alkalinity could be attributed to discharges of industrial effluents (e.g. from VALCO, TOR) into the drain and waste dumping and open defecation activities of nearby settlements (e.g. Abonkor, Zinginshore, Manhean etc.).

4.3 Description of the Biological Environment

**Flora:** The vegetation along the pipeline route is mostly degraded due to the current land use. The proposed pipeline route passes alongside human settlements, industrial areas, and farmlands (farms and farm regrowths). The mangrove swamp vegetation along the Chemu Lagoon has been converted into a waste dump site and therefore its primary ecological functions have been substantially modified, the lagoon could be described as essentially dead. The original scrub vegetation has been converted largely to industrial concerns and human settlements and agriculture.

**Fauna:** The port area is moderate to high in marine biodiversity, especially in fish resources. Demersal fish are widespread on the continental shelf along the entire length of the Ghanaian coastline with a tropical assemblage of species representing several families such as Triggerfish; Grunts (Haemulidae); Croakers or Drums; Seabreams (Sparidae) or Porgies; Goatfishes (Mullidae /red mullet); Snappers; Groupers Marine reptiles and mammals occur in Ghana. Reptiles observed and or confirmed via interviews during the survey include Agama (Agama/Rainbow lizard), Chamaeleo gracilis (Chameleon), Varanus niloticus (Nile monitor), and Naja melanoleuca (Black-and-white Cobra), Bits gabonica (Gaboon Adder/Viper). The ESIA record indicates, Mammals such as African Fruit Bat, Senegal Galago/Bush baby (Cricetomys gambiaus), Thryonomys swinderianus (cane rat) and Birds include Herons, Egrets, Bitterns, common/hooded vulture, Pied crow are recorded.

4.4 Description of the Socio-Economic Environment

**Demographic Characteristics:** The population of Tema Metropolis according to the 2010 Population and Housing Census, is 292,773 representing 7.3 percent of the region’s total population. Males constitute 47.8 percent and females represent 52.2%.

**Land Use and Visual Issues:** Land uses within Tema area is attributed by areas like commercial and industrial, residential, agriculture, fishing and recreational. Around the port, land uses include a wide range of industrial and commercial companies, producing or handling among others petroleum products, cement, food items, iron and steel, aluminum products, and textiles. The eastern side of harbor areas is occupied by fishing harbour, landing beach for artisanal fishers, the Chemu lagoon.

**Tema Fishing Harbour:** The Fishing Harbour comprises the Inner Fishing Harbour, the Outer Fishing Harbour, and the Canoe Basin. The Inner Fishing Harbour was commissioned alongside the main harbour in 1962 to provide landing facilities for semi-industrial and industrial fishing vessels and to promote the development of the Ghanaian fishing industry. The Outer Fishing Harbour was added in 1965 to provide deeper draft for larger vessels of the national fishing fleet. More recently, a tuna wharf was commissioned in 1995 to accommodate larger tuna fishing vessels to encourage landing of tuna in Ghana.

**Cultural Heritage and Archaeology:** Areas around the Gao lagoon at the eastern portions is a sacred grove comprised of undisturbed neem trees and baobab tree, which serves as a shrine for the people of the area. Rites are performed at this shrine during festive periods and other important occasions to seek for the blessings of the gods and deities, and to usher in a new year. A similar tree near the Meridian Hotel is also regarded as a deity by the traditional people of Tema. The Chemu lagoon and Sakumo II lagoon are also worshipped as deities with annual rites.
**Vulnerable Groups**: The ESIA identified vulnerable groups in communities such as Abonkor, Manhean, and Bankuman. These communities including those living closest to the proposed pipeline route, communities with low income, poor sanitation and drainage conditions, and the artisanal fishing community near the fishing harbor with low income. Other vulnerable groups included owners of pig farms and subsistence farmers; elderly people; children and women residing Abonkor and Manhean areas with poor sanitation situation.

**Project Affected Persons (PAPs)**: The pipeline line corridor outside the port boundary comprises of farms, fallow and bare areas and strips of mangrove swamps at sections of the Chemu stream. The following PAPs were identified during the ESIA:

- A total of 15 people will be affected due to the construction of the pipeline. Of the 15 PAPs:
  - 7 of them are owners of subsistence farmers (with farm plot sizes of 0.5ha or less). The identified affected crop types are vegetables, which include okro and onions, cassava, maize, plantain. Two of the likely affected farmers were of retirement age and considered as vulnerable during the ESIA study.
  - 8 affected households who are the owners of Piggery farms. The affected structure are wooden structures used as a fence and/or compartment. The pig owners are involved in other jobs, including fish mongering. Of the 8 pig farmers affected by the project, 2 were identified as vulnerable.

5 **POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS**

A detailed assessment of all potential impacts associated with project related activities was undertaken. Several potential impacts were identified and assessed. The most significant and main project impacts for the construction and operational phases is presented in this ESIA Summary.

5.1 **Positive Impacts during the construction and operational phase**

The potential positive impacts from the project activities are discussed below:

**Employment Opportunities, Local resource use and Improved Local Economy**: During the construction phase, approximately 500 Ghanaians will be employed with peak numbers expected to be at 591. Unemployed youth within the project area may also have the opportunity to be gainfully employed as unskilled workers during the pipeline construction. Unskilled workers also required for temporary works during the construction of pipeline, local workshops, offices, and camp site.

**Availability of Natural Gas**: The proposed project is expected to help the nation to meet its natural gas demand. The availability of natural gas to the power generating plants in Tema will facilitate the ongoing electricity grid expansion programme and provide an adequate reserve margin.

**Improved Institutional & National Revenue**: Revenue will accrue to the State in the form of tax deductions from wages of workers and contractor fees. Government agencies e.g., Energy Commission and EPA will charge processing and permit fees, which will increase the revenue base of these institutions.

In the medium to longer term, government will earn tax revenue both directly from the project and indirectly from the expanded industrial and commercial activities. Resources, which were hitherto used to import fuel for combustion in thermal plants and in industry, could be channelled into other areas of the economy.

5.2 **Negative Impacts during the construction and operational phase**
The potential adverse environmental and social impacts which could possibly arise from the construction and operation of the proposed project are set out below.

5.2.1 Negative Impacts on the Bio-Physical Environment

Air quality deterioration: Dust generation will arise from site preparation, excavations, general construction works, and topsoil handling by mechanical equipment and portable auxiliary equipment. Vehicular/truck movements and transport of materials/equipment to and from site on the untarred routes/roads will also generate dust. Fugitive emissions of natural gas may also occur during product transfer as well as through leaks in valves, pumps, tanks, pressure relief valves, flanges, and coupling joints.

Vibration and noise nuisance: Activities that will contribute to increased noise levels during the construction phase include; vehicular and truck movement, site clearing and preparation, Dredging works, piling, construction of breakwater, underwater blasting, subsea trenching for pipeline installation, etc.

Loss of vegetation and impacts on flora and fauna: The vegetation within the ROW for pipeline construction is highly disturbed, as its route passes near human settlements, through industrial areas, subsistence farms, fallow areas, and farm-regrowth. As a result, impacts on flora and fauna are anticipated to be limited in scale and significance.

Sanitation/Waste Generation: Hazardous wastes to be generated from the proposed project activities, include waste equipment and facility maintenance chemicals (e.g., paints, lubricants, and cleaners), used chemical containers, waste oils, oil-contaminated rags, hydraulic fluids, used batteries, oily sludge from oil-water separators and scrap metals, would have also an impact to the nearby biophysical and social environment.

Marine and surface water contamination/impact on aquatic organisms and biodiversity: Accidental spills of oils, lubricants, fuels and other oily liquids may also contaminate the water quality at the harbour, and cause damage to fishery resources and aquatic biota. Site preparation, comprising of vegetation clearance in the ROW, as well as trenching works for pipeline would facilitate erosion and sediment transport into the nearby Chemu Stream/lagoon and marine area. Discharge of water from hydro testing into natural water bodies as well as dredging/breakwater construction and piling activities (that results in increased turbidity) could lead to the disturbance to marine life, especially fish resources that are in the harbour vicinity due to.

Introduction of Invasive Marine Pest Species: Transfer of LNG from LNG carriers overseas to the FSU at the Tema Port will occur twice a month. Marine species are usually transported in ships ballast water and also transported via biofouling. There will be a possibility for introduction of new invasive species which possibility could result in impacts to the marine environment through competition for resources, predation, or disease transmission.

5.2.2 Negative Impacts on the Human/Socioeconomic Environment

Land/way leave Acquisition: The construction of the proposed 8 km pipeline will require a temporary right of way of about 20-40 m width for construction space and 2.0-3.5m during operational phase. The 3.5m ROW will be a restricted ROW that has no access in the ROW area. This affects temporary wooden structures of 8 pig farmers and another 7 subsistence farmers with less than 0.5ha land each, a total of 15 PAPs.

Public and Occupational and Health & Safety: Public and occupational health and safety impacts could arise from the various project activities and various causes over the project implementation period. These include, hazard from the operation of construction machinery/equipment, transportation of construction material,
unhygienic working conditions, electrocution and fire risks from welding works, poor waste management, child labour and the spread of HIV/AIDS as well as other Sexually Transmitted Diseases (STDs).

Impact on cultural heritage: No culturally sensitive areas have been identified to be potentially affected by the proposed project. However, a chance find procedure will be put in place to ensure that any cultural resource chanced upon is retrieved, identified, and appropriately managed.

5.2.3 Cumulative Impacts

With regard to the proposed Project, Cumulative impacts may arise, especially due to the ongoing Tema Port Infrastructure Development and Dredging Project (commonly referred to as the Tema Port Expansion Project), which started in 2014. The Tema Port Expansion Project (TPEP) comprises the following: (i) Construction of breakwaters; (ii) Dredging and reclamation; (iii) Construction of quay; (iv) Cargo handling and berthing furniture at all the respective berths; (v) Cargo handling and operations terminals; (vi) Upgrading of ports’ access roads and the development of new major dedicated access roads to the Port of Tema; and (viii) Coastal reclamations and/or reformations, especially near the Sakumo beach as a result of possible accretion and growth of sandy beach landforms.

The valued environmental and social components (VESC) of concern considering the projects (proposed project and TPEP) include: marine ecology/water quality and aquatic life within the port; the coastal zone/shoreline; and truck traffic and congestion issues.

6 MITIGATION /ENHANCEMENT MEASURES

6.1 Mitigation Measures

A summary of the proposed mitigation/enhancement measures of impacts during the pre-construction, construction and operational phases is presented in Annex I and Annex II respectively. The tables present the significance rating based on a pre-mitigation and post mitigation (residual impact) assessment detailed in the ESIA.

6.2 Mitigation measures for cumulative impacts

To minimize the potential cumulative impacts on marine ecology/aquatic life and water quality and coastal zone/shoreline, the ESIA recommended the following mitigation measures:

- Dredging activities under the two projects should not be done at the same time, - when one project is doing dredging, the other project should hold on or agree to carry out dredging at different times.
- If there is any underwater blasting for the two projects, it should not be done at the same time.

In relation to air quality, the project area of influence for the air quality monitoring sites are all over 3km away from the location of the proposed project facilities within the Port. There is no overlap with the monitoring sites of the proposed . The proposed project does not anticipate any influence on air quality from the ongoing Port Infrastructure Development Project.

6.3 Livelihood improvement measures for PAPs.
The construction of the gas transport pipeline, an associated project to the FSU/FRU will result in the economic displacement of 15 PAPs, including 7 subsistence farmers (each with farm plots of 0.5ha or less) and 8 pig farmers (2 of which are identified as vulnerable PAPs).

A livelihood Improvement Plan in line with the requirements of the AfDB OS2 (i.e. PAP identification, asset valuation, cut off dates, compensation rates as well as the livelihood improvement and community development program) has been prepared for the project. Social programs included in the livelihood improvement plan for the PAPs and wider project affected communities (PACs) include the provision of public places of convenience for residents, provision of waste skips, engagement of waste management company for a specified period and later transfer to local assembly, provision of communal washing area, employment opportunity, particularly for youth, provision of clean water for the community, community school science project-to showcase techniques in aquaponic farming.

7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.1 Introduction to the ESMP

Environmental and social management of a proposed activity is a crucial tool to ensure any project’s environmental and social performance. This ESMP aims to establish the guidelines for best practice environmental and social management of the Project, through a clear definition of the environmental and social actions and management procedures to be implemented in each phase of project development, as defined in the ESIA.

By formally documenting environmental and social management measures and commitments, the ESMP serves a vital role in ensuring that potential negative impacts are minimized and positive impacts enhanced. In the event that impacts are found to be higher than initially predicted, additional mitigation measures will need to be implemented to control, reduce or prevent an impact from occurring. As such, this ESMP will need to be continuously updated and amended as necessary, throughout the project life cycle, to ensure that any negative impacts from the Project are prevented or reduced and positive ones are enhanced.

The ESMP shall remain a dynamic document and will be revised as and when necessary to ensure its relevance and effectiveness. Any significant changes will be discussed with the relevant authorities the Ghana EPA and the lenders.

7.2 Roles and Responsibilities for the implementation of the ESMP

The main roles and responsibilities for the implementation of the ESMP are set out below. It should be noted that TLTC are building all the infrastructure and functionally will be responsible for the implementation of the ESMP during the construction and operational phase for all assets, including the FSU/FRU procedure by the Access LNG BV entity.

7.2.1 The Proponent (TLTC)

The TLTC will set up an Environmental Health and Safety and Security (EHSS) Department or Unit that will seek to implement proactive sustainable practices with the purpose to ensure compliance with internal and external requirements to drive continuous improvement. Key resources within the TLTC organization with overall responsibility for ensuring the ESMP is effectively implemented and monitored are:
• The **General Manager** shall have overall responsibility for the formulation, implementation, monitoring, and evaluation of Health, Safety, and Environmental Issues of the proposed project.

• The **Project Manager** (PM) will be resident on site to lead the Project Team. He will be bestowed with sufficient authority for the overall management of the contract within the constraints of efficient, safe, environmental, and economic operation. S/He will also be responsible for all the formal liaisons and communications with Tema LNG Terminal, the Supervising Engineer, and with other stakeholders who will be affected by the works.

• The **marine facilities manager, Pipeline Onshore manager, Permitting/ Quality Assurance, Health, Safety and Environment (QHSE) manager** shall be responsible for ensuring the implementation of HSE activities in the different departments and will report directly to the Local Project Manager at the Local Corporate office.

• At the Tema Site office, the QHSE officer, assisted by two persons (i.e. QHSE supervisor and representative) will liaise with the Site Manager for the management of the environment, health and safety of farmers and workers, and security at the project site. The site manager will liaise with the QHSE/Permissioning manager at the Local Corporate office.

### 7.2.2 Contractors

The Contractors will implement all construction-related mitigation actions; and develop and implement all management plans and procedures set out in this ESMP for the construction phase. When appointing subcontractors, they will also ensure that they are contractually required to abide by all requirements of the ESMP.

The Construction Manager will also take the responsibility for ensuring the protection of the environment, health, and safety of all persons affected by the works, whether directly or indirectly, by providing a safe working environment, safe plant and equipment, thorough training, suitable protective equipment, and all other measures required by Statutory Regulations and the Project HSE Plans.

In addition to the plans already detailed in the ESIA, the contractors will be required to develop specialized site-specific management plans such as the Dredging Management Plan, Waste management plan, Emergency preparedness plan, Traffic Management Plan, Health & Safety Management Plan, etc.

### 7.2.3 Environment, Health and Safety Committee (Proponent and Contractors)

The Tema LNG Terminal will establish an Environmental, Health and Safety Committee in collaboration with the EPC Contractor to formulate policies and draw up programs and procedures to manage the project during the construction phase. The EPC contractor and sub-contractors of the project will implement the EHSS Committee during this phase of the project. The Committee shall have monthly meetings to discuss and deliberate on environment, health, safety and security issues.

### 7.2.4 African Development Bank
The African Development environmental and social safeguards officers will ensure (i) the completion of all complementary studies, related to environmental and social risk management; (iii) monitoring the implementation of ESMP during the construction phase; and (ii) reviewing periodic progress reports related to the implementation of the ESMP and the Livelihood Improvement Plan for the 15 PAPs directly affected by the construction the onshore gas transport pipeline.

7.3 Monitoring Program

The purpose of the environmental and social monitoring program is to ensure the effective implementation of the environmental and social mitigation measures detailed in the ESMP. Its main objectives are (i) to ensure compliance with the laws, regulations and strategies in force within the administrations involved; (ii) review and update the ESMP in the event that an unpredicted impact is identified during the construction and operational phases; (iii) allow the TLTC (including Access LNG BV) (Project Proponent) to respond promptly to the failure of a planned mitigation or enhancement measure; (v) apply penalties as provided for in the various contracts established between the TLTC and the main contractors and their subcontractors during the construction phase and during the operation phase.

The proposed monitoring program during the construction and operational phases of the Project is summarized in Table 7.1. A special monitoring program will also be put in place for the gas transport pipeline during the construction and operational phase of the wider project.

7.4 Capacity Building, Training and Reporting

Capacity building and training of key actors in the implementation of the proposed project will be organized to enhance and develop their capabilities to successfully implement the Project in an environmentally sound and socially acceptable manner. The training will cover relevant components of the ESIA/ESMP/ESMS including the potential impacts/risks, mitigation and management measures, grievance redress mechanism, Livelihood improvement, EPA permit schedules as well safeguard requirements such as those of the African Development Bank.

The capacity building and training program is provided in Table 7.2
<table>
<thead>
<tr>
<th>Environmental component</th>
<th>Parameters to be monitored</th>
<th>Monitoring Sites</th>
<th>Methodology/ standards</th>
<th>Frequency/ Responsibility</th>
<th>Estimated cost/ annum (GH¢)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise Levels</td>
<td>Sound levels in dBA</td>
<td>Tema Port at established Sampling Points</td>
<td>Noise Level Data Logger /EPA guidelines</td>
<td>Quarterly /EPC contractor /EHS Officer</td>
<td>15,000.00</td>
</tr>
<tr>
<td>Air quality</td>
<td>VOCs, Noxious gases (NOx, COx, SOx), and particulate matter (PM_{10} and TSP)</td>
<td>Tema Port at established Sampling Points</td>
<td>HiVol Sampler and DraeggerTubes/ EPA guidelines</td>
<td>Quarterly /EPC contractor /HSE Officer</td>
<td>-</td>
</tr>
<tr>
<td>Loss of vegetation and impacts on flora and fauna</td>
<td>Area of land cleared or disturbed outside authorization(m²)</td>
<td>Pipeline route to header station</td>
<td>Field Observations and measurements.</td>
<td>Weekly / Contractor /EHS Officer</td>
<td>-</td>
</tr>
<tr>
<td>Water quality</td>
<td>General physicochemical parameters, including Oil/grease and trace metals</td>
<td>Port basin at Established Sampling Points</td>
<td>Sampling, field work and laboratory analysis/ EPA guidelines</td>
<td>Quarterly/Contractor /EHS Officer</td>
<td>16,000.00</td>
</tr>
<tr>
<td>Sediment quality</td>
<td>General physicochemical parameters, heavy metals (V, Cu, Zn, Pb, Mn, Fe and Cd)</td>
<td>Port basin at Established Sampling Points</td>
<td>Sampling, field work and laboratory analysis/ EPA or internationally accepted guidelines, e.g. CEQG</td>
<td>Quarterly/Contractor /EHS Officer</td>
<td>24,000.00</td>
</tr>
<tr>
<td>Invertebrate biota</td>
<td>Mollusc and crustacean</td>
<td>Harbour area at specified locations</td>
<td>field work and laboratory analysis</td>
<td>Quarterly/Contractor /EHS Officer</td>
<td>11,000.00</td>
</tr>
<tr>
<td>Port area and Coastline (eastwards)</td>
<td>Marine mammals/ sea turtles</td>
<td>From Fishing harbour through landing beach to Gao lagoon</td>
<td>Field inspections/ observations</td>
<td>Weekly</td>
<td>-</td>
</tr>
<tr>
<td>Rate of shore recession at down-drift areas and material accretion upstream</td>
<td>Physical inspection of accretion and erosion of windward and leeward areas of the port respectively</td>
<td>Area around the port basin</td>
<td>Physical inspections and reporting</td>
<td>Biannually</td>
<td>8,000.00</td>
</tr>
</tbody>
</table>
| Sanitation /Waste generation Concerns | Metallic wastes  
- Garbage  
- Waste oil  
- Hazardous waste  
- Dredged material  
- Construction Spoil | Port basin  
- Along the pipeline routes  
- Along the harbor  
- Along the pipeline  
- Along the harbor | Record quantity and type of waste generated. Inspect quantity of waste.  
- Inspect quantities and conditions of waste bins  
- Keep records of time and place of final disposal  
- Assessment of KPIs | Daily /EHS Officer  
Contractor | 25,000.00 |
| --- | --- | --- | --- | --- | --- |
| Occupational Health and Safety concerns and Labour issues | Type, frequency and cause of injuries /accidents  
- Availability /Use of Personal protective gears (Life jackets, Safety boots, gloves, earplug, Helmet etc.)  
- Occupational health and safety training records  
- Worker grievance mechanism records  
- Records of worker contracts and payments. | Harbour area, Pipeline route, header station | Observation, audits, complaint/ incident records/ Safety Policy of GPHA/Safety Policy of Contractor /Local Labour Laws/ OS 5 | -Daily-Contractor  
/EHS Officer  
- Quarterly  
Daily  
/Quarterly | 40,000.00 |
| Public Health and Safety and security | Human and vehicular traffic  
- Port related road accidents/ incidents  
- Public complaints, Type and nature of complaints and concerns  
- Records on training of security personnel  
- Records of human rights abuses  
- Records to show that security providers have been vetted. | Harbour area/ communities along pipeline route | Observations and complaints/incidents records/ Safety Policy of GPHA/Contractor  
Records of grievances and implemented actions  
Stakeholder meetings  
OS 1 and OS 5 requirements | -Daily –EHS officer | 5,000.00 |

### Operational Phase

<table>
<thead>
<tr>
<th>Air quality</th>
<th>VOCs, Noxious gases (NOx, COx, SOx), and particulate matter (PM10 and TSP)</th>
<th>Tema Port at established Sampling Points</th>
<th>HiVol Sampler and Draeger Tubes/ EPA guidelines</th>
<th>Quarterly/ QHSE officer</th>
<th>15,000.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contamination of marine environment</td>
<td>Heavy metals (V, Cu, Zn, Pb, Mn, Fe and Cd),</td>
<td>Port basin at Established Sampling Points</td>
<td>Sampling, field work and laboratory analysis/ EPA guidelines/ CEQG</td>
<td>Quarterly/QHSE officer</td>
<td>26,000.00</td>
</tr>
<tr>
<td>Invasive marine species</td>
<td>Marine ecology (Mollusc and crustacean)</td>
<td>Port basin</td>
<td>field work and laboratory analysis</td>
<td>Annually /QHSE officer</td>
<td>6,000.00</td>
</tr>
</tbody>
</table>
### Table 7.2. Capacity Building and Training Program

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Target Group/ Participants</th>
<th>Timeline/ Frequency</th>
<th>Proposed Facilitator</th>
<th>Estimated Cost/(GH¢)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>CONSTRUCTION PHASE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Training Workshop on ESMP/ESMS, grievance redress mechanism, public</td>
<td>-TEMA LNG workers</td>
<td>At the onset of</td>
<td>Tema LNG HSE Manager/ Environmental Consultant and or AfDB Safeguard Staff</td>
<td>20,000.00</td>
</tr>
<tr>
<td></td>
<td>health and safety issues, ESMP monitoring and reporting, EPA</td>
<td>-EPC Contractor</td>
<td>Construction Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>permit Schedule, AfDB operational safeguard,</td>
<td>-Sub-Contractors</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Health and Safety Policy/Plan training/induction</td>
<td>Construction workers</td>
<td>Construction phase</td>
<td>Tema LNG HSE Manager/ EPC Contractor</td>
<td>10,000.00</td>
</tr>
<tr>
<td>3.</td>
<td>Security, safety and human rights training</td>
<td>Security personnel, drivers/operators</td>
<td>Construction phase</td>
<td>Tema LNG HSE Manager /EPC Contractor</td>
<td>8,000.00</td>
</tr>
</tbody>
</table>

**TOTAL** 240,000.00
Table 7.2. Capacity Building and Training Program

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Target Group/ Participants</th>
<th>Timeline/ Frequency</th>
<th>Proposed Facilitator</th>
<th>Estimated Cost/(GH¢)</th>
</tr>
</thead>
</table>
| 4.  | Site meetings to discuss and review ESHS issues and develop corrective actions | - EPC Contractor  
-Sub-Contractors  
-Tema LNG (HSE Team and Engineers)  
-GPHA representatives | Monthly | EPC Contractor and Tema LNG Project Manager | 10,000.00 |
| 5.  | Community sensitization on project, Environment/Social & Health/ Safety/ Security issues, grievance redress mechanism. | Affected project Communities (Abonkor, Manhean & Bankuman) | Annually at the community places | Tema LNG Terminal Company | 20,000.00 |
| 6.  | Sub-total (Construction Phase)                                          |                                                                             |                    |                                                                                      | 68,000.00 |

**OPERATIONAL PHASE**

| 1.  | Training Workshop on ESMP/ESMS, GRM, public health and safety issues, monitoring plans, EPA Permit Schedule, AfDB Operational Safeguard | Tema LNG Terminal workers  
-EHS Officers  
-Security Coordinator | One-off training at the commencement of operations | Tema LNG Project Manager and HSE Manager/ Environmental Consultant | 10,000.00 |
| 2.  | Environmental Health and Safety Trainings                                | EHS Representatives (EHSRs)  
-EHS Officers (EHSOs) | Annually | HSE Consultant or made to attend a refresher course | 30,000.00 |
| 3.  | Community sensitization on project, EHS issues, GRM, field demonstrations on emergency response procedures | Affected Project communities (Abonkor, Manhean and Bankuman) | Annually at the community places | Tema LNG Terminal Site Manger and HSE Manager | 20,000.00 |
| 4.  | Sub-total (Operational Phase)                                            |                                                                             |                    |                                                                                      | 60,000.00 |
| 5.  | TOTAL COST                                                               |                                                                             |                    |                                                                                      | 128,000.00 |
7.4 **Environmental and Social Performance Reporting**
Quarterly monitoring reports, annual environmental and annual environmental audit reports on the implementation of the ESMP will be prepared by the proponent and submitted to the Bank for review and approval. The objective of the compliance monitoring reports will be to demonstrate that the mitigation/enhancement measures in the ESMP and Livelihood Improvement Plan have been effectively implemented and monitored.

7.5 **Estimated ESMP Implementation Budget**

The estimated ESMP implementation budget is **GH₵1,233,700 annually** (excluding some contractor and terminal cost or budget) as detailed in **Table 7.3**. The estimated costs can be refined with detailed cost analysis after detailed project design. The estimated costs do not include contractor ESMP implementation costs, which will be an integral part of the EPC Contractor’s costs.

**Table 7.3. Estimated ESMP implementation budget (annual)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Programme</th>
<th>Cost/year (GH₵)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Implementation of mitigation actions (refer Table 6.1)</td>
<td>715,700+</td>
</tr>
<tr>
<td>2.</td>
<td>Environmental monitoring (refer to Table 7.1)</td>
<td>240,000</td>
</tr>
<tr>
<td>3.</td>
<td>Staff Information and Awareness Creation Program</td>
<td>30,000</td>
</tr>
<tr>
<td>4.</td>
<td>Environmental Auditing and Reporting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Annual environmental, health and safety audits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Returns of Monitoring Reports to EPA (in line with LI 1652)</td>
<td>20,000</td>
</tr>
<tr>
<td></td>
<td>• Preparation of Annual Environmental Reports (in line with LI 1652)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Preparation of Environmental and Social Management Plan (in line with LI 1652)</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Capacity Building and Training (Table 7.2)</td>
<td>128,000</td>
</tr>
<tr>
<td>6.</td>
<td>Implementation of Grievance Redress mechanism</td>
<td>10,000</td>
</tr>
<tr>
<td>7.</td>
<td>Implementation of Stakeholder Engagement Programme</td>
<td>20,000</td>
</tr>
<tr>
<td>8.</td>
<td>Community Development Program/Social Responsibility</td>
<td>20,000</td>
</tr>
<tr>
<td>9.</td>
<td>Preparation and Implementation of emergency response plan</td>
<td>50,000</td>
</tr>
<tr>
<td>10.</td>
<td>Livelihood improvement plan (refer LIP, 2019)</td>
<td>200,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1,433,700+</strong></td>
</tr>
</tbody>
</table>
8  PUBLIC CONSULTATION AND DISCLOSURE

8.1  Summary of Consultation Undertaken

Stakeholder engagements has been undertaken at all stages of the ESIA process i.e. scoping stage and ESIA stage. The objectives of public consultation were to inform all Interested and Affected Parties about the project activities, predicted impacts, and the respective mitigation measures; to ensure that legislative requirements and project standards were met during the assessment period; and to allow them an opportunity to voice their opinions, concerns, and expectations regarding the Project.

A stakeholder engagement and communication strategy including a detailed presentation of relevant stakeholders within the project area of influence is presented in the ESIA. Extensive stakeholder consultations have been carried out by TLTC (since December 2017) and SAL Consult Ltd (since January 2018). The Tema LNG Terminal Company has been engaging the key stakeholders involved in the siting of project facilities as well as owners of the pipeline ROW, including Ghana Ports and Harbours Authority (GPHA), Energy Commission, Tema Oil Refinery (TOR), Ghana Petroleum Mooring Services (GPMS), Volta Aluminum Company Ltd (VALCO) and Tema Development Corporation (TDC).

Among the potential issues raised during the consultations process were the land acquisition, loss of livelihoods, and restriction of the gas pipeline construction within existing rights of ways (RoW). The ESIA assessed potential impacts and set out mitigation measures in the ESMP. A livelihood improvement plan has also been prepared for the project.

The ESIA includes a provisional grievance redress mechanism (GRM) which aims at providing an effective, transparent and timely system that would give aggrieved persons redress, minimize bad publicity, avoid/minimizes delays and avoid litigation in execution of the Tema LNG Terminal project. This ensures public health and safety, and sustainability of the project. The GRM will provide all affected stakeholders avenues through which they can express their concerns and receive the needed corrective actions in an appropriate and timely manner.

8.2  Ongoing Consultation

It is expected that the public consultation process will continue throughout the implementation phase in order to accommodate stakeholders' aspirations and to orient the stakeholders positively towards the project implementation including efficiently addressing any project-related grievances that may arise.

9  CONCLUSIONS

The ESIA study for the proposed project has been carried out in line with Ghanaian regulations and applicable international safeguard standards including the African Development Bank’s Integrated Safeguards System (ISS). The overall goal of the ESIA was to identify and assess the potential environmental and social impacts of the proposed Project, evaluate alternatives and propose appropriate measures to mitigate the significant adverse effects and enhance potential benefits in order to ensure that the proposed Project is environmentally sustainable and socially inclusive.
The ESIA has identified a series of measures to enhance potential positive impacts of the proposed project as well as technically and financially feasible measures to address negative impacts. These include; sound engineering design; good construction practices; effective maintenance and adequate supervision; the application of appropriate mitigation measures and enforcement during the project life cycle. In addition, a comprehensive ESMP has also been developed. The plan uses the mitigation hierarchy to manage the residual environmental and social impacts throughout the development phases of the project. Furthermore, a grievance redress mechanism will be implemented to ensure stakeholder concerns and grievances are managed effectively to minimise potential conflicts during project implementation.

In consideration of the above, there are no residual environmental or social issues that could impede the implementation of the proposed development of the Project, which is expected to increase reliability of gas supply to power generators (IPPs) in the Tema area with subsequent reduction in tariffs which will benefit the people of Ghana.

10 REFERENCES AND CONTACTS

10.1 References


10.2 Contacts

For additional information in relation to the Project, contact the following individuals

For additional information in relation to the Project, contact the following individuals

For Tema LNG (Project Proponent)

- Mr. Ogbemi OFUYA, Helios Investment Partners, email: oofuya@heliosllp.com
- Mr. Edmund AGYEMAN-DUAH, Project Manager, email: edmund.agyemanduah@temalng.com
- Francis Okyere, HSE Manager, email: francis.okyere@temalng.com

For the African Development Bank (Project lender)

- Mbianyor BAKIA, Chief E & S Compliance Officer, e-mail: m.bakia@afdb.org
- Osric Tening FORTON, Principal E & S Safeguards Officer, e-mail: o.forton@afdb.org
- Bedilu Amare RETA, E & S Safeguards Consultant, e-mail: b.reta@afdb.org
## Impact Description

### Land (ROW) Acquisition and Destruction of crops/farm, pigsty, loss of livelihood and access to land/resources
- **Significance Rating**: MODERATE - PREVENTION, NEGLIGIBLE - POST-MITIGATION
- **Main mitigation measures**:
  - Ensure all stakeholders are engaged in the early stage of the project.
  - All approved permits and necessary documentation shall be ready for acquiring ROW.
  - Prepare and implement a livelihood restoration/improvement plan and compensation plan.
  - Ensure affected persons are well informed about their affected crops and structures prior to commencing construction.
  - Implement appropriate compensation for affected standing crops and pigsty/pigpen at proven value will be paid.
  - Conduct regular monitoring and verification during and after implementation of compensation / livelihood, assistance measures and verify they have been effective.

### Air Quality Deterioration
- **Significance Rating**: MODERATE - PREVENTION, MINOR - POST-MITIGATION
- **Main mitigation measures**:
  - Use of standard dust suppression measures e.g. dampening of unpaved surfaces.
  - Ensure vehicular speed limits of 30mph over any unpaved landscape and traffic density area.
  - Material dumping will be regulated to reduce dust emissions.
  - Monitor dust emission and remedial action.
  - Dust-related grievances will be investigated and managed as part of the GRM.
  - Regular maintenance of machinery/equipment in accordance with manufacturer specifications.

### Road crossing and traffic impact
- **Significance Rating**: MODERATE - PREVENTION, MINOR - POST-MITIGATION
- **Main mitigation measures**:
  - Inform the local community on the schedule for the crossing of the untarred access road connecting Bankuman to the TOR area.
  - Schedule crossing of the untarred access road when the traffic is low.
  - Adequate warning signs and notices shall be posted at strategic places and diversion routes.
  - Reinstate damaged sections of the roads.
  - Develop and implement traffic management plans.
  - Use appropriate methodology to cross the VALCO exclusive road to minimize delays in transport of people to and from the clinic.

### General Disturbance of Port construction and Operations
- **Significance Rating**: MINOR - PREVENTION, NEGLIGIBLE - POST-MITIGATION
- **Main mitigation measures**:
  - Elicit the assistance of the Harbour master, GMA as well as representative bodies of the port users to ensure that construction activities are scheduled so that port operations are not unduly interrupted.
  - The harbor master will ensure all passing vessels are well informed of construction work, e.g. dredging, piling etc., and are cautious when moving in and out of the port facility.
  - The extension of the breakwater will correspondingly shift the turn further away from the harbor entrance, thus creating a greater distance between the LNG facility and the turn for moving vessels.

### Vibration and noise nuisance
- **Significance Rating**: MODERATE - PREVENTION, NEGLIGIBLE - POST-MITIGATION
- **Main mitigation measures**:
  - Employ standard noise abatement measures and engineering best practices to reduce to acceptable limits.
  - Ensure that earthworks and other construction activities will be controlled to reduce noise generation during construction.
  - All equipment and vessels shall be operated and maintained in accordance with appropriate industry and equipment standards.
  - Machines in intermittent use shall be shut down in the intervening periods.
  - Provide appropriate PPEs for workers use.
  - Regularly monitor Marine mammal/sea turtle impact with sound and vibration.
  - Consider soft-starts for noise generating activity.
  - Reduce underwater noise levels associated with percussive piling by employing Quieter hydraulic hammers.
  - Ensure the use of silent equipment for the terminal operations.
  - Use silencers, mufflers, and other appropriate engineering control devices on the noise generating equipment.

### Loss of vegetation and impacts on flora and fauna
- **Significance Rating**: MINOR - PREVENTION, NEGLIGIBLE - POST-MITIGATION
- **Main mitigation measures**:
  - Undertake pre-clearing survey and assessment of the flora.
  - Develop construction code of practice and avoid encroaching of critical areas such as the remaining mangrove swamps along the Chemu stream/lagoon.
  - Allow adequate buffer zone for remnant native vegetation.
  - Limit construction activities to only designated places and clearly mark out all vegetation, which will not be cleared.
  - Dismantle and remove all equipment and machinery after construction from site.
  - Rehabilitate trenches and disturbed areas as soon as possible.
  - Develop a biodiversity management plan.

### Sanitation
- **Significance Rating**: MAJOR - PREVENTION, NEGLIGIBLE - POST-MITIGATION
- **Main mitigation measures**:
  - Transport waste to the designated disposal site or to land for re-use, recycling, treatment, or disposal in alignment with the contractors WMP.
### Annex I: Summary of potential impacts during the Pre-Construction and Construction Phases

<table>
<thead>
<tr>
<th>Impact Description</th>
<th>Significance Rating</th>
<th>Pre- mitigation</th>
<th>Post- mitigation</th>
<th>Main mitigation measures</th>
</tr>
</thead>
</table>
| Waste Generation (General and Construction waste) | MAJOR | MINOR | MINOR | • Provide waste storage bins at conspicuous locations.  
• Good site practices shall be implemented to avoid waste generation and promote waste minimization.  
• All scrap or other solid wastes will be disposed of at the approved disposal site.  
• Develop and implement a Waste Management Plan (WMP)  
• Excavated soils/concrete will be reused as much as possible for backfilling trenches dug during construction.  
• Contaminated soil will be disposed of accordingly at the Kpone Landfill Site. Facilities. |
| Sanitation/ Waste Generation (Marine environment) | MAJOR | MINOR | MINOR | • Develop a detailed dredge management plan  
• Restrict disposal or dump of any kind of wastes into the marine waters.  
• Develop and implement a Waste Management Plan (WMP)  
• Appoint a waste management coordinator.  
• All hazardous waste (e.g. oily waste) generated during construction/installation will be appropriately stored as per manufacturer’s instructions.  
• Ensure chemical wastes are stored, handled and disposed of in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes  
• All the collected wastes shall be transferred to the Port Waste Reception and Treatment |
| Marine water contamination/ impacts on aquatic organisms and biodiversity | MODERATE | MINOR | MINOR | • Develop and implement Dredge Management Plan  
• Ensure dredge cuts and lifts are designed such as to prevent undercutting of material at the cutter head.  
• Reduce the level of re-suspended material released into the water column  
• Ensure that the works cause no visible foam, oil, grease, litter or other objectionable matter to be present in the water within and adjacent to the dredging area.  
• Marine mammal/ sea turtle observance and monitoring will be carried out during dredging to observe the presence of marine mammals and turtles.  
• Restricting trenching times, particularly during periods of high wave/wind activity to reduce turbidity and spill, design and implement a trenching management plan.  
• Install appropriate silt curtains around offshore works  
• Prepare and implement a spill prevention and control plan;  
• Monitoring and spill prevention drills to ensure impacts are avoided to the maximum extent practical. |
| Under water blasting effects | MAJOR | MINOR | MINOR | • Avoid underwater blasting as much as possible and consider other alternatives such as hammering.  
• Technical persons and the Inspectors shall be consulted and approve of the blasting design and supervise and observe the blasting operation. If there are any problems encountered, the problems shall be evaluated by the technical persons to provide solutions prior to the next blasting event.  
• Marine mammal/ sea turtle observance and monitoring will be carried out during any underwater blasting to observe any appearance of such animals along the coast/shoreline or in the waters.  
• In tidal areas, follow the recommended procedure for blasting (i.e. slack or low-tide conditions).  
• If multiple charges are required, time-delays will be used to reduce the overall detonation pressures.  
• All shock-tubes and detonation cord or electric wires will be recovered and removed after each blast.  
• All blasting events shall conducted in a suitable climatic conditions, prohibit under windy conditions, during periods of fog and heavy rain.  
• All blasting will occur during daylight hours to ensure that optimal observation conditions. |
| Occupational Health and Safety Concerns and Labour Issues | MAJOR | MINOR | MINOR | • Establish and maintain high standards of occupational health, safety and environmental protection system at the workplace.  
• Develop and implement an Occupational Health and Safety Plan  
• Apply the hazard hierarchy when planning work to avoid/reduce risks.  
• Educate workers on Company’s health and safety policy, provide adequate first aid kits at the construction areas and arrange hospitals for serious case treatment.  
• Ensure that well-trained workers will be engaged for the various construction roles.  
• Allow only drivers with the requisite licenses to handle vehicles and earth-moving equipment into the port. Provide Initial training and testing in machine/equipment handling and safe working procedures to drivers, operators and other field workers.  
• Provide appropriate PPE  
• Movement of tanks, pipes and other construction materials to site or storage areas will be carried out in phases and properly regulated.  
• All equipment’s shall be in good condition with regular maintenance. |
### Annex I: Summary of potential impacts during the Pre-Construction and Construction Phases

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<tr>
<th>Impact Description</th>
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</tr>
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<tbody>
<tr>
<td></td>
<td>Pre-mitigation Post-mitigation</td>
<td>• Develop and implement a Human Resource Policy and plan that adheres to the requirements of AfDB OSS, including requirements for workers to have contracts, Workers Grievance Mechanism, etc.</td>
</tr>
<tr>
<td></td>
<td>MAJOR MINOR</td>
<td>• Maintain security at the proposed site to ensure that authorized persons are allowed into the construction area.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide temporary crossings over trenches at the Abonkor community section.</td>
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<tr>
<td></td>
<td></td>
<td>• Provide mobile toilet facilities for workers during construction of the pipeline route and for Abonkor and Manhean suburbs near the VALCO fence wall for use to prevent open defecation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Uncovered trenches or deep excavations will be protected using indicator linings or illustrative warning notices or wire mesh. All trenches and excavation will be covered as soon as possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Prepare and implement a Traffic Management Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All the vehicles to be used for the project will be serviced regularly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All the drivers to be engaged/assigned would be required to hold the requisite driver’s license and would be educated on public safety issues.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Traffic management measures (including speed restrictions at 20-30 km/hr, covering trucks transporting friable material) will be instituted to caution and create safety awareness.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Organisation of Will organize awareness creation seminars and educational programmes for all workers and the general public on the behavioral changes required to prevent the spread of HIV/AIDS and other STDs.</td>
</tr>
</tbody>
</table>

### Annex II Summary of potential impacts and mitigation measures during the operation phase

<table>
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<tr>
<th>Impact Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-mitigation Post-mitigation</td>
<td>• Ensure proper management and disposal of waste generated and continue to educate workers on its waste management plan and appoint a waste management coordinator.</td>
</tr>
<tr>
<td></td>
<td>MAJOR MINOR</td>
<td>• Ensure different types of waste are segregated in different containers and all the collected wastes shall be transferred to the Port Waste Reception and Treatment Facilities</td>
</tr>
<tr>
<td>Waste Management</td>
<td></td>
<td>• Ensure regular maintenance of the sewage treatment plant, manhole for runoff clarification and coalescence separator for the treatment of runoff in areas where fuels and light liquids are handled (e.g. fuel station, workshop).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensure best waste management practices that the waste reception facilities for the collection, storage, treatment, and transfer of waste at the port are utilized by vessels arriving at the port.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Prepare and implement storm water management plan and conduct regular inspection of storm water drains to remove settled materials to avoid blockage and ensure the proper discharge in the drainage systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The terminal operator will ensure that the likelihood of oil spills are reduced to the barest minimum through regular monitoring and audits of vessels being used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Prepare and implement oil spill contingency plan to promptly clean up oil spills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Punitive measures will be enforced for all persons observed to throw waste into the port waters.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The polluter pays principle is in place at the port and education of port users will be intensified to increase awareness.</td>
</tr>
<tr>
<td>Contamination of Marine Environment</td>
<td>MODERATE MINOR</td>
<td>• The terminal operators will ensure that silent equipment (low noise versions, which may cost a little extra) are used for the terminal operations. Additionally, silencers, mufflers, and other appropriate engineering control devices shall be used on the noise generating equipment. Where possible, electrical instead of diesel or diesel-electric moving equipment will be used.</td>
</tr>
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<td></td>
<td></td>
<td>• The terminal operators will ensure that silent equipment (low noise versions, which may cost a little extra) are used for the terminal operations. Additionally, silencers, mufflers, and other appropriate engineering control devices shall be used on the noise generating equipment. Where possible, electrical instead of diesel or diesel-electric moving equipment will be used.</td>
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<tr>
<td>Noise Nuisance</td>
<td>MAJOR MINOR</td>
<td>• The terminal operators will ensure that silent equipment (low noise versions, which may cost a little extra) are used for the terminal operations. Additionally, silencers, mufflers, and other appropriate engineering control devices shall be used on the noise generating equipment. Where possible, electrical instead of diesel or diesel-electric moving equipment will be used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regular site inspections will be carried out to audit the compliance with regard to noise control.</td>
</tr>
</tbody>
</table>
Annex II Summary of potential impacts and mitigation measures during the operation phase

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<td></td>
<td>Pre-mitigation</td>
<td>Post-mitigation</td>
</tr>
<tr>
<td>Dust</td>
<td>MINOR</td>
<td>• Will provide appropriate PPEs for workers use.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensure regular maintenance of the sewage treatment plant, manhole for runoff clarification and coalescence separator for the treatment of runoff in areas where fuels and light liquids are handled (e.g. fuel station, workshop).</td>
</tr>
<tr>
<td></td>
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<td>• Ensure best waste management practices that the waste reception facilities for the collection, storage, treatment, and transfer of waste at the port are utilized by vessels arriving at the port.</td>
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<td></td>
<td></td>
<td>• Prepare and implement storm water management plan and conduct regular inspection of storm water drains to remove settled materials to avoid blockage and ensure the proper discharge in the drainage systems</td>
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<td>• The terminal operator will ensure that the likelihood of oil spills are reduced to the barest minimum through regular monitoring and audits of vessels being used.</td>
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<td>• Punitive measures will be enforced for all persons observed to throw waste into the port waters.</td>
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<td>• The polluter pays principle is in place at the port and education of port users will be intensified to increase awareness.</td>
</tr>
<tr>
<td>Contamination of Marine Environment</td>
<td>MAJOR</td>
<td>• Regular maintenance of machinery/equipment in accordance with manufacturer specifications.</td>
</tr>
<tr>
<td></td>
<td>MINOR</td>
<td>• Incorporate the Air Quality Management Plan into standard operations, which include dust from vehicular movement, dust from cleaning activities, exhaust emission from vehicles and machinery, fumes from chemicals and welding, VOCs from fuel storage and dispensing areas, noise from operation of machinery, monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Maintaining stable tank pressure and vapour space by coordinating filling and withdrawal schedules (offshore)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monitor dust and remedial action will be taken</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dust-related grievances will be investigated and managed as part of the GRM.</td>
</tr>
<tr>
<td>Contamination of Marine Environment</td>
<td>MAJOR</td>
<td>• Risk assessments will be undertaken and avoidance / elimination of hazards prioritized to reduce the need for manual handling of chemicals.</td>
</tr>
<tr>
<td></td>
<td>MINOR</td>
<td>• Ensure that workers handling fuels, chemicals, machinery and equipment are well trained. Such workers will be provided with the necessary documentations, Material Safety Data Sheet (MSDS)) to serve as reference sources on the dangers and ways of handling these chemicals, fuels etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All equipment’s shall be in good condition with regular maintenance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Develop and implement Company’s Health and safety management plan, emergency preparedness and response plan.</td>
</tr>
<tr>
<td>Accidental Events and impacts on properties, marine/terrestrial ecology</td>
<td>MAJOR</td>
<td>• The design of the facilities have incorporated adequate safety and security considerations as provided in Section 3 (project description) to minimize potential accidents.</td>
</tr>
<tr>
<td></td>
<td>MINOR</td>
<td>• The company will develop and implement an emergency preparedness and response plan in collaboration with relevant stakeholders, including GPHA, GPMS, VALCO, Gridco, and WAPCo as appropriate.</td>
</tr>
<tr>
<td>General Disturbance of Port construction and Operations</td>
<td>MODERATE</td>
<td>• The extension of the breakwater will correspondingly shift the turn further away from the harbor entrance, thus creating a greater distance between the LNG facility and the turn for moving vessels.</td>
</tr>
<tr>
<td></td>
<td>NEGLIGIBLE</td>
<td>• During STS transfer to FSU, passing vessels should as much as possible aim to maximize clearance of the LNGC. That would imply a safe clearance of at least 100-150 m from the traffic lane.</td>
</tr>
<tr>
<td>Air Quality deterioration</td>
<td>MINOR</td>
<td>• Ensure the Air Quality Management Plan into standard operations, which include dust from vehicular movement, dust from cleaning activities, exhaust emission from vehicles and machinery, fumes from chemicals and welding, VOCs from fuel storage and dispensing areas, noise from operation of machinery, monitoring</td>
</tr>
<tr>
<td>Occupational Health and Safety Concerns and Labour issues</td>
<td>MAJOR</td>
<td>• Risk assessments will be undertaken and avoidance / elimination of hazards prioritized to reduce the need for manual handling of chemicals.</td>
</tr>
<tr>
<td></td>
<td>MINOR</td>
<td>• Ensure that workers handling fuels, chemicals, machinery and equipment are well trained. Such workers will be provided with the necessary documentations, Material Safety Data Sheet (MSDS)) to serve as reference sources on the dangers and ways of handling these chemicals, fuels etc.</td>
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<td>• All equipment’s shall be in good condition with regular maintenance.</td>
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<td></td>
<td></td>
<td>• Develop and implement Company’s Health and safety management plan, emergency preparedness and response plan.</td>
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### Annex II Summary of potential impacts and mitigation measures during the operation phase

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<th>Main Mitigation measures</th>
</tr>
</thead>
</table>
| **Public Health and Safety and Security Impacts** | MAJOR | MINOR | • Good housekeeping practices will be an integral part of ports operations to maintain a well laid out working space and avert accidents resulting from slippage, fires from torn electrical wires, cobwebs etc.  
• Prepare comprehensive maintenance programme on commencement of operations to avert any serious breakdowns or failures. The required maintenance for the systems will include among others: Environmental incident/accident investigation; Routine equipment maintenance/inspection schedule; Annual equipment inspection and maintenance record; Procedure for pre-arranged repair service; Procedure for preventive maintenance; and Regular calibration of equipment.  
• Non-conductive hand tools rated for the voltage at which live electrical work is being performed at the substation will be provided.  
• Caution/warning signs should be placed at vantage points around the site  
• Provide barricades and signage for all live electrical equipment  
• Other safety precautions will be implemented to minimise danger of electrocution  
• Ensure that all staff working on live equipment or lines will be without conductive apparel (watches, bracelets, rings, key chains, necklaces, zippers, cloth with conductive thread, etc.) |
| **Introduction of Invasive Marine Pest Species** | MINOR | NEGLIGIBLE | • Ensure extensive dissemination of information on Ballast water management as prescribed in the International Convention for the Control and Management of Ships Ballast Water and Sediments.  
• Training and education of ships masters and crews regarding the risks associated with biofouling: The transference of marine pests and procedures of minimising risk such as: Using anti-fouling systems appropriate to a ship hull and activity; Applying appropriate operational management practices to reduce the development of biofouling (e.g. maintaining seawater intake system cleaning); Maintaining a biofouling management plan and record; book to identify procedures prescriptive to each ship regarding biofouling management and to maintain records of procedures and measures being applied for each ship’s biofouling management  
• Ensuring ship maintenance (e.g. of the anti-fouling system or other vessel components where biofouling accumulates) is completed on an appropriate life cycle to minimize growth of biofouling  
• Where in-water inspection of ships is required, consider whether targeted maintenance of areas where biofouling accumulates is appropriate. Risks associated with environmental harm from in-water cleaning are acknowledged by the biofouling guidelines and a number of measures to reduce risk of harm are identified, including completion of risk assessments, avoidance of cleaning where harm is likely  
• Ensure effective dissemination of information of relevance to biofouling management to ensure appropriate biofouling management systems are implemented by all vessels |