

CHINA UNION INVESTMENT LIBERIA BONG MINES IRON ORE PROJECT
UPDATED ESIA AND ESMP
FOR THE MINES, PORT AND RAILWAY



Submitted To:
Environmental Protection Agency of Liberia
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ACRONYMS

CITES	Convention on International Trade in Endangered Species
CLO	Community Liason Officer
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
COD	Chemical Oxygen Demand
CPRs	Common Property Resources
CR	Critically Endangered
CUPM	China Union Project Manager
dB	Decibels
DD	Data Deficient
DIN	German Deutsches Institut fuer Normung
DPM	Diesel Particulate Matter
DTM	Digital Terrain Model
DWT	Deadweight tonnage
EPA	Environmental Protection Agency
EPAA	Environment Protection Agency Act
ERP	Emergency Response Plan
EC	Electrical Conductivity
ECOWAS	Economic Community of West African States
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EM	Environmental Manager
EMP	Environmental Management Plan
EITI	Extractive Industries Transparency Initiative
EMS	Environmental Management System
ERP	Emergency Response Plan
EPs	Equator Principles
ERM	Environmental Resources Management
ESIA	Environmental Social Impact Assessment
ESMP	Environmental and Social Management Plan
EZ	Eastern Zone
FDA	Forestry Development Authority
FDI	Foreign Direct Investment
Fe	Iron
GDP	Gross Domestic Product
GIIP	Good International Industry Practice
GLCC	Global Land Cover Characterisation
GoL	Government of Liberia
GPS	Geographic Positioning System
GSM	Gravel, Sand and Mud
HFO	Heavy Fuel Oil
HSE	Health Safety and Environment
Hz	Hertz

IA	Impact Assessment
IBAs	Important Bird Areas
ICMM	International Council on Mining and Metals
IDPs	Internally Displaced Persons
IFC	International Finance Corporation
IFC	International Finance Corporation's
IH	Instream Habitat
IHI	Index of Habitat Integrity
ILO	International Labour Organization
ISO	International Standards Organisation
ITCZ	Inter Tropical Convergence Zone
ITTA	International Tropical Timber Agreement
IUCN	International Union for the Conservation of Nature
IWRMP	Integrated Water Resources Management Plan
kg	Kilogram
km	Kilometre
KPIs	Key Performance Indicators
kWh	Kilowatt Hour
LAC	Liberia Agriculture Company
LC	Least Concern
LF	Low Flow
LMC	Liberia Mining Company
LNP	Liberia National Police
LOM	Life of Mine
LWSC	Liberia Water and Sewage Corporation
m	Meter
m ²	Meter Squared
m ³	Meter Cubed
mamsl	Metres above mean sea level
MAP	Mean Annual Precipitation
mbgl	Metres below ground level
MDA	Mineral Development Agreement
mg	Milligram
MoA	Ministry of Agriculture
MoF	Ministry of Finance
MoHSW	Ministry of Health and Social Welfare
MoLME	Ministry of Land, Mines and Energy
MoPW	Ministry of Public Works
MoT	Ministry of Transport
MRL	Minimum Risk Level
Mt	Million Tonnes
Mtpa	Million tonnes per annum
MW	Mega Watt
NEAP	National Environmental Action Plan

NEC	National Energy Committee
NEP	National Environmental Policy
NEPC	National Environmental Policy Council
NFPA	National Fire Protection Association
NGO's	Non-Government Organisations
NIA	Noise Impact Assessment
NO	Nitrogen Monoxide
NO ₂	Nitrogen Dioxide
NoI	Notice of Intent
NOx	Nitrogen Oxides
NPA	National Ports Authority
NSR	Noise Sensitive Receptor
NT	Near Threatened
NTMP	National Transport Master Plan
O ₃	Ozone
OECD	Organisation for Economic Co-operation and Development
PAP	Project Affected People
PEC	Predicted Environmental Concentration
PNL	Project Noise Level
PM	Particulate Matter
PM10	Thoracic particulate matter with an aerodynamic diameter of less than 10mm
PM2.5	Thoracic particulate matter with an aerodynamic diameter of less than 2.5mm
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment
ppm	Parts per Million
PPV	Peak Particle Velocities
PS	Performance Standards
RAP	Resettlement Action Plan
ROM	Run of Mine
RPF	Resettlement Policy Framework
RRAP	Resettlement and Rehabilitation Action Plan
SAP	Social Action Plan
SASAC	State-owned Assets Supervision and Administration Commission of the State Council
SASS5	South African Scoring System 5
SCVPS	Social Contribution Value Per Share
SDF	Social Development Fund
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SIC	Stones in Current
SMP	Soil Management Plan
SOEs	State-Owned Enterprises
SO ₂	Sulphur Dioxide
SOOC	Stones out of Current

SoW	Scope of Work
SSC	Shanghai Stock Exchange
STIs	Sexually Transmitted Infections
TB	Tuberculosis
TDS	Total Dissolved Solids
TLC's	Tribal Land Certificates
ToR	Terms of Reference
TS	Technical Standards
TSF	Tailings Storage Facilities
TSP	Total Suspended Particulate Matter
TWQR	Target Water Quality Range
UGF	Upper Guinea Forest
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

EXECUTIVE SUMMARY

INTRODUCTION

The Bong Range iron ore reserves were originally mined by the Bong Mining Company (BMC) from 1965 to 1990. During this period, Liberia was Africa's largest iron ore producer and the world's fourth largest iron ore exporter, and the Bong Mine operated by the Bong Mine Company was a major producer. The Bong Range is located approximately 78 km north-west of the capital Monrovia.

In early 2008, following the end of the conflict and in the course of the reviving of Liberia's economic resources, the Government of Liberia (GoL) published a general solicitation for bid proposals for the Bong Range Concession Area.

Through an international competitive bidding process, China Union's bid was accepted and on 19 January 2009, China Union's subsidiary companies China Union (Hong Kong) Mining Company Limited and China Union Investment (Liberia) Bong Mines Company Limited (referred to as China Union) signed a 25year Mineral Development Agreement with the Government of the Republic of Liberia (GoL) for the exploration and mining of iron ore in the Bong Range of Liberia.

This document provides a Non-Technical Summary (NTS) of the Environmental and Social Impact Assessment (ESIA) undertaken for the proposed redevelopment and expansion of the Bong Iron Ore Mine. The full report can be obtained and commented on from the Environmental Protection Agency in Monrovia.

Project comprises of the follow key components:

- Iron ore Mine in Bong County;
- Railway from the Mine to Free Port in Monrovia; and
- Port located in the Free Port of Monrovia.

This NTS provides a summary of ESIA for the **Port, Mines and Rail**.

WHO ARE CHINA UNION?

China Union is a Hong-Kong registered, China based mining company largely owned by Wuhan Iron and Steel Company (WISCO). WISCO the third largest steel producer in China and invested in by the China-Africa Development Fund.

BENEFITS OF THE PROJECT

Liberia is currently in an economic developmental phase following many years of conflict ending in 2004. As a result of the conflict Liberia's export earnings were extremely low. The GoL is working to enhance the country's economic development by rejuvenating Liberia's core industries including mining resulting in both foreign investment and increased economic growth of a regional and county scale.

Mining of iron ore is recognized as a critical aspect of the country's economic recovery as a large volume of iron ore has been proven through historic exploration and mining activities. In addition, mines such as the Bong Mine have been successfully operated in the past and some infrastructure still remains and therefore development of the project is likely to be faster than green field's projects. Taking this into account the mining of iron ore at the Bong Mine has potential to contribute to the country's GDP in the short term and continue into the long term and is in line with the GoL's plan for economic recovery.

In addition to the country level economic development the project will also provide employment in Bong County and result in increased trade due to the increased need for goods and services. Given that construction activities have already underway at the Mine some economic benefit has already been recognized in communities near the mine. The project will employ a total of 2 150 workers (including mine, railway and port), and contribute to Liberian government tax 53,061,000 USD.

PROJECT DESCRIPTION

The iron ore from the mine will be transported by rail to the port where it will be temporarily stored and loaded onto cargo ships for export to the market. China-Union will upgrade and redevelop an area of the Port of Monrovia previously operated by BMC to allow for the export of the iron ore from the Bong Mine, and the import of necessary equipment, oil and other goods. The BMC port is considerably degraded since the civil war and will require a considerable amount of construction works.

The Project will be developed in phases. In Phase 1, the Port will be restored to its former capacity for storage, ship loading and export of 1 Mtpa. This will involve rehabilitation and upgrading of the existing infrastructure as well as installation of new equipment and construction of new facilities at the Port. Phase 1 will operate for approximately 2 years.

In Phase 2, parts of the Port infrastructure will be expanded in order to store and export 10 Mtpa of iron ore. Phase 2 will run for approximately 25 years.

The majority of construction and refurbishment activities will occur during Phase 1. Phase 1 construction is currently underway with ground clearing, leveling, upgrade and construction of the Jetty, Railway, Roads, Buildings, power generators, fuel storage tanks, ore stockpile area, ore stackers, sewage treatment plant and conveyor belts. In Phase 2 the storage stockpiles and ship loading equipment will be expanded to accommodate storage and loading of 10 Mtpa of iron ore concentrate.

THE IMPACT ASSESSMENT PROCESS

How was the ESIA Carried out?

The purpose of the ESIA is to predict the significance of the Project's impacts on the existing (baseline) physical, biological and socio-economic environment; and to identify measures to minimize negative impacts and maximize positive ones. This information will be used to inform decision making by the GoL.

The ESIA study comprised the following steps:

- A scoping study was undertaken to identify potentially significant impacts from the Project thus targeting the scope of the baseline studies and impact assessment.
- Stakeholder concerns raised during the scoping phase and these concerns were given consideration for the ESIA study.
- The existing baseline conditions and any environmental or socioeconomic sensitivity were determined through fieldwork and review of existing information.
- The significance of impacts prior to mitigation measures was predicted and their significance determined. The measure of significance takes into consideration the sensitivity of the existing environment and the magnitude of change. In some cases, predictive modelling was used e.g. the Air Quality study.
- Mitigation measures were developed and refined to lower the significance impacts as far possible and the residual impact was determined. An environmental and social management plan was developed based on these mitigation measures.

STAKEHOLDER ENGAGEMENT

- The Stakeholder Engagement Process
- Stakeholder engagement (including communication with local communities) is a critical part of the ESIA process and activities were carried out at key stages of the ESIA process to ensure that stakeholder concerns and comments are addressed in the ESIA.

The initial stage of the stakeholder engagement process was to identify the Key stakeholders these included:

- National Government;
- Regional and Local Government;
- Directly affected communities and businesses;
- National and Local NGOs;
- International organizations;
- Economically interested parties; and
- Other interest groups

The stakeholder engagement process for the EIA was divided into the following four key phases:

- Phase 1: Scoping;
- Phase 2: Consultation as part of Baseline Studies, and development of the impact assessment and mitigation measures;
- Phase Three: Disclosure; and
- Phase Four: On-going Engagement/ Implementation.
- Phases One and Two have been completed as part of the development of the ESIA. Phase Three will comprise the activities around disclosure of the ESIA, and Phase Four will consist of on-going consultation during the proposed construction and operation of the Project.

Phase 1: Scoping

- The stakeholder engagement team met with the EPA, the ESIA director at
- China Union as well as China Union representatives from the Monrovia
- Office. Following these meetings, the team travelled extensively in the Concession Area and along the railway in order to gather information with respect to the potential key issues and impacts associated with the proposed mine expansion Project

Phase 2: Consultation as part of Baseline Studies Phase

Stakeholder Engagement for the ESIA was undertaken through a combination of public meetings and one-on-one interviews with key informants and stakeholder representatives. These activities are described in more detail below.

One-to-one interviews were held with key regional and national level stakeholders in Monrovia, Kakata and Gbarnga before and during the ESIA. At the national level, in addition to stakeholders that were identified during the scoping stage, several other national stakeholders were consulted with, including the Land Commissioner and the Bureau of Regional Planning.

SUMMARY OF EXISTING BIO-PHYSICAL ENVIRONMENT

Surface Water and Aquatic Ecology

The closest surface water body to the is the Montserrado River which is approximately 1 km to the East of the Port site and discharges to the ocean approximately 3.5 km south of the site. There is a mixed urban and industrial area between the site and the Montserrado River, and it is likely that the water quality in the river is impacted by these activities. The next closest surface water body is the St Paul River which is approximately 3km to the north of the site, where it discharges to the ocean.

There are no other surface water bodies near the site. Storm water on the site will be captured and discharged to the ocean; any uncontrolled runoff is likely to drain towards the ocean as well. Given there are no surface water users between the site and the ocean, and the nearest water body is 1 km away, no impact on surface water or aquatic ecology due to the port activities is expected.

The largest water body in close proximity to the railway is the St Paul River which runs to the north-west of the site from the mine area to the port. North of Bekung Town the St Paul River is approximately 10 km from the railway, south of Bekung the river is between 500 m and 5 km from the railway. The waters from the Saint Paul are used to feed the Mount Coffee hydro-electric plant located 60 km downstream of the existing abandoned BMC intake.

Soil, Land Capability and Terrestrial Ecology

The port site is a highly modified area. The area has previously been used for shipping of iron ore. The soils have been physically disturbed, heavily compacted and there are visual signs of hydrocarbon contamination on the surface. The soils on the site are considered of no value with respect to supporting terrestrial ecology or agriculture. Due to the degraded nature of the soil resources there will be no significant impact on soil or terrestrial ecology at the site.

Groundwater

The Port area was previously used by BMC and is a highly disturbed area. The onshore activities are located close to the marine environment and groundwater flow will be in the direction of the sea. Water levels are reportedly shallow in the port area, although no water level data is currently available. The highly permeable sedimentary sands form the main aquifer unit, with recharge primarily from precipitation. Water flow is towards the coast with a high level of connectivity with the ocean predicted.

The area between the sea and project site is owned by China Union and there are no down gradient groundwater users. As there is visible hydrocarbon contamination in some areas of the site and as the hydrocarbon contamination is likely to have been present for over 30 years it is likely that groundwater underlying the site is also contaminated. In addition, there is evidence of damaged historic septic tanks on the site and it is possible that the groundwater has at times been contaminated by sewage water.

Given the groundwater down gradient of the site has no users and is likely to be contaminated, the sensitivity of the groundwater is considered very low and impacts on groundwater are considered insignificant.

Marine Environment

The marine and shore line environment were assessed in a single site visit and review of literature. The marine and shoreline environment are heavily degraded due various sources of pollution and are considered of low value for marine or shoreline ecology. In summary:

- *Mangroves:*

Much of the Liberian coastline is/was known for its rich mangrove density and biodiversity in its estuaries, but this is not so around the city of Monrovia and the Project site. Where the majority of mangroves have been removed and any remaining plants are covered in solid wastes.

- *Sandy Beach Fauna:*

No fauna were found on the beach during the field survey, apart from a small unknown oyster-type bivalve growing on the rusting steel infrastructure and wrecks in the area.

- *Fish and Fishing:*

There is little to no fishing happening directly in the harbour. The reasons for this are that the National Ports and Harbours Authority has banned the use of nets in the ports and also because there are few larger fish found in the harbour. There is evidence of an annual occurrence of an (unknown) species of grouper, Epinepheline, along the shore areas and also within the harbour breakwaters. This seasonality suggests that the harbor area, and probably other nearshore zones, are important in the life histories of these fish.

- *Marine Mammals:*

According to the Director of Ports and Harbours and the Port Captain of Monrovia, cetacean visits to the harbour are rare, with a single unidentified whale spotted in the last 5 years. Dolphins are reported to occur sporadically.

Air Quality

With respect to air quality three parameters of concern for human health were assessed:

- Particulate matter (PM10 and PM2.5) - varies widely in physical and chemical composition, source and particle size.
- Gaseous emissions of oxides of nitrogen (NOx) - NOx comprises both nitric oxide (NO) and nitrogen dioxide (NO2).
- Gaseous emissions of sulphur dioxide (SO2).

In addition, dust deposition can be a nuisance to human receptors as it settles on property and agricultural areas.

Short term measurements for particulate matter (PM1, PM2.5 and PM10) were undertaken at the Port. Although the short-term monitoring data is not directly comparable with the air quality guidelines (as they are not based on a 24-hour average upon which the standards are based due to logistical circumstances), they do provide an indication of short-term concentrations. The mean monitoring results at the port are well below the 24-hour IFC guideline values.

The long-term monitoring of dust deposition, SO2, NOx and NO2 was undertaken between June 2012 and January 2013. The long-term monitoring in the area of the port showed exceedances of the dust deposition threshold for possible nuisance complaints on three out of six months of monitoring. This is consistent with the monitoring locations being close to industrial areas and adjacent to a city with heavy traffic.

Average NO2 concentrations during the monitoring period were well below the annual average guideline for the protection of human health. SO2 concentrations were below the guidelines for the protection of human health.

Noise

Long term noise measurements were made at the port. Based on these the acoustic environment is relatively high, being close to the harbour, thus the ambient noise levels and background noise levels, are considerably higher during the day and lower during the night.

The ambient noise levels during the day (until 20:30), around the port site, were higher than the IFC threshold for day time due to the activities taking place in this area. It is typical to observe noise levels, above the IFC thresholds close to the port area, being adjacent to the city.

The dominant noise sources are associated with shipping operations and are mainly the loading and unloading of containers such as clanging chains, engines, cranes and trucks. Construction works such as hammering and power generators was also observed in the port area during the

daytime period. Although night time noise levels are generally lower than daytime, they still exceed the IFC thresholds.

Socio-Economic Baseline

- **Demography**

A house survey was used to inform the socio-economic baseline. The total sample size for the household survey was 279 households, or, 1 479 individuals, including 721 males, and 758 females. Similar to other areas in Liberia, the population is generally young. 51 percent of males and 49 percent of females are eighteen, or younger. Very few people were reported to be aged more than 70. The average age for males, and females were 23.2 and 22 respectively which is slightly higher than the country median age (18 for males, and 18.3 for females).

The average size of surveyed households is 5.3. In many families, more than one member contributes to household expenses. The average dependency ratio for the whole sample is 1:3, i.e. every individual who earns money, on average, should support three other individuals in the household.

The majority of households surveyed (75.6 percent) attributed household headship to a male family member. Despite this general trend, many young females between the ages of 20-30 considered themselves as the head of household.

- **Ethnicity**

The Port has high ethnic diversity compared to the Mine and the Railway. Kru people constitute the majority at 27 percent of the surveyed population.

- **Migration**

Individuals who had migrated to their current place of residence at some point during their lives were categorized as migrants. Migration data indicated that migrants constitute 48.3 percent of the population in the sample population. This rate indicates that the surveyed population have a relatively high mobility. Women are as likely to move as men. Migrants are distributed across age-groups with higher probability to move among older individuals.

- **Livelihoods**

There are nine livelihood zones that have been distinguished across the country. The Port is located in Livelihood zone 9.

Livelihood Zone 9: Monrovia Peri-Urban: Petty Trade, Market Gardening and Casual Employment

This zone comprises a sizeable population who are within the Monrovia urban district but outside the city proper. They are not simply spread in a neat and measurable radius around the city hinterland but extend particularly along and near the main roads. They are semirural in that they have land on which they produce at least vegetables if not also a little cassava, and they commonly keep poultry. Their economy is more or less completely defined by the city: they sell vegetables

and chickens to it, they perform casual employment, and they are part of the chain of petty trade in farm/garden produce, fish, charcoal and many other items. Above all, the staples they eat, especially rice, are purchased.

Frequency and Profitability of Livelihoods in the Study Areas

Although it is a commonly held view that most people in rural economies of sub-Saharan Africa are subsistence farmers, the household survey findings show that, in fact, there are a plethora of economic activities both in rural and urban settings.

In fact, most people have more than one economic activity; 65 percent of the working age economically active population are reported as having more than one income generating activity. In Monrovia the largest income generating activity is Government employment. Income earned from fishing accounted for 5.8 percent of the total income earned in the Port area.

- **Remittances**

The origins of the remittances were classified as originating from ‘another local town’, ‘Monrovia’ and ‘abroad’. The data indicates that remittances in the interior tend to come from Monrovia while remittances in Monrovia tend to come from abroad. The average remittance at the Port site was US\$720.

- **Variation in Income**

The average income per capita of the sampled population (total income recorded divided by number of individuals in the sample) was US\$896. The average income per capita recorded is 2.5 times higher than that reported in the UN Human Development Index (US\$360). The relatively high average income is due to the high average income in the Freeport (US\$1527).

Utilities

- **Water Sources**

At the Port 63 percent of households had access to a water source within 5 minutes walking distance. The level of underground water in Freeport area is unusually high, however, water taken out from wells is contaminated and is not suitable for drinking. This means that those living in the Port area are forced to source their drinking water mostly from the local market.

- **Cooking Fuel**

At the Port, charcoal is the main cooking fuel in the Port area, everyone had access to charcoal, and they source it within 5 minutes walking distance.

- **Community Infrastructure**

Community leaders were asked to identify the distance of their town/community to the closest institutions, such as schools, hospitals, police depot. Residents of Bong Mine Town and the Port enjoyed relatively good access to all these public facilities, whereas households living in the

concession area and along the Railway generally had more difficulty with accessing public facilities.

- **Education**

37 percent of adults aged 15 and over (n = 853) in the directly impacted areas have never been to school. Women were more likely than men to miss out on school; 47 percent of women aged 15 and over (n=449) had never been to school compared with 27 percent of men (n=400).

11 percent of children aged between 6 and 18 (n=441) had never been to school. Girls were less likely to be registered in school than boys but only marginally; 12.3 percent for school age girls (N=220) and 9.6 percent school age boys (n=218). 45 percent of the sample aged 15-18 had started high school education. The data shows that girls are as likely to enter high school as boys.

- **Social Capital**

Participation in community activities

By far the most common and popular community groups were church groups. There was a church group in almost every town. Overall, 58 percent of sampled individuals aged 15 and over were reported to be a member of a church group. Women were slightly more likely to be members of church groups. 63 percent of women sampled (n=449) were participating in church groups, compared with 53 percent of men sampled (n=400).

Women's groups and Youth groups were active around the Port. In the Port area 25.6 percent of youth aged 15 to 25 were members of a youth group

- **Religion**

The majority of the sample was Christian (93 percent). About 4 percent of the population practiced Islam, and 2 percent held traditional beliefs. Another 1 percent mentioned that they practiced a mixture of traditional beliefs and Christianity.

- **Community Health**

Overview of Health in Liberia

Liberia has a total population of 5,000,000, according to latest available estimates. Life expectancy at birth is 57 years for females and 54 years for males, which is slightly higher than the regional average (56 for females and 52 for males). Liberia has one of the highest maternal mortality ratios in the world, 770 per 100,000 live births, exceeding both the regional (480 per 100,000) and global ratios (210 per 100,000). HIV prevalence remains below the regional average, 15 per 1 000 adults aged 15 to 49 are estimated to be infected with the virus in Liberia – the equivalent regional average is 47 per 1 000 adults. Liberia has a relatively high level of tuberculosis prevalence, with 476 per 100,000 people infected, superseding both regional (332 per 100,000) and global (178 per 100,000) averages. Leading causes of death for children under 5 include malaria (18 percent), pneumonia (14 percent) and other diseases (13 percent).

The Liberian medical sector currently offers 1 physician for every 100,000 individuals – that is 4 percent of the regional average which is 22 for every 100,000 individuals. Nurses and midwives are also in relatively short supply, with 27 for every 100,000, less than a third of the regional average which is 90 for every 100,000.

- **Communicable Diseases**

Vector borne diseases

Malaria overwhelmingly dominates as the primary health concern across all surveyed areas – it is also the only vector borne disease found to be diagnosed.

Mobile and regular pharmacists, in addition to hospital staff and patients, reported that the vast majority of malaria cases remain undiagnosed by medical health professionals. Those afflicted were said to, in most cases, rely on self-medication using anti-malarial obtained directly from pharmacies, or herbal medicine or to abstain from treatment altogether, while only seeking modern medical care in severe cases.

- **Sexually Transmitted Infections and HIV/AIDS**

All clinics apart from Koon town, Wonjah Smith Memorial and Haindi conducted HIV testing. Nyehn reported one positive case in 2012. Redemption Hospital reported that 10 percent of all HIV tests conducted at the hospital are positive, with on average of 100 new cases confirmed every month.

- **Respiratory Diseases**

Confirmed cases of influenza were not reported at any of the surveyed facilities. Two cases of Tuberculosis (TB) were reported at Yeamai clinic in 2011 but none had been confirmed during 2012. Acute Respiratory Infection (ARI) was one of three major health concerns in Zanna town. At Redemption hospital, one of the few facilities that reported any deaths on site, ARI was stated as a leading cause of death.

- **Faecal-oral diseases**

Yeamai clinic staff and community members reported an increase in diarrhea cases during the dry season when the only functioning hand pump in the town dries up for three months (January until March), forcing the population to seek alternative, less clean water sources.

Parasites that were specifically diagnosed included seven (7) cases of schistosomiasis at Bong Mines Outpatients Department, a figure which is likely to represent a small proportion of the actual infected population, as this is a common parasite related to poor sanitation and contaminated water.

Nutritional Disorders

- **Malnutrition**

Yeamai reported three (3) cases of malnutrition in August and Haindi also cited malnutrition amongst conditions seen on a monthly basis. Bong Mines Hospital Outpatients Department sees

on average one case per month. Koon town staff highlighted malnutrition among children in particular as a major health concern in the area.

Nyehn health centre had for the past two years been providing corn meal supplied by the World Food Programme (WFP) to pregnant women and children aged between 6 months and 2 years old, which had greatly reduced the number of malnutrition cases seen at the clinic.

- **Vitamin Deficiencies**

Bong Mines Hospital Outpatients Department said scurvy is diagnosed every couple of days, but this was not reflected in the analyzed clinic records.

SUMMARY OF KEY IMPACTS

The ESIA identifies a number of potential impacts associated with the Project. The impacts were identified and assessed and are designated as being of Minor, Moderate or Major impact significance.

Mitigation measures and enhancement measures were then identified to be implemented as part of the Project design, construction, operation and decommissioning phases. The impacts were then reassessed, with the implementation of the mitigation measures and a residual significance was assigned to each impact.

The table below summarizes the pre-mitigated and residual impacts assessed in the ESIA.

KEY FINDINGS

Summary

The Port area is highly disturbed and as such the receptor sensitivities are considered low for all receptors near the Port. In addition, there is likely to be at most a moderate scale change over background conditions for both social (livelihoods, community health and safety) and biophysical receptors (soil, water etc). Therefore, all but one of the impacts (introduction of alien species) are considered Negligible to Moderate prior to mitigation and Negligible to Minor after mitigation.

Introduction of Alien or Invasive Species

Bulk ore carriers will enter the harbour under ballast and will then discharge the ballast water whilst being loaded with ore at the export berths. Ballast water discharges bring the risk of releasing organisms entrained in source ports into the receiving harbour environment. Once released into ports, alien species can become invasive through the establishment of populations and disrupt ecological processes.

In view of the globally recorded negative effects of alien species transfers the International Maritime Organization (IMO) considers their introductions to new environments via ship's ballast water, or other vectors, as one of the four greatest current threats to the world oceans. This impact is considered to be of Major significance as a result of the China Union Project prior to mitigation and of Moderate significance after mitigation.

Mines

The impact assessment for the Mine predicts that there would be many impacts of Major significance prior to mitigation. By implementation of the recommended mitigation measures, many of these impacts can be reduced to Moderate significance or below. There would be instances where residual impacts of Major significance would still occur. These are discussed below and summarized in the table below.

Surface Water

The degradation of water quality or a reduction in the volume of water in surface water bodies is predicted to have Major impacts on human and ecological receptors. The water management approach at the mine is currently conceptual in nature and in some instances does not align with best practice. As a result, it is currently not possible to develop specific mitigation measures to reduce the significance of the impacts. The ESMP (Chapter 20) outlines work that needs to be undertaken in order to develop a site wide Water Management Plan designed to minimize the impacts that relate to surface water.

Terrestrial Habitat

The residual impacts on habitat loss and fragmentation and species diversity are rated of Moderate to Major significance. It is unlikely that these impacts can be further mitigated.

Endangered Species

The impacts on endangered species (Cherry Mahogany and Ringed River Frog) remain of Major significance post mitigation. Further studies would be required to gain a better understanding of the regional importance of these species. The outcome of these studies could be that an offset is required.

Air Quality

The human health impacts due to degradation of air quality are considered

Major prior to mitigation. The residual impacts are considered Minor. However, to achieve impacts of Minor significance the resettlement of a number of communities will be required. In addition, to manage SO₂ to an acceptable concentration at sensitive receptors, specific mitigation at the Power Station will be required. This requires the use of heavy fuel oil (HFO) with a Sulphur content of 0.5% and a stack height of at least 50.

HIV/AIDs and STIs

The residual impact due to an increase in the prevalence of HIV/AIDs and other STIs remains of Moderate to Major. It is unlikely that these impacts can be mitigated further.

Rail

Due to land take, the Railway expansion will directly impact accessibility for farmers and land users to certain water courses and areas from where nonfood products would normally have been harvested. This loss of access will result in economic displacement of some farmers and artisanal

quarriers. In other cases, for those currently living within the 26 metre rail Right of Way, permanent land take will result in physical displacement of land users and householders from their land, property and sources of livelihood. This displacement is likely to impact on approximately 2000 people along the Railway some of which will be close to the Mount Coffee site.

The Mount Coffee site will also require the settlement of approximately 380 people, the additional number of people to be resettled will further compound the impact on livelihoods due to displacement and increase the competition for alternative sources of resources and income. The Resettlement Action Plan's (RAP) prepared by the government of Liberia in partnership with project proponents will need to consider this cumulative impact.

CUMULATIVE IMPACTS

- **Introduction of Alien and Invasive Species**

The other projects operating or planned at the Port will impact the marine environment in a similar way to the China Union Project and it is likely that, even with effective management of ballast water, the significance of cumulative impact will be greater than that of the China Union Project alone. All projects will need to adhere to guidelines provided by the IMO to minimize the introduction of alien and invasive species.

- **Increase in Offshore Accidents**

There will be a significant increase in the number of vessels entering the port due to both the China Union and Western Cluster Limited (WCL) iron ore projects. This has potential to increase the number of accidents that will occur at sea, predominately due to collisions with smaller boats. The impact due to the China Union project alone is considered of Minor significance after mitigation. However, there is likely to be a cumulative impact due to WCL project and there will be greater potential for accidents to occur. Currently the planned increase in vessels due to the China Union and WCL projects is unknown and it is not possible to assess the significance of the cumulative impact. Both projects should undertake all maritime operations in line with International Maritime Law and safe practice.

Table 1: Impact summary pre and post mitigation

Topic	Description	Impact Direction	Before Mitigation	With Mitigation
Impacts on Bio-physical Receptors/ Resources				
Marine	Degradation of water quality	Negative	Minor	Negligible
	Degradation of sediments quality on the Shoreline	Negative	Minor	Negligible
	Introduction of Alien / Invasive Species	Negative	Major	Moderate
Noise	Noise impacts on sensitive receptors during operations	Negative	Negligible to Major	Negligible
Impacts on Economy and Livelihoods				
Impacts to fisheries-based livelihood		Negative	Minor	Minor to Negligible
Economic Benefits from				

Increased Activity at the Port		Positive	Minor (+VE)	Minor (+VE)
Impacts on Community Health and Safety				
Socio-economic	Injuries and fatalities due to road traffic accidents	Negative	Moderate	Minor
	Injuries and fatalities due to accidents onshore and offshore at the Port site.		Minor to Moderate	Minor
	Malaria and Other Vector Borne Diseases			
	Sexually Transmitted Infections and HIV/AIDs	Negative	Moderate	Negligible
	Impacts on Human Health due to degradation of air quality	Negative	Moderate	Minor
		Negative	Negligible	Negligible

1 PROJECT OVERVIEW

1.1 PURPOSE OF THE REPORT

This Environmental and Social Impact Assessment (ESIA) Report presents an assessment of the potential environmental, social and community health impacts associated with the proposed re-opening and expansion of the Bong Iron Ore Mine located in Bong county Liberia (the ‘Project’). The Project comprises:

- Iron ore Mine in Bong County;
- Railway from the Mine to Free Port in Monrovia; and
- Port located in the Free Port of Monrovia.

This report presents the findings of the updated ESIA for the Port, railway and Port.

The report has been prepared for the China Union Investment Company Ltd (China Union) by Environmental Resources Management (ERM) and presents the objectives, methodology and outcomes of the Impact Assessment (IA).

China Union is a Hong-Kong registered, China based mining company largely owned by Wuhan Iron and Steel Company (WISCO), the third largest steel producer in China, and invested in by the China-Africa Development Fund.

The sections below provide a brief description of the Project activities and infrastructure. A more detailed description of the Port is presented in Chapter 2 (Project Description).

1.2 BACKGROUND

The Bong Range iron ore reserves were originally mined by the Bong Mining Company (BMC) from 1965 to 1990. During this period, Liberia was Africa’s largest iron ore producer and the world’s fourth largest iron ore exporter, and the Bong Mine operated by BMC was a major producer. Mining at the Bong Mine ceased in 1990 in part due to the Liberian armed conflict. In early 2008, following the end of the conflict and in the course of the reviving of Liberia’s economic resources, the Government of Liberia published a general solicitation for bid proposals for the Bong Range Concession Area.

Through an international competitive bidding process, China Union’s bid was accepted and on 19 January 2009, China Union’s subsidiary companies China Union (Hong Kong) Mining Company Limited and China Union Investment

(Liberia) Bong Mines Company Limited signed a 25-year Mineral Development Agreement with the Government of the Republic of Liberia (GoL) for the exploration and mining of iron ore in the Bong Range of Liberia.

Following a period of planning, China Union Investment (Liberia) Bong Mines

Company Limited (referred to as the Project Proponent) is now proposing a Project to re-commence mining. The main aspects of the Project entail the restoration, reconstruction, and expansion of the previously existing infrastructure. This principally includes an open pit, raw ore

processing plant, a heavy-oil fired power plant, the former BMC export jetty in the Port of Monrovia, and the Bong Mine Railway that links the mine to the Port.

1.3 IMPACT ASSESSMENT SCOPE

1.3.1 Project phase

The Project will be developed in phases. The approval for Phase 1 construction was first granted by issue of a Temporary Environmental Clearance Certificate (TECC) that expires in July 2013. Therefore, this ESIA is limited to Phase 1 operations and Phase 2 operations and construction.

The construction activities relating to Phase 1 are completed or underway. However, construction is ongoing and Phase 1 construction, Phase 1 operations and Phase 2 construction will be/or are all happening concurrently. The Port locality is shown in Map 1-1.

A brief description of the project components is described below, and a detailed description of the Project is provided in Section 2 of this report.

1.3.2 The Port

The iron ore from the mine will be transported by rail to the port for export to the market. China-Union will upgrade and redevelop an area of the Port of Monrovia previously operated by BMC to allow for the export of the iron ore from the Bong Mine, and the import of necessary equipment.

The Mines

The proposed Mine site will be located southwest of Bong County in central Liberia, approximately 78 km northeast of Monrovia, the capital of Liberia. The Mine site is approximately 40 km from the city of Kakata. The proposed Mine site is located in the south-west of the final concession area (approximately 610 km²) and the initial concession area (approximately 240 km²). The Mine site and the concession areas.

The Mine area will comprise of open-pit mining, surface facilities for ore transportation and processing, a Waste Rock Dump (WRD), a Tailings Storage Facility (TSF) and supporting utilities.

1.4 IMPACT ASSESSMENT OBJECTIVES

The objectives of this Impact Assessment (IA) are to:

- Facilitate an understanding of the elements of the existing baseline conditions that are relevant to resources/receptors that could be significantly impacted by the Project.
- Identify the aspects of the Project likely to result in significant impacts to resources/receptors.
- Document how stakeholders have been engaged during the IA Process, and how stakeholder feedback has been considered in the IA.
- Predict and evaluate the significance of the impacts of the Project.
- Identify the environmental, social and health aspects of the Project that need to be managed and recommend appropriate and justified mitigation and enhancement measures.
- Determine the significance of residual impacts, taking into account the implementation of mitigation measures.

- Generate plans for the management and monitoring of the impacts on the social and environmental baseline due to project activities.

1.5 PROJECT JUSTIFICATION

1.5.1 INTRODUCTION

This Chapter outlines a description of the justification or need for the proposed Project.

The key points which support the development of the Project include alignment with:

- The national restoration and rehabilitation initiatives;
- The focus on the development of the mining sector;
- Opportunities and needs for restoration and development with Bong County and suitability of the Project location.
- Assisting in meeting global demands for iron ore; and
- Iron ore as Liberia's key potential source of fiscal revenue.

These aspects are discussed in further detail in the following Section.

1.5.2 National Restoration and Rehabilitation

Liberia is emerging from the shadow of a 14-year civil war which ended in 2004. The United Nations Mission in Liberia (UNMIL) was established by Security Council Resolution 1509 (2003) of 19 September 2003 to support the implementation of the ceasefire agreement and the peace process. A United Nations Peacekeeping Forces has since been present in Liberia. Since the 2005 election of President Ellen Johnson-Sirleaf, the country is slowly working through the devastations brought by the civil war, the subsequent lack of infrastructure and human capital and a fragile security situation. The Government of Liberia (GoL) intends to enhance domestic economic development through restoration and rehabilitation of the pillar industries so as to achieve the development of a stable society.

As part of this policy, the Government is encouraging local and foreign investment into the country's private sector and has successfully signed several multi-billion US dollars deals with multinational corporations. The Chinese government encourages Chinese enterprises to participate in the restoration and reconstruction of Liberia, to achieve win-win results in economic cooperation. As such, China Union was joined by the institutional investor China Africa Development Fund and finally by Wuhan Iron and Steel Company, as its largest investor, for the development of the Bong Range Project.

1.5.3 Mining as a Key Sector for Development

Rubber and mining had historically been the pillar industries in Liberia but were severely damaged during the civil war. The rubber exportation industry has been affected by the global economic crisis since 2008. Therefore, the recovery of the domestic economy highly relies on the restoration and development of the mining industry, and accordingly, it has been categorized as the focus industry in the national economic development policy implemented by the Liberian government.

1.5.4 Revitalizing Mining within the Bong province

Bong County, due to its proximity to Montserrado County, rendered it vulnerable during the war as various groups struggled at various times to take control of the capital, Monrovia. Bong suffered during the war years, incurring significant losses to private property and public infrastructure. Bong County holds ample natural resources such as rubber, timber, diamonds, iron ore, gold, water, stone and sand, and fertile agricultural land and is therefore considered well-situated to recovery.

In addition, previous mining activities and infrastructural development in the area allow for revitalization projects, with lower cost and planning overheads than completely new developments. There are proven abundant iron reserves at the Bong Range, with mineral reserves estimated at 4 billion tones. The Bong Mines Project in Bong County therefore represents a significant reserve, the development of which aligns with the government's initiative as part of the effort to restore and develop the mining industry.

1.5.5 Suitability of the Project Location

While the mine needs to be located near the resource, the Project setting is advantageous for a number of factors related to its particular situation with existing infrastructure, labour and water supply:

Abundant labor force: The Bong Mine is close to the Bong Town which accommodates approximately 30,000 residents.

Supporting infrastructure: Currently, there is an asphalt road from Monrovia to Kakata and a dirt road from Kakata to the Bong Mine. Monrovia is served by an international airport and international ports. A railroad links the Bong Mine to the Monrovia port and has been run for decades; and **Access to water supply:** The project can extract water from St Paul River which is located approximately 30 km to the north of the mine.

1.5.6 Meeting Global Demand for Iron Ore

China has the largest demand of iron and steel in the world. Domestic production in China is only able to supply approximately 40 – 50 percent of domestic demand, while the balance relies on imports. Chinese development of global iron resources is also expected to help stabilize iron ore prices to a more reasonable level as the iron ore supply is increased.

1.5.7 Iron ore as an Important of Fiscal Revenue

Foreign direct investment in the Liberian iron ore sector is reportedly expected to increase in the next three to five years as the planned major iron ore projects are realized. Although exploration activities have begun as a result of expected potential for oil and gas development, these are still at an early stage and no major petroleum finds have been made. Mining exports are therefore expected to support GDP growth in the short term and iron ore production is identified as the mineral commodity with the largest potential to generate fiscal revenues for Liberia.

Extractive industry payment data (including the mining sector) from the 2009-2010 period (EITI report) shows that these industry companies paid USD 69.7million in taxes, royalties, and other administrative fees over this period.

1.6 Report Structure

The structure of this Port ESIA report is as follows:

Chapter 2 – Project Description

Presents the Project Description which was used as the basis for the impact assessment. The Volume presents construction, operation and closure activities as well as the phasing of the Project.

Chapter 3 – Administrative Framework

Presents the legislative requirements, international standards and company policies that the project complies with (referred to as The Administrative Framework).

Chapter 4 – Impact Assessment Methodology

Presents the impact assessment methodology that has been used in this assessment.

Chapter 5 – Screening & Scoping

Presents details of the scoping phase of the project.

Chapter 6 – Stakeholder Engagement

Presents the details of the stakeholder engagement activities conducted for the project.

Chapter 7 – Baseline

Presents the environmental baseline for the Project's area of influence.

Chapter 8 – Social Baseline

Presents the social baseline for the Project's area of influence.

Chapters 9 to 12 - Impact Assessment and Mitigation

Present the details and findings of the impact assessment, the recommended mitigation measures and the significance of the mitigated impact.

Chapter 13 – Unplanned Events

There are various impacts that could occur that are very difficult to plan for and need to be managed in a specific way. These are outlined in this section and the way forward briefly described.

Chapter 14 – Cumulative Impacts

An assessment of the potential cumulative impacts.

Chapter 15 – Environmental & Social Management Plan

Describes how the project will manage and ensure implementation of the mitigation measures, how the mitigation measures will be audited and monitored.

Section 16 – Summary & Conclusions Provides a summary of the impact assessment.

2 PROJECT DESCRIPTION

2.1 INTRODUCTION

This section provides a detailed description of the project (Project Description) for the Port, Mines and Rail; it defines the infrastructure and activities that were assessed in this ESIA. The general Port layout is shown in Map 2-1. As stated previously the approval for Phase 1 construction was first granted by issue of a Temporary Environmental Clearance Certificate that expires in July 2013. Therefore, this ESIA is limited to Phase 1 operations and Phase 2 operations and construction.

The iron ore from the mine will be transported by rail to the Port where it will be temporarily stored and loaded onto cargo ships for export to the market. China-Union will upgrade and redevelop an area of the Port of Monrovia previously operated by BMC to allow for the export of the iron ore from the Bong Mine, and the import of necessary equipment, oil and other goods. The BMC port is considerably degraded since the civil war and will require a considerable amount of construction works.

The Project will be developed in phases. In Phase 1, the Port will be restored to its former capacity for storage, ship loading and export of 1 Mtpa. This will involve rehabilitation and upgrading of the existing infrastructure as well as installation of new equipment and construction of new facilities at the Port. Phase 1 will operate for approximately 2 years.

In Phase 2, parts of the Port infrastructure will be expanded in order to store and export 10 Mtpa of iron ore. Phase 2 will run for approximately 25 years.

The construction activities relating to Phase 1 are completed or underway. However, construction is ongoing and Phase 1 construction, Phase 1 operations and Phase 2 construction will be/or are all happening concurrently. Therefore, at times there is no clear distinction between the Phases.

A summary of the activities that will occur in each of the phases is provided in Table 2. and described in more detail in the following sections.

2.2 Mines

The Project will be developed in phases. In Phase 1, the Mine will be restored to its former capacity for mining, processing and shipping of 1 Mtpa of iron ore concentrate. This will involve rehabilitation and upgrading of the existing infrastructure as well as installation of new equipment and construction of new facilities at the Mine. Phase 1 will operate for approximately 2 years.

Phase 1 construction activities have been on-going since 2011.

Phase 1 construction will (or has) include the expansion of an existing tailings storage facility (TSF), water take infrastructure at the St Paul River and re- open an existing partially mined pit. A new processing plant, power station, explosives store, waste rock dump (WRD), explosives store and living quarters will be constructed.

In Phase 2, the Mine will be expanded in order to produce 10 Mtpa of iron ore. During operations the open pit will be expanded resulting in a final open pit area of 235 Ha. Phase 2 will run for approximately 25 years.

Mining will take place by blasting with explosives, excavating and transfer with trucks and diggers. The waste rock from mining will be deposited in a waste rock dump to the north of Bong Peak with a final area of 490 Ha. Iron ore will be stockpiled near the processing plant and processed to make iron ore concentrate. This processing produces a waste material known as tailings which will be deposited in the TSF. The processed iron ore (iron ore concentrate) will be transported to the Port by Railway.

2.3 RAIL

The existing Bong Mine railway stretches across the Montserrado, Margibi and Bong Counties in Liberia. The existing railway begins at the Monrovia Port, and extends from the south of the Saint Paul River to the northeast, ending at the Bong Mine Station located in Bong Town. This existing railway line has a length of 76 km. The new railway line to be constructed is known as the Bong Peak railway line and will connect the Bong Mine Station to the industrial complex of the Bong Peak Mine. The length of the Bong Peak railway line is 8 km thus resulting in the total length of the route being 84 km.

The Project will be developed in phases. In Phase 1, the Railway will be restored to its former capacity for transport of transport of 1 Mtpa of iron ore concentrate to the Port. In Phase 2, the Mine will be expanded in order to transport 10 Mtpa of iron ore. Phase 2 will run for approximately 25 years

The railroad development project will involve the renovation of the existing railway between the Port and the Bong Mine Station, re-furbishment of six (6) stations on the line, construction of a section of railway between Bong Mine Station and Bong Peak Station, construction of Bong Mine train depot at Bong Mine Station, installation of computer interlocking between the Port Station and #1 Station, laying of optical fiber cable and installation of digital control for inter-station communication, and construction of auxiliary buildings, electricity and water supply systems.

The GoL is responsible for all relocation, reimbursement or other costs associated with removing Project Affected Persons (PAP's) within the Railway Right of Way (ROW). In August 2010 the Ministry of Land, Mines and Energy (MoLME) engaged the services of a consortium of local consultants, in collaboration with the Bureau of Lands and Survey to perform the surveying and mapping of the Railway ROW. The Railway ROW corridor is 86.96 km long and 56.5 m wide. Within this area, 403 structures were recorded, of which half fall on the boundary line, and over 94% are located in the first 10km from the Port. Considering there were 403 households recorded, the estimated number of PAP's within the ROW is estimated to be 2 000 people.

2.4 LOCATION AND LAND USE

The project site (historic BMC port area) is located within the existing port of Monrovia within an industrial area (see Map 2-1). The Port of Monrovia is currently the largest harbour within Liberia and one of the main ports in West Africa. The Saint Paul River is located to the north of the port. The BMC port area occupies 18 Ha (approximately 10 percent) of the port of Monrovia

(approximately 165 Ha). The land use of the project site is considered industrial. Land use to the north and south of the project site is also industrial. To the east of the site the land use is considered residential.

The project is located in Bong County approximately 65 km north of Monrovia (Map 2-1). China Union has a total concession area of approximately

24,000 Ha for 25 years as per their mineral development agreement. The proposed development will exploit iron ore resources in the Non Gomma range including Bong Peak, Zaweah I and Zaweah II deposits.

The project will result in development of approximately 3 000 Ha of land which is approximately 15 percent of the initial concession area and 5 percent of the final concession area.

Approximately 865 Ha of the development area is covered in either primary or secondary rain forest; approximately 365 Ha is a historic tailings storage facility which is now used by local communities for farming activities and approximately 715 Ha of the area consists of historically flooded mine pits. There is also one partially mined pit that is now covered in sparse grassy vegetation, this will be the pit developed during Phase 1 operations.

Table 2 PROJECT DEVELOPMENT PHASES

Project Element	Phase1 Construction and commissioning	Phase1 Operation (Expansion)	Phase 2	Phase 2 Operation
Timeframe	2010 to 2013 (currently ongoing)	2012 through Phase 2 Construction	2013 to 2015	2015 with operating life estimated as 36 years
Port	• Redevelopment of the Port landside facilities and repair of rail • line, and repair and extension of the Export Jetty. • Maintenance dredging of the • Area around the Export Jetty • Turning basin and approach channel.	Receiving of the iron ore via rail car, offloading, and stockpiling. Loading of the iron ore to 50,000 DWT sized vessels and export approximately every 14 days. Receiving of imported fuel to supply Port and Mine operations.	Expansion of the iron ore staging area.	Stockpiling of iron ore. Loading of the iron ore to 50,000 DWT sized vessels and export approximately every 1 to 2 days. Receiving of imported fuel to supply Port and Mine operations

2.5 EXISTING BMC PORT INFRASTRUCTURE

As stated above the site was previously used for export of iron ore from 1965 to 1990. However, as a result of the civil war the majority of infrastructure and all records from the site have been removed or destroyed. The components remaining on site are as follows:

- **Port of Monrovia** -Two breakwaters with ten berths exist in the Port of Monrovia. Three berths are still in use, specifically the Main Wharf, LMC and BMC jetty. The port currently

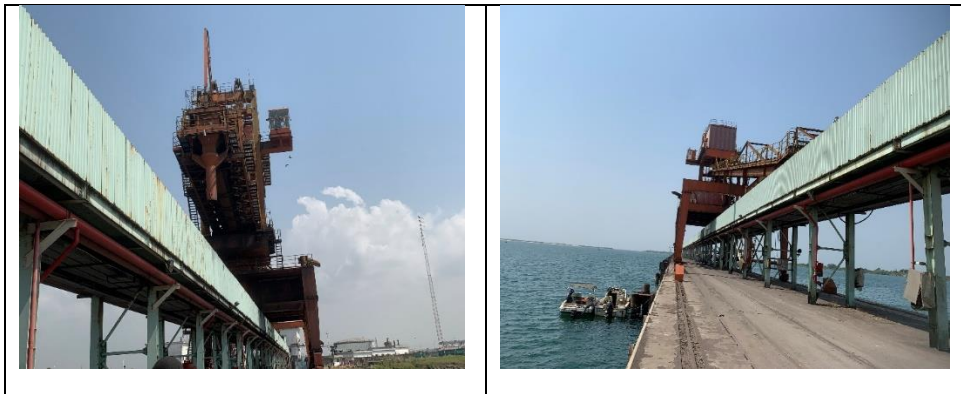
has a berthing capacity of 90,000 tons and is only able to handle containers, general cargo, cement, and food through these three berths.

- **Port of Monrovia Access** - The depth of original design approach channel is 14.3 m with a width of 154 m. Since there has been no maintenance dredging in several years, the channel depth has been reduced through accumulation of sediment. The channel depth is currently an approximate average of 11.6 m (ranging between -9 m and -15.6 m), with a minimum depth of 4 m at the south side of the harbour entrance near the south breakwater. In addition, access to the port is obstructed as a result of the sinking of a 30,000 Deadweight Tonnage (DWT) vessel in the deep approach channel and a sand bank which has accumulated inside the south breakwater.
- **Port Security** - The port is fenced with controlled access 24 hours a day. Permits are required from the port authority to gain access.
- **Fuel Tanks** - Two fuel storage tanks, one 26,500 m³ heavy fuel oil (HFO) tank and one 3 000 m³ diesel tank.
- **The BMC Jetty** - The existing BMC jetty (Figure 2.1) was built in 1962, with a design water depth of 14 m and an actual depth in front of the jetty of 13 m. The jetty is 270.4 m long and 12.5 m wide. The BMC jetty is currently used for the berthing of fishing vessels (Figure 2.2), with any cargo offloaded by the cranes located on the vessels themselves. There is no loading equipment on the jetty.
- **Stockpile Yard** - An area of previously disturbed land used for stockpiling is located in the middle of the BMC port onshore area. Currently no iron ore is stockpiled at this site.
- **Buildings and roads** – Some existing buildings roads and rail infrastructure still remain on site. This infrastructure will be upgraded and expanded as part of the Port Re-opening works.

Figure 1: EXISTING BMC JETTY



Figure 2 Existing BMC Jetty with China Union Ship Loader



2.6 PROJECT ALTERNATIVES

This section describes the alternatives considered during the course of the Project design and the ESIA process. For the Port component of the Project, the following types of alternatives were considered:

- Layout design and technology alternatives;
- Location alternatives; and
- No-Go alternative.

Factors that guided the choices between alternatives included practicality, constructability, geological conditions, environmental and social considerations, existing infrastructure and financial viability.

2.6.1 Design and Technology Alternative

The following technology alternatives were considered:

Option I: The use of a dewatering plant to dewater iron ore slurry prior to transfer of dewatered ore to the stockpile; and

Option II: The dry and direct transfer of iron ore concentrate to the stockpile area from locomotives.

Option II was selected based on the alternative selection for the transport options, the rationale is as follows:

For Option I, an 86 km ore concentrate slurry pipeline would be constructed alongside the existing Port to Bong Mine Railway for ore concentrate transportation. Slurry would be dewatered and sent to storage stockpile at the port prior to export.

For Option II, the existing Port to Bong Mine Railway would be renovated, and a new railway will be constructed between the Bong Mine and Bong Peak for the transportation of iron ore concentrate by rolling stock. Iron ore would be offloaded to storage stockpile at the port prior to export.

Option I requires management of a considerable volume of water at the Port end and the new pipeline construction has greater environmental impacts than renovation of the existing railroad. Additionally, pipeline method is relatively new in Liberia with little local experience, which may lead to permitting and operation uncertainties.

Therefore, the preferred transport option was by rail and therefore Option II, dry handling of iron ore at the port was selected.

2.6.2 Location Alternative

The Port facility is located at the existing port in the land previously used by the Bong Mine. The location of the Freeport of the Monrovia and is a predetermined location, there are no location alternatives.

2.6.3 No-Go Alternative

The Port is an integral part of the overall Bong Mine Project as it provides a means of export iron ore concentrate to the global market.

The no-go alternative implies that the proposed project would not be undertaken. Assessment of the no-go alternative requires an evaluation of the relative trade-offs between the economic and social development benefits associated with the project against the environmental and social costs of the project.

The re-opening of the Mine, Port and Railway is likely to have significant impacts on the current environmental and social situation. These impacts are assessed in the following chapters of this ESIA. The ESIA aims to reduce all impacts to a level acceptable to stakeholders including the EPA. However, it is inevitable that there will still be some significant impacts due to the project.

Liberia is currently in an economic developmental phase following many years of conflict ending in 2004. As a result of the conflict Liberia's export earnings were extremely low. The government of Liberia is working to enhance the country's economic development by rejuvenating Liberia's core industries including mining resulting in both foreign investment and increased economic growth of a regional and county scale.

Mining of iron ore is recognized as a critical aspect of the country's economic recovery as a large volume of iron ore has been proven through historic exploration and mining activities. In addition, mines such as the Bong Mine have been successfully operated in the past and some infrastructure still remains and therefore development of the project is likely to be faster than green field's projects. Taking this into account the mining of iron ore at the Bong Mine has potential to contribute to the country's GDP in the short term and continue into the long term and is in line with the Government of Liberia's plan for economic recovery. In addition to the country level economic development the project will also provide employment in Bong County and result in increased trade due to the increased need for goods and services. Given that construction activities have already underway at the Mine some economic benefit has already been recognized in communities near the mine. The project will employ a total of 2 150 workers (including mine, railway and port), and contribute to Liberian government tax 53,061,000 USD.

Local communities have expressed the need for socio-economic development in the form of training, employment and community development projects. In the event that the Project does not proceed, the local communities would lose the investment in the local human resources and in the local economy.

Should the No Go alternative occur (ie no development of the project) none of the likely environmental and social impacts would occur due to the Project. However, none of the country and county wide economic benefits will be realized. In addition, having the client pull out may result in further unrest as local communities no longer benefit from the current or longer increase in employment and economic activity.

2.7 PORT PROJECT PHASES

The Bong Mine Project will develop a mine and associated infrastructure to process 10 Mtpa of iron ore with a total life of mine of 25 years.

The project will be constructed in two phases as detailed below. A summary of the components for Phase 1 and Phase 2 is described in Table 3:

- **Phase 1:** The Initial rehabilitation stage; this phase involves storage and export of 1 Mtpa of iron ore. Phase 1 construction is currently underway with ground clearing, leveling, upgrade and construction of the Jetty, Railway, Roads, Buildings, power generators, fuel storage tanks, ore stockpile area, ore stackers, sewage treatment plant and conveyor belts.
- **Phase 2:** In the expansion phase; operations will be expanded to handle and export a total of 10 Mtpa of iron ore. This will involve the expansion of power generators, ore conveyers, ore stackers and stockpile area.

2.7.1 Key Project Components

The port design is intended to use the existing infrastructure where possible and to retain the original layout of the Port of Monrovia. The key technical components of the Phase 1 and Phase 2 developments are provided in Table 3 and the layout of these project components is presented in Map 2-1.

Table 3 Key Phase 1 and Phase 2 Components

Item	Phase 1	Phase 2
Berths	1	1
Berth dimension	270 x 12.5 m	270 x 12.5 m
Total land area	275,100 m ²	275,100 m ²
Excavation quantity	25,532 m ³	0
Backfill requirement	11,330 m ³	15,000 m ³
Stockpile area	28,380 m ²	99,960 m ²
Road area	20,140 m ²	17,280 m ²
Building area	5 677 m ²	5 265 m ²
Capital dredging quantity	1,150,000 m ³	0

2.8 Phase 1 and 2 construction

2.8.1 Background

As stated previously Phase 1 construction is permitted under a separate process and is not assessed in this ESIA. Phase 1 construction started in 2012 and is ongoing. In order to provide context to the Phase 1 operations and Phase 2 construction and operations, a summary of the infrastructure constructed during Phase 1 is provided below.

In Phase 2 the facilities at the site will mostly remain the same as that of the Phase 1. In Phase 2 construction will include two additional stacker reclaimers, a corresponding transfer station and additional conveyors as well as the expansion of the stockpile area.

2.8.2 Infrastructure

The following infrastructure will be (or has been) constructed or upgraded during Phase 1 construction:

- A steel connection bridge between the western mooring dolphins and the jetty platform.
- Fixing and strengthening the former BMC Pier to meet the cargo requirements.
- Construction of a new ship loader crane.
- An ore stockpile area (28,380 m²) with a storm water drainage ditch.
- Repair of 210 m of railway on the jetty platform.
- Vehicle service station, lay-down areas, cement storage shed, parking areas, site buildings, boiler house, guard house and fencing.
- A domestic waste water treatment plant with bio-chemical treatment process.
- A power station consisting of four (4) sets of 640 Kw diesel generators and two (2) 510 Kw diesel generators were constructed.
- The construction to be carried out in Phase 2 construction is discussed below in more detail:
 - The ore stockpile area will be increased from 28,380m² to 99,960m².
 - Roads and hardstand areas will be covered by cement.
 - Five additional conveyors will be constructed.
 - Two additional stacker reclaimers and the corresponding transfer station will be constructed.



Construction of new Beneficiation Plant at the Mines left and New TSF

2.8.3 Site preparation

The land elevation of the port area was between 2.8 and 3.6 m. In order to level the site to an elevation of 3.2 m, the remaining ore from the BMC project was used to fill the site where required. The excavation quantity used was 20,060 m³ and the backfill quantity was 29,610 m³.

2.8.4 Capital Dredging

Dredging was required to allow ship access to the jetty. Dredging will be undertaken using suction hopper dredgers. The total volume dredged will be 1.15 million m³. The capital dredging process is the responsibility of the Monrovia Port Authority, therefore impacts relating to capital dredging are not assessed in this ESIA.

The dredged spoil will be disposed of offshore in a deep-water area approximately 10 km offshore of the port. The disposal site is routinely used by the Monrovia Port Authority and the impact of disposal is managed by the Port Authority. In order to reduce the amount of dredged material, the channel was routed through the deepest water and the angle of the channel optimized to reduce the impact of transverse waves of vessels entering and leaving the port.

The average depth around the jetty is -11.6 m with a range between -9 m and 15.6 m. This is a sufficient depth for the berthing and turning of the 20,000 DWT Diesel vessels and the 50,000 DWT iron ore vessels in ballast state. However, dredging is required to allow 50,000 DWT vessels to depart the port at full load. The bottom width will be dredged to a consistent depth of 13.2 m.

2.6.5 Refurbishment of existing Tanks in the Tank Farm

Diesel and heavy fuel oil will be stored in the existing tanks in the tank farm. These tanks were previously used by BMC and there was evidence that the tanks have leaked in the past resulting in visible hydrocarbon contamination around the tank farm.

During Phase 1 construction China Union has refurbished the HFO (26,500 m³) and diesel (3 000 m³) tanks. The tanks bottom surfaces were replaced, internal walls reinforced, surface holes, manholes and guard rails were repaired. Asphalt was set on the bottom surface of the tanks to reduce the potential for seepage. An isolation belt was installed to reduce the risk of scalding operators and inspectors. Rust was removed from the tanks and the internal and external tank walls were painted.

2.8.5 Waste Management

Waste generated during the site preparation and construction phase generated hazardous and non-hazardous waste including: vegetation, concrete, scrap metal, paper, packaging materials, wood, empty containers, old machinery, excavated road material and food wastes. All waste was collected onsite in waste bins and transferred to the municipal landfill for disposal.

2.8.6 Water Supply

All water will be supply from a water tank that was constructed by LWSC to supply China Union facilities at the port and mines. The total water consumption is listed in Table 4.

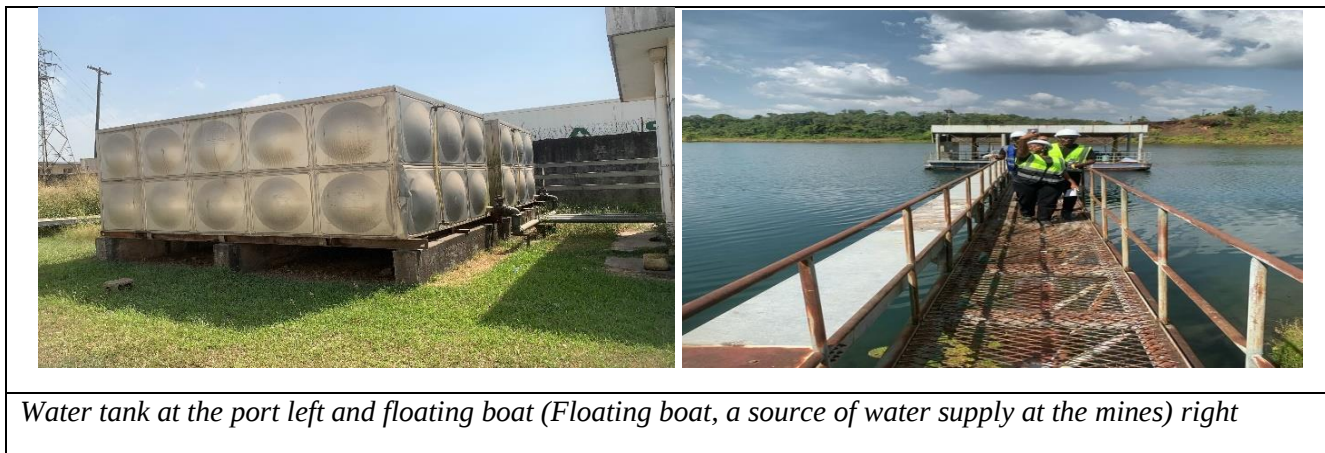


Table 4 phase 1 Water Consumption-Operations

	Volume (m ³ / d)
Potable water	12
Ship water	400
Environmental water	30
Dust suppression water	180
Water for power generation	240
Other (unplanned)	172
Total	1034

2.8.7 Power Supply

The source of power at the port is from four KVA power generator that supplies the Ship loader, conveyor belt, reclaimer and the rest of the facilities.



2.9 Phase 1 Operation

2.9.1 Background

The Phase 1 operations are expected to start during the fourth quarter of 2013. Phase 1 operations will store and off load 1 Mtpa of iron ore concentrate. The details of the operation are described below.

2.9.2 Ore handling

Trains (with 60t rail wagons) will use an upgraded rail line to transport the iron ore from the Bong Mines to the port. As trains arrive at the port (in the south of the ore yard), a hydraulic excavator will be used to unload the ore from the trains and stockpile within the yards. Single-bucket loaders will be used for stacking of the iron ore.

The ore will then be loaded onto conveyor belts (width of 1 200 mm to 1 400 mm) which will transport the ore from the yard to the export berth. At the export berth, one bucket wheel stacker-reclaimer with capacity of 2 000t/hr will be used for stacking and reclaiming. Two conveyors will be used to transport ore to the ship loader with the following specifications:

- Conveyor 1 – belt width 1 200 mm and belt speed 2 m/s; and
- Conveyor 2 – belt width 1 400 mm and belt speed 3.15 m/s

A ship loader will be used on the wharf to load the ore to the vessels at a rate and capacity of approximately 4 000 tons per hour.

The key pieces of equipment used in ore handling are listed in Table 5.

Table 5 Key Equipment used in Ore Handling (Phase 1)

Equipment	Type/ specification	Number
Single bucket loader	ZL50	4
Hydraulic excavator		4
Ship loader	4 000 t/h	1
Stacker-reclaimer	2 000t/h	1
No 6 conveyor	Width: 1.2 m	1
No 9 conveyor	Width: 1.4 m	1
No 10 conveyor	Width: 1.4 m	1
Electric hoist		2

Dust suppression techniques will be implemented during transport of the ore on the conveyor belts and storage area. Water spraying systems will be used on the conveyor belts during Phase 1 and Phase 2 operation. Bag collector systems will be installed at the end of the conveyor belts. In addition, a spray suppression system with 26 spray-gun sets will be installed around the ore storage areas.

2.9.3 Storage and Handling of Liquid Hydrocarbons

The dock will include a multi-purpose loading/ unloading 20,000 DWT berth for bulk liquid chemical offloading. The hydrocarbons will be pumped through stainless steel hose to pipelines on the dock and to the tank farm. The tank farm will consist of:

- One 26,500 m3 dome roofed tank (42 m diameter x 18 m height) for Heavy Fuel Oil (HFO); and
- One 3 000 m3 dome roofed tank (21 m diameter x 9 m height) for diesel.

From the tank farm Hydrocarbons will be pumped through pipelines using an oil pump to the railway top loading arm and into the railway hydrocarbon tanks for transport from the port to the mine by rail. The railway loading area include a pump shed and three top loading arms, two for heavy fuel oil and one for diesel.

In addition, diesel is being pumped via underground pipelines from the tank farm to the underground tanks (20 m3 capacity) at the filling station to allow refueling of port and other vehicles.

2.9.4 Waste Water Treatment

A waste water treatment plant will be operated on site to treat domestic wastewater and runoff from the storage yard and tank farm. The specifications of the plant are yet to be defined. The treatment plant will be designed to meet the Integrated Wastewater Discharge Standard of China (GB8978-1996). The treated wastewater will be discharged to the sea via the storm water discharge pipe.

2.9.5 Storm Water Management

Storm water from roofs and roads are collected and discharged to the sea via a storm water drain. Runoff from the storage yard and tank farm will be treated in the wastewater treatment system and discharged to the sea after treatment. Runoff from the oil terminal and handling area will be treated in an oil and water separator prior to discharge to the sea.

2.9.6 Utilities and Buildings

Buildings

The new buildings on site include administrative buildings, a guardhouse, transfer tower, a filling station, a machine repair workshop and material store, with a total area of 5 677.04 m². The administrative buildings include a kitchen, canteen, ablutions, offices and a conference room.

Building materials such as wood, cement and masonry can be bought from the local markets, while steel was imported from China. The port buildings have ventilation and air conditioning systems during Phase.

2.9.7 Communication and control systems

The bulk handling PLC and oil handling PLC control systems will be reconfigured and extended during the implementation of Phase 2.

2.9.8 Maintenance Dredging

The dredging program will be the same as in Phase 1 operations.

2.9.9 Marine Traffic

A full marine traffic study is yet to be undertaken, based on the importation of 220,000t per year of HFO by 20,000 DWT vessels and export of 10 Mtpa ore concentrate using 50,000 DWT vessels.

2.9.10 Employment

The operational phase (Phase 1) includes a total of 158 employees. A breakdown of these employees is provided in Table 6.

Table 6 Operation Staff Breakdown

Position	Number
Production staff	
Drivers	78
Sailors	6
Electrical and control personnel	5
Communications	2
Drainage and fire protection	3
Environmental Officer	1
Oil loading and diesel station	20
Non-production staff	
Managers	11
Logistical personnel	14
Total	140

3 ADMINISTRATIVE FRAMEWORK

3.1 INTRODUCTION

This Chapter summarizes the institutional framework applied to the Project and the most relevant national legislation. In particular, this Chapter provides a description of the following:

- Liberian administrative and legislative organization.
- The Liberian environmental and social laws and regulations applicable to the Project.
- Status of protected areas and species that may have an effect on the proposed development.
- International conventions and standards to which Liberia is a signatory and which the Project must therefore take into account.
- Consideration where relevant, of other international conventions and standards with which the Project will also be consistent.
- International treaties, conventions and protocols relevant to the Project relate to such issues as biodiversity, climate change, marine pollution and employment conditions.

3.2 LIBERIAN GOVERNMENT AND ADMINISTRATION FRAMEWORK

This section outlines the relevant Regulatory Authorities and the relevant Acts and Regulations pertaining to this Project.

3.2.1 *Environmental Protection Agency and Related Environmental Committees.*

The Environmental Protection Agency (EPA) is the agency responsible for coordinating, integrating and harmonizing the implementation of the Environmental Policy under the guidance of the National Environmental Policy Council (NEPC). The NEPC was established under Section 7 of the Environment Protection Agency Act (EPAA) (Section 3.4.2).

Key functions of the EPA are to:

- Propose environmental policies and strategies to the NEPC and ensure the integration of environmental concerns in overall national planning.
- Collect, analyze and prepare basic scientific data and other information pertaining to pollution, degradation, environmental quality, resource use and other environmental protection and conservation matters. This includes undertaking research and preparing and disseminating a report on the state of the environment in Liberia every two years.
- Ensure the preservation and promotion of important historic, cultural and spiritual values of natural resources heritage and, in consultation with indigenous authority, enhance indigenous methods for effective natural resource management.
- Encourage the use of appropriate environmentally sound technologies and renewable sources of energy and natural resources.
- Establish environmental criteria, guidelines, specifications and standards for production processes and the sustainable use of natural resources for the health and welfare of future generations.
- Review and approve environmental impact statements (EIS) and environmental impact assessment (EIA).

- Initiate and co-ordinate actions required in a state of environmental emergency or any other situation which may pose serious threat to the environment and public health.
- Function as the national clearinghouse for all activities relating to regional and international environment-related conventions, treaties and agreements, and as national liaison with the secretariat for all such regional and international instruments.
- Advise the state and participate in the process of negotiating, ratifying or acceding to relevant regional and international environmental agreements.
- The EPA also has a Board of Directors to oversee the implementation and successful operation of the National Environment Management Policy and functions of the EPA. The government constituted the NEPC, Board of Directors and the Executive Director.

3.2.2 *National Environmental Commission of Liberia*

The National Environmental Commission of Liberia (NECOLIB) was created in 1999 with the mandate to coordinate environmental management activities, including the conservation of biological diversity. NECOLIB is the focal institution for the Convention on Biological Diversity, the Cartagena Protocol on Biosafety, United Nations Framework Convention on Climate Change and its Kyoto Protocol, and the Stockholm Convention on Persistent Organic Pollutants (POPs). See Table 7 for the International Conventions to which Liberia is a signatory.

3.2.3 *Forest Development Authority*

The Forest Development Authority (FDA) was established in 1976. The FDA is in charge of the sustainable management of the forest and associated resources, including forest lands and wildlife. It provides medium and long-term planning within the forest sector, the preparation and promulgation of forest policy, law and administration, the release of forest concession agreements, monitoring activities of timber companies and managing protected area programs and wildlife and national parks. Other FDA activities include forest conservation, educational awareness, agro-forestry programs, environmental awareness-raising in communities surrounding protected areas and discussion of trans-border issues.

3.2.4 *Ministry of Lands, Mines and Energy*

The Ministry of Lands, Mines and Energy ensure the sustainable management and judicious utilization of the country's Lands, Mines & Energy resources.

There are three main departments: Lands, Mineral Resources and Energy. These are further described below.

Lands Department

- The Lands Department provides various types of services including:
- Management and Administration of State Land and properties leased to Government;
- Identify and initiate development proposals for vacant land and assist the National Housing in the upgrading and resettlement of squatter areas
- Procurement of land for all Government departments;
- Carrying out aerial photography, preparation and compilation of maps, plans and continuous updating and maintenance of land records;

- Examination and approval of all land surveys and overseeing the accuracy of land surveys undertaken by registered surveyors in the country;
- Upgrade and maintain the geodetic network of Liberia for a sound survey system; and
- Provision of a National Land Information system for Liberia.

Mineral Resources Department

- The Mineral Resources Department also acts as the National Geological Survey and Mines Department of the Republic of Liberia, with the mandate to look after the Mining Sector. Its two major operating areas are Mines Administration and Geological and Mineral Investigations, which address the following:
- Administration of exploration and mining tenements, processing of applications for grant and renewal, granting licenses, special site licenses or permits as well as certification of mining personnel and specific mining equipment;
- Monitoring mining and exploration activities, through regular inspections, for adherence to safe environmental practices, health and safety of workers and other specified conditions laid down in the licenses;
- Issuing of licenses for importation, possession and transportation of explosives and fireworks and granting of export permits for geological and mineral samples;
- Facilitating mining and exploration projects through assistance in negotiations with relevant Government and non-government agencies and providing support with landowner liaison; and Hydrogeological assessment and advice on groundwater potential, the siting of potential abstraction sites and drilling of abstraction wells for groundwater.

Energy Department

- Beginning in 1981, the Energy unit within the Office of the President of Liberia was integrated into the then Ministry of Lands and Mines.
- The Department of Energy consists of the Bureau of Hydrocarbons and the Bureau of Energy Technology and Policy Development.
- The Ministry has reactivated the National Energy Committee (NEC) an inter-agency advisory body on energy matters comprising nine members including government ministries and public corporations. This is in agreement with the multi-sectoral approach being encouraged by the Economic Community of West African States (ECOWAS).
- The Department of Energy continues to serve and maintain linkages with energy-oriented organizations both state-controlled and privately owned.
- In addition, it continues to monitor and coordinate the energy sector (both conventional and non-conventional) in an effort to ensure effective and efficient utilization and management of energy resources.
- It encourages sustainable forestry, including production of “green” charcoal from such forests, with revenues used to support local communities, and to ensure that energy considerations are integrated with food and farming policies.

3.3 RELEVANT DEVELOPMENT POLICY AND PLANS

3.3.1 *National Environmental Policy (NEP)*

The Constitution of Liberia (1986) provides for the protection and management of the environment and natural resources. The National Environmental Policy (NEP) provides a broad framework for the implementation of national objectives and plans. The policy aims at ensuring a sound management of resources and the environment.

The policy provides for:

- Integration of environmental considerations in sectoral, structural, regional, and socio-economic planning at all levels;
- Sound management of the environment and natural resources;
- Protection and maintenance of human habitats, the ecosystems, and ecological processes essential for the functioning of the biosphere;
- Guidance for national action plan and for healthy environmental practices on the national development effort;
- Sustainable development; and
- A common approach to environmental issues. The primary aim of this policy is pursued through harmonization and enforcement of relevant laws on environment protection. The NEP identifies that the EPA will operate under the guidance of the National Environment Council.

3.3.2 *The National Environmental Action Plan (NEAP)*

Under Section 30 of the Environmental Protection Agency Act (EPAA), the EPA will prepare a National Environmental Action Plan (NEAP) every five years in consultation with the Line Ministries and County Environmental Committees.

The National Environmental Action Plan will:

- Contain all matters affecting the environment and provide general guidelines for the management and protection of the environment and natural resources of Liberia as well as the strategies for preventing, controlling, or mitigating any deleterious effects;
- Be the basis for national environment planning and implementation of development programmed;
- Recommend appropriate economic and fiscal incentives as instruments for environmental protection to be incorporated into the planning and operational processes of the economy; Recommend areas for environmental research outlining methods of utilizing research information;
- Recommend methods for building national awareness on the importance of sustainable use of the environment and natural resources for national development;
- Take into account County Environment Action Plans (CEAP); and
- Identify and recommend policy and legislative approaches for preventing, controlling or mitigating specific as well as general adverse impacts on the environment.

3.3.3 Mineral Policy, 2010

The Mineral Policy was introduced in 2010. The policy is intended to provide adequate indications to the investment community (both national and foreign) of a competitive mineral regime in Liberia that is informed by international trends, adheres to international norms, is grounded in local conditions and is accountable to national common interests.

3.3.4 Terms of Mineral Development Agreement (MDA)

Section 5.3 of the MDA states that the Environmental Impact Assessment Study Report and the Environmental Management Plan (EMP) shall comply with the requirements laid down by the EPA.

- The EIA shall at a minimum identify pre-existing environmental conditions and set forth the potential adverse impact of the construction and operation of the Mining Plant and the Infrastructure proposed in the Feasibility Report shall take into account all activities or improvements to be undertaken by the Company and referred to in Section 6.7(d), 6.7(e) or 11.6 of the Mining Law, and shall otherwise comply with applicable Law. The EMP shall at a minimum set forth detailed plans consistent with the EIA for the mitigation of environmental harm attributable to, and the restoration or remediation of the environment to the extent affected by, the implementation of the Development Plan and subsequent Operations, including the actions to be taken by the Company to comply with Sections 8.1 through 8.3 of the Mining Law, International Mining Standards and other applicable Law, and shall in any event comply with applicable EPA requirements and Section 5.7(b).
- Section 5.3 (b) states that the EMP must include a closure management plan and a closure management budget designed to ensure that upon closure it shall not present any health or safety issues (including provision for the control of acid drainage and other long-term environmental hazards). The proposed production area shall be restored to productive
- use or reforested or where restoration is impractical, suitably remediated. The closure management plan must include a list and assessment of risk and any uncertainties associated with the preferred closure option, address the social aspects of closure and rehabilitation, and provide a process for participation by the community and other stakeholders in closure management and monitoring.
- Section 5.3(c) states that the EMP must also set forth the means by which the Company proposes to ensure the availability of funds to finance its environmental restoration and remediation obligations under Sections 8.2 and 8.3 of the Mining Law (the “Environmental Restoration Obligations”) so that the cost of closure will be borne by the Company and not the public or the Government.
- Section 5.4 (d) requires that the Company shall have held public hearings on the EIA and the EMP at least in Monrovia, in the county seat of each county in which a Proposed Production Area is located and in the county seat of each county in which the Railroad, Port, Power Plant or any Road described in Section 6.6 is located or to be located. Means must be taken to publicize the hearings, an indication of the numbers of persons who attended such hearings and their affiliates, a summary of the issues raised at such hearings, and a discussion of the actions taken by the Company in response to such hearings. The

Ministry may set forth by regulation additional standards consistent with accepted practice in OECD countries for the location of, notification of and conduct of such hearings.

- Section 5.6 (a) enlists the requirements to be covered under Social Impact Assessment (SIA) including the potential adverse impact of the construction and operation of each proposed Mine, and the related Mining Plant and Infrastructure on the individuals and community's resident in and around the Bomi Hills Mine and facilities; whether using Company provided infrastructure or equipment, or facilities or equipment provided by the Government or third parties.
- Section 5.8 (a) of MDA enlists the requirements for the Social Action Plan (SAP) including reasonable measures, in light of the costs involved, for the mitigation of the adverse impact referred to in Section 5.8(a) as well as making provision for the continuing economic and social viability of enters of population that have formed and which may form as a result of Operations during the term of this Agreement.
- Section 5.4 (b) also requires the inclusion of a Resettlement Action Plan (RAP) component if communes located in or adjacent to each Proposed Production Area or to Mining Plant or Infrastructure not located in the Proposed Production Area should under International Mining Standards be resettled for health or safety reasons. The RAP shall provide for (but not be limited to) suitable area(s) of resettlement to be undertaken at Company expense with key emphasis on shelter and livelihood continuity.

3.3.5 *Integrated Water Resources Management Plan (IWRMP), 2009*

The Integrated Water Resources Management Plan (IWRMP) (2009) provides an overarching approach to manage water resources in Liberia that is sustainable and beneficial to most people. This policy was designed to provide a broad-based charter that must be recognized by all concerned sector institutions and be considered by all public and private projects and programs. Two broad areas are covered in this policy:

- Water Resources Management: this covers the management framework, including policy objectives, principles and strategies for monitoring, assessment, allocation and protection of resources; and
- Water Resources Use: this covers the policy objectives, principles and strategies for the development and use of water for people, water for food security, water for industry and other water uses such as hydropower, recreation, non-revenue water and water for maintenance of productive ecosystems.

3.3.6 *National Forestry Policy, 2006*

The National Forest Policy was published in 2006. The aim of the forestry policy of Liberia is to conserve and sustainably manage all forest areas, so that they will continue to produce a complete range of goods and services for the benefit of all Liberians. The conservation of these forest areas is also to contribute to poverty alleviation in the nation, while maintaining environmental stability and fulfilling Liberia's commitments under international agreements and conventions.

3.3.7 *National Biodiversity Strategy and Action Plan, 2004*

The overall goal of the National Biodiversity Strategy and Action Plan (2004) is to sustainably use biodiversity on a long-term basis to meet the needs of both the present and future generations.

3.4 LIBERIAN LAWS AND REGULATIONS

3.4.1 *New Constitution of Liberia*

- The constitutional basis for environmental law is provided in Article 7 of the Constitution (1986). The Article provides for:
- Environmental protection as a fundamental rule;
- Public participation of all citizens in the protection and management of the environment and natural resources; and
- Binds state organizations to adopt and activate environmental policy and formulate national development plans that are environmentally sustainable

3.4.2 *Environmental Protection Agency Act (EPA's mandate)*

This act establishes the EPA as the principal authority in Liberia for the management of the environment. The role of the authority is to coordinate, monitor, supervise and consult with relevant stakeholders on all activities in the protection of the environment and sustainable use of natural resources.

If an EIA is required, the proponent will be requested to carry out a public consultation termed scoping. The scoping exercises will identify what possible impacts there may be from the project and from alternatives considered. This process will also lead to the identification of a Terms of Reference (ToR) for preparation of the Environmental and Social Impact Statement of the proposed project. The EPA must approve the ToR prior to commencement of the ESIA study. Consultants for the ESIA must also meet the qualification criteria set by the Agency and be in its Registry.

Because of the nature of the proposed Project activities, under the requirements of the EPAA, WCL is required to obtain environmental permits for the Project. This requires that WCL carryout an ESIA to include a Scoping phase. The Environmental and Social Impact Assessment (ESIA) process to be followed for this project.

3.4.3 *Environment Protection and Management Law*

The Environmental Protection and Management Law (EPML) provides for a wide-ranging responsibility for environmental management by the EPA. One of the most prominent issues is the need for development of administrative procedures for the preparation of the EIA to ensure effective environmental governance.

It establishes regulations for environmental quality standards; pollution control and licensing; guidelines and standards for the management of the environment and natural resources. It also addresses the protection of biodiversity, national heritage and the ozone layer. Other areas covered include environmental restoration orders, inspections, international obligations, information access, education and public awareness.

3.4.4 *Public Consultation*

Section 37 of the EPAA of Liberia requires the following public consultation process to be carried out:

- Identify, inform and receive input from affected stakeholders and interested parties;
- Determine and narrow the scope of the issues to be addressed in the EIA;
- Identify and define, at an early stage of the EIA process, the significant environmental issues, problems and alternatives related to the different phases of the proposed project or activity;
- Ensure public participation early in the EIA process;
- Ensure that all relevant issues and alternatives are adequately addressed in the environmental impact study;
- Provide the applicant with the information necessary for formulating the terms of reference for the environmental impact study and impact statement; and
- Guide the applicant's consultants in preparing the Environmental Impact Statement (EIS).

Section 5.4 (c) of the MDA signed between China Union and the Liberian Government mentions the requirement of public hearings on the Social Impact Assessment (SIA) and the Social Action Plan (SAP).

- The public hearing should be conducted at least in Monrovia, in the county seat of each county in which a Proposed Production Area is located and in the county seat of each county in which the Railroad, Port or Mine in Section 5.4 is located or to be located. A public hearing should be held in Monrovia, Gbarnga County and Bong County.
- It shall include a statement of the means taken to publicize the hearings, an indication of the numbers of persons who attended such hearings and, to the extent known to the Company, the names of the organizations such persons represent, a summary of the issues raised at such hearings, and a discussion of the actions taken by the Company in response to such hearings.

3.4.5 Regulations Pertaining to Mining Minerals and Mining Act

The Minerals and Mining Act (2000) states that minerals on the surface of the ground or in the soil or subsoil, rivers, streams, watercourses, territorial waters and continental shelf are the property of Liberia. Section 3.4 allows for the establishment of a Minerals Technical Committee consisting of: Minister of Lands, Mines and Energy, Ministry of Justice, Ministry of Finance, Ministry of

Planning and Economic Affairs, National Investment Commission, Ministry of Labour, Council of Economic Advisors, and Central Bank of Liberia. This committee has the power to negotiate agreements for Class A Mining Licenses.

The Law, which is administered by the Ministry of Lands, Mines and Energy, has a clearly defined exploration and licensing system, as explained in the following sections:

Exploration Licenses

Exploration licenses are issued to exploration and mining companies at an initial term of three years and are renewable for a single two-year term upon written application of the holder who has fulfilled its work and expenditures obligations.

At or before the expiration of the initial period of the exploration license the holder may select the entire area or any part of a production area. If the holder does apply for an extension of the exploration license, 50 percent of the exploration area is surrendered at the end of the initial term.

At the end of the extension period, the holder can declare all or part of the entire remaining area as production area. The remaining area is surrendered to the government.

Class A Mining Licenses

Upon notice to the Minister that exploitable deposits were found under the exploration program, the Minister can grant a Class A Mining License.

A Feasibility Report is then to be submitted to the Minister. The initial terms of a Class A License is not more than 25 years; it can however be extended, if proven reserves are shown to exist, and upon submission of an updated feasibility report, for consecutive additional terms of up to 25 years. In order to receive an Exploration License or a Class A License, an applicant must conclude a Mineral Development Agreement (MDA) with the Government.

The terms contained in the MDA are valid for no more than 25 years and are subject to periodic review every five years.

The surface rights granted under a license include the following:

- Erection of habitations, office buildings, mill buildings, engine houses, store houses;
- Building of dumps, ditches for drainage and roads within the surface boundaries of the production area;
- Making trenches and open cuts for mining operation;
- Cutting of timber only to clear for the construction of buildings and other infrastructure as required; and
- Use of water and other resources necessary for the work.

Chapter 8 of this Law deals with environmental protection and states that an

Environmental Impact Assessment Study for a Class A and Class B Mining License and Environmental Management Programs are to be prepared under Sections 8.5 and 8.6, respectively. Section 8.2 identifies the requirement for environmental restoration. These are further discussed below:

- Section 8.2 states that every holder of a mining license must restore the site disturbed by exploration of mining to its original state. If this is not possible, then it is to be restored to a state that is environmentally and socially desirable.
- Section 8.3 stipulates that all water polluted by exploration or mining is restored to its original state and that any water courses that have been closed are re-opened or a suitable

water course opened to maintain natural runoff with minimal erosion. Reforestation is also required if exploration or mining resulted in large scale felling.

- Section 8.4 states that each applicant for a Class A and Class B License must submit, as a precedent to the granting of the license, an Environmental Impact Assessment Study. The study is to give special attention to potential impacts to nearby communities. The Minister of Mines will only grant a license after review of this study and confirm that the mitigation and reclamation procedures are adequate to protect the environment.
- Under Section 8.5, an Environmental Management Plan is to be submitted by the holder of a mining right for any affected land by exploration, mining or other operations and this plan will be submitted prior to the start of operations.

Chapter 11 addresses rights of owners and occupants of land affected by the Minerals and Mining Law, which is discussed further as follows:

- Section 11.3 provides for compensation to landowners or occupants diminution in the land value caused by the government to exercise its rights as owner of mineral rights, which supersedes any landowner or occupant rights with respect to exploration and mining.
- Any landowner or lawful occupant has the right of first refusal in any application for Class A or Class B Mining License against third parties (Section 11.4).
- Chapter 16 addresses health and safety requirements. Section 16.2 states that the permission to import, export, buy, sell, manufacture, store, handle purchase, use, dispose or otherwise deal with explosives needs to apply to the Ministry of State of Presidential Affairs.

3.4.6 Terms of Mineral Development Agreement (MDA)

Section 5.3 of the MDA states that the Environmental Impact Assessment Study Report and the Environmental Management Plan (EMP) shall comply with the requirements laid down by the EPA.

- The EIA shall at a minimum identify pre-existing environmental conditions and set forth the potential adverse impact of the construction and operation of the Mining Plant and the Infrastructure proposed in the Feasibility Report shall take into account all activities or improvements to be undertaken by the Company and referred to in Section 6.7(d), 6.7(e) or 11.6 of the Mining Law, and shall otherwise comply with applicable Law.
The EMP shall at a minimum set forth detailed plans consistent with the EIA for the mitigation of environmental harm attributable to, and the restoration or remediation of the environment to the extent affected by, the implementation of the Development Plan and subsequent Operations, including the actions to be taken by the Company to comply with Sections 8.1 through 8.3 of the Mining Law, International Mining Standards and other applicable Law, and shall in any event comply with applicable EPA requirements and Section 5.7(b).
- Section 5.3 (b) states that the EMP must include a closure management plan and a closure management budget designed to ensure that upon closure it shall not present any health or safety issues (including provision for the control of acid drainage and other long-term environmental hazards). The proposed production area shall be restored to productive use

or reforested or where restoration is impractical, suitably remediated. The closure management plan must include a list and assessment of risk and any uncertainties associated with the preferred closure option, address the social aspects of closure and rehabilitation, and provide a process for participation by the community and other stakeholders in closure management and monitoring.

- Section 5.3(c) states that the EMP must also set forth the means by which the Company proposes to ensure the availability of funds to finance its environmental restoration and remediation obligations under Sections 8.2 and 8.3 of the Mining Law (the “Environmental Restoration Obligations”) so that the cost of closure will be borne by the Company and not the public or the Government.
- Section 5.4 (d) requires that the Company shall have held public hearings on the EIA and the EMP at least in Monrovia, in the county seat of each county in which a Proposed Production Area is located and in the county seat of each county in which the Railroad, Port, Power Plant or any Road described in Section 6.6 is located or to be located. Means must be taken to publicize the hearings, an indication of the numbers of persons who attended such hearings and their affiliates, a summary of the issues raised at such hearings, and a discussion of the actions taken by the Company in response to such hearings. The Ministry may set forth by regulation additional standards consistent with accepted practice in OECD countries for the location of, notification of and conduct of such hearings.
- Section 5.6 (a) enlists the requirements to be covered under Social Impact Assessment (SIA) including the potential adverse impact of the construction and operation of each proposed Mine, and the related Mining Plant and Infrastructure on the individuals and community’s resident in and around the Bomi Hills Mine and facilities; whether using Company provided infrastructure or equipment, or facilities or equipment provided by the Government or third parties.
- Section 5.8 (a) of MDA enlists the requirements for the Social Action Plan (SAP) including reasonable measures, in light of the costs involved, for the mitigation of the adverse impact referred to in Section 5.8(a) as well as making provision for the continuing economic and social viability of enters of population that have formed and which may form as a result of Operations during the term of this Agreement.
- Section 5.4 (b) also requires the inclusion of a Resettlement Action Plan (RAP) component if communes located in or adjacent to each Proposed Production Area or to Mining Plant or Infrastructure not located in the Proposed Production Area should under International Mining Standards be resettled for health or safety reasons. The RAP shall provide for (but not be limited to) suitable area(s) of resettlement to be undertaken at Company expense with key emphasis on shelter and livelihood continuity.

3.5 INTERNATIONAL CONVENTIONS AND AGREEMENTS

Liberia is a signatory to a number of international conventions, co-operative agreements and legal obligations concerned with environmental and social issues (see Table 7), which have contributed to shaping and influencing the development of the Liberian policy, guidelines and regulations that are applicable to the Project.

Table 7 Main International Conventions and Agreements Ratified by Liberia

Convention	Date of Ratification/ Accession	Key objectives
United Nations International Covenant on Economic, Social and Cultural Rights	1967	The granting of economic, social and cultural rights to individuals, including rights to adequate health, education and living standards.
Organization of African Unity's Convention on the Conservation of Nature and Natural Resources	21 September 1978	Encourages action to conserve, use and develop soil, water, flora and fauna sustainably
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	11 March 1981	Aims to ensure that international trade in specimens of wild animals and plants do not threaten their survival.
United Nations Convention to Combat Desertification (UNCCD)	03 March 1998	To combat desertification and mitigate the effects of drought through national action programs.
United Nations Convention on Biological Diversity	08 November 2000	Conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources.
UNEP Stockholm Convention 2002 on Persistent Organic Pollutants		Governs the use of 12 Persistent Organic Pollutant substances (including DDT).
UNESCO Convention 2002 Concerning the Protection of the World's Cultural and Natural Heritage		To protect cultural and natural heritage of national and international value.
UNESCO Ramsar Convention 02 November 2003 on Wetlands of International Importance		Protection and conservation of wetland resources.
United Nations Framework 2003 Convention on Climate Change (UNFCCC)		Requires efforts to combat global warming and a key tool in promoting sustainable
UNEP Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	01 December 2004	Controlling the trade of endangered species.
UNCTAD International Tropical Timber Agreement (ITTA)	2006	The sustainable management of timber resources through improved forest management.
Extractive Industries Transparency Initiative (EITI)	2007	Strengthen governance by improving transparency and accountability in the extractives sector.
IMO Convention for Prevention of Pollution from Ships	1959	Covers accidental and operational oil pollution as well as pollution by chemicals, goods in packaged form, sewage, garbage and air pollution.
UN Convention on Law of the Sea	25 September 2008	Addresses Protection and Preservation of the Marine Environment and gives basic obligations to prevent, reduce and control pollution from land-based sources; pollution from sea-bed activities subject to national jurisdiction; pollution from activities in the Area; pollution by dumping; pollution from vessels; and pollution from or through the atmosphere.
Abidjan Convention and Protocol on Management And Protection of Coastal and Marine Environment in the Sub-Region	22 March 2005	Provides a framework through which national policy makers and resource managers implement national control measures in the protection and development of

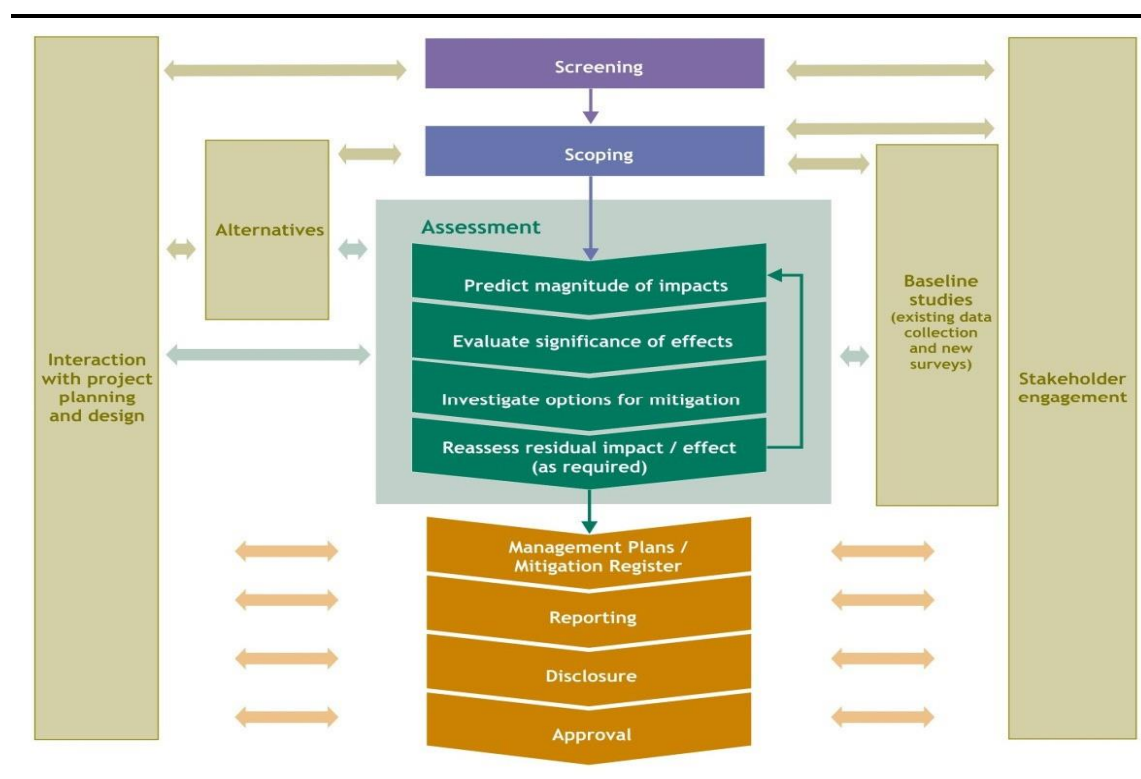
		the marine and coastal environment of the West and Central African Region.
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4 IMPACT IDENTIFICATION AND ASSESSMENT

4.1 INTRODUCTION

This Chapter presents the methodology used to conduct the ESIA. The ESIA methodology (ERM's Impact Assessment Methodology - version 1.1) follows the overall IA approach illustrated in Figure 3. The ESIA has been undertaken following a systematic process that predicts and evaluates the impacts the Project could have on aspects of the physical, biological, social/ socio-economic and cultural environment, and identifies measures that the Project will take to avoid, minimize/reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the ESIA process are described below.

Figure 3 Impact Assessment Process



4.2 SCREENING

At the initial stage of the ESIA process, preliminary information was provided to aid in the determination of what legal and other requirements apply to the Project. This step was conducted utilizing a high-level description of the Project and its associated facilities.

ERM reviewed the existing available data of the Project with the client, prefeasibility (scoping) report of the Project and secondary information available in public domain with regard to the Project, Project location and its surroundings and conducted a reconnaissance visit of the Project site and surroundings. The screening process was undertaken to identify environmental, social and other sensitivities and risks associated with the Project. A review of the applicability of the

reference framework with respect to the Project was also undertaken as part of the screening exercise.

4.3 SCOPING

Scoping has been undertaken to identify the potential Area of Influence for the Project (and thus the appropriate Study Area), to identify potential interactions between the Project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to priorities these impacts in terms of their likely significance.

This stage is intended to ensure that the IA focusses on those issues that are most important for design, decision making and stakeholder interest. The findings of the scoping exercise are reported in Chapter 5 of this ESIA Report. Table 4.1 presents the resources/receptors considered in the scoping stage, together with the changes that might indicate a Project- related impact.

Table 8 Resources/Receptors and Impacts Considered in Scoping

Resources/Receptors	Impacts
Environmental Receptors	
Geology & Soil	Changes to geology, geomorphology, topography and changes to physical and chemical properties and soil ecology
Benthic marine flora and fauna	Changes to marine flora and fauna composition
Water Quality (Surface, Groundwater, Marine)	Changes to physical, chemical or biological quality of surface, ground water and marine water bodies. Introduction of exotic species, changes in habitat quality, abundance and diversity. Effluent discharge.
Visibility	Change in visibility within surrounding environs.
Terrestrial Ecology - Vegetation	Changes to vegetation population, health, species abundance and diversity, impact on endangered and economic species, food chain effects
Terrestrial Ecology - Wildlife	Changes to wildlife assemblages, impact on endangered and economic species, food chain effects.
Air Quality	Emissions of pollutants such as NO _x , SO _x , PM, CO, VOC, TSP etc
Noise and Vibration	Change in noise or vibration levels
Heritage and Archaeology	Physical disturbances of shrines, burial grounds, archaeological resources or any other desecration.
Social Capital and cultural heritage	
Demographics (including physical displacement)	Changes in population, total population, gender ratio, age distribution. Physical displacement from residence as a result of Project land take or activities.
Cultural sites	Loss of access to cultural sites for secret societies.
Education & Skills	Change in availability or quality of education or skills provision

Social cohesion and networks	Displacement of people and communities may result in a breakdown of the existing social structure
Social deterioration	Increased numbers of people in the project are can result in an increase in crime and violence
Livelihoods and cultural heritage	
Access to land	The access to land may be reduced by direct land take for the project expansion resulting loss of income generated by natural resources.
Labour force	The project may hire workers who are currently involved in agricultural activities resulting in the ability of farmers to farm crops.
Employment	The project will hire people from local communities and therefore have a positive impact on employment in the area.
Economic activities	The project will have a secondary positive impact on businesses and service providers in the area due to increased demand from the increased population.
Infrastructure and services	
Access to infrastructure and services	Strain on public infrastructure and services due increased number of people in the area
Community Health and Safety Resources	
Environmental Change	Changes in air quality, contamination of surface waters and potable ground water, changes in vibration and noise, changes in night time light beyond acceptable limits and changes to the visual environment.
Communicable & Non Communicable Diseases	Change in incidence and/or prevalence of communicable and non-communicable diseases or disease-causing factors.
Vector Borne Diseases	Changes in the incidence and /or prevalence of vector borne diseases, the density of these vectors and their breeding grounds.
Sexually Transmitted Diseases	Changes in the incidence and/or prevalence of STD and the factors that contribute to this (external workforce, transport routes etc).
Resource and Ownership	Temporary or permanent displacement from land or water-based livelihood activities; changes in ownership of such resources.

4.4 DETERMINE THE PROJECT DESCRIPTION

In order to set out the scope of the Project features and activities, with particular reference to the aspects which can impact on the environment, a Project Description has been prepared. This is based on information included in the Feasibility Report and other information as provided by the Project Proponent. This is presented in Chapter 2.

4.5 BASELINE CONDITIONS

To provide a context within which the impacts of the Project can be assessed, a description of the physical, biological, social/socio economic and cultural conditions that would be expected to prevail in the absence of the Project is presented. The Baseline includes information on all resources/receptors identified that have the potential to be significantly affected by the Project. In instances where a significant impact is anticipated the baseline studies were more rigorous than for impacted areas of less significance.

The baseline characterization is provided in the relevant assessment chapters of this ESIA report.

4.6 STUDY AREA

The Study Area refers to the area that needs to be studied in order to adequately understand and describe the baseline conditions likely to be affected by the Project. This is different to the Project Footprint (as discussed below).

4.6.1 Project Footprint

The Project Footprint is the area that may reasonably be expected to be physically touched by Project activities, across all phases. The Project Footprint includes all the land used on a temporary basis such as lay down areas or construction haul roads, as well as disturbed areas in transport corridors, both public and private.

4.6.2 Area of Influence

The area of influence (AoI) defines the area to be assessed in the ESIA, the area may vary depending on the impact to be assessed and the resource/receptor that is impacted. The AoI will include:

- The project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project.
- Impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.
- Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.
- Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted

4.7 STAKEHOLDER ENGAGEMENT

An effective ESIA Process requires engagement with relevant stakeholder throughout the key stages. This assists in understanding stakeholder views on the Project and in identifying issues that should be taken into account in the prediction and evaluation of impacts. Further detail is provided in Chapter 6 for the approach undertaken for this ESIA.

4.8 IMPACT ASSESSMENT

Impact identification and assessment starts with scoping and continues through the remainder of the ESIA Process. The principal ESIA steps are summarized in Figure 4. and comprise:

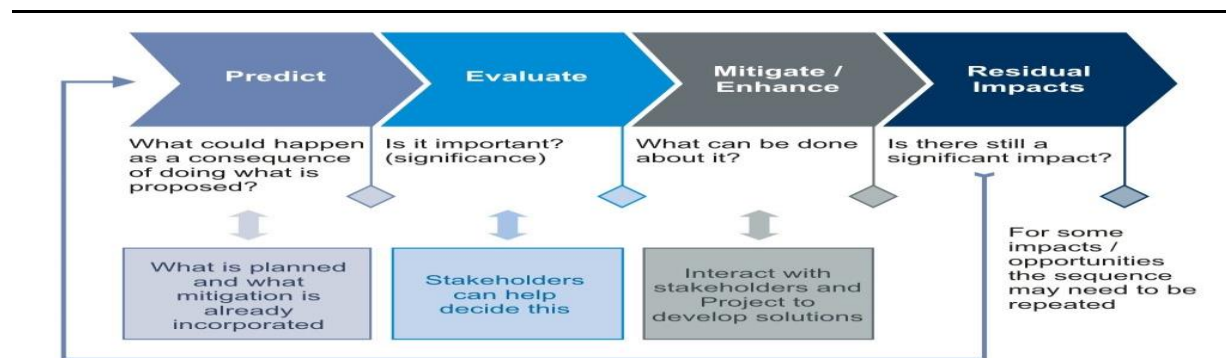
Impact prediction: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.

Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor.

Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.

Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

Figure 4 Principal ESIA Process



4.8.1 Prediction of Impacts

Prediction of impacts is essentially an objective exercise to determine what is likely to happen to the environment as a consequence of the Project and its associated activities. From the potentially significant interactions identified in Scoping, the impacts to the various resources/receptors are elaborated and evaluated. The diverse range of potential impacts considered in the IA process typically results in a wide range of prediction methods being used, including quantitative, semi-quantitative and qualitative techniques.

4.8.2 Evaluation of Impacts

Impact Characterization

Once the prediction of impacts is complete, each impact is described in terms of its various relevant characteristics (e.g. type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in Table 9.

Table 9 Impact Characterization Terminology

Characteristic	Definition
Type	A descriptor indicating the relationship Direct of the impact to the Project (in terms of Indirect cause and effect). Induced
Extent	The "reach" of the impact (e.g., confined Local to a small area around the Project Regional Footprint, projected for several International kilometers, etc.).

Characteristic	Definition	Designations
Duration	The time period over which a resource / receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	No fixed designations; intended to be a numerical value or a qualitative description of “intensity”
Frequency	A measure of the constancy or periodicity of the impact.	No fixed designations; intended to be a numerical value or a qualitative description.

The definitions for the type designations are shown in Table 10. Definitions for the other designations are resource/receptor-specific and are discussed in the resource/receptor-specific impact assessment chapters presented later in this ESIA report.

Table 10 Impact Type Definitions

Designation	Definition
Type Direct	Impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected).
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce).

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is likelihood. The likelihood of an unplanned event occurring is designated using a qualitative scale, as described in Table 11.

Table 11 Definitions for Likelihood

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions.
Possible	The event is likely to occur at some time during normal operating conditions.
Likely	The event will occur during normal operating conditions (ie, it is essentially inevitable).

Determination of magnitude

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

- Extent;
- Duration;
- Scale;
- Frequency; and
- Likelihood (for unplanned events).

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. As discussed above, the magnitude designations themselves are universally consistent, but the descriptions for these designations vary on a resource/receptor-by resource/receptor basis. The universal magnitude designations are:

- Positive
- Negligible
- Small
- Medium
- Large

In the case of a positive impact, no magnitude designation (aside from ‘positive’) is assigned. It is considered sufficient for the purpose of the IA to indicate that the Project is expected to result in a positive impact, without characterizing the exact degree of positive change likely to occur. In the case of impacts resulting from unplanned events, the same resource/receptor-specific approach to concluding a magnitude designation is utilized, but the ‘likelihood’ factor is considered, together with the other impact characteristics, when assigning a magnitude designation.

Sensitivity

In addition to characterizing the magnitude of impact, the other principal impact evaluation step is definition of the sensitivity/vulnerability/ importance of the impacted resource/receptor. There are a range of factors to be taken into account when defining the sensitivity/vulnerability/importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors may also be considered when characterizing sensitivity/vulnerability/importance, such as legal protection, government policy, stakeholder views and economic value.

As in the case of magnitude, the sensitivity/vulnerability/importance designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor basis. The sensitivity/vulnerability/importance designations used herein for all resources/receptors are:

- Low
- Medium
- High

Impact Significance

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterized, the significance can be assigned for each impact. Impact significance is designated using the matrix shown in Figure 5.

Figure 5 Impact Significance

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

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix. Figure 6 provides a context for what the various impact significance ratings signify.

It is important to note that impact prediction and evaluation take into account any embedded controls (ie, physical or procedural controls that are already planned as part of the Project design, regardless of the results of the ESIA Process). An example of an embedded control is a standard acoustic enclosure that is designed to be installed around a piece of major equipment. To avoid the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

Figure 6 Context of Impact Significances

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be ‘imperceptible’ or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (ie ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

4.8.3 Cumulative Impacts

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from another activity to create an additional impact. Potential cumulative impacts are discussed in the relevant assessment chapters. How the impacts and effects are assessed is strongly influenced by the status of the other activities (e.g. already in existence, approved or proposed) and how much data is available to characterize the magnitude of their impacts.

The approach to assessing cumulative impacts in this ESIA is to screen potential interactions with other projects on the basis of: Projects that are already in existence and are operating;

- Projects that are approved but not as yet built or operating; and
- Projects that are a realistic proposition but are not yet built.

4.8.4 Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterized, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this ESIA, the following Mitigation Hierarchy has been adopted:

- **Avoid at Source, Reduce at Source:** avoiding or reducing at source through the design of the Project (eg avoiding by siting or rerouting activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity);
- **Abate on Site:** add something to the design to abate the impact (eg pollution control equipment, traffic controls, perimeter screening and landscaping);
- **Abate at Receptor:** if an impact cannot be abated on site then control measures can be implemented off site (e.g. noise barriers to reduce noise impacts at a nearby residence or fencing to prevent animals straying onto the site);
- **Repair or Remedy:** some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or material storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures; and
- **Compensate in Kind, compensate through Other Means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g. planning to replace damaged vegetation, financial compensation for damaged crops or providing community facilities, recreation and amenity space).

The priority in mitigation is to first apply mitigation measures to the source of the impact (ie to avoid or reduce the magnitude of the impact from the associated Project activity) and then to

address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e. to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

4.8.5 *Residual Impact Evaluation*

Once mitigation and enhancement measures are declared, the next step in the ESIA process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the implementation of the proposed mitigation and enhancement measures.

4.8.6 *Management, Monitoring and Audit*

The final stage in the ESIA process is definition of the basic management and monitoring measures that are needed to identify whether a) impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

A Register of Commitments, which is a summary of all actions which the Project Proponent has committed to executing with respect to environmental/social/ health performance for the Project, is also included as part of this ESIA. The Register of Commitments includes mitigation measures, compensatory measures and offsets and management and monitoring activities.

5 SCREENING AND SCOPING

5.1 BACKGROUND

Potential impacts have been identified through a systematic process whereby the features and activities (both planned and unplanned) associated with the construction, operation and decommissioning of the Project have been considered with respect to their potential to interact with resources/receptors. Potential impacts have each been classified in one of three categories:

- **No interaction:** where the Project is unlikely to interact with the resource/receptor (e.g. wholly terrestrial projects may have no interaction with the marine environment).
- **Interaction likely, but not likely to be significant:** where there is likely to be an interaction, but the resultant impact is unlikely to change baseline conditions in an appreciable/detectable way.
- **Significant interaction:** where there is likely to be an interaction, and the resultant impact has a reasonable potential to cause a significant effect on the resource/receptor.

As a tool for conducting scoping, the various Project features and activities that could reasonably act as a source of impact were identified, and these have been listed down the vertical axis of a Potential Interactions Matrix. The resources/receptors relevant to the Baseline environment have been listed across the horizontal axis of the matrix.

Each resulting cell on the Potential Interactions Matrix thus represents a potential interaction between a Project feature/activity and a resource/ receptor.

The completed Potential Interactions Matrix is presented below. Those cells that are colored white are ‘scoped out’ of further consideration in the IA Process. Those interactions that are grey are also ‘scoped out’, but the IA report includes a discussion that presents the evidence base (e.g. past experience, documented data etc.) used to justify the basis upon which this decision was made. Those interactions that are shaded black are retained for further consideration in the IA Process.

5.2 INTERACTION MATRICES

The bio-physical and social impact interaction matrices are presented in Table 12 and Table 13 respectively.

Table 12 Bio-physical Interaction Matrix

	Soil	Surface water	Groundwater	Aquatic ecology	Terrestrial Ecology	Air	Noise	Marine ecology and water quality	Visual
Construction – Phase 2									
Upgrade and construction of on shore facilities.									
Upgrade and construction of the jetty.									
Construction phase work force.									

	Port of Rotterdam	Port of Amsterdam	Port of Antwerp	Port of Zeebrugge
Loading and unloading of trains.				
Stockpiling of iron ore.				
Power generation.				
Sewage and storm water discharge.				
Loading and unloading of ships.				
Operational phase work force.				
Spillages from chemical and fuel storage (unplanned events).				
Maintenance dredging.				

Livelihoods and economic
Community Health and Safety
Social capital and heritage
Infrastructure and services

Activity	Phase 1	Phase 2	Phase 3	Phase 4
Operations –Phase 1 and 2				
Loading and unloading of trains.				
Stockpiling of iron ore				
Power generation.				
Sewage and storm water discharge.				
Loading and unloading of ships.				
Operational phase work force.				
Spillages from chemical and fuel storage (unplanned events).				

5.3 JUSTIFICATION

The justifications used to scope out the impacts that are likely to occur but are insignificant are presented in Table 14 and Table 15 for bio-physical and socioeconomic impacts respectively. The descriptions of the significant impacts are provided in Table 16 and Table 17 for bio-physical and socio-economic impacts respectively.

Table 14 Bio-physical Impacts Identified as Likely but not Likely to be Significant

Resource/receptor	Justification
Soil	The soil at the site has been previously disturbed, removed, compacted and in some areas contaminated with visible quantities of hydrocarbons, therefore any additional impact is considered insignificant.
Surface water	The closest surface water body is the St Paul River over 1km away from the port site. The direction of flow from any surface water runoff or discharges will be towards the marine environment and therefore there will be no impact on surface water bodies.
Aquatic ecology	As there will be no impact on surface water flow or quality in the St Paul River there will also be no impact on aquatic ecology.
Terrestrial ecology	The China Union Port is located in an existing busy port area. The China Union site was previously used as a storage and transfer station for iron ore for BMC. In addition, there are some areas of visual soil contamination. As a result, the area is highly degraded, and the habitat is not considered suitable for terrestrial flora and fauna.
Visual	The China Union port is located within a gated area in Monrovia Free Port. The area cannot be viewed by receptors outside of the Port.
Marine ecology and water quality	The impacts relating to maintenance dredging at the Port are the responsibility of the Monrovia Port Authority and are not considered project impacts.

Table 15 Socio-economic Impacts Identified as Likely but not Likely to be Significant

Resource/ Receptor	Justification
Infrastructure and services	The additional work force will live in Monrovia, thus the increase in population and demand for services (health care etc) is considered insignificant.

Table 16 Bio-physical Impacts Identified as Likely and Likely to be Significant

Resource/ Receptor	Justification Description
Ground water	Seepage of hydrocarbon contaminated soil into the groundwater.
Air	- Construction activities such as excavation and fabrication will mobilize dust and increase PM₁₀ and PM_{2.5} concentrations. - Windblown dust from storage and handling of iron ore concentrate may generate dust and increase PM₁₀ and PM_{2.5} concentrations. - Emissions from vehicles and power generators may increase SO_x and NO_x concentrations.

Noise	• Construction activities such as excavation and fabrication may increase noise levels near the site. • Operation of moving equipment such as vehicles and conveyers may increase noise levels near the site
Marine water quality	• Stockpiling of iron ore has potential to generate wind-blown dust that will settle on the water surface and potentially contaminate the water column. • Storm water will be mixed with treated sewage water and discharged to the marine environment. • Shipping ballast discharges have potential to introduce contaminants into the marine environment.
Marine ecology	• Degradation of water quality due to wind-blown dust, ballast discharges or storm water/ waste water discharges can result in the marine habitat becoming unsuitable for marine species. • Windblown-dust or iron ore material being lost to the marine environment has potential to settle on the ocean floor near the port and smother benthic organisms. • Shipping discharges can result in contamination of the water column and introduction of alien species.

Table 17 Socio-economic Impacts Identified as Likely and Likely to be Significant

Resource/ Receptor	Justification/ description
Livelihoods and economics	Positive increase in the informal industry at the port, negative impact in terms of illicit trade/drugs and alcohol. Negative impacts to fishing livelihoods around the port.
Community health and safety	Influx results in potential increase in communicable diseases/ STIs Minor possibility of increased road traffic accidents around entrance to port.
Social capital and heritage	Increased CU workforce at the port resulting in potential for cultural conflict between CU workforce and local community. Unmet expectation for employment (people waiting at gate of the port) leading to negative impacts (violence, crime).

6 STAKEHOLDER ENGAGEMENT

This chapter documents the stakeholder engagement process undertaken to inform the ESIA for the proposed China Union Bong Mine Expansion Project. It provides a concise overview of the approach to stakeholder engagement, meetings held and a summary of key issues that were raised by stakeholders during consultation. A record of stakeholder engagement undertaken to date as part of the ESIA process, including meeting minutes and attendance registers is provided in Annex 1.

A full plan for stakeholder engagement going forward, beyond the ESIA and throughout the life cycle of the Project can be found in Annex 1.

6.1 OBJECTIVES OF THE STAKEHOLDER ENGAGEMENT PROCESS

The key objectives of the stakeholder engagement process are as follows:

- To facilitate an open and inclusive approach to consultation. One that provides timely and transparent information concerning the Project and ESIA process to all stakeholders and to increase their opportunity to provide comment on the project and to voice their opinions.
- To provide the mechanism to deliver key messages to stakeholders and manage community expectations (e.g. about job opportunities) and address concerns.
- To gather baseline environmental, health and socio-economic data and verify the significance of predicted environmental, social and health impacts identified.
- To establish a feedback mechanism for ensuring that affected stakeholders have the opportunity to voice their opinions via a transparent process.

6.2 ADMINISTRATIVE FRAMEWORK

6.2.1 Liberian Legislation

The Environment Protection and Management Law of the Republic of Liberia

The Environment Protection and Management Law establishes the legal framework for the sustainable development, management and the protection of the environment by the Environment Protection Agency (EPA) in partnership with regulated Ministries and organization and with the people of Liberia.

One of the key objectives of the law is to encourage and ensure participation by the people of Liberia in the management and decision-making processes of the environment and natural resources.

The EIA Procedural Guidelines (2006)

The EIA Procedural Guidelines include requirements which specify the need for integrated public consultation on socio-economic and biophysical project related issues.

The EIA permitting process in Liberia is subject to a public review and involves the following procedure:

- If an EIA is considered to be required, the project proponent shall carry out public consultation termed ‘scoping’. The Terms of Reference contained for preparation of the Environmental Impact Statement must take into account results of these consultations.

- Following publication of the EIA, the Agency will invite comments from the public, within thirty days of the publication of the notice. Once public comments have been received, the agency will hold a public hearing if five or more persons submit written requests for a hearing or if the Agency determines that controversy about the project makes a public hearing necessary. The public hearing is required to be held at a venue that is convenient to communities specifically affected by the project.

Summary of National Legislative Requirements on Stakeholder Engagement

Key national legislative requirements on ESIA and stakeholder engagement is summarized in Table 18.

Table 18 National Legislative Requirements

Law/Policy	Summary
<i>The Environmental Protection and Management Law (2003)</i>	Four key principles guide the legislation including the principle of sustainable development and the principle of public participation. It regulates for the use of participative public consultation and disclosure during the environmental permitting process to ensure inclusive engagement and protect the right of the public to influence the design process at an early stage in the project cycle.
<i>The Mineral Policy of Liberia (2010)</i>	The exploitation of mineral resources should be underpinned by broad based sustainable growth and socio-economic development objectives.
<i>Community Rights Law (2008)</i>	Provides communities access, use and management rights of community and traditional (customary) lands and forest resources on them.
Law/Policy	Summary
<i>Land Rights Policy Statement (Draft)</i>	The policy statement does not address existing land concessions, but it does lay the foundations for a legal framework protecting people with customary land rights.
<i>Liberian Labour Law (1989)</i>	Regulates the protection of the workforce in providing guidelines and restrictions relating to recruitment, wages, hours of work and general conditions of employment.
<i>Liberian Public Health and Safety Law (1956)</i>	Regulates occupational health and safety standards in the workplace as well as on environmental sanitation.
<i>Liberian law on Resettlement</i>	A resettlement process must ensure that households are justly compensated based on an evaluation of current market value, for loss of property; and if land is in public use at the time it is revoked, the Government should replace it with land of commensurate value.

6.2.2 International Standards and Policies

Although China Union is not seeking funding for the Project consideration has been given to the International Finance Corporation (IFC) policies, manuals, standards and principles. These

provide a guide as to international best practice and the stakeholder engagement programmed for the EIA has taken these into consideration.

IFC Performance Standard 1 Assessment and Management of Environmental and Social Risks and Impacts (IFC PS1), makes specific reference to stakeholder engagement activities that apply to the Project, see figure 7.

Figure 7 IFC Performance Standards: Requirements for Stakeholder Engagement

IFC PS1: Assessment and Management of Environmental and Social Risks and	 International Finance Corporation World Bank Group	Impacts
Stakeholder engagement is an on-going process that may involve, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and on-going reporting to Affected Communities.		
Disclosure of relevant project information Provide affected communities with access to relevant information on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such communities and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.		
Informed Consultation and Participation For projects with potentially significant adverse impacts on affected communities, conduct an informed consultation and participation process. It should involve deep exchange of views and information, and an organized and iterative consultation, leading to the project incorporating into their decision-making process the views of the affected communities on matters that affect them directly, such as the proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues. The process should be documented, in particular the measures taken to avoid or minimize risks to and adverse impacts on the affected communities. The communities should be informed about how their concerns have been considered.		
External Communications Implement and maintain a procedure for external communications that includes methods to (i) receive and register external communications from the public; (ii) screen and assess the issues raised and determine how to address them; (iii) provide, track, and document responses, if any; and (iv) adjust the management program, as appropriate. In addition, clients are encouraged to make publicly available periodic reports on their environmental and social sustainability.		
Grievance Mechanism for Affected Communities Establish a grievance mechanism to receive and facilitate resolution of affected communities' concerns and grievances about the client's environmental and social performance.		
On-going Reporting to Affected Communities Provide periodic reports to the affected communities that describe progress with implementation of the project Action Plans on issues that involve on-going risk to or impacts on affected communities and on issues that the consultation process or grievance mechanism have identified as a concern to those communities. IFC standards requires that after completion of an environmental assessment the consultation and disclosure must continue throughout the life cycle (construction and operation phase) of the project. Source: IFC Performance Standard 1, 2012.		

6.2.3 Internal Corporate Standards and Policies

Wuhan Iron and Steel Company (WISCO), which owns a 60 percent stake in China Union Investment Company is listed on the Shanghai Stock Exchange

(SSE). In 2008, the SSE released the Shanghai Corporate Social Responsibility (CSR) Notice and the Shanghai Environmental Disclosure Guidelines on strengthening listed companies' application

of social responsibility. Listed companies that promote CSR are offered incentives like priority election into the Shanghai Corporate Governance Sector, or simplified requirements for examination and verification of temporary announcements. The SSE has also developed the concept of social contribution value per share (SCVPS) to measure a company's value creation. The Shanghai Environmental Disclosure Guidelines allow for the SSE to take "necessary punishment measures" against companies for violations of the disclosure rules.

As WISCO is a state-owned enterprise, it is subject to a rapidly evolving strategic framework established by State-owned Assets Supervision and Administration Commission of the State Council (SASAC). Under this framework, State-Owned Enterprises (SOEs) are expected to focus on becoming internationally competitive and internationally listed corporations, signaled by securing Global Fortune 500 status.

In 2008, SASAC published a set of CSR guidelines for SOEs. The guidelines emphasize the importance of the 'principle of human-oriented and the Scientific Outlook on Development' to establish 'a "responsible" public image by Chinese enterprises and more internationally influential, or significant for China to spread an image as a responsible nation.' The Chinese Government has outlined a fourfold set of corporate obligations for SOEs which include:

- To run businesses that are successful over the long term;
- To pay taxes and behave ethically;
- To safeguard workers' rights and interests; and
- To protect the environment and to contribute to social welfare through philanthropic spending.

China's Ministry of Commerce and Ministry of Environmental Protection further published Guidance on Protection of Overseas Investment Environment on February 18th, 2013. The guidance requires companies that invest overseas to:

- Target for sustainable development in host country.
- Respect local residents' religion, cultural tradition, and national customs of host countries protect labours' legal rights and provide trainings and job opportunities to affected residents.
- Promote the harmonious development of local economy, environment, and community, and cooperate with host countries based on the principles of mutual benefit and reciprocity.
- Consider the project impacts on historical and cultural heritage, scenic spot, local tradition and customs, and take mitigation measures.

6.3 STAKEHOLDER IDENTIFICATION AND CHARACTERISATION

Stakeholder identification and characterization determines those groups that should be made aware of the intended Project and ESIA process and ensures that less vocal and marginalized groups are enabled to take part in the consultation and engagement process.

During the scoping stage, an initial stakeholder database was prepared by ERM. This stakeholder database was further developed during the ESIA process and will be maintained and updated by China Union during project execution. The stakeholder database is attached in Annex 1.

Key stakeholder groups were identified based on the following criteria:

- Stakeholders involved in the Project.
- Stakeholder activities that coincide or overlap with those proposed by the Project.
- Stakeholders who may be directly affected by the Project.
- Stakeholders who may have a stake (i.e. an interest in or ability to influence) in the project.
- Stakeholders were identified from the categories as shown in figure 8.

Figure 8 Stakeholder Categories

Stakeholder Category	Definition
National Government	Stakeholders that are of national political importance to the project and the ESIA process.
Regional and Local Government	Leaders from Bong County and that are of local and regional importance to the Project, and to the ESIA process.
Directly affected communities and businesses	Stakeholders that will be directly impacted (positively and/or negatively) by the Project as well as businesses such as lodges and tour operators.
National and Local NGOs	NGOs based mainly in Monrovia with potential interests in the Project and concerned with its effect on civil society and the environment.
Stakeholder Category	Definition
International organizations	Organizations based within and outside Liberia with an interest in the Project. These include international NGOs, multilateral and bilateral organizations.
Economically interested parties	Individuals with direct interest in the Project e.g. running businesses or occupying land within the Project Area of Influence or providing services and supplies to the Project.
Other interest groups	These comprise, for example, media (both national and international), and political parties/groups.

The following stakeholder groups were identified for engagement during the scoping phase as shown in Table 19.

Table 19 Stakeholder Groups Identified: Scoping Phase

Stakeholder Group	Stakeholder	Level
Government Authorities	Ministry of Land, Mines and Energy	National
	Environment Protection Administration Agency	National
	Forestry Development Administration	National
	Land Commission	National
	Centre for Development and Resettlement	National
	Bureau of Regional Planning	National
	Monteserrado County Government	County
	Margibi County Government	County
	Bong County Government	County
	Kakata District Government	District
	Fuamah District Government	District
	Paramount Chief of District Influence	District
Affected Communities	Bong County Community Liaison	County
	Community police in Bong Mine Town	Community
	Bong Mine Community	Community
	Johnson Town Community	Community
	King Peter Town Community	Community

	Caldwell Community	Community
Traditional authorities	Clan chiefs of Yarboyan, Zaweahkomu and Golorhama Clans	Clan
Religion leaders	Zhoos and spiritual leaders	Community
NGO	Rights and Rice Foundation	National
	Flora and Fauna International	International
	Sustainable Development Institute	National
	Green Advocate	National
Multilateral agencies and international organisations	GIZ (that is running an extractive resource governance programme)	International
	The World Bank	International
Academic institutions	Liberia Forestry Initiative	National
	Environmental Law Institute – Liberia	National
Mining sector companies and other operators	CHICO	International
	Western Cluster Limited	International
	LONGDA	National
	64 MW Mount Coffee Hydropower Plant, Liberia	National
Economically interested parties	Charcoal producers along the railway	Community
	Railway cart owners	Community
	Artisanal quarry miners along the railway	Community
Stakeholder Group	Stakeholder	Level
	Traders who attend the markets along the railway	Community
	Fishermen in the dams	Community
	Farmers in the dams	Community
Contractors	RB Group	International
	Genesis Liberia Trucking Company	Regional
China Union internal stakeholders	Engineers, Management team	Internal

In preparation for the EIA, these stakeholder groups were organized into to local, regional and national categories. Local level stakeholders were invited to public consultation meetings which were attended by representatives by China Union. Regional and national level stakeholders were engaged with in one-to-one interviews. Using the information gathered during the public consultation meetings and one-one-one interviews, additional stakeholder groups were identified. These included:

- Charcoal producers along the railway;
- Railway cart owners;
- Farmers in the dams;
- Zhoos and spiritual leaders;
- Community police in bong town;
- Fishermen in the dams;
- Artisanal quarry miners along the railway; and
- Traders who attend the markets along the railway.

6.4 STAKEHOLDER ENGAGEMENT PROCESS

The stakeholder engagement process for the EIA was divided into the following four key phases:

- Phase One: Scoping;

- Phase Two: Consultation as part of Baseline Studies, and development of the impact assessment and mitigation measures;
- Phase Three: Disclosure; and
- Phase Four: On-going Engagement/ Implementation.

Phases One and Two have been completed as part of the development of the ESIA. Phase Three will comprise the activities around disclosure of the ESIA, and Phase Four will consist of on-going consultation during the proposed construction and operation of the Project. The stakeholder engagement process is an iterative process. Should further Project expansion occur over time the engagement process and reporting will be revised and updated throughout the life of the Project to ensure that developments in Project specific activities are adequately consulted upon and grievances are managed proactively.

6.4.1 Phase One: Scoping Phase Stakeholder Engagement Preparation for Engagement

To prepare for the ESIA public meetings, the stakeholder engagement team met with key Project stakeholders and undertook an extensive field visit as part of the Scoping Phase activities.

The stakeholder engagement team met with the EPA, the ESIA director at China Union as well as China Union representatives from the Monrovia Office. Following these meetings, the team travelled extensively in the Concession Area and along the railway in order to gather information with respect to the potential key issues and impacts associated with the proposed mine expansion Project, and to identify suitable locations and venues for planned the public meetings.

In addition to the initial consultations with the Project stakeholders, public meetings and one-on-one interviews were conducted with broader stakeholders. Through this process, stakeholders were identified and involved in organizing the public meetings. This provided opportunities for stakeholders to comment on the forthcoming ESIA and to suggest their preferred forms of communication, through which to receive feedback on the study.

Public Meeting Location Identification

Key locations were identified for public meetings including Bong Mine community itself, which included communities from within the Non-Goma Deposits Area. Three other meeting locations were identified including Johnson Town (located about a third of the way down the railway towards Monrovia), Caldwell (along the railway on the outskirts of Monrovia) and King Peter Town (the first dwellings across the road at the point where the railway enters Freeport before reaching the BMC Pier). Once these locations were agreed, contact was made with Town Chiefs and Youth/Women Group leaders to allow them to inform the community well in advance of the time and location of the public meetings.

6.4.2 Phase Two: Stakeholder Engagement as part of the ESIA

Stakeholder Engagement for the ESIA was undertaken through a combination of public meetings and one-on-one interviews with key informants and stakeholder representatives. These activities are described in more detail below.

Public Meetings

Engagement with local stakeholders for the ESIA was undertaken through public consultation in the form of four public meetings. The objective of the meetings was to inform the community of the planned ESIA and to gather local information which would inform the design of the social baseline studies.

During the four public consultation meetings, a structured group work approach was used in order to give all participants the opportunity to express their views. Figure 9 details the agenda that was followed for each of the public meetings:

Figure 9 Agenda for Public Meetings

-
1. Introductions – purpose(s) of meeting (Local Chair/the IDL group)
 2. Explanation of the ESIA process (the IDL group)
 3. Questions and issues about the ESIA (Group work then report to plenary)
 - Are there any problems that we might be encounter during the ESIA?
 - Do we need to do anything else to prepare for the ESIA?
 4. The Bong Mine development (China Union)
 5. Questions and issues about the Bong Mine development (Group work then report to plenary)
 - What are the issues?
 - Do you have any specific questions?
 - From where did you get your information about this?
 - Discussion on how we can best communicate with you
 - Close of meeting
-

The rationale for this agenda was to ensure that the less contentious but important topic of introducing the ESIA was covered in a group forum early in the meeting. It was expected that issues related to the mine and resettlement would become emotionally charged thus it was decided to break the group into sub-groups to discuss these topics. Each group was asked to prepare their questions and statements in advance of the meeting. Representatives from China Union attended each of the meetings and introduced the work of the mine and spoke to wider aspects such as the social development fund. A detailed report on the content of each consultation is provided under Annex 1.

At each meeting an attendance register was taken, as were notes on the key issues raised. The sub-groups were asked each to provide their own written reports of the meeting proceedings and key issues raised. These would later be used to triangulate and verify what was heard at the meeting. The issues and responses given at the time are provided in a table at the end of each consultation summary (see Annex 1). It is recommended that the summaries of the meetings should be relayed to the community by China Union staff, as a means of maintaining contact with the communities

involved. This will represent part of the company's proactive efforts towards demonstrating accountability and to conducting on-going consultation.

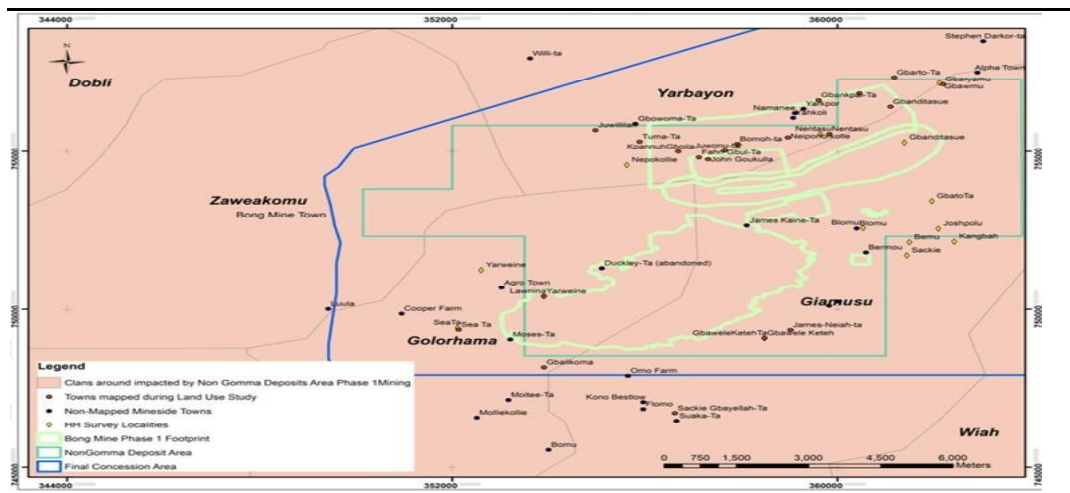
The public meetings introduced community stakeholders to personnel from China Union (and vice versa) and provided a platform for both sides to express their expectations and concerns for the future. Over 300 people attended the four consultation events. Attendance sheets are provided in Annex 1. A full list of all key stakeholders met by the team is provided in Annex 1.

6.4.3 One-to-one interviews

One-to-one interviews were held with key regional and national level stakeholders in Monrovia, Kakata and Gbarnga before and during the ESIA. At the national level, in addition to stakeholders that were identified during the scoping stage, several other national stakeholders were consulted with, including the Land Commissioner and the Bureau of Regional Planning.

At the regional level, county superintendents were consulted. At the clan and district level, clan chiefs and paramount chiefs of clans directly impacted by Project activities in the Non Gomma Deposits Area were consulted, in addition to the District Commissioners and Development Chairpersons for Fuamah and Kakata. The clans identified as directly impacted by the Project activities include the Yarboyon Clan, the Zaweahkomu Clan, the Golorhama Clan and the Giamusu Clan (Figure 10).

Figure 10 Clans impacted by the Project in the Non Gomma Deposits Area



Stakeholders consulted in one-to-one interviews at the national and regional level are listed in Table 20.

Table 20 Consultation with National and Regional Stakeholders

Organization/ Agency	Name of representative	Position	Date of consultation
	Varney Conneh	Head of Compliance	4.10.12

Environmental Protection Agency	Morris Gontor	Assistant Coordinator, ESIA	
Ministry of Lands, Mines and Energy	Mr. Hines Williams	Assistant Minister, MLME	4.10.12
	Aagon Gwaikolo,	Director of Mines	
Land Commission	Cecil T.O. Brandy,	Chairman	4.10.12
Centre for Development and Resettlement	John Saah Nyumah	Director	4.10.12
Flora and Fauna International	Hon. Janslund Hanson	Director	5.10.12
Green Advocate	Alfred Brownell	President	5.10.12
Bureau of Regional Planning	Sedekie B Kamara		5.10.12
Local Government	Hon. Grace-Tee Kpaan,	County Superintendent Montserrado	5.10.12
Local Government	Hon. John Z. Buway,	County Superintendent Margibi	9.10.12
Local Government	Hon. Selena P. Manpay,	County Superintendent Bong County	17.10.12
Local Government	Omega M. Sawyer	District Commissioner Kakata	03.10.12
Local Government	Giddens, District	Commissioner Fuamah	26.09.12
Local Government	Mr. Whyies B. Mente,	District Development Chairperson, Kakata, District	9.10.12
Local Government	Mr. Atta Barclay,	District Development Chairperson, Fuamah, District	9.10.12
Local Government	Hon. Tati Joseph	Paramount Chief (Yarboyan, Zaweahkomu and three other clans outside the area of direct influence)	26.09.12
Local Government	Hon. Brown Kollie	Clan Chief Zaweahkomu Clan	26.09.12
Local Government	Hon. Bondo P.Z.Dennis	lan Chief Golorhama Clan	01.10.12
Local Government	Hon. Mulbadh Garter	Clan Chief Yarboyan Clan	01.10.12

6.4.4 Phase Three: EIA Disclosure

Public consultation associated with the EIA disclosure is governed by the Environment Protection and Management Law and the EIA Procedural Guidelines. It is recommended that all stakeholders that were consulted during the Scoping and EIA phase engagements are engaged again as part of the EIA disclosure. This is in keeping with best practice and aims to address the expectations raised with stakeholders that they will receive feedback on the EIA process.

6.4.5 Phase Four: On-going Engagement Activities

On-going engagement will be required throughout the life-cycle of the Project and China Union will need to develop a Stakeholder Engagement Plan (SEP) to describes tools and approaches and

guide engagement activities at key milestones going forward. Such a plan would be considered to be a ‘live’ document that is to be updated iteratively over time. The draft Project SEP can be found in Annex A6-2.

It is recommended that the channels of communication stay open and remain accessible during the early phases of the Project, especially the period between the EIA disclosure and the commencement of construction, if the Project is approved by the relevant authorities. Based on feedback from the stakeholder engagement process, face-to-face meetings are the preferred form of engagement for the communities.

6.5 KEY FINDINGS OF THE STAKEHOLDER ENGAGEMENT PROCESS

Broadly, China Union has the support of many local stakeholders who appreciate the company’s effort to re-establish the mine. There are high expectations among the communities in the concession area for work and for resettlement and compensation, which pose a risk to China Union. People also expect China Union to deliver on a range of government responsibilities such as health, education and roads, which is partly a legacy of the paternalistic BMC era, when the mining company was seen as the provider of economic stability, jobs and social support.

A number of key issues recurred through the interviews and consultations. These are summarized as:

- **Resettlement** – most people appear to accept the necessity of being resettled but they are not happy with the uncertainty (or at least lack of information) around the timing of resettlement and the expected compensation.
- **The railway** – there is speculation about what is going to be built in the 25m-wide strip either side of the track; in some places the width of the concession area is disputed as Government surveyors have marked houses for demolition that are 96 feet from the track rather than 82 feet ¼inch (25m)
- **Working conditions** – a range of issues from salary level to health care to safety equipment were mentioned in community interviews and were reinforced at the time of the workers blockade. Industrial relations may pose a reputation risk to China Union and could have an impact on the way China Union is perceived as a company.

China Union’s current mechanisms for engagement and grievance management are ineffective meaning information on the Project is not readily accessible. Community relations efforts by China Union to date have been well-meaning but ad hoc and risk being counter-productive if not conducted in a strategic manner.

Where China Union does not have direct responsibility, they can appear to take a ‘hands-off’ approach. This is particularly the case with resettlement for example which is formally the Government’s responsibility and China Union have communicated clearly to stakeholders that they do not intend to play a role. Communities however, do not trust Government to implement resettlement plans effectively.

There is reported recognition among China Union staff that a lack of effective direct engagement with stakeholders could present a real risk to the Project, where minor issues can quickly grow into tense or volatile situations if left unaddressed. As one senior manager at the mine put it:

‘Without a good local relationship, we will lose the project.’

7 BIOPHYSICAL BASELINES

7.1 INTRODUCTION

This chapter summarizes the existing biophysical environment for the ESIA. The baseline is an important part of the ESIA study as it provides a background on which changes as a result of the project can superimposed and their significance assessed.

This section is arranged in the following way:

Section 7.2 Climate and Meteorology

Section 7.3 Surface Water

Section 7.4 Groundwater

Section 7.5 Marine

Section 7.6 Soil and Land Use

Section 7.7 Air Quality

Section 7.8 Noise

The full baseline studies containing more detail and data are presented in Annexes 3 to 5.

7.2 METEOROLOGY AND CLIMATE

7.2.1 Air Temperature

Liberia and the Project Area have a hot, wet tropical climate typical of areas close to the equator where tropical solar radiation is intense and uniform across the country. There is little seasonal temperature variation except for a small variation between the wet and dry seasons and between coastal areas and highlands.

The mean annual temperature ranges between 21 °C and 27 °C across the country. The mean monthly minimum temperature ranges between 15.5 °C at the highlands of the northwest and 21.0°C in Monrovia and along the coastal area. The mean monthly maximum temperature reaches 32.2 °C but this maximum temperature decline to 26.6 °C during the rainy season.

7.2.2 Precipitation

Regional Precipitation

In general, precipitation in Liberia decreases from coastal to inland areas but increases again in the highlands. The coastal area experiences the heaviest annual precipitation and ranges from 3 937 mm per annum to 4 445 mm per annum in the western part of Liberia and 2 540 mm in the southeast (UNDP, 2006) (1). According to Hadden (2006) (2) the dry season in Liberia lasts from November to mid-April and the rainy season starts in April/May and lasts until November with a peak rainy season from July to September.

Port Site

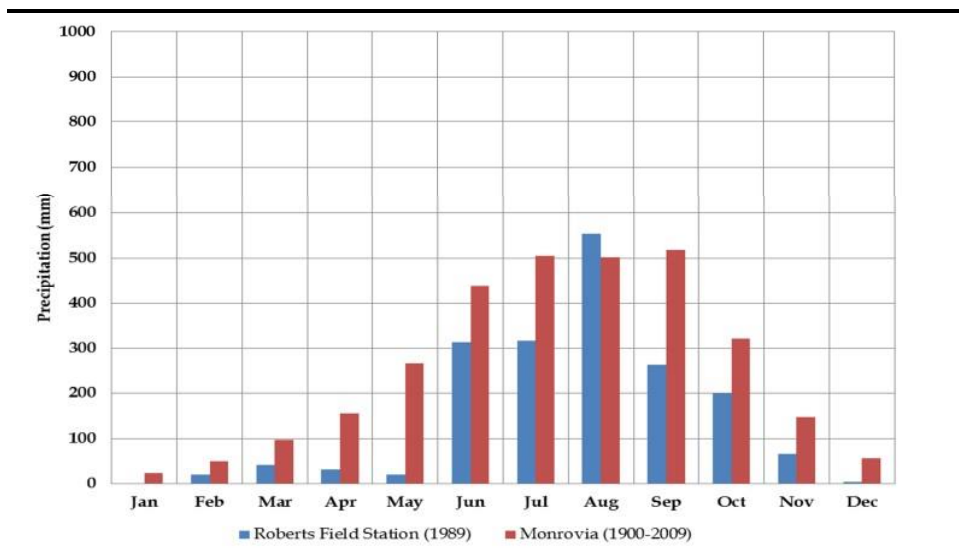
Precipitation data for the Port is based on data from existing climatological stations located near the Port. These stations are Roberts Field and Monrovia. The Roberts Field station showed that the wettest and driest months corresponded to August and January, respectively (Figure 11), based on only one year of data, 1989. The Roberts Field had an annual total of 1 832.6 mm for that year.

The station located in Monrovia (intermittent data from 1900 to 2009) shows that the wettest months correspond to the June-September period and the driest correspond to January (also shown in Figure 12). This precipitation trend is also observed in the Mine Site meteorological station dataset.

Figure 11 Summary of climatological stations near the Port

Station		Location	Period for available records	Average Annual Precipitation
Roberts	Field	Latitude: 6.250° Longitude: -10.350° Elevation: 10 m	1989*	1832.6 mm
Monrovia1		Latitude: 6.31° Longitude: -10.80° Elevation: NA	1900-2009**	3087.3 mm

Figure 12 Historical monthly precipitation recorded at the Roberts Field Climatological Station (2012)



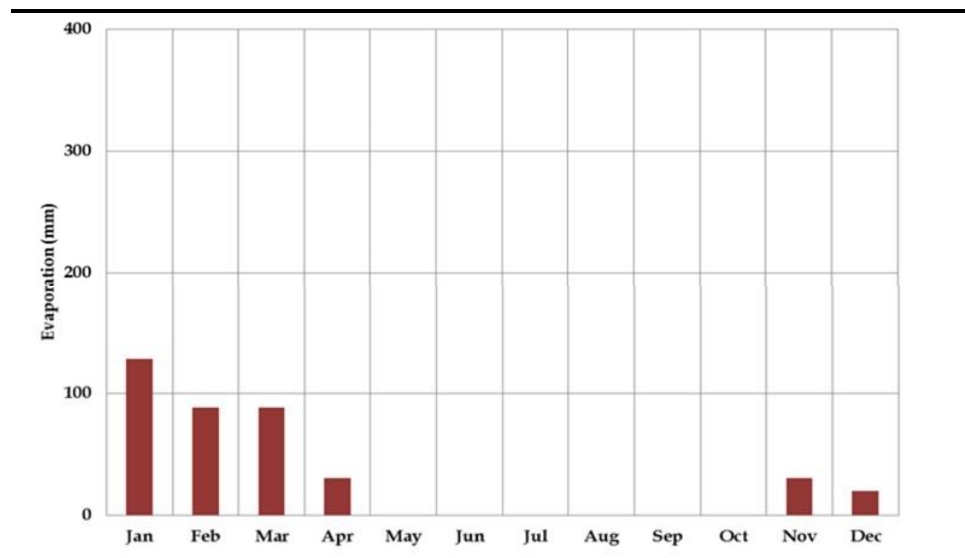
7.2.3 Relative Humidity

Relative humidity is high across the country with average values that range between 70 and 90 percent. Seasonal relative humidity varies from coastal to inland areas due to differing influences of the continental and maritime air masses.

7.2.4 Evaporation

Based on a technical and feasibility study for the Mount Coffee hydropower facility (LEC, 2008), the estimated annual evaporation rate in Liberia is 388.6 mm. Monthly averages are shown in Figure 13. The maximum evaporation is 129.5 mm in January and there is no net evaporation from May to October.

Figure 13 Estimated net evaporation (Modified from LEC, 2008)



7.3 SURFACE WATER

The closest surface water body to the is the Montserrado River which is approximately 1 km to the East of the Port site and discharges to the ocean approximately 3.5 km south of the site. There is a mixed urban and industrial area between the site and the Montserrado River, and it is likely that the water quality in the river is impacted by these activities. The next closest surface water body is the St Paul River which is approximately 3km to the north of the site, where it discharges to the ocean.

There are no other surface water bodies near the site. Storm water on the site will be captured and discharged to the ocean; any uncontrolled runoff is likely to drain towards the ocean as well.

Given there are no surface water users between the site and the ocean, and the nearest water body is 1 km away, no impact on surface water due to the port activities is expected.

7.4 GROUNDWATER

The Port area was previously used by BMC and is a highly disturbed area. The onshore activities are located close to the marine environment and groundwater flow will be in the direction of the sea.

Water levels are reportedly shallow in the port area, although no water level data is currently available. The highly permeable sedimentary sands form the main aquifer unit, with recharge primarily from precipitation. Water flow is towards the coast with a high level of connectivity

with the ocean predicted. The area between the sea and project site is owned by China Union and there are no down gradient groundwater users.

There is visible hydrocarbon contamination (Figure 14) in some areas of the site and soil sampling around the site reported highly elevated concentrations of hydrocarbons. As the hydrocarbon contamination is likely to have been present for over 30 years it is likely that groundwater underlying the site is also contaminated. In addition, there is evidence of damaged historic septic tanks on the site and it is possible that the groundwater has at times been contaminated by sewage water.

Given the groundwater down gradient of the site has no users and is likely to be contaminated, the sensitivity of the groundwater is considered very low and as indicated in the scoping section, impacts on groundwater are considered insignificant.

Figure 14 Visible hydrocarbon contamination at Port



7.5 MARINE

This section defines the current state of the marine and shoreline environment (baseline) at the Harbour site.

The full Marine Study is located in Annex 3.

7.5.1 Methodology

The approach followed in this assessment included:

- Field investigations and measurements in the harbour, and
- Interrogation of the available peer and non-peer reviewed scientific literature.

7.5.2 Regional Setting

This description is partly based on a site visit and interviews with state representatives, namely the National Harbours and Ports Authorities, the storm water and sewage offices of Monrovia and numerous local fishers and community elders, supplemented by published sources as cited.

Oceanography

The coast of Liberia is bounded by the Guinean Current, which has an overall surface flow moving northwest to southeast along the coast of West Africa, with surface temperatures uniformly warm (26-28 °C) and of low salinity due to heavy rainfall and high river discharge. There is a seasonal

oscillation of the thermo-cline and nutrients according to the oscillation of the equatorial undercurrent (Brandolini and Tigani, 2006).

Existing Sources of Marine Pollution

Major sources of pollution of the sea in the region include domestic sewage, industrial and solid waste disposal. The inadequacy of sewage treatment facilities results in raw sewage being discharged or released directly into the Atlantic Ocean or the rivers and estuaries flowing into the ocean. In addition, the lack of adequate solid waste disposal facilities constitutes a major problem. Residents, who live near water courses or beaches, use them to dump their solid garbage and additional wastes resulting in pollution of the coastal and marine environment.

General Coastal and Marine Biodiversity

The coastline of Liberia is 579 km long, has a continental shelf area of 14,894 km² and territorial sea of up to 159,200 km². The area produces 7 616 tonnes of fish and 126 metric tonnes of molluscs and crustaceans annually (EPA 2007). However, increasing human and environmental pressure on the marine and coastal ecosystems has changed the functioning and structure of many of their components leading to overexploitation, degradation, and resource loss resulting in an overall decline in marine productivity (GCLME 2010).

The following is a description of the various biodiversity areas identified:

- **Mangroves:** Mangroves are among the most productive terrestrial ecosystems and are a natural renewable resource. They characterize the coastal wetlands of Liberia and cover a large area along the coast, from Cape Mount in the southwest to Cape Palmus in the southeast. The mangroves grow at the edges of lagoons, riverbanks, and river estuaries and also widespread in areas of swamps. In addition to serving a nursery function mangrove also harbour some species of crocodiles and the endangered West African manatee, *Trichechus senegalensis* (GCLME 2006). Recent reports are of widespread decimation of mangrove stands by coastal communities for fuel/ building materials.
- **Benthos:** Liberia is reported to be low in benthos diversity on the continental shelf compared with adjacent countries in the Guinea Current Large Marine Ecosystem (GCLME 2010), which is an indicator of low productivity in the natural environment.
- **Primary production:** Along the south eastern coast of Liberia, chlorophyll concentration reaches a maximum on the inshore side of the continental shelf. The seasonality is pronounced with the highest values (1.3 mg/m³) recorded during the main upwelling season from June to September. Primary production in the coastal area is estimated to be in the region of 0.98 g/c/m²/day during the main upwelling season (EPA 2007).
- **Birds:** GCLME (2006) reports that “Among the marine and seashore birds found in the Gulf of Guinea are: common ringed plover (*Charadrius hiaticula*), knot (*Calidris canutus*), curlew sandpiper (*Calidris ferruginea*), bartailed godwit (*Limosa lapponica*), cattle egret (*Bubulcus ibis*) and the whitewinged tern (*Chlidonias leucopterus*). Also, a number of seabirds breed in the area between Guinea Bissau and Angola. This includes the gull-billed tern (*Gelochelidon nilotica*), the royal tern (*Sterna maxima albididorsalis*) the white-tailed tropic bird (*Phaeton lepturus*) and the brown booby (*Sula leucogaster*). It is estimated that

the area between Sierra Leone and Ghana holds about 700,000 waders in winter”. Birdlife International records indicate that there are 18 seabird species in Liberia. There are no listed Important Bird Areas’ (IBAs) near the coast.

- **Cetaceans:** Knowledge on the distribution and ecology of cetaceans in the Gulf of Guinea is reported by Vande Waerebeek et al (2009) as being rudimentary.
- **Turtles:** Four of the seven remaining species of marine turtles in the world can be found in Liberia where they lay eggs at selected places along the shores. The four species are the green turtle (*Chelonia mydas*), the leatherback (*Dermochelys coriacea*), the hawksbill (*Eretmochelys imbricata*) and the olive riley (*Lepidochelys olivacea*). Both the leatherback and hawksbill are classified as critically endangered (IUCN 2012). Despite international initiatives to protect these endangered species, marine turtles are hunted for food throughout Liberia, and caught in nets during trawling. Their eggs are also collected by humans and destroyed by dogs and pigs on the beaches (EPA 2007, GCLME 2010).

7.5.3 *Site Specific Setting*

Ecology and Ecosystem Services

Much of the Liberian coastline is/was known for its rich mangrove density and biodiversity in its estuaries (Brandolini and Tigani 2006), but this is not so around the city of Monrovia, where mangroves have been removed, and plastic solid waste is found thickly scattered at the major river mouths and on the adjoining beaches; resulting in limited species biodiversity along the coastline.

- **Sandy Beach Fauna:** No fauna were found on the beach during the field survey, apart from a small unknown oyster-type bivalve growing on the rusting steel infrastructure and wrecks in the area (Figure 15).
- **Fish and Fishing:** There is little to no fishing happening directly in the harbour. The reasons for this are that the National Ports and Harbours Authority has banned the use of nets in the ports and also because there are few larger fish found in the harbour. There is evidence of an annual occurrence of an (unknown) species of grouper, *Epinephelinae*, along the shore areas and also within the harbour breakwaters. This seasonality suggests that the harbour area, and probably other nearshore zones, are important in the life histories of these fish.
- **Marine Mammals:** According to the Director of Ports and Harbours and the Port Captain of Monrovia, cetacean visits to the harbour are rare, with a single unidentified whale spotted in the last 5 years. Dolphins are reported to occur sporadically.

Figure 15 Unidentified oyster found growing on steel infrastructure around the pier.



- **Benthic Habitat:** The longshore sediment transport system carries sediment from the south of the port into the dredged approach channels and turning circle within the harbour and creates the need for maintenance dredging at the harbour to be undertaken every two years (pers. comm. Barnabas B. Kasor). Sediment samples were assessed for benthic fauna and sediment type, however, as could be expected due to the recent dredging, negligible benthic life was found in the sediments.

7.5.4 Developments and Pollution Sources in the Port

The majority of the southern end of the harbour has been developed with seawalls and pier infrastructure, while in the northern end the China Union pier is bounded by approximately 500 m of sandy beach on either side. The northern sandy beach is privately managed as UN property and is currently inaccessible to the public. It was not surveyed. The southern stretch of beach was found to be heavily polluted with oils, plastic solids and ship wreckage (Figure 16).

Figure 16 *The southern pier beach heavily polluted with hydrocarbons, plastics and ship wreckages.*



The breakwaters of the harbour are currently in urgent need of maintenance, with many of the larger original boulders having moved significantly since construction. The southern breakwater separates the harbour from the highly polluted Mesurado/ Du River mouth, and due to the current state of the breakwater there is direct mixing between the effluent rich water of the Du River and the sea water within the harbour. The Du River receives waste from the city of Monrovia with approximately 250 tons of waste per day being dumped into it or its tributaries (EPA 2007).

There is a secondary point-source of storm-water run-off into the harbour, located approximately in the middle of the sandy beach south of the China Union pier, which collects the effluent rich storm-water runoff from the main road and the surrounding residential infrastructure inshore of the harbour.

7.5.5 Adjoining Coastline

The coastal and marine environments are also subjected to other pressures such as erosion due to sand mining, oil pollution, solid and liquid wastes dumps, human settlements adjoining the high-water mark and the discharge of municipal wastewater due to lack of proper water and environmental facilities and management plans. Coastal erosion has been severe in Monrovia, in Buchanan and Greenville as a result of land-based activities. Between 1981 and 1997 about 100 meters of beaches was lost due to sand mining and natural processes. In terms of mangrove areas which serve as a breeding ground for some marine resources, exploitation for mainly firewood and charcoal has removed any remaining stands around the harbour.

On all the beaches surveyed during the field trip, between approximately 20 km south of the Du River and St. Paul River, each of the beaches was heavily polluted with plastics and building rubble. The Du and St. Paul Rivers were in flood during the survey and the areas around the river mouths were littered with solids. This pollution becomes worse during times of no flooding.

7.6 SOIL AND LAND USE

The port site is a highly modified area. The area has previously been used for shipping of iron ore. The soils have been physically disturbed, heavily compacted and there are visual signs of hydrocarbon contamination on the surface. The soils on the site are considered of no value with respect to supporting terrestrial ecology or agriculture. Due to the degraded nature of the soil resources there will be no significant impact on soil or terrestrial ecology at the site.

7.7 AIR QUALITY

This Project has the potential to adversely impact ambient air quality by creating emissions of primarily fugitive dust from stockpiles and loading/ unloading, and to a lesser extent, gases from combustion of fuels in stationary and mobile equipment. In order to understand the potential for adverse impacts, it is necessary to understand the baseline ambient air quality conditions so that any changes can be predicted by modelling and measured as the project progresses.

The study area (Map 7-1) primarily focused on the area surrounding the Port as this is the area where the greatest impacts will arise. The full Air Quality Study is included in Annex 4.

7.7.1 Air Quality Standards and Guidelines

Overview

There are currently no air quality standards specific to Liberia, therefore international standards and guidelines have been used for the assessment. These are primarily those advocated by the IFC and based upon guidelines set out by the World Health Organization.

IFC WHO Guidelines

Human Health

The air quality guidelines for the protection of human health are based upon those set out by the IFC which follow the World Health Organization Guidelines. The IFC guidelines are set out in Table 21.

Table 21 Air Quality Guidelines for the Protection of Human Health

Parameter	Measurement Period	Standard ($\mu\text{g}/\text{m}^3$)
PM10	24 hours mean (as the 99 th percentile)	150 (Interim target 1) 100 (Interim target 2) 75 (Interim target 3) 50 (Guideline)
	Annual mean	70 (Interim target 1) 50 (Interim target 2) 30 (Interim target 3) 20 (Guideline)

PM2.5	24 hours mean	75 (Interim target 1) 50 (Interim target 2) 37.5 (Interim target 3) 25 (Guideline)
	Annual mean	35 (Interim target 1) 25 (Interim target 2) 15 (Interim target 3) 10 (Guideline)
NO₂	1 hour mean	200
	Annual mean	40
SO₂	10-minute mean	500
	24 hours mean	125 (Interim target 1) 50 (Interim target 2) 20 (Guideline)

Dust Deposition

Dust emissions from the project site may result in nuisance issues when depositing onto surfaces such as property, vehicles and washing. Dust per se does not pose a specific risk to human health and as such the IFC and WHO guidelines (which are focused around human health) do not include guidelines for nuisance dust. A number of organizations have set guidelines for dust deposition; however only those from German TA Luft are set in regulation. Therefore, these are used in this study and are set out in Table 22.

Table 22 Dust Deposition Nuisance Thresholds

Nuisance Effect	Deposition Rate (mg/m²/day) Source
Possible Nuisance	350 (monthly mean) TA-Luft
Very Likely Nuisance	650 TA-Luft

7.7.2 Air Quality Parameters

The air quality baseline focuses on the current air quality at sensitive receptors for air quality parameters of concern, these parameters include:

- Dust deposition– dust can be a nuisance to human receptors as it settles on property and agricultural areas.
- Particulate matter (PM10 and PM2.5) - varies widely in physical and chemical composition, source and particle size. PM10 particles (the fraction of particulates in air of very small size (<10 µm)) and PM2.5 particles (<2.5 µm) are of concern to human health, as they are small enough to penetrate
- into the bronchiole (PM10) and alveolar (PM2.5) regions of the lungs and so potentially pose significant health risks.
- Gaseous emissions of oxides of nitrogen (NOx) - NOx comprises both nitric oxide (NO) and nitrogen dioxide (NO₂). NO₂ itself is a respiratory irritant. In addition, NOx reacts with ammonia, moisture, and other compounds to form nitric acid vapor and related

particles which can cause inflammatory reactions in the lungs. Inhalation of such particles may cause or worsen respiratory diseases, such as emphysema or bronchitis, and may also aggravate existing heart disease. NO_x also reacts with volatile organic compounds (VOCs) in the presence of sunlight to form ozone which can cause damage to lung tissue and reduction in lung function, mostly in susceptible populations (children, elderly, asthmatics). NO_x may also adversely affect sensitive ecology.

- Gaseous emissions of sulphur dioxide (SO₂) – SO₂ is a respiratory irritant. Inhaling sulfur dioxide is associated with respiratory symptoms and disease, difficulty in breathing, and is associated with premature death. SO₂ can adversely affect sensitive ecology.

7.7.3 Methodology

A desktop evaluation was undertaken, and existing information was reviewed to assess existing climatic data, review regional air quality and identify sensitive receptors.

There are no meteorological stations in the vicinity of the project that capture data concerning wind speed; wind direction; precipitation; relative humidity; temperature; and cloud cover. Data modelling was thus undertaken using the MM5 model to estimate five years of meteorological data including wind directions and for the generation of wind roses. The MM5 model uses global macro-scale meteorology to predict local meteorological conditions at any given location in the world.

Both long and short-term monitoring was carried out in the vicinity of the Port in June 2012 to monitor particulate matter (PM₁, PM_{2.5} and PM₁₀). Parameters were measured with a handheld monitor (Grimm EDM 107) which takes a continuous air sample with a flow-controlled pump.

A six-month monitoring programme of gaseous emissions and dust was commissioned in June 2012 to January 2013. The survey monitored SO₂, NO₂, NO_x and dust deposition. Only one sampling station was set up for the monitoring described above and was located at the proposed stockpile at the port (Map 7-1).

Climate Modelling

According to MM5 modelled meteorological data for 2007 to 2011, southwesterly winds dominate due to the coastal location of the site. Wind speeds average ~ 2.2 m/s, with a maximum of ~ 8 m/s. Emissions of dust are only likely to occur from open exposed surfaces (such as stockpiles, stripped ground etc) at wind speeds of greater than 5.3 m/s. Over the 5 years of data wind speeds were below 5.3 m/s for 96.8 percent of the time.

Wind roses for the mine location are set out in Figure 17, Figure 18 and Figure 19.

Figure 17 Wind Rose (2018 and 2019)

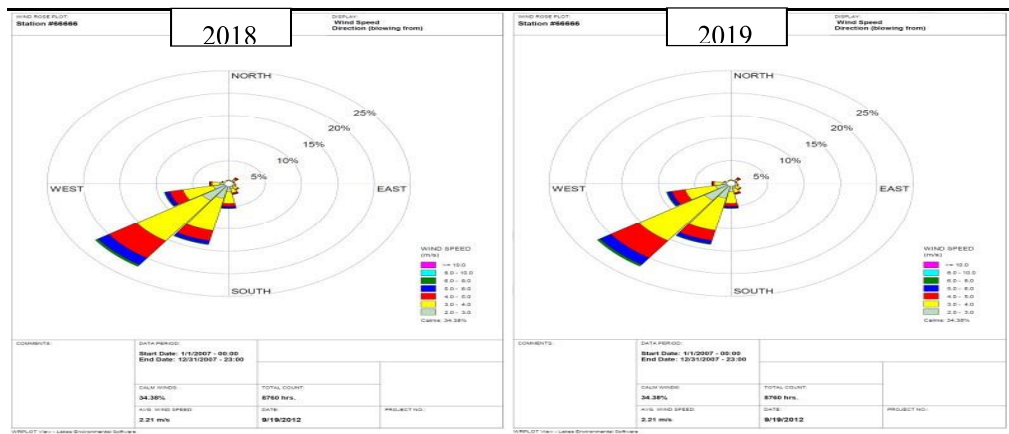


Figure 18 Wind Rose (2020 and 2021)

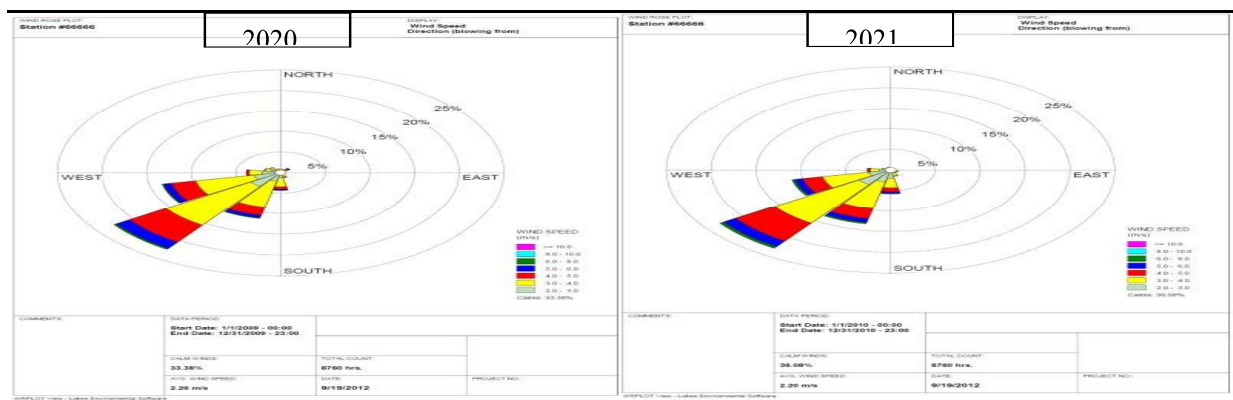
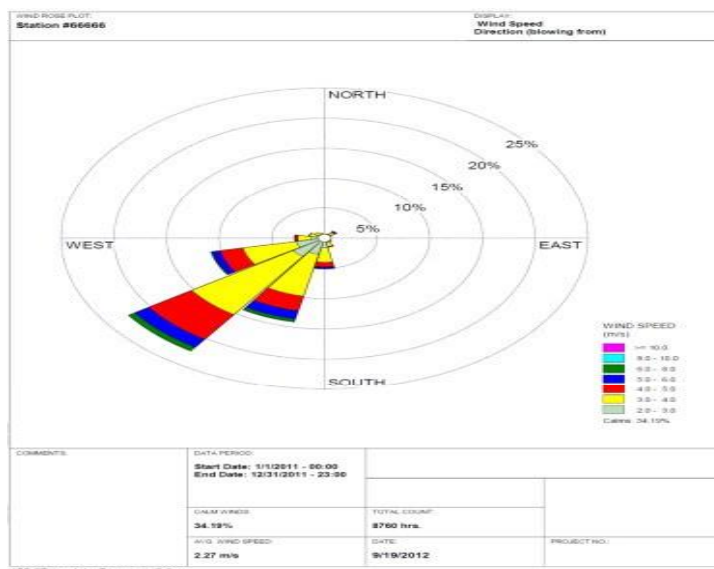


Figure 19 Wind Rose 2022



7.7.4 Sensitive Receptors

Sensitive Human Receptors

Sensitive receptors around the port are located to the east of the port and are largely residential areas in the city of Monrovia. In addition, there are industrial areas to the north and south of the port facility which may be sensitive to dust.

Sensitive Ecological Receptors

There are no sensitive ecological receptors in the vicinity of the Port.

7.7.5 Baseline Air Quality

Short Term Monitoring

Particulate matter (PM₁, PM_{2.5} and PM₁₀) was measured at Site P2 (China Union port offices) in June 2012 (Map 7-1).

Although the short-term monitoring data is not directly comparable with the air quality guidelines (as they are not based on a 24-hour average upon which the standards are based due to logistical circumstances), they do provide an indication of short-term concentrations. Results of the sampling can be seen in Table 23.

Table 23 Short term monitoring results ($\mu\text{g}/\text{m}^3$)

Location	Name	Specific local sources of pollutants	Monitoring	PM₁₀	PM_{2.5}	PM₁
P2	China Union port offices, Monrovia port	Port (paved and unpaved service roads) and city traffic and industrial activities	period: 6/5/2012 10:08 AM - 6/6/2012 8:20 AM duration: 22h 12 min	Mean: 21 1 minute Max: 509.1	9.69 69.9	5.03 34.2

The mean monitoring results at the port are well below the 24-hour IFC guideline values within the Port area.

Long Term Monitoring

Locations

The long-term monitoring of dust deposition, SO₂, NO_x and NO₂ was undertaken between June 2012 and January 2013 at the following locations (Map 7-1):

D7 (Port, east of ore storage); and

D8 (Port, workshop).

Monitoring data is presented in Table 24.

Monitoring in the area of the port showed exceedances of the dust deposition threshold for possible nuisance complaints on three out of six months of monitoring. This is consistent with the monitoring locations being close to industrial areas and adjacent to a city with heavy traffic.

Average NO₂ concentrations during the monitoring period were well below the annual average guideline for the protection of human health. One (1) monthly average exceeds the annual guideline value. However, looking at the long-term trend this appears to be anomalous.

SO₂ concentrations were below the guidelines for the protection of human health.

Table 24 Monitoring results (mg/m².d)

Location Name	Description	Sources of pollutants	June	July	August	September - October	November	December	Average*
Dust Monitoring Results (mg/m ² .d)									
Port, east of future ore storage next to the railroad	Port area in Monrovia on a D7 small grassland	Port (unpaved service roads) and city traffic and industrial activities	17	156	53	52	76	183	89
D8 Port, CU workshop	Port area in Monrovia inside CU premises	Port (unpaved service roads) and city traffic and industrial activities, work shop activities	3,629*	142	190	170	871*	477	913 (245)
NO ₂ Monitoring Results (µg NO ₂ /m ³)									
Port, east of future Ore storage next to the railroad	Port area in Monrovia on a D7 small grassland	Port (unpaved service roads) and city traffic and industrial activities	23.8	39.4	35.0	16.8	22	24.050	26.86
D8 Port, CU workshop	Port area in Monrovia inside CU premises	Port (unpaved service roads) and city traffic and industrial activities, work shop activities	23.3	25.1	69.1	23.5	23.4	19.740	30.72
NO _x Monitoring Results (µg NO ₂ /m ³)									
Port, east of future ore storage next to the railroad	Port area in Monrovia on a D7 small grassland	Port (unpaved service roads) and city traffic and industrial activities	n.a.	n.a.	53.0	34.9	38.4	21.210	36.87

D8 Port, CU workshop	Port area in Monrovia inside CU premises	Port (unpaved service roads) and city traffic and industrial activities, work shop activities	n.a.	n.a.	100.8	48.2	40.6	27.590	54.30
SO ₂ Monitoring Results (µg SO ₂ /m ³)									
Port, east of future ore storage next to the railroad	Port area in Monrovia on a D7 small grassland	Port (unpaved service roads) and city traffic and industrial activities	1.51	4.09	4.86	3.10	2.88	3.980	3.40
D8 Port, CU workshop	Port area in Monrovia inside CU premises	Port (unpaved service roads) and city traffic and industrial activities, work shop activities	1.21	1.54	10.5*	3.19	2.27	4.000	3.78 (2.44)

NOISE

7.7.6 Methodology

A desk top study was undertaken to identify the location of sensitive receptors and sampling points using GIS mapping (Map 7-2).

Both long-term (24 hours) and short-term (daytime) measurements were undertaken over the period from 1 to 6 June 2012.

The full Noise Baseline study is included in Annex 5.

Long Term Measurements

Long term measurements were collected at one location, PL 5, close to Monrovia Port (Map 7-2).

At this location, continuous noise monitoring was conducted to provide an estimate of background noise levels and to understand the variation between the daytime and night time periods. The microphone of the long-term monitor was set on a tripod to a height of 1.5 m and greater than 3.5 m from any reflective surface (except ground) so that it was a free-field measurement. The monitors automatically logged environmental noise measurement parameters including LAeq, LA90, LA10, LAMax and LAMin parameters.

Short Term Attended Measurements

A series of short-term (day time) measurements were undertaken to identify the nature, character and dominant noise sources surrounding and within the Study Area (Map 7-2). Short-term measurements were also undertaken at the long-term measurement location to verify the long-term measurement.

A Sky watch Explorer 2 anemometer was used to measure the wind speed.

National Guidelines and Standards

There is no specific Liberia national guidance for road traffic noise. The IFC Environmental, Health, and Safety (EHS) Guidelines, however, provide noise level guidelines which have been adopted and are further defined below.

IFC Guidelines

The IFC Environmental, Health, and Safety (EHS) Guidelines provide noise level guidelines (Section 1.7) which have been adopted for use in this Project. The guideline states:

“Noise impacts should not exceed the levels presented in Table 25 or result in a maximum increase in background levels of 3 dB at the nearest receptor location offsite.”

Table 25 IFC EHS Guideline Values for noise

Maximum Allowable Ambient Noise Levels, LAeq,1hr, dB(A) Free field		
Receptor	Daytime	Night-time
	07:00 – 22:00	22:00 – 07:00
Residential, institutional, educational	55	45
Industrial, commercial	70	70

The IFC general EHS guidelines (2007) are used to assess impacts on people caused by disturbance and consequential annoyance from industrial noise. The guidelines use LAeq,1hr levels for daytime and night-time to assess disturbance effects on people. The IFC EHS guidelines indicate that significant disturbance effects on people have a threshold of 55 dB LAeq,1hr, and 45 dB LAeq,1hr for daytime and night-time respectively. In cases where ambient noise levels are already above these threshold levels significant disturbance impacts are deemed to arise if LAeq,1hr levels are increased by more than 3 dB.

7.7.7 Monitoring Results

Long Term Measurement Results

The results of the long-term monitoring are summarized in Table 26 the location of the site is shown in Map 7-2.

The long-term monitoring data was analyzed to calculate hourly LAeq, LA90 and LA10 parameters were then ‘averaged’ to calculate typical period or overall values presented in Table 26 The overall LAeq levels are the logarithmic average of the LAeq,1hr values and the overall statistical values are calculated as the arithmetic average. The LAeq,T represents the equivalent energy average noise level for the period; and the LA90,T represents the background noise level for the period.

Table 26 Unattended noise monitoring results

Measurement Location	Measurement Parameter, dBA					
	Daytime			Night time		
	Leq,t	L10,t	L90,t	Leq,t	L10,t	L90,t
PL5 - Port	71	68	60	50	51	49
IFC Impact Threshold	55			45		

The acoustic environment at PL5 is relatively high, being close to the harbour, thus the ambient noise levels, LAeq, T and background noise levels, LA90, are considerably higher during the day and lower during the night.

The ambient noise levels during the day (until 20:30), around the port site, were higher than the IFC threshold for day time due to the activities taking place in this area. It is typical to observe noise levels, above the IFC thresholds close to the port area, being adjacent to the city. The dominant noise sources are associated with shipping operations and are mainly the loading and unloading of containers such as clanging chains, engines, cranes and trucks. Construction works such as hammering and power generators was also observed in the port area during the daytime period. Although night time noise levels are generally lower than daytime, they still exceed the IFC thresholds.

Short Term Measurement Results

Table 27 summarizes the daytime ambient noise levels at each of the two attended short-term monitoring locations.

Table 27 Ambient noise levels – short term

Location ID	Description	GPS Co-ordinates	LAeq,t dBA	LA90,t dBA	LA10,t dBA	LAmx,dBA
SML 10	Port Security Shed	N 06 21' 04.9" W 010 47' 17.0"	57	51	62	77
SML 11	Proposed Iron Ore Stockpile yard	N 06 21' 06.8" W 010 47' 27.9"	52	51	53	62

Note 1: Human's activities during these measurements were present and cannot be considered as representative and have not been used in this assessment

SML 10 and SML 11 have similar noise environments, composed mainly of construction and shipping activities.

8 SOCIO-ECONOMIC BASELINE

8.1 INTRODUCTION

8.1.1 *Background to the Project*

This report is a summarized version of the Social Baseline sections of the Mine, Port and Rail ESIA Reports (2012) prepared by the IDL group for ERM. These three study areas have been summarized together in this Chapter as social interactions between the Project areas are complex and there is a significant amount of overlap between the communities. For the full Social Baseline Study conducted see Annex 2.

8.1.2 *Study Areas*

Three social studies were prepared as part of the Social Impact Assessment for the Project. The studies included a socio-economic baseline study, a land use and cultural heritage study, and a health study. For the studies, the directly impacted population were defined as:

- Those living within the final concession area for the Mine;
- Those living in Bong Mine Town;
- Those living within 500m of the Railway; and
- Those living within 2km of the Port.

The Project spans three counties in central Liberia: Bong, Margibi and Montserrado Counties, within which seven districts are likely to be directly affected by Project Components.

8.2 METHODOLOGY

8.2.1 *Socio-Economic Baseline*

The methodology used to establish the socio-economic baseline was a statistically representative household survey. The aim of which was to provide reliable baseline data from which it will be possible to assess and mitigate future impacts of China Union operations. Directions and rates of change can be measured through subsequent repeats of the same survey.

A survey was designed to include questions on key socio-economic characteristics of the populations including demographic information, income, expenditure, economic activity of household members, education levels, access to key resources/community infrastructure and social capital. The sampling unit was the household. Three major socio-economic groups were determined as the preliminary strata for sampling; urban, peri urban and rural. A list of households was not available for any stratum prior to the survey; therefore, random sampling was carried out.

8.2.2 *Land Use and Cultural Heritage Study*

The findings presented on land use are based on a field visit from 11th September to 1st October 2012 plus a rapid review of some key literature. The unavailability of key data (e.g. recent high-quality satellite imagery, settlement maps) imposed constraints on the amount and quality of data that could be collected.

The fieldwork priority was given to the Mine area. The methodology employed was to visit as many communities as possible in the immediate vicinity of the mine site and through a community mapping exercise, understand the extent and use of their surrounding lands.

Survey work along the Rail corridor was cursory and was conducted over four days using a pushcart from Bong Mines town to Siamaku, approximately 8 km from the port terminal. During the journey, notes and GPS points were taken on land use visible on both sides of the tracks and occasional stops made to converse with local land users.

8.2.3 Health Study

The purpose of the health study was to establish a preliminary baseline of key health indicators for the population living in the Mine area, along the Railway and around the Port. A mixed methods approach was employed to capture as accurate as possible a rapid baseline within the limited time-frame.

Secondary quantitative data consisting of patient records were gathered from Yeamai, Haindi and Bong Mine Hospital (Bong Mines Hospital), where all patients visiting the clinics are registered. Names and other means of identification were omitted from the analyses in order to protect patient confidentiality.

Primary qualitative data was gathered from clinics, traditional healers and pharmacies to enable triangulation and thorough investigation of selected issues. Staff at selected clinics were interviewed regarding the current state of services and facilities to enable triangulation with secondary accreditation data. The baseline health indicators that were established, as recommended by the International Council of Mining & Metals (ICMM) measure incidence in health conditions where mining operations in general have been found to have an impact:

The main limitation that should be considered is the potentially unreliable diagnosis at the clinics and hospitals due to lack of clinical expertise and/or capacity to verify diagnosis. Whilst the more obvious diagnoses can be made (ARI, gastritis, malaria, thrush, trauma and injury) there are many categories that have unusually low numbers (HIV for example). This may reflect the lack of available resources in order to confidently diagnose such conditions and also a reticence of the local populace to come forward to have their symptoms checked.

8.3 SOCIO-ECONOMIC CHARACTERISTICS OF THE IMPACTED AREAS

8.3.1 Overview of the Impacted Areas

Mine area

The Mine area includes lands from three counties; Bong, Margibi, and Montserrado and measures 613 km² (Map 2-1). In all parts of the Mine area, agriculture dominates as a source of income, the southern areas by large-scale rubber and sugar cane farms and in the eastern and northern parts more rice is grown, and the rubber and sugar cane operations are somewhat smaller in scale.

Bong Mine Town

Bong Mine Town is inhabited by a heterogeneous mix of people including migrants from the surrounding counties who fled to Bong Mine Town for safety during the war, traders from Guinea, and migrants from Monrovia and beyond who seek work with China Union. The town is principally a trading town. The market at Bong Mine Town operates daily and trades in a range of goods. The town is an urban Centre for the surrounding area with a large high school, court, police depot and hospital.

Railway corridor

The Railway corridor is at present the primary transportation link between hundreds of villages along the 72 km stretch between Bong Mine Town and Monrovia. The main mode of transportation for goods along the Railway is with handmade wooden carts called ‘Make-a-Ways’ which can be pushed up and down the track using ball bearings as wheels. Land beside the track is intensively farmed in places, including large scale rubber and sugar cane farms.

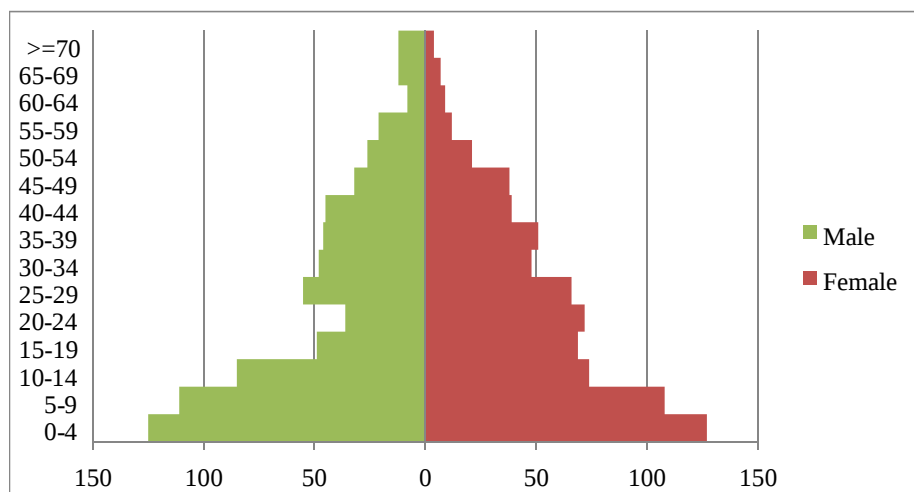
Port

The Port area is in the immediate vicinity of Freeport, i.e. Bushrod Island in Monrovia. Prior to the land being industrialized, the area was originally inhabited by the Kru people from Grand Kru that migrated there to work in the port and to fish. However, the port area has drawn many other populations with the promise of employment. Farming is not common in this study area; however, the surrounding swamps provide important farm and gardening land in the dry season. Map 8-1 delineates the area of potentially sensitive receptors.

8.3.2 Demography

The data on demography is taken from the household survey. As the household survey used a statistically representative sample, the data presented here can be understood as representing the population in each of the study areas. Figure 20 indicates the population demographics for the entire population sampled.

Figure 20 Population pyramid for the entire sample



The total sample size for the household survey was 279 households, or, 1 479 individuals, including 721 males, and 758 females.

Similar to other areas in Liberia, the population is generally young. 51 percent of males and 49 percent of females are eighteen, or younger. Very few people were reported to be aged more than 70. The average age for males, and females were 23.2 and 22 respectively which is slightly higher than the country median age (18 for males, and 18.3 for females). The average size of surveyed households is 5.3. In many families, more than one member contributes to household expenses

(on average 1.7 per household). The average dependency ratio for the whole sample is 1:3, ie every individual who earns money, on average, should support three other individuals in the household.

The majority of households surveyed (75.6 percent) attributed household headship to a male family member. Despite this general trend, many young females between the ages of 20-30 considered themselves as the head of household.

Ethnicity

In three of the study areas, Bong Mine Town, the Mine area and the Railway corridor the ethnic composition of the population is dominated by the Kpele people at 49 percent, 88 percent and 67 percent each, respectively. The only exception is in Freeport where the highest ethnic diversity was observed and the Kru people constitute the majority at 27 percent of the surveyed population.

Migration

Individuals who had migrated to their current place of residence at some point during their lives were categorized as migrants. Migration data indicated that migrants constitute 48.3 percent of the population in the sample population. This rate indicates that the surveyed population have a relatively high mobility. The migrant population ratio varies in different strata. The ratio is highest in the Port area (60.4 percent) and the lowest in the rural areas of the Mine (39 percent). In the sample as a whole, women are as likely to move as men. Migrants are distributed across age-groups with higher probability to move among older individuals.

8.3.3 Livelihoods

Livelihood Zones

A useful starting point to understand the livelihoods in the Mine area and along the Railway corridor is to use the nine livelihood zones (LZ) (Figure 21) that have been distinguished across the country (FEWS NET, 2011). The Mine area and Railway corridor fall across three of these zones.

Livelihood Zone 1: Rice Inter-cropped with Cowpeas and Groundnuts and Palm Oil

Rice grown on rainfed upland fields is the major staple, but cassava is an important secondary staple. Before the war, cocoa and some coffee were widely grown as cash crops, but there has been little reinvestment since the end of the conflict. People trust far more in annual crops, of which rice, cowpeas and groundnuts are the most important.

Livelihood Zone 8: Rubber and Charcoal with Food Crops

Rubber has defined this zone since the 1920s and an important percentage of the rural population work on the big rubber plantations at Firestone and Salala. Small, private plantation owners and smallholders also grow rubber independently, selling the latex to the bigger companies. Rubber is tapped across the year, and private planters employ local tappers and thus rubber is by far the most important income source in this zone. Both cassava and rice are grown largely for home

consumption, but the vast majority of staple food is purchased. Generally, the private/smallholder rubber producers make further cash by selling vegetables and charcoal.

Livelihood Zone 9: Monrovia Peri-Urban: Petty Trade, Market Gardening and Casual Employment. This zone comprises a sizeable population who are within the Monrovia urban district but outside the city proper. They are not simply spread in a neat and measurable radius around the city hinterland but extend particularly along and near the main roads. They are semirural in that they have land on which they produce at least vegetables if not also a little cassava, and they commonly keep poultry. Their economy is more or less completely defined by the city: they sell vegetables and chickens to it, they perform casual employment, and they are part of the chain of petty trade in farm/garden produce, fish, charcoal and many other items. Above all, the staples they eat, especially rice, are purchased.

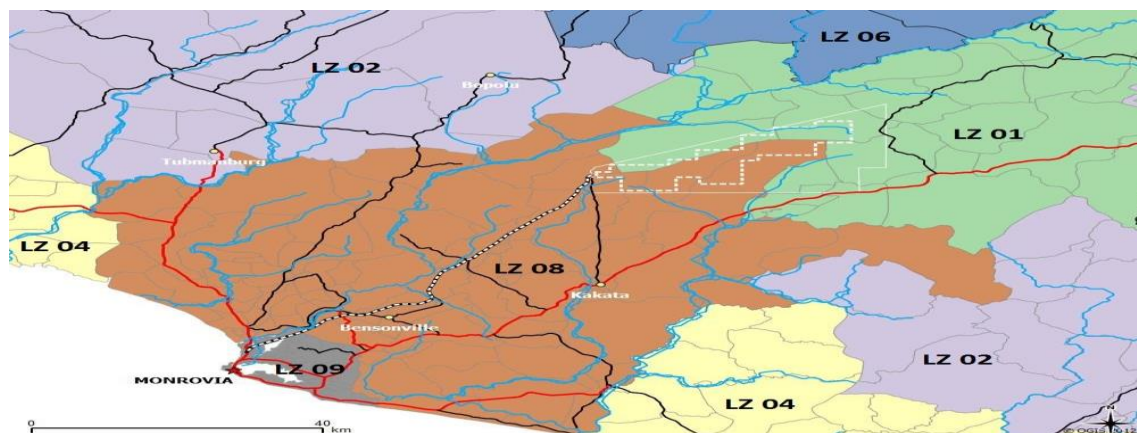
Frequency and Profitability of Livelihoods in the Study Areas

Although it is a commonly held view that most people in rural economies of sub-Saharan Africa are subsistence farmers, the household survey findings show that, in fact, there are a plethora of economic activities both in rural and urban settings.

In fact, most people have more than one economic activity; 65 percent of the working age economically active population are reported as having more than one income generating activity. The three major livelihoods that most people use to earn money include remittances, rice farming and retail trade.

Ranking of livelihoods in terms of amount of money estimated as earned from this activity in the preceding 12 months for each of the Study Areas gives the following picture. In Bong Mine Town, the restaurant business generates the largest amount of income compared with other livelihoods. In the Mine area, the largest income generating activities rely directly on land and water access; rubber production, charcoal, rice farming and fruit and vegetable production. Along the Railway corridor, the major income generating activity is charcoal production. In Monrovia the largest income generating activity is Government employment. Interestingly, income earned from fishing accounted for 5.8 percent of the total income earned in the Port area, indicating a high reliance on an unpolluted ocean.

Figure 21 Residential Livelihood Zone

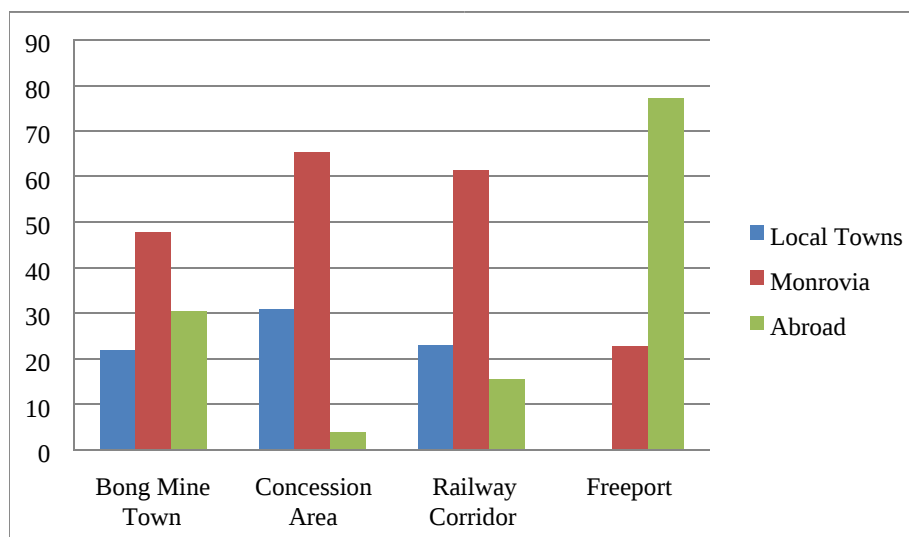


Remittances

12 percent of the population receives remittances and remittances are the 4th and 5th largest income generating activities in the Port area and Bong Mine Town respectively. The origins of the remittances were classified as originating from ‘another local town’, ‘Monrovia’ and ‘abroad’ (Figure 22). The data indicates that remittances in the interior tend to come from Monrovia while remittances in Monrovia tend to come from abroad.

Overall, average remittances are the highest along the Railway corridor at US\$808 followed by the Port area at US\$720, Bong Mine Town at US\$490 and finally the Mine area at US\$221.

Figure 22 Origin of remittances by study area (%)



8.3.4 Variation in Income

The average income per capita of the sampled population (total income recorded divided by number of individuals in the sample) was US\$896. The average income per capita recorded is 2.5 times higher than that reported in the UN Human Development Index (US\$360). The relatively high average income is due to the high average income in the Freeport (US\$1527).

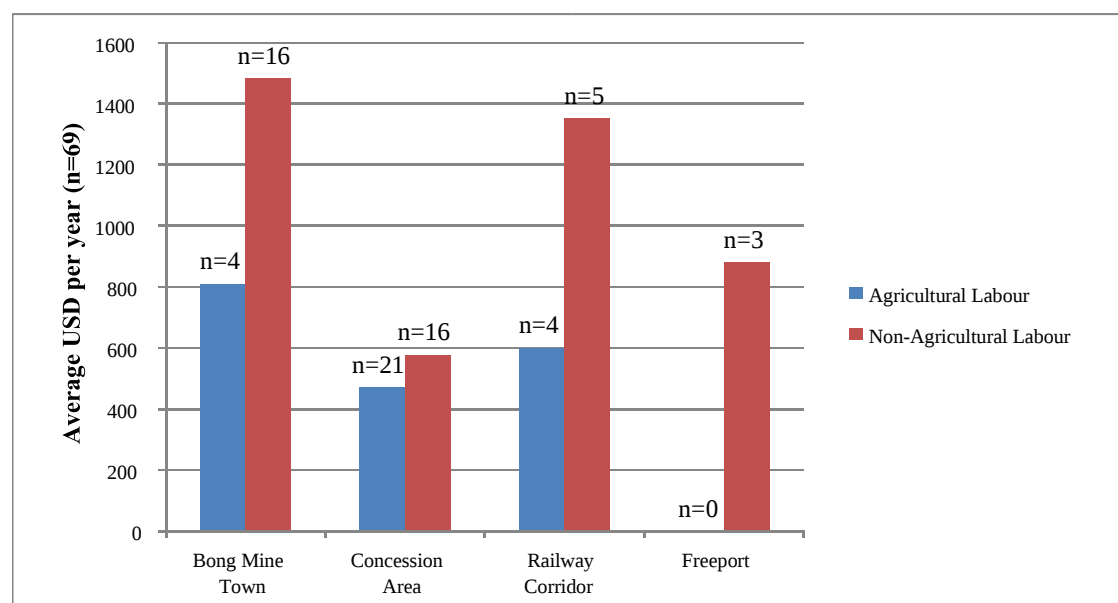
8.3.5 Agricultural and Non-Agricultural Labour Markets

Both agricultural and non-agricultural labour markets play a significant role in rural and urban economies. China Union has the potential to have a positive impact on local communities through providing wage labour employment. However, changes in the non-agricultural labour market can have adverse impacts on agricultural labour markets. If more people are employed in non-agricultural work, agricultural production can suffer.

Figure 23 shows the different average incomes per annum from agricultural and non-agricultural labour. Agricultural labour here is defined as all labour relating to agricultural production of crops which includes clearing the forest for charcoal burning. Non-agricultural labour refers to contract work that is not related to agricultural production. This can range from skilled labour such as masonry or machine operators to unskilled clearing of the forest for construction works or road

maintenance. As can be seen from the chart, nonagricultural labour is better paid than agricultural labour in all study areas.

Figure 23 Average income per annum for agricultural and non-agricultural labour by study area



8.3.6 Utilities

Water Sources

In the household survey, household heads were asked about the source of water they use and the distance from their house. In Bong Mine Town, almost half of the surveyed population used hand pumps, and the other half used wells for their drinking water. In the Port area, more than 92 percent had access to hand pumps, while the remaining population used springs/streams. Households living in the Mine area and along the Railway corridor had far less access to hand pumps and wells. More than 61 percent of the surveyed households in the Mine area, and about 40 percent of communities in the Railway corridor used either springs or rivers for drinking water.

In terms of distance to water source in the different strata, in Bong Mine Town, about 37 percent of the households were located less than five minutes from a water source. Except for one household, every other household was within 20 minutes walking distance to a source of water. In the Mine area, around 47 percent of the households were just less than 5 minutes from a water source. Every other household, except one, were located within 20 minutes from a water source. About 54 percent of households along the Railway could source their water within 5 minutes walking distance, and no household needed to walk more than 20 minutes. Finally, 63 percent of households in the Freeport area had access to a water source within 5 minutes walking distance. The level of underground water in Freeport area is unusually high, however, water taken out from wells is contaminated and is not suitable for drinking. This means that those living in the Port area are forced to source their drinking water mostly from the local market.

Sanitation

Most people living in the Mine area or along the Railway used the bush as a toilet (about 70 percent). About 25 percent of surveyed households in these areas used pit latrine toilets and the remaining 5 percent used a mix of river, bucket, and flush toilets. In Bong Mine Town, 57 percent used a flush toilet facility mainly due to the number of houses built by BMC two decades ago.

Cooking Fuel

Charcoal and firewood were identified as two major sources of cooking fuel with charcoal predominating in urban settings and firewood in rural areas. Almost all the surveyed population in the more urban settings, ie Bong Mine Town (98 percent) and the Port, reported charcoal as their main cooking fuel. In the Mine area, 93 percent of households reported firewood as their main source of fuel.

Within Bong Mine Town, people sourced charcoal from an average of 10 minutes walking distance. In the Mine area, firewood could be collected on average 13 minutes walking distance from the village. Households along the Railway corridor who use charcoal source it within 9 minutes walking distance. Finally, in the Port area, everyone had access to charcoal, and they source it within 5 minutes walking distance.

Community Infrastructure

Community leaders were asked to identify the distance of their town/community to the closest institutions, such as schools, hospitals, police depot. Residents of Bong Mine Town and the Port area enjoyed relatively good access to all these public facilities, whereas households living in the concession area, or along the Railway corridor, generally, had more issues with accessing public facilities.

8.3.7 Education

37 percent of adults aged 15 and over (n = 853) in the directly impacted areas have never been to school. Women were more likely than men to miss out on school; 47 percent of women aged 15 and over (n=449) had never been to school compared with 27 percent of men (n=400).

11 percent of children aged between 6 and 18 (n=441) had never been to school. Girls were less likely to be registered in school than boys but only marginally; 12.3 percent for school age girls (N=220) and 9.6 percent school age boys (n=218). 45 percent of the sample aged 15-18 had started high school education. The data shows that girls are as likely to enter high school as boys.

8.3.8 Social Capital

Participation in community activities

By far the most common and popular community groups were church groups. There was a church group in almost every town. Overall, 58 percent of sampled individuals aged 15 and over were reported to be a member of a church group. Women were slightly more likely to be members of church groups. 63 percent of women sampled (n=449) were participating in church groups, compared with 53 percent of men sampled (n=400).

Poros/Sandé groups were the second most popular community groups in all the strata, except in the Port area. 24.3 percent of sampled individuals aged 18 and over in Bong Mine Town, 36.4 percent in the Mine area, and 39.6 percent along the Railway were members of these secret societies.

Women's groups were relatively active in all strata. Youth groups were not as prevalent as women's groups in most of the strata, except in the Port area where 25.6 percent of youth aged 15 to 25 were members of a youth group. This proportion was 13 percent in Bong Mine Town, 16 percent in the Mine area, and 9.1 percent in communities along the Railway.

Kuu groups are well established groups in the rural areas, and both male and female contribute equally to these groups.

8.3.9 Religion

The majority of the sample was Christian (93 percent). About 4 percent of the population practiced Islam, and 2 percent held traditional beliefs. Another 1 percent mentioned that they practiced a mixture of traditional beliefs and Christianity.

8.3.10 Cultural Heritage

During the baseline's studies, several culturally significant areas in the landscape were either indicated during the community mapping exercises or reported in visits to other towns. The cultural heritage sites identified in the Mine area can be seen in Map 8-1 (Mine).

8.3.11 Community Health

Overview of Health in Liberia

Liberia has a total population of 3,994,000, according to latest available estimates. Life expectancy at birth is 57 years for females and 54 years for males, which is slightly higher than the regional average (56 for females and 52 for males). Liberia has one of the highest maternal mortality ratios in the world, 770 per 100,000 live births, exceeding both the regional (480 per 100,000) and global ratios (210 per 100,000).

HIV prevalence remains below the regional average, 15 per 1 000 adults aged 15 to 49 are estimated to be infected with the virus in Liberia – the equivalent regional average is 47 per 1 000 adults. Liberia has a relatively high level of tuberculosis prevalence, with 476 per 100,000 people infected, superseding both regional (332 per 100,000) and global (178 per 100,000) averages. Leading causes of death for children under 5 include malaria (18 percent), pneumonia (14 percent) and other diseases (13 percent).

The Liberian medical sector currently offers 1 physician for every 100,000 individuals – that is 4 percent of the regional average which is 22 for every 100,000 individuals. Nurses and midwives are also in relatively short supply, with 27 for every 100,000, less than a third of the regional average which is 90 for every 100,000.

Health, Social Care and Public Service Provision in Liberia

Public health services in Liberia are overseen by the Ministry of Health and Social Welfare (MoHSW) via County Health Teams located in county capital cities. Private healthcare is also provided by practitioners largely operating in or near urban centres. Public health care facilities

across all three counties are either fully funded by the MoHSW, or jointly funded by MOH alongside non-governmental organizations (NGO), including faith-based organizations, Africare, Save the Children, Medecins du Monde (MDM), MERCI, Merlin, MTI and private benefactors.

Health and Wellbeing Profile

The individual diagnosis ledgers analyzed at Bong Mines Hospital, Yeamai and Haindi, provided a snapshot of the demographic distribution across the clinics. It is notable that the inpatient department has a relatively equal distribution of male and female patients, compared to the outpatient departments where females are seen in greater numbers. The outpatient departments are visited by pregnant women seeking ante natal care.

In the household survey, people were asked about whether there was a trained mid wife present at the birth of infants born to the household in the preceding year. 100 percent of infants born in Bong Mine Town and Port area, 78 percent of infants born along the Railway, and 57 percent of infants born in the Mine area were born in hospital, or in the presence of a trained midwife.

Communicable Diseases

- ***Vector borne diseases***

Malaria overwhelmingly dominates as the primary health concern across all surveyed areas – it is also the only vector borne disease found to be diagnosed.

China Union officials estimated that at least 50 percent of the current work force had at some point required treatment for malaria. The number of malaria cases in China Union workers seen at Bong Mines Hospital has decreased since an in-house doctor started practicing at the China Union staff quarters in March 2012.

Mobile and regular pharmacists, in addition to hospital staff and patients, reported that the vast majority of malaria cases remain undiagnosed by medical health professionals. Those afflicted were said to, in most cases, rely on self-medication using anti-malarials obtained directly from pharmacies, or herbal medicine or to abstain from treatment altogether, while only seeking modern medical care in severe cases.

Sexually Transmitted Infections and HIV/AIDS

All clinics apart from Koon town, Wonjah Smith Memorial and Haindi conducted HIV testing. Nyehn reported one positive case in 2012. Redemption Hospital reported that 10 percent of all HIV tests conducted at the hospital are positive, with on average of 100 new cases confirmed every month.

Respiratory Diseases

Confirmed cases of influenza were not reported at any of the surveyed facilities. Two cases of Tuberculosis (TB) were reported at Yeamai clinic in 2011 but none had been confirmed during 2012. Acute Respiratory Infection (ARI) was one of three major health concerns in Zanna town. At Redemption hospital, one of the few facilities that reported any deaths on site, ARI was stated as a leading cause of death.

Faecal-oral diseases

Yeamai clinic staff and community members reported an increase in diarrhea cases during the dry season when the only functioning hand pump in the town dries up for three months (January until March), forcing the population to seek alternative, less clean water sources.

Parasites that were specifically diagnosed included seven (7) cases of schistosomiasis at Bong Mines Outpatients Department, a figure which is likely to represent a small proportion of the actual infected population, as this is a common parasite related to poor sanitation and contaminated water.

Other diseases associated with poor sanitation and overcrowding

Scabies was reported to be the most common skin disease in Yeamai, Koon town and Bensonville, where ring worm was also frequently cited. It is notable that impetigo is found in Bong Mines, Haindi and Yeamai clinic data as this is a highly contagious skin infection and spreads easily through contact and is hence a good indicator of overcrowding. Similarly, scabies may be relied on as an indicator of overcrowding as it only spreads through the sharing of beds.

8.3.12 Non-Communicable Diseases

Cardiovascular disease

Hypertension and cardiovascular disease was reported in the Bong Mines, Haindi and Yeamai clinic records. The China Union clinic reported one (1) case of heart disease since March 2012.

Cancer

Bong Mines Hospital Outpatients Department report one (1) case of cervical cancer during September 2012 and Haindi clinic had recorded one (1) case since October 2011. No cases were reported at Yeamai, but the China Union clinic had recorded one (1) case of liver cancer since March 2012 and Redemption hospital reported up to 50 cases since October 2011.

Chronic Respiratory Diseases

Bronchitis

No cases of bronchitis were confirmed at the surveyed clinics.

Asthma

Yeamai clinic cited one asthmatic patient that had died in 2010 after refusing to visit hospital for treatment. Haindi clinic had recorded one (1) case of asthma since October 2011. Bong Mines Hospital had seen one case in

September and reported that more cases were seen during the dry season.

Diabetes

Even though very few patients were diagnosed with diabetes (only one confirmed in analyzed Bong Mines, Haindi & Yeamai data), data from Bong Mines Hospital revealed 11 patients diagnosed with hypoglycaemia.

8.3.13 Nutritional Disorders

Malnutrition

Yeamai reported three (3) cases of malnutrition in August and Haindi also cited malnutrition amongst conditions seen on a monthly basis. Bong Mines Hospital Outpatients Department sees on average one case per month. Koon town staff highlighted malnutrition among children in particular as a major health concern in the area.

Nyehn health centre had for the past two years been providing corn meal supplied by the World Food Programme (WFP) to pregnant women and children aged between 6 months and 2 years old, which had greatly reduced the number of malnutrition cases seen at the clinic.

Vitamin Deficiencies

Bong Mines Hospital Outpatients Department said scurvy is diagnosed every couple of days but this was not reflected in the analyzed clinic records.

Obesity

The only clinic visited that reported cases of obesity was Redemption Hospital, even here the staff highlighted that patients never sought medical treatment for obesity, as being overweight is in general seen as a positive condition.

8.3.14 Trauma and Injuries

Physical Accidents

Bong Mines Hospital staff recalled that physical injuries from artisanal mining used to occur regularly. Mining injuries sustained by China Union workers are seen on a regular basis.

Community and Domestic Violence

No domestic violence cases were reported at Yeamai clinic. Haindi had seen two (2) sexual assault cases this year in addition to bruises and lacerations which were seen almost every day, many of them due to domestic violence. Bong Mines Hospital Outpatients Department reported around one case of injury due to violence per year.

8.3.15 Heavy Metal and Chemical Exposure – Air, Water and Soil

Clinic staff and community members at Yeamai in Bong County complained that the nearby Yeamai River had been polluted since BMC initiated mining activities at Bong Mines in the 1960's. At its worst, the river ran red from iron ore and was blamed for the death through severe diarrhea of seven (7) people for one week. The water had subsequently been declared unusable by BMC who installed two hand pumps in the village to provide alternative drinking and washing water. The pumps have since broken and village members complained that the river water continued to cause diarrhea when ingested and rashes on sticky, itchy skin followed by hot sweats and nausea if used for washing.

8.3.16 *Mental Health and Wellbeing*

Suicide

No known cases of suicide were cited by any of the medical professionals consulted during the assessment apart from at Wonjah Smith Memorial where a 21-year-old female had reportedly attempted to commit suicide by drinking chlorine during 2011.

Alcohol and Drugs

Alcohol, tobacco and other intoxicant consumption were not reported at any of the surveyed clinics apart from one case of a 45-year-old male with alcohol intoxication who was admitted to Bong Mines Hospital.

Mortality

Two facilities visited reported deaths on site, Bong Mines Hospital and Redemption hospitals. Redemption reported 499 deaths during 2011 – 363 of which were children and adolescents and 136 which were adults, including 32 maternal deaths. Bong Mines Hospital reported 41 deaths in total during the same period.

8.4 LAND USE

8.4.1 *Customary and Statutory Land Tenure in the Project Area*

Before looking at some of the specifics of land use around the Mine, it is important to contextualize the tenure setting in which it occurs. Liberia has two systems of land tenure, customary and statutory. A brief description of each system follows.

Customary Land Tenure in the Project Area

A simple though useful way of understanding customary land tenure in Liberia is to conceive it in terms of a complex and dynamic web of social relationships that link, or can be crafted to link, individuals to land access. Typically, the 'right' to provide land access to others is invested in the first comers (often referred to as the town or chiefdom 'owners') and their heirs.

A key manifestation of an individual's social position vis-a-vis land access under customary tenure is the type of crops that they are permitted to cultivate. Here a fundamental distinction is typically drawn between the major subsistence crops, rice and cassava, on the one hand and tree crops (frequently referred to as 'live' crops) such as rubber and cocoa on the other. Recent arrivals in settlements (often called 'strangers') are, with the correct deference to the town 'owners' and authorities, easily granted permission to grow rice and cassava, sometimes under certain conditions. The right to plant 'live' crops, however, is altogether a different matter and it may take many years as well as in-marriage to the landowning lineages for this to be permitted.

Statutory Land Tenure in Liberia

The recent detailed review of land tenure in Liberia notes:

“The most obvious conclusion to be drawn as to the statutory effects upon customary law is simply that its provisions are discriminatory, dangerously outdated, insufficient, and confused”. The Land Commission is, however, currently working hard to amend this confusion, but before considering their work, a very abridged review of the evolution of the statutory tenure situation is necessary (figure 24):

Figure 24 Abridged Overview of the Evolution of Statutory Land Tenure in Liberia

The Hinterland Era: 1923-1956 During this period, and for various reasons, the Liberian government, rather uniquely in Africa, provided collective legal ownership entitlement in commonhold to the 'aborigines', the legal term in use at the time for the indigenous population. The Appropriation Era: 1956 to the present Starting in 1956 some subtle, but very significant word changes were made to tenure aspects of the Hinterland Laws when they were brought into full statutory force as Title 1 Aborigines Law in the Liberian Code of Laws (1956-58). Whereas previously the indigenous people were recognized as having land ownership, they suddenly became only lawful occupants of land belonging, by default, to the State. The implication of this was that if communities wanted secure simple rights to their customarily owned land, they had to buy them back from the government. The means of doing this was through the Public Land Sale process outlined in the same Code of Laws and revised in various iterations, notably in 1972-3 and enshrined in the 1974 Land Registration Law. In brief, this process starts with an applicant requesting a Tribal Land Certificate from the customary authorities (town clan and paramount chiefs). If they agree that the desired plot may be, in effect, sold by the government, their signatures permit a survey to proceed. This signed certificate then has to be counter signed by the County Land Commissioner who may need to inspect the land and then signed by the County Superintendent. The applicant next has to pay for the land to be surveyed. After which, with a Certificate of Survey in hand, a fixed acreage fee needs to be paid at the Revenue Office. There are then several other stages before the application finally gets to the President of the Republic for the authorizing signature, after which the deed must be registered with the Probate Court and sent to the National Archives.
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The interaction between Customary Land Tenure Systems and Statutory Land Tenure Systems in the Project Area

In order to understand the relevance of statutory land tenure to land use around the mine, it is instructive to recall the brief historical outline of the area given earlier. Fuamah District was created during the hinterland era and it was under the land laws of this time that Botoe Barclay acquired an extensive deed for his district. This deed was not examined by Wily but presumably it bears the all-important presidential signature after the phrase, “my successors in office will forever Warrant and Defend” the rights they transfer. How this squares legally with the subsequent granting of a mining concession over part of Fuamah district by President Tubman to BMC and now China Union is not known.

How much of the land acquired around Kakata during the rubber boom of the 1940s and 50s was fully processed into deeds is also not known, but presumably the biggest of what Marguerite called the 'Big Men' had the all-important political connections at the top to get the presidential signature. Those of lesser influence probably settled for initiating the deed acquisition process by acquiring Tribal Land Certificates (TLCs) and getting their areas surveyed and/or at least demarcated. The usual means of demarcation in the area is with 'soap trees' that are easily propagated through stem cuttings and are robust and long-lived. These trees dot the landscape around the mine and hint at the local significance of land acquisition processes through elements of the statutory tenure mechanism.



Soap Tree being used as a boundary marker near Sea-Ta

Though local chiefs are not theoretically in a position to gain financially from issuing TLC's since the land is not legally theirs to dispose of, —Fuamah could however be an exception here, since the paramount chief holds it in trust for the district—they play a pivotal role in their issuance which is unlikely to go unrewarded. Whether motivated by reward or under political pressure, the first chief of Giamasu Clan, Gbomo Kollie, as well as his successor, Seley Smah, reportedly issued numerous TLC's in the 1960s and 70s in the northern interior of the clan up to and over the Bong Range, in what was then a probably sparsely inhabited, inaccessible area. To understand who was acquiring land in this area and why brings us to the third important historical current in the area.

The installation of BMC significantly changed the local economy and behind the jobs and business opportunities came an increased interest in land acquisition. Bledsoe (1980: 35) has described how around the mine in 1974, land formerly used for rice farming was being bought up by entrepreneurs for cash crops such as rubber, oranges and coffee and the resulting squeeze on land available for rice farming was being felt as far as Haindi by 1978. Those who acquired TLC's at this time seem to have been a mixture of better paid BMC employees and those in successful businesses or local government. How many were local as opposed to in-movers is impossible to

say, but it is likely that the marriages of some of the latter group, who were without much doubt in the majority (ibid. p.38), to local women facilitated their acquisitions.

8.4.2 Land Use in the Non Gomma Deposits Area Settlement Pattern

A key objective was determining the nature and distribution of all settlements around the Non Gomma deposit area, as a pre-requisite to examining land use.

A general reading of the towns indicates some important similarities and differences between the three clans:

- Golorhama clan probably has the two oldest towns in the area (Sia-Ta and Gbalikoma) and has experienced some land sales but also lost a lot of land to the tailings dams which displaced at least one town and several landowners.
- The oldest towns in the part of Giamasu Clan area under consideration are probably Sackie-Gbeyallah, Bemou and Gbaryamu. While the latter town has probably been particularly instrumental in border politics, the other two have experienced considerable land sales around them. South of the Bong Range, there has been a lot of land lost to the BMC tailings dams and four towns here are currently being removed by China Union. One small town (Line-Ma) on the north side of the ridge was abandoned because of water pollution caused by BMC mining on Bong Peak in the last years of its operation.
- The oldest currently inhabited settlement in Yarbayon clan area is BarclayTa which dates from 1945. Given this date, the town's name and its border location, its foundation is probably entwined with the territorial claiming processes instrumented by Botoe Barclay: encouraging in-movers on one's territory is a typical frontier strategy reported in the area (Murphy & Bledsoe, 1987). There seems to have been less land sales in this part of

Yarbayon compared to Giamasu, perhaps because of the district wide 'mother' deed. BMC mining has displaced several towns below the ridge.

The surveyed settlements in the Non Gomma deposit area are small clustered towns consisting of around seven (7) households with the two largest settlements (Gbaryamu and Gbart-Ta) made up of only about 35 households each.

A notable feature of the settlement pattern is the frequency of displacements through force majeure. Many towns in the area have, however, voluntarily shifted over short distances (generally less than a few hundred metres) from old town spots which remain culturally significant sites linking the population to their deceased relatives. In one case these movements have seen three separate towns (Nentasu, Barclay and Yarkpasoma) co-locate but they still retain their individual identity and specific linkages with particular parts of the surrounding landscape. The critical point to bear in mind in terms of the settlement pattern is that regardless of whether towns are occupied or abandoned, the connection of particular people to parts of the landscape often remains embedded in local readings of it. To grasp the basis of these connections requires understanding how people have transformed the landscape from the original forest cover.

Rice Farming

Upland rice is the dominant staple crop grown around the Non Gomma Deposit Area with cassava playing an important but secondary role. Upland rice farming needs to be understood as more than a means of food production as it is also a significant socio-cultural activity that creates and cements social bonds through its high labour requirements. Given the inter-annual shifts in the location of upland rice farms, understanding this significant land use requires consideration of three important factors: the size of the farms, the length of time they are left in fallow and other land uses. Each of these will be considered below.

Upland Rice Farm Sizes

Once a household has determined where it can make its next rice farm its size is set in relation to factors such as household labour availability, seed rice supply and means to recruit additional labour. On the basis of ad hoc questions about upland rice farms sown in 2012, a range of 0.2 to 3.2 ha with 1 ha as a median figure was revealed.

Fallow Lengths

In shifting agricultural systems, as found across Liberia, fallow periods provide the essential means for soil nutrients to recover. All too often, however, these systems tend to be generalized in terms of the ideal length of this period, with farming in shorter fallows often labelled as unsustainable. These blanket generalizations ignore the complex realities of these farming systems, such as intrinsic differences in soil properties across sites and the variable composition and growth patterns of the fallow vegetation.

The ad-hoc data assembled illustrates a significant range of fallow periods in 53 upland rice farms made in 2012, from 3 to 36 years with the median being 8.5 years.

Rubber Farms

In terms of land coverage, rubber is probably second only to upland rice farming around the mine, but these two land uses are intimately related as the former essentially removes land available for the latter.

In every town where mapping was completed, some people either had old rubber and/or were planting new stock. This reflects something of a national trend that is particularly noticeable within Liberia's rubber corridor and periphery, where the mine is located. Several factors lie behind this rubber planting boom. The simplest factor to cite is the high prices that have been available in recent years

Rubber takes seven years before it is ready to be tapped and for some early planters, that time is now or soon approaching. To what extent the trees are or have been maintained in the interim is not known, but it will be far more interesting to see how they are managed when they come into production. The Bong Mines area certainly has locational advantages in terms of access to buying stations, but latex prices will clearly have an important bearing on their future roles in local livelihoods, particularly in terms of how they compare to other income-generating opportunities such as working with China Union.

Sugar Cane Farming

The future scenario that rubber will take over the land is somewhat simplistic as there are several other profitable alternate lands uses currently practiced around the mine. Of these, sugarcane production for the manufacture of 'cane juice' (rum) is probably the most profitable. However, it is essential that the grower is within easy transport distance of the grinder and steam mill needed for the distillation of the cane.

Vegetable Gardening

Another potentially profitable use of some types of river side land is vegetable gardening in the dry season (January to April). Though the largest share of local vegetable gardening is produced on the old tailings dams which are conveniently located for sale at either Bong Mine Town or export to Kakata and beyond. At much smaller scales, other localities along some of the rivers and streams coming off the Bong Range are important such as the Suakoyah, a tributary of the Wedea.

Cocoa and Oil Palms

Before drawing this discussion to a close, two outstanding tree crops need to be mentioned, cocoa and oil palms. Though they are of lesser importance than rubber, they are of more significance in local livelihoods than any of the remaining tree crops grown in the area such as citrus, coffee and kola.

8.4.3 Land Use along the Rail Corridor

The earlier review of livelihood zones in Liberia highlighted the national dominance of the greater Monrovia region in terms of population and economic influence. The Railway from Bong Mines to the Freeport of Monrovia provides a unique transport artery to this market which has a significant bearing on land use within its corridor. The uniqueness of the BMC railroad is that in the last 20 years it has provided a market access option to places where these arterial roads do not run.

With the cessation of BMC mining activities coupled with war-time provisioning constraints it was not long before the transport opportunities of the railroad were exploited. The initial method of transport developed, the "Make-A Way" push cart, remains to be examined in detail.

Without detailed information on the scale of the proposed widening of the Bong Mine Railway, it is difficult to contextualize land use within the narrow corridor beside the railroad that will be directly impacted by the proposed widening scheme. However, several observations can be made:

- Agricultural land use beside the railroad is similar to that found around the mine: inter-annual shifting bush fallow farming of rice and cassava, some shifting rice swamp farming, longer duration sugar cane production and permanent tree crop plantations. In several places' farms can be observed very close to the tracks (< 5m) which is probably within the operating distance maintained by BMC.
- Two similar but rather distinct land uses along the rail corridor are worthy of particular mention despite occupying relatively small areas, alluvial gold mining around the Koin

Creek that runs between Todee and Careysburg Districts and artisanal quarrying southwest of Louisiana.

Land tenure along the length of the rail corridor is a similar combination of statutory and customary forms as found around the mine, though it is almost certain, given the history of colonization, that customary succeeds to statutory closer to Monrovia. Two indicators suggest that in terms of total area, statutory tenure probably dominates. The first is the frequency of tree crop plantations, with some notably extensive rubber plantations around Todee that flank both sides of the railroad for several kilometres. The second set of indicators is less visible but is highly significant in terms of the historical precedence that has been set in terms of land acquisition. These are the BMC boundary markers illustrated in Figure 8.6. What is more important is that they demarcate a width (said to be 40 ft. (12.19 metres) either side of the track but not measured) which is shorter than that required by China Union and most significantly, these areas were reportedly purchased by BMC and the landowner's deeds adjusted accordingly.

By way of conclusion, it cannot be too strongly underlined that preparations for the planned developments along the rail corridor need to be given adequate time and resources. Not only do a large number of both statutory and customary land owners need to be identified for land take and land access negotiations—it is inconceivable that works can be confined to a 25m corridor—but other sensitivities need to be identified and negotiated. For example, the potential loss or damage to income generating resources such as palm trees, rocks for aggregates and watercourses for fishing and drinking water. To date numerous properties falling within the right-of-way have been marked for removal and the owners and occupants are awaiting negotiations.



BMC rail corridor cornerstone near Nancy Walker Town

9 MARINE IMPACT ASSESSMENT

9.1 INTRODUCTION

Development at a Port will invariably result in impacts on the marine environment with the potential for degradation of water quality, sediment quality and introduction of alien species. The objective of this impact assessment is to estimate the significance of these impacts for the China Union Port development/ rehabilitation and to recommend appropriate mitigation measures to reduce the impacts to levels that are as low as reasonably possible.

9.1.1 Overview of Impacts Assessed

This report assesses the following three broad impacts:

- Degradation of marine water quality;
- Degradation of sediment quality and structure; and
- Introduction of alien species.

9.2 BASELINE SUMMARY

General Coastal and Marine Biodiversity

The coastline of Liberia is 579 km long. The country has a continental shelf area of 14,894 km² and territorial sea of up to 159,200 km².

The following is a description of the various biodiversity elements that occur:

- **Mangroves:** Mangroves are among the most productive terrestrial ecosystems and are a natural renewable resource. Recent reports are of widespread decimation of mangrove stands by coastal communities for fuel/ building materials.
- **Benthos:** Liberia is reported to be low in benthos diversity on the continental shelf compared with adjacent countries which is an indicator of low productivity in the natural environment.
- **Primary production:** Along the south eastern coast of Liberia, chlorophyll concentration reaches a maximum on the inshore side of the continental shelf.
- **Birds:** It is estimated that the area between Sierra Leone and Ghana holds about 700,000 waders in winter. Birdlife International records indicate that there are 18 seabird species in Liberia. There are no listed Important Bird Areas' near the coast.
- **Cetaceans:** There have been very few sightings in the recent past.
- **Turtles:** Four of the seven remaining species of marine turtles in the world can be found in Liberia. However, despite international initiatives to protect these endangered species, marine turtles are under immense pressure from humans and animals.

Developments and Pollution Sources in the Port

Much of the coastal and marine area around Monrovia has been severely impacted upon in the past. Mangroves no longer exist in the area; minimal fishing is taking place in and around the harbour and large marine mammals are very infrequently seen near the harbour. From samples taken it is also evident that negligible benthic life on the sediments exists.

The majority of the southern end of the harbour has been developed with seawalls and pier infrastructure, while in the northern end the China Union pier is bounded by approximately 500 m of sandy beach on either side. The southern stretch of this beach was found to be heavily polluted with oils, plastic solids and ship wreckage.

The breakwaters of the harbour are currently in the urgent need of maintenance. The southern breakwater separates the harbour from the highly polluted Mesurado/ Du River mouth. Due to the state of the breakwater the polluted river water is mixing with the sea water within the harbour. There is also a secondary point-source of storm-water run-off into the harbour which collects the storm-water runoff of surrounding residential area.

Adjoining Coastline

The coastal and marine environments are also subjected to other pressures such as erosion due to sand mining, oil pollution, solid and liquid wastes dumps, human settlements adjoining the high-water mark and the discharge of municipal wastewater due to lack of proper water and environmental facilities and management plans.

Site Specific Setting

The following summarizes the baseline conditions at the port site:

Mangroves: Around the city of Monrovia mangroves have been removed, and plastic solid waste is found thickly scattered at the major river mouths and on the adjoining beaches; resulting in limited species biodiversity along the coastline.

Sandy Beach Fauna: No fauna were found on the beach during the survey, apart from a small unknown oyster-type bivalve.

Fish and Fishing: There is little to no fishing happening directly in the harbor as the National Ports and Harbours Authority has banned the use of nets in the ports as well as there being few larger fish found in the harbour.

Marine Mammals: Cetacean visits to the harbour are rare, with a single unidentified whale spotted in the last 5 years. Dolphins are reported to occur sporadically.

Benthic Habitat: Sediment samples were assessed for benthic fauna and sediment type, however, due to the recent dredging, negligible benthic life was found.

9.3 IMPACT ASSESSMENT METHODOLOGY

9.3.1 *Defining magnitude*

For impacts on marine water quality, sediment and ecology, the criteria used to assess the magnitude of impacts are presented in below:

- ***Magnitude Criteria for Ecological Impacts***

A Large Magnitude Impact: The water quality of the marine environment is likely to exceed guideline limits routinely or sediment structure and/or quality is degraded to an extent that it no

longer supports benthic life or invasive species are likely to become wide spread and reside permanently.

A Medium Magnitude Impact The water quality of the marine environment is likely to exceed guideline limits occasionally or sediment structure and/or quality is occasionally impacted but is reversible or invasive species occur in low numbers or for short periods of time.

A Small Magnitude Impact The water quality of the marine environment is likely to be within guideline limits or sediment structure and/or quality is impacted but within natural variation or invasive species are not likely to be observed.

9.3.2 Defining Sensitivity

Near field receptors

- The receptors in the localized Port environment (near field) include:
- Marine water quality;
- Sediment quality;
- Benthos life;
- Shore line environment and mangroves; and
- Marine animals.

As discussed in the baseline section and in greater detail in Annex 3 the marine water quality in the area of the port is highly contaminated with hydrocarbons and wastewater. The sediments support very low benthos life and sediment quality is likely to be highly degraded. The shore line has been highly altered due to sand mining and contamination from solid waste. No functioning mangrove environments remain and mega fauna are rarely sighted. Therefore, the sensitivity of all receptors in the current state is considered low.

Far field receptors

Sensitivity of receptors outside the immediate Port environment (far field) is unknown. Due to this uncertainty impacts that can influence the marine environment outside the Port area are considered High as is the case for impacts due to alien and invasive species.

9.4 DEGRADATION OF WATER QUALITY

9.4.1 Background to impact

Iron ore will be stored in stockpiles at the port, these stockpiles will be exposed to rain fall and runoff containing iron ore may discharge with storm water into the marine environment. In addition, there is potential for iron ore dust to be disbursed from stockpiles and ship loading activities during dry periods, this dust will settle in the marine environment. This can result in increased turbidity in the water that can reduce light penetration and have adverse effects on marine species. In addition, there is potential for metals within the ore or adsorbed to its surface to leach into the water.

9.4.2 Pre-mitigated Impact

The change to water quality due to sediment runoff or wind-blown dust can potentially increase turbidity or suspended solids concentrations above guideline values (large scale). Geochemical

analysis indicates that there is low potential for acid generation and low concentrations of metals in leachates and concentrations of metals in the marine environment are unlikely to exceed guideline values. The impact will occur locally, infrequently and for the life of the operation, resulting in a medium magnitude. Given the low sensitivity of the receptors the impact will be of Minor significance.

9.4.3 *Recommended Mitigation Measures*

It is recommended that the following measures will be implemented:

- Dust suppression with water in combination with chemical suppressants if required to reduce dust generated.
- Water mist sprays or dampening at handling and conveyor transfer points wherever practicable.
- Implement storm water control measures to separate clean and dirty water and reduce run-off into the ocean.
- Fuel storage tanks and dispensing areas should be bunded and lined with hard standing to prevent spillages and the consequent contaminated runoff into the ocean (See Chapter 18 for Unplanned Events).
- Re-establish vegetation cover where practicable using approved indigenous plant species most suited to the environment that do not exhibit invasive properties. All plant species for use by the project should be reviewed and approved prior to use on site.

9.4.4 *Residual Impact*

Effective implementation of the above mitigation measure will ensure that the residual impact remains Minor.

Table 28: Degradation of Water Quality

Criteria	Pre-mitigation Impact	Residual Impact	Comment
Impact – Iron Ore Sediments in Storm-Water Run-Off			
Nature	Negative	Negative	
Type	Direct	Direct	
Duration	Long term	Long term	Throughout the life of the project ore will be stockpiled at the port and the impact could potentially occur.
Extent	Local	Local	The impact will only occur within a small distance from the site.
Scale	Large	Small	The turbidity of the water is likely to increase to above guideline values near the discharge or settling location. However, implementation of the mitigation measures will reduce exceedance of guideline
Frequency	Infrequent	Infrequent	Impact will occur throughout the life of the mine.
Magnitude	Medium	Medium	The magnitude of the impact will remain medium.
Receptor sensitivity	Low	Low	The receptor sensitivity is considered to be low due to the marine environment in the Port already being highly impacted.
Significance	Minor	Negligible	

9.5 DEGRADATION OF SEDIMENTS ON THE SHORELINE

9.5.1 *Background to the Impact*

Fine iron ore dust particles will likely be dispersed by wind into the immediate vicinity of the stock-pile during windy events, or from the ore transfer operations to the carriers. The dust can be expected to possibly settle in the near-shore environment of the harbour and modify sediment structure.

9.5.2 *Pre-mitigated Impact*

During the dry season if there is no implementation of mitigation measures, windblown dust as well as dust generated from conveying material from the train to stockpiles and during loading of the ships, can result in dust settling onto the surrounding areas resulting in modification of the sediment structures. The impact will occur locally, infrequently (mostly only in the dry season) and for the life of the operation, resulting in a medium magnitude.

Given the low sensitivity of the receptors the impact will be of Minor significance.

9.5.3 *Recommended Mitigation Measures*

It is assumed that the following measures will be implemented:

- Dust suppression with water in combination with chemical suppressants if required to reduce dust generated; and
- Water mist sprays or dampening at handling and conveyor transfer points wherever practicable.

9.5.4 *Residual Impact*

The use of effective controls on dust generation phases will reduce the likelihood of iron ore dust causing adverse impacts on sediment structure and would reduce the significance rating to Negligible.

Table 29: Degradation of Sediments on the Shoreline

Criteria	Impact Pre-mitigation	Residual Impact	Comment
Impact – Degradation of Sediments on the Shoreline			
Nature	Negative	Negative	
Type	Direct	Direct	
Duration	Long term	Long term	Throughout the life of the project ore will be stockpiled at the port and the impact could potentially occur.
Extent	Locally	Locally	The impact will only occur within a small distance from the site.
Scale	Small	Small	The impact will only occur within a small distance from the site.
Criteria	Impact Pre-mitigation	Residual Impact	Comment
Frequency	High	Low	Impact will occur mostly during the dry season only.
Magnitude	Medium	Small	The magnitude of the impact can be reduced to small with implementation of dust reducing measures.

Receptor sensitivity	Low	Low	The receptor sensitivity is considered to be low due to the marine environment in the Port already being highly impacted.
	Minor	Negligible	

9.6 INTRODUCTION OF ALIEN / INVASIVE SPECIES

9.6.1 *Background to the Impact*

Bulk ore carriers will enter the harbour under ballast and will then discharge the ballast water whilst being loaded with ore at the export berths. Ballast water discharges bring the risk of releasing organisms entrained in source ports into the receiving harbour environment. Once released into ports, alien species can become invasive through the establishment of populations and disrupt ecological processes. The invasive animals include planktonic dinoflagellates and copepoda, nektonic Scyphozoa, Ctenophora, Mysidacea and fish, and benthos such as Annelid Oligochaeta and polychaeta, Crustacean Brachyura crabs and Molluscan bivalves. Establishment of benthic species, especially, is aided by the presence of un-colonized surfaces such as those associated with new berth developments in ports.

In view of the globally recorded negative effects of alien species transfers the International Maritime Organization (IMO) considers their introductions to new environments via ship's ballast water, or other vectors, as one of the four greatest current threats to the world oceans.

9.6.2 *Pre-mitigated Impact*

Bulk ore carriers' discharges of any untreated ballast water into the harbour could include eggs, larvae or adults of alien species, and barges may carry 'hitch-hiking' sessile alien species; these become invasive and alter local and regional biological communities.

Any introduction of these species into the Monrovia harbour could have far reaching impacts on not only local biological species which could have impacts throughout the food chain but could also have potential health impacts.

The impact could occur on a regional scale, frequently if not controlled and for the life of the operation, resulting in a large magnitude.

Given the high sensitivity of the receptors the impact will be of Major significance.

9.6.3 *Recommended Mitigation Measures*

The following IMO guidelines to prevent the discharge of untreated ballast water in the harbour or Liberia's territorial seas, thereby reducing the probability of successful alien species invasions.

All ships entering the harbour that are linked in any way to the proposed ore export development are to strictly abide by IMO regulations on ballast water treatment including open ocean ballast water exchanges. Also, all ore carriers are to be early adopters of revised and additional ballast water treatment procedures as may be advised by the IMO in the future.

9.6.4 Residual Impact

The use of effective controls on vessels during construction and operational phases will reduce the likelihood of release of non-indigenous organisms, or their survival in the new environment, and would bring the significance rating down to Moderate.

Table 30: Introduction of Alien / Invasive Species

Criteria	Impact Pre-mitigation	Residual Impact	Comment
Impact –Alien/ Invasive Species Introductions			
Nature	Negative	Negative	
Type	Direct	Direct	
Duration	Permanent	Long term	Provided the mitigation measures are implemented the duration can be brought down from a potential permanent change to the impact just being potential for the lifetime of the project.
Extent	Regional/ National	Regional	The extent can be far reaching if the correct precautions are not implemented.
Scale	Large	Large	Invasive species, if present, can have a large-scale impact.
Frequency	High	Low	The potential for the impact to occur will continue throughout the life of the mine, however, the potential for the impact can be significantly reduced.
Magnitude	Large	Small	The magnitude of the impact can be reduced to small.
Receptor sensitivity	High	High	The receptor sensitivity will remain high as the species remain vulnerable.
	Major	Moderate	

10 AIR QUALITY IMPACT ASSESSMENT

10.1 INTRODUCTION

This report is a summary of the Air Quality Impact Assessment (AQIA), undertaken to predict the impacts on local air quality as a result of the operations at the Port processing area and ship loading point located at the Port of Monrovia required for the time of greatest impact for the Project that is Phase 2 operations.

The proposed Project has the potential to degrade the air quality at and around the Port area. The main parameters of concern that impact on air quality are dust, particulate matter as PM10 and PM2.5, oxides of nitrogen (NOx), nitrogen dioxide (NO2) and sulphur dioxide (SO2).

The key activities and infrastructure that have potential impact on air quality include:

Processing, storage, loading and export (by ship) of up to 10 Mtpa of iron ore concentrate and Operations of the power generating facility.

Sources, such as those described above, are assigned emission values based on information provided by China Union or known literature values. This is referred to as an emissions inventory. The emissions inventory is used in air dispersion modelling to predict the impact at receptors around the Port site.

10.2 OVERVIEW OF IMPACTS ASSESSED

This report assesses the following broad impacts:

- Impact of air quality on human health;
- Impacts on people due to nuisance dust; and
- Impacts on vegetation.

10.2.1 *Pollutants of Interest*

The International Finance Corporation's (IFC) Environmental, Health, and Safety Guidelines for Mining, identify key emissions of concern generated by the extraction, movement and processing of ore, from the perspective of human health, and impacts on sensitive ecology. These are primarily PM10 and PM2.5, and to a lesser extent NOx, NO2 and SO2.

In addition, during the processing of ore, dust may be deposited onto surfaces in quantities sufficient to cause nuisance for people, for example by soiling surfaces.

Power demands for the Project cannot be met by existing local infrastructure, and therefore on-site diesel power generation is required. The operation of these generators will result in emissions to air of NOx, NO2, PM10, PM2.5 and SO2.

Traffic sources, including road traffic and marine/shipping traffic, will also result in emissions of NO2, PM10, PM2.5 and SO2.

10.2.2 Air Quality Standards and Guidelines

Protection of Human Health

Predicted emissions were compared to standards set out in the IFC guidelines based upon the World Health Organization (WHO) Air Quality Guidelines for Europe 2000 and 2005 update. These are the principle air quality guidelines utilized in the assessment. These are set out in Table 31.

The guideline values are aspirational and are intended to confer a maximum degree of protection of human health. Interim targets are set at points to allow the staged achievement of air quality standards, with the Interim 1 target representing concentrations in ambient air above which it could be reasonably expected that health effects would begin to be observed.

The aim will be to achieve the guidelines where practicable. Meteorological conditions during the dry season in Liberia result in elevated background concentrations of particulate matter (PM₁₀ and PM_{2.5}) and dust deposition. Therefore, in regard to PM₁₀ and PM_{2.5} achieving the guidelines is not considered practicable and this assessment will refer to the interim targets.

Table 31 Air Quality Guidelines for the Protection of Human Health

Pollutant	Averaging period	IFC/WHO (µg/m ³)
Dust (Total Suspended Particulates)	24 hours mean (as third highest PM ₁₀ 150 (Interim target 1) hourly mean)	No AQS 100 (Interim target 2) 75 (Interim target 3) 50 (Guideline) 50 (Interim target 2) 30 (Interim target 3) 20 (Guideline)
PM _{2.5}	24 hours mean	75 (Interim target 1) 50 (Interim target 2) 37.5 (Interim target 3) 25 (Guideline)
	Annual mean	35 (Interim target 1) 25 (Interim target 2) 15 (Interim target 3) 10 (Guideline)
NO ₂	1 hour mean	200
	Annual mean	40
SO ₂	10-minute mean	500
	24 hours mean	125 (Interim target 1) 50 (Interim target 2) 20 (Guideline)

Protection of Vegetation

The European Union Air Quality Standards for the protection of vegetation related to emissions of oxides of nitrogen (NO_x) and SO₂, set out in the Directive on Ambient Air Quality and Clean Air for Europe, have also been taken into consideration. These are used as the IFC does not define criteria for protection of vegetation. These standards are set out in Table 32.

Table 32 Air Quality Standards for the Protection of Vegetation

Pollutant	Averaging Period	EU ($\mu\text{g}/\text{m}^3$)
NO _x	Annual mean	30
SO ₂	Annual mean	20

Dust Deposition

With regards to dust deposition standards, there are several standards and guidelines published by various bodies.

There is no clear consensus as to the level of dust deposition that is likely to result in nuisance issues. As a result, dust deposition nuisance thresholds have been developed and are presented in Table 33.

Table 33 Dust Deposition Nuisance Thresholds

Potential for complaint	Measure of soiling ($\text{mg}/\text{m}^2/\text{day}$)	Data source
National Guidelines		
Possible Nuisance	350 (monthly mean)	German TA-Luft
Very Likely Nuisance	650	German TA-Luft
First Loss of Amenity	133 (monthly mean)	West Australia Nuisance Standard
Unacceptable reduction in air quality	333	West Australia Nuisance Standard
Serious nuisance	200	UK recommended nuisance dust deposition rate
Nuisance dust deposition	133	Malaysia air quality standard

10.3 BASELINE SUMMARY

In order to understand the potential for adverse impacts, it is necessary to understand the baseline ambient air quality conditions such that any changes in baseline can be predicted by modelling and measured as the Project progresses.

Monitoring results at the Port show no exceedances of the 24hr IFC guideline value for PM10. As these measurements took place during the wet season, it can be expected that these concentrations will be higher during the dry season, potentially giving rise to occasional exceedances of the 24hr guideline values.

There are exceedances of the dust deposition threshold for ‘possible nuisance’ and the annual average NOx guideline for the Protection of Vegetation at the Port. This is consistent with the monitoring locations being close to industrial areas and adjacent to a city with heavy traffic.

Average NO2 concentrations over the whole monitoring period at the Port were well below the annual average guideline. One monthly average exceeds the annual guideline value; however, looking at the long-term trend this appears to be anomalous.

SO2 concentrations at the Port were below the SO2 annual guideline value for the Protection of Vegetation.

10.4 IMPACT ASSESSMENT METHODOLOGY

10.4.1 Air Quality Assessment Significance Criteria

Magnitude – Human Health

The Impact Assessment methodology followed is detailed in Chapter 4 of this ESIA. The magnitude criteria relating to extent and duration are the same as those presented in Chapter 4. In all cases the duration of the impacts are considered long term, the extent local and the frequency is continuous.

Therefore, in the case of air quality the scale (size of the impact) is of greatest importance and is the only criteria that differs and as such is the parameter that determines if magnitude is negligible, small, medium or large.

The magnitude of impacts was quantified using predictive techniques based on dispersion modelling. The magnitude of the impact was determined by comparison of predicted air quality to air quality standards (AQS) and guidelines.

Magnitude is based on both the ‘Process Contribution (PC)’; this is the impact arising solely from Project related emissions, and the Predicted Environmental Concentration (PEC); this is the PC added to the existing baseline.

The IFC Performance Standards (IFC, 2012) make differentiation in the magnitude of impacts in relation to NO2, SO2, PM10 and PM2.5 based upon the existing baseline air quality in the vicinity of a proposed Project. Essentially, this is based upon whether there is a significant risk to human health due to the predicted changes of the existing baseline air quality.

In instances where the baseline air quality is below AQS’s (un-degraded airsheds) scale is determined by determining the proportion (percentage) of the AQS contributed by the PC and the PEC. For degraded airsheds with baseline air quality above the AQS, the magnitude is determined by the proportion contributed by the PC only. The magnitude designations are presented in Table 34.

Table 34 Determination of magnitude based upon Performance Standards methodology

Scale	Undegraded Airshed (Baseline<AQS)	Degraded Airshed (Baseline >AQS)
Negligible	PC <25% of AQS	PC<10% of AQS
Small	PC > 25% but < 50% of AQS	PC > 10% but < 15% of AQS and PEC < 100% of AQS
Medium	PC > 25% but < 50% of AQS and PEC > 100% of AQS; OR PC > 50% but < 100% of AQS and PEC < 100% of AQS	PC > 15% but < 25% of AQS
Large	PC > 50% but < 100% of AQS and PEC > 100% of AQS OR PC > 100% of AQS	PC > 25% of AQS

Magnitude – Nuisance Dust

With regard to dust deposition there is no clear consensus as to the level of dust deposition that is likely to result in nuisance issues. However, on the basis of pragmatic consideration of the various guidelines used internationally, the scale criteria developed relating to dust deposition is presented below:

- Negligible: <120mg/m²/day;
- Small: 120 – 200 mg/m²/day;
- Medium: 200 – 350 mg/m²/day; and
- Large: >350 mg/m²/day.

The significance of impacts associated with dust deposition are assessed in terms of the PC only. Impacts associated with deposition of dust relate to the potential to cause nuisance issues, with this being related to dust deposition over and above that which already exists. Therefore, the guidelines refer to increased deposition only; this is in contrast to other pollutants where the total concentration is considered, as impacts are assessed against an absolute health-based standard.

Magnitude – Dust on Vegetation

There is limited information available on levels at which dust deposition affects plants. However, one key source, Farmer (1993) summarizes evidence for damage to vegetation due to dust soiling. The study showed that impacts vary considerably between species and with different dust types. Broadly, however, the evidence suggests that damage to vegetation due to dust deposition will occur at approximately the same rate as nuisance will occur for human receptors. On this basis, the same criteria have been used to determine the point at which nuisance issues for sensitive human receptors may arise and damage to vegetation may occur.

Sensitivity

In order to determine the significance of those impacts, consideration is then required as to the sensitivity of the area in question, based on sensitivity of human health within the general

population. There are a small number of specific cases where the sensitivity may be defined as ‘High’; these include hospitals where there are intensive care units or high dependency wards. In general, the approach used in this assessment assumes that sensitivity within the general human population is medium. Under no circumstances is the sensitivity for human health described as low.

Figure 25 Context of impact significances

An impact of **negligible** significance is one where a receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be ‘imperceptible’ or is indistinguishable from natural background variations.

Impacts of **moderate** and minor significance are harder to define but are based on the Scale of the impact as defined in *Table 34*.

An impact of **major** significance is one where a receptor will experience a noticeable effect and the impacts on health can be considered to be unacceptable

10.4.2 Modelling

Overview

The model used in the assessment is the USEPA AERMOD dispersion model. AERMOD is a state-of-the-art dispersion model that can be used to model complex multiple emission sources and predict air quality at receptor locations taking into account meteorology. The model is widely recognized for use in this type of application, including by the IFC, US Environmental Protection Agency, UK Environment Agency and Australian Environmental Protection Agency.

Dispersion modelling has been used to predict concentrations of pollutants at ground level locations outside the site boundaries of the Project area, at sensitive human receptors and sensitive ecological receptors. Five years of hourly sequential meteorological data have been used, so that inter annual variability is incorporated in the model.

The results of the assessment are based upon the worst-case result for any of the five meteorological years used for each of the receptors considered. The dispersion modelling has considered a number of embedded control measures and the presented predicted impacts have assumed implementation of these controls. Further information regarding these measures is presented in the AQIA and are also presented in the section below.

Based upon the results of the modelling, further mitigation is investigated where required.

Assessment Scenario

The potential impacts from the operations of the Port were based on 10Mtpa of iron ore concentrate export rate. It has been assumed that operations at the Port occur continuously over 330 days (1 year). The emission rates that were derived from each operation have been grouped according to the type of operation and according to the location of the activity. The modelling scenario has been developed to reflect net emissions from all sources occurring simultaneously. Volume

sources have been defined to reflect emissions from material handling as a result of loading and unloading from stockpiles and wind erosion. A single point source has been defined to reflect the position of the power generator stack, and further point sources have been defined along the length of the proposed railway line to reflect the arrival and departure of trains. More information regarding the modelling scenario and inputs are presented in the AQTA (Annex 4).

10.4.3 *Embedded Controls*

A number of ‘embedded controls’ have been included as part of the assessment scenario. That is they have been applied to the pre-mitigated scenario as they are considered to be standard activities based on information provided by China Union or as can be reasonably assumed for a project of this scale:

These include:

- Unloading ore from trains will be undertaken in an enclosed environment therefore emissions will be negligible.
- Conveying of material from train to stockpile area/ship, stockpile area to ship etc will be within an enclosed process therefore emissions will be negligible.
- The use of water sprays to help reduce emissions of fugitive dust/PM10 from the handling of material eg wheel and bucket reclaimers used to stack and reclaim ore from stockpiles.
- The use of water sprays to help reduce emissions of fugitive dust/PM10 from the stockpiles themselves.

More detailed information regarding the key sources identified, the modelling scenario determined, and modelling inputs are presented in the AQTA (Annex 4).

10.5 MODEL RESULTS – IMPACTS ON HUMAN HEALTH

10.5.1 *Background to Impact*

An initial scenario was defined to reflect operations occurring at the port. The assessment was performed based on the following parameters:

- Dust and PM10 ‘embedded mitigation’;
- Phase II Power Plant specifications include:
 - 32m stack;
 - 5 generators in operation;
 - generators operating at 90.6 percent of their maximum power output; and
 - Diesel containing 3.5 percent sulphur (conservative approach).

10.5.2 *Pre-mitigated Impact*

The scenario was developed using information contained within the project description. It assumes a number of ‘embedded’ mitigation measures and specifications considered as standard to a project of this size and nature (Section 10.4.3). Further information regarding these measures is presented in Annex 4. Modelling results related to this scenario are presented in Table 35.

The extent is considered local and the duration long term for all parameters (NO₂, SO₂ and PM₁₀) and the sensitivity of all receptors is considered medium.

SO₂

The magnitude of 10 the minute mean SO₂ concentration at all receptor sites is considered negligible resulting in an impact of Negligible significance (Table 35).

NO₂

The magnitude of annual mean NO₂ concentration is considered negligible at all receptor sites resulting in an impact of Negligible significance (Table 35).

PM₁₀

The magnitude of annual mean PM₁₀ concentration is considered negligible at all receptor sites resulting in an impact of Negligible significance (Table 35).

Dust

With regard dust deposition, Negligible impacts are found at every receptor location when comparing the PC to the criteria presented in Annex 4 (Table 35). However, observations from other iron ore export ports indicate that there is potential for fine iron ore dust to be windblown a small quantity can discolor buildings and deposit on outside surfaces. The extent of this issue cannot be quantified as it is dependent on the physical properties of the ore concentrate, therefore regular monitoring of dust deposition and its presence on outside surfaces will be undertaken.

Table 35: Significance of impacts at sensitive human receptors around the Port processing area: initial impacts

Receptor	NO ₂ 1-hour mean	NO ₂ 1-hour Mean	SO ₂ 24-hour Mean	SO ₂ 10-minute Mean	PM _{2.5} Annual Mean	PM ₁₀ 24-hour Mean	TSP 24-Hour Mean
Ballahtown	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Baple field	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Bong Mine Bridge	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Borbor town	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Caldwell	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Calwell Coffee Farm	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Carpet Street Com	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Catholic Clinic Com	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Central New Kur Town	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Colonel West	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Conner West Kur town	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Gbani Town Com	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Gbani Town Com	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Jemecaroad	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
King Peters Town	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kingdom Hall Com	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Little White	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Chapel							
Logan Quai Steet	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Logan Town Coal Yeah	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Logan Town Kukujumuku	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
LoganTownKollie Yeah	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Momo Town	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
MTC Community	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
New Kru Town	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Point 4 area	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Popo Beach Point 4	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Quai	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Sluton Creek	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Structon Creek	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Zolo Town	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

10.5.3 Recommended Mitigation Measures

The results presented above demonstrate that with the ‘embedded’ mitigation measures applied, negligible impacts are found at every sensitive receptor located in the vicinity of the Port processing area and associated infrastructure for SO₂, NO₂, PM₁₀ and TSP. No additional mitigation is therefore required to reduce the impact significance.

In addition to the embedded controls described above the following measures are recommended for management of dust:

- Damping of bulk earthworks areas;
- Dust suppression with water in combination with chemical suppressants if required to reduce dust generated by trucks traveling on haul roads;
- The use of variable height stackers and telescopic chutes to mitigate dust when loading stockpiles; and
- The use of windbreaks around stockpiles.

The air quality within the Mine and at sensitive receptors should be routinely monitored and compared to guideline levels and modelling results. Should routine exceedances occur China Union will develop a strategy to reduce ground level concentrations to below guideline concentrations.

Dust deposition monitoring will be undertaken weekly to determine the spread of iron or dust at and around the site. Visual assessments of buildings and outside surfaces will be made to see if fine iron ore dust is sticking to these surfaces. Should it be found that fine dust is adhering to surfaces or is wide spread further management options will be investigated and implemented to reduce the impact of iron ore dust deposition.

10.5.4 Residual Impact Assessment

The residual impacts at all sensitive human receptors in the vicinity of the Port processing area are found to be negligible.

Table 36 Impact of NO₂, SO₂, PM₁₀ and TSP at sensitive human receptors

Criteria	Impact Pre-mitigation	Residual Impact	Comment
Impact of NO₂, SO₂ and PM₁₀ at Sensitive Human Receptors			
Nature	Negative	Negative	
Type	Direct	Direct	The development of the port infrastructure has a direct impact on air quality.
Duration	Long term	Long term	Residual impacts associated with port will continue until closure of the port.
Extent	Local	Local	The extent of the impact is local.
Scale	Negligible	Negligible	Result of the impact assessment shows that the scale/magnitude of impact is negligible at all receptors.
Frequency	Continuous	Continuous	The emissions will be continuous throughout the life of mine and export operations.
Magnitude	Negligible	Negligible	Magnitude determined by PC and PEC. Impacts have been determined based on an undegraded airshed.
Criteria	Impact Pre-mitigation	Residual Impact	Comment
Receptor sensitivity	Medium	Medium	Approach assumes that the sensitivity for human health within the general population is Medium.
Significance			
	Negligible	Negligible	

10.6 IMPACTS ON VEGETATION

Mesurado Wetland is located in the city of Monrovia and within 2km of the proposed Port development. The site is identified as being important for the protection of three mangrove species including *Rhizophora harrisonii*, *R. mangle* and *Avicennia Africana*. The site also provides habitat and feeding ground for several species of birds including the African spoonbill *Platalea alba*, Common Pratincole *Glareola nuchaltis* and Curlew *Numenius arquata*.

Results from the detailed modelling assessment indicate that at no point do the SO₂ and NO_x annual mean concentrations exceed 2 µg/m³ and 3 µg/m³ respectively and are therefore less than 10 percent of the Critical Levels set for the protection of vegetation. As a result, these impacts are considered Negligible.

No specific information is available on the responses of various species to dust deposition; thus, no conclusions can be made on any impacts that may arise as a result of processes occurring at the Port.

11 NOISE IMPACT ASSESSMENT

11.1 INTRODUCTION

This Chapter presents the Noise Impact Assessment (NIA), performed to predict the impacts of noise on sensitive receptors in the vicinity of the Port during Phase 2 of the proposed development (the largest impact phase of the project).

The typical operational scenario for the Port includes the following activities which have the potential to impact on sensitive receptors:

- unloading of trains by excavators;
- conveying material to the stockyard;
- stacking and reclaiming material from the stockyard;
- conveying the material to the export wharf;
- loading of ships; and
- operation of the harbour.

The full Noise Impact Assessment is presented in Annex.

11.1.1 Overview of Impacts Assessed

The impact that has been assessed in this Chapter is:

- The noise impact of Port operations on sensitive receptors

11.2 SUMMARY OF BASELINE ENVIRONMENT

11.2.1 Long Term Measurements

Long term measurements were collected at one (1) location (P1) close to the Monrovia Freeport (Map 7-2). This location is considered to be representative of the acoustic environment, located in and around the Port.

At Site P1, continuous noise monitoring was conducted to provide an estimate of background noise levels and to understand the variation between the daytime and night time periods. The monitors automatically logged environmental noise measurement parameters including LAeq, LA90, LA10, LAMax and LAMin parameters.

The acoustic environment at P1 is relatively high due to its location close to the harbour. As such the ambient noise levels, LAeq, T and background noise levels, LA90, are considerably higher during the day and lower during the night time.

11.2.2 Short Term Attended Measurements

A series of attended short-term (day time) measurements were undertaken to identify the nature, character and dominant noise sources surrounding the Port. Short-term measurements were also undertaken at two (2) locations (S11 and S12) to verify the long-term measurement.

Short term noise levels measured at locations S11 and S12 are relatively high, being influenced mainly by construction and shipping activities. Noise levels would be expected to be lower the further from the Port receptors are located.

11.2.3 Noise Sensitive Receptors

There are a number of human receptors in the vicinity of the Port that have the potential to be affected during all phases of the proposed Project. Noise sensitive receptors within 2 km of the Port are listed in Table 37.

Existing ambient and background noise levels within the Project area and surrounds were measured to inform the impact assessment. The methodology for determining representative existing noise levels is described in Section 11.4.1.

An overview of the Study Area highlighting the location of the proposed Project, baseline noise measurement locations and noise assessment locations are shown in Map 7-2.

Table 37 Noise sensitive receptors within 2 km of the Port

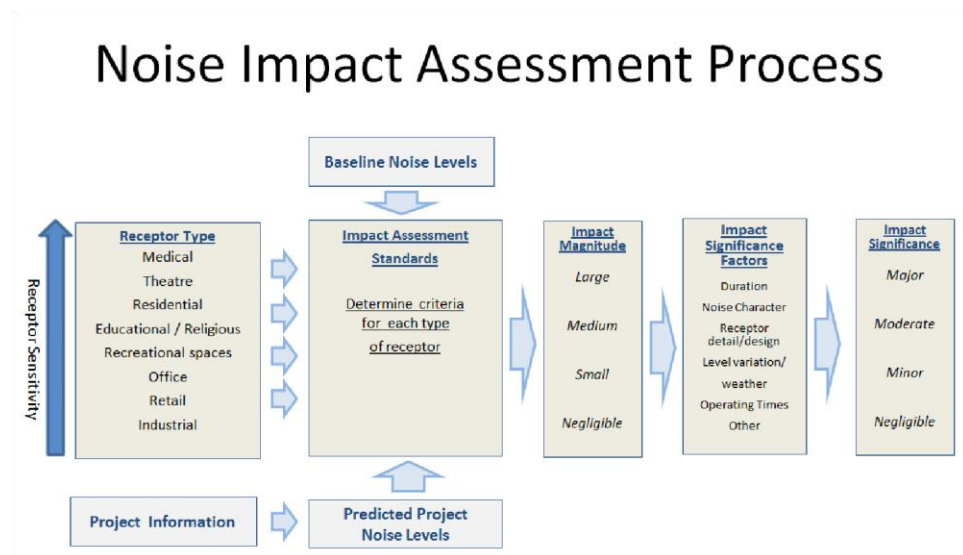
NIA ID	Name	Type	Proximity to Port (metres)
01	Logan Quai	Urban Residential	120
02	Zolo Town		250
03	Ballahtown		520
04	Kukujumuku		630
05	BapleField		680
06	King Peter		780
07	Kollie Yea		
08	Coal Yeah		850
09	CatholicCl		
10	White Chap		900
11	Gbardee		1000
12	Kingdom Ha		1100
13	Jemecaroad		1300
14	Gbani		1400
15	BongMineBr	Suburban Residential	1400
16	Popo Beach		1500
17	ColonelWes		1600
18	Point		1600
19	West Kur		1800
20	Borbor		1800

11.3 IMPACT ASSESSMENT METHODOLOGY

11.3.1 Evaluating Noise Significance

The impact significance process for noise is shown in Figure 26.

Figure 26 Noise Impact Assessment process



For noise impact significance, the assessment considers the type of receptor, draws on relevant standards or guidance to determine impact magnitude, and then considers any other factors which may determine significance.

Magnitude of Noise Impacts

Noise impact assessment standards and guidelines generally give threshold levels that have the potential to create nuisance or disturbance regardless of the existing noise levels, or they define changes in the noise levels above which significant noise impacts are expected. In using such guidance, it is necessary to scale impact magnitude into ranges required in impact assessment. IFC General EHS Guidelines: Air Emissions and Ambient Air Quality (2007) involve two requirements – to meet the allowable threshold noise levels or to not increase background noise levels by more than 3 dBA.

Determining Significance

As indicated in Figure 25. above, the step from impact magnitude to significance may involve considering factors that influence significance, but in cases where these factors are not required to be considered the magnitude descriptors Negligible, Small, Medium and Large would be replaced

by the significance descriptors Negligible, Minor Moderate and Major respectively as presented in Table 38.

Table 38 Noise Impact Significance terminology

Impact Parameter		Impact Significance - Daytime or Night time			
		Negligible	Minor	Moderate	Major
Disturbance Impact Project Noise Level (PNL), LAeq,1hr dB	Daytime	<50	50-55	>55-60	>60
	Night time	<40	40-45	>45-50	>50
Amenity Impact Daytime or Night time LAeq,PNL – LA90,ABL dB		<5	5-10	>10-15	>15

The threshold noise levels summarized in Table 38. are the values where noise impacts are expected to occur. Impacts rated as moderate or above should be mitigated where practicable with proportionately more emphasis as the rating increases.

Significance Influencing Factors

Examples of factors that may influence significance, beyond that taken into account in the guidelines used to assess impact magnitude include:

- Duration of impact;
- Time of day impact occurs;
- Character of noise;
- Receptor detail or design; and
- Meteorological conditions.

11.4 MODELLING

11.4.1 Noise Prediction Methodology

Brüel & Kjaer's Predictor V8.12 noise modelling software was used to calculate noise emissions from the Project utilizing the widely used international standard ISO 9613-2 (1) combined with the meteorological effects as determined by the widely accepted CONCAWE calculation method.

The model incorporates identifiable noise source data, meteorological data, surrounding terrain characteristics and the barrier effects of nearby buildings and structures. The model may be used to predict the contributed noise levels from the proposed operations at the nearest potentially affected receptors for several operating scenarios.

Significant noise sources considered in the assessment are:

- Unloading of trains by excavators;
- Conveying material to the stockyard;
- Stacking and reclaiming material from the stockyard;
- Conveying the material to the export wharf;
- Power generators;
- Loading of ships; and
- Operation of the harbour.

11.5 NOISE IMPACTS ON SENSITIVE RECEPTORS DURING OPERATIONS

11.5.1 *Background to Impact*

Due to various operations which will be taking place at the Port as described in Section 11.4.1 certain amounts of noise will be generated during both day and night time which have the potential to have a nuisance impact on nearby sensitive receptors. However, it must be remembered that the Port is located in a busy industrial area and there are also a number of other activities taking place which result in high background noise (Section 7.8.2).

11.5.2 *Pre-mitigated Impact*

Daytime Operations

Noise levels from Port operations during the daytime period are predicted to comply with the 55 dB LAeq,1hr IFC threshold at all receptors (Table 39). The impact assessment process results in Negligible significance impacts at all receptor locations except at Logan Quai receptor location immediately to the East of the Port (Table 39) which is expected to experience Minor significance impacts during the day (Map 11-1).

The dominant noise source from Port operations contributing to the high noise level at the receptor Logan Quai, Zolo Town and Ballahtown is primarily due train unloading operations and the transfer conveyor to the stockyard.

(1) International organization for Standardization (ISO), (1996); International Standard 9613-2: Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation.

Night time Operations

Noise levels from Port operations during the night time period are predicted to comply with the 45 dB LAeq,1hr IFC threshold at most receptors except for a few sites. These sites include Logan Quai, which exceeds the threshold values by 7 dB () and as such the pre-mitigated impact at this location is assessed to be of Major significance (Map 11-2).

Also impacted is Zolo Town which exceeds the threshold values by 3 dB. The impact at Zolo Town at night is assessed to be Moderate due to a slightly further distance from the noise source.

There are also a number of receptor sites that are assessed to have a minor night time noise impact. These are:

- Ballahtown;

- Kukujumuku;
- King Peter;
- Gbardee; and
- Bong Mine Br.

11.5.3 *Recommended Mitigation and Management*

The assessment has identified the potential for Minor, Moderate and Major significance noise impacts.

Minor impacts will be managed by adoption of good site practices during operation including:

- Locating plant (e.g. compressors, generators) as far from the nearest potential sensitive receptors as possible, orienting it to direct emissions away from receptors as far as possible, and using on-site structures and terrain to screen sensitive locations wherever practicable.
- Operating strict speed limits for all vehicles moving around the site and maintaining road surfaces to avoid increases in noise from vehicles travelling over uneven ground.
- Regular maintenance of equipment and vehicles in accordance with manufacturer specifications to prevent increases in noise emissions.
- Planning vehicle routes to minimize the need for reversing and using of audible reversing alarms only when necessary for health and safety; and
- Considering noise performance in the selection of equipment and vehicles.

Where future predictions or monitoring indicate that Moderate or Major impacts will occur at any dwellings, consideration will be given to the design of mitigation measures including:

- Relocating noise sources so that there is no direct line of sight between the source and receptors;
- Selection of alternative lower noise equipment;
- Installation of noise shielding on noisy sources;
- Use of noise barriers (berms or fences) located between the noise source and the receptor; and
- Receptor improvements such as provision of windows for houses.

Table 39 Noise Impact Assessment results

		Predicted LAeq1hr (dB)		Background LA90 (dB)		Impact Rating Disturbance		Impact Rating Amenity	
Name	Description	Day	Night	Day	Night	Day	Night	Day	Night
01	E Logan Quai_18	52	52	60	49	Minor	Major	Negligible	Negligible
02	SE Zolo Town_30	48	48	60	49	Negligible	Moderate	Negligible	Negligible
03	E Ballahtown_1	42	42	60	49	Negligible	Minor	Negligible	Negligible
04	E Kukujumuku_20	41	41	60	49	Negligible	Minor	Negligible	Negligible
05	SE BapleField_2	34	34	60	49	Negligible	Negligible	Negligible	Negligible
06	E King Peter_15	41	41	60	49	Negligible	Minor	Negligible	Negligible
07	E Kolie Yea_21	38	38	60	49	Negligible	Negligible	Negligible	Negligible
08	E Coal Yeah_19	39	39	60	49	Negligible	Negligible	Negligible	Negligible
09	E CatholicCl_8	38	38	60	49	Negligible	Negligible	Negligible	Negligible
10	E White Chap_17	37	37	60	49	Negligible	Negligible	Negligible	Negligible
11	E Gbardee_13	41	41	60	49	Negligible	Minor	Negligible	Negligible
12	E Kingdom Ha_16	36	36	60	49	Negligible	Negligible	Negligible	Negligible
13	E Jemecaroad_14	39	39	60	49	Negligible	Negligible	Negligible	Negligible
14	E Gbani_12	39	39	60	49	Negligible	Negligible	Negligible	Negligible
15	NE BongMineBr_3	40	40	60	49	Negligible	Minor	Negligible	Negligible
16	N Popo Beach_26	39	39	60	49	Negligible	Negligible	Negligible	Negligible
17	N ColonelWes_10	33	33	60	49	Negligible	Negligible	Negligible	Negligible
18 19	N Point 4_25	38	38 35	60	49	Negligible	Negligible	Negligible	Negligible
	N West Kur_11	35		60	49	Negligible	Negligible	Negligible	Negligible
20	N Borbor_4	23	23	60	49	Negligible	Negligible	Negligible	Negligible

21	N CarpetStre_7	33	33	60	49	Negligible	Negligible	Negligible	Negligible
22	N MTC_23	32	32	60	49	Negligible	Negligible	Negligible	Negligible
23	N Sluton_28	28	28	60	49	Negligible	Negligible	Negligible	Negligible
24	NE Structon_29	34	34	60	49	Negligible	Negligible	Negligible	Negligible
25	N New Kur_9	33	33	60	49	Negligible	Negligible	Negligible	Negligible
26	N Momo Town_22	31	31	60	49	Negligible	Negligible	Negligible	Negligible
27	N New Kru_24	32	32	60	49	Negligible	Negligible	Negligible	Negligible
28	NE CalwellCof_6	17	17	60	49	Negligible	Negligible	Negligible	Negligible
29	NE Caldwell_5	16	16	60	49	Negligible	Negligible	Negligible	Negligible
30	NE Quai_27	17	17	60	49	Negligible	Negligible	Negligible	Negligible

11.5.4 *Residual Impact Assessment*

The assessment has identified the potential for Minor, Moderate and Major noise impacts during operation at some nearby settlements and during Port operations during the night time period. The dominant noise source from Port operations contributing to the high noise level at the receptor Logan Quai, Zolo Town and Ballahtown is primarily due train unloading operations and the transfer conveyor to the stockyard.

Logan Quai is relatively close to the operation (150 metres), whereas Zolo Town and Ballahtown are further afield, but they are all generally affected by the same noise source.

A reduction in noise level from the train unloading operation could be achieved through following some of the basic principles of noise control as outlined in Section 11.5.3. Reducing the noise emitted from the locomotive (by at least 5 dB) whilst pulling through the car dumper would result in an impact reduction to Moderate. This could be achieved from the installation of a noise barrier along the eastern boundary, shielding those receptors situated immediately adjacent to the Port facility from all the noise sources. The implementation of such a barrier would reduce impacts at Logan Quai, Zolo Town to Minor.

12 SOCIAL IMPACT ASSESSMENT

This chapter provides an assessment of potential socio-economic impacts from the proposed Project at the Port.

The Environmental and Social Impact Assessment (ESIA) methodology is outlined in Chapter 4. This section details how the magnitude and significance of these impacts are assessed, taking into account the vulnerability of the receptors and resources affected, and their associated ability to adapt to changes. The approach to the assessment has been informed by the ERM Impact Assessment Standard.

The approach to this ESIA was to identify the potential impacts and assess those likely to be significant. Impacts that were judged unlikely to be significant were scoped out from the assessment during the scoping phase. Potential impacts are presented as worst cases (or ‘pre-mitigation impacts’) as they do not consider the implementation of mitigation measures.

The assessment then presents the mitigation measures the Project will implement to avoid, reduce, remediate or compensate for potential negative impacts and enhance positive benefits of the Project. The impacts that remain following implementation of the mitigation measures (called residual impacts) are then assessed.

12.1 METHODOLOGY

12.1.1 Screening

Screening was conducted at the initial stage of the SIA, based on analysis of a high-level project description, to determine the relevant legal and regulatory framework governing the Project.

12.1.2 Scoping

The scoping phase consisted of a site visit, ground-truthing and engagement with key informants and stakeholders to establish the potential area of influence for the Project (and thus determine the appropriate study area). The information collected was used to analyse potential interactions between the Project and identified sensitive resources/receptors and to assess the likely impacts. The impacts were then prioritized in terms of their potential significance for those receptors. The scoping exercise is intended to ensure that the IA is focused on those key material issues and risks to the project and its host environment.

Data gaps in the socio-economic environment of the study area were identified during the scoping studies carried out by ERM in August 2011. The baseline studies carried out as part of the SIA were designed to address these gaps through appropriate primary data collection. Research methodologies used during the baseline studies included a statistically representative household survey; a rapid health survey of local infrastructure and services in the Initial Concession Area affected by Project activities and along the railway; and finally, focus group discussions to understand land tenure practices and governance structures amongst potentially impacted land users in the Non Gomma Deposits Area.

12.1.3 Impact Assessment

The Impact Assessment evaluates the significance of potential impacts by determining the vulnerability (ability to adapt to change) of social receptors (people and communities) combined with the magnitude of the expected change as a result of the Project. The significance of the ‘worst case’ or prelitigation impact is first assessed. Appropriate mitigation measures are then identified with the aim of minimizing the negative effects and enhancing the positive benefits of change, thereby reducing the receptor vulnerability and limiting the magnitude of the impact. Mitigation measures are applied, and the significance is again assessed to give a residual or post-mitigation impact. This approach is described more fully below.

Defining Vulnerability

Vulnerability describes the sensitivity of the receiving environment, ie of social receptors that experience impacts. It is a pre-existing status that is independent of the Project or any Project related activities. A vulnerable receptor may experience adverse impacts more severely than others based on their susceptible or disadvantaged status. A higher level of vulnerability can result in increased predisposition to negative impacts or a limited ability to take advantage of positive impacts.

Vulnerable receptors lack one or more livelihood assets that could help them respond to or manage specific changes (Figure 27).

Figure 27 Components of Livelihood: Capital

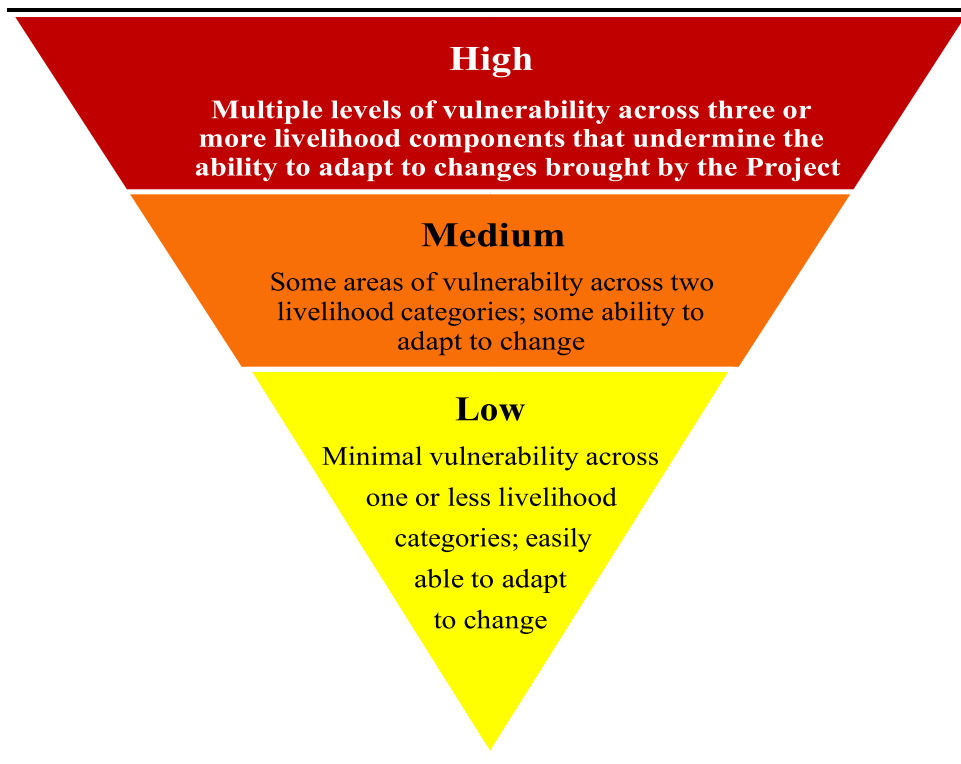
Physical Capital	•Access to infrastructure and equipment such as schools and health facilities
Social Capital	•Access to social networks and organizations such as religious and cultural institutions
Economic Capital	•Diversity of livelihoods; access to cash, savings, income
Human Capital	•Access to skills and knowledge; and overall community health and nutritional status
Natural Capital	•Access to and dependancy on natural resources such as water, land, and timber

Vulnerability is rated by the assignment of levels low, medium, or high based on the receptor’s lack of access to livelihood assets and on their relative access to transforming structures or processes, namely legal, political or cultural structures that may exacerbate their vulnerable status. The vulnerability levels are defined as follows, and shown in Figure 28:

- Low: Lack of one or less livelihood components;

- Medium: Lack of two livelihood components; and
- High: Lack of three or more livelihood components.

Figure 28 Levels of Vulnerability



Differential Vulnerability

Vulnerability status is often shared by a collective or group of individuals with common living standards, and similar access to capital. It is important to note, however, that vulnerability can also vary significantly amongst individuals or sub-groups within a population where some may be considered more vulnerable or susceptible to change than others due to their specific characteristics and ability to adapt in a given context. Similarly, some receptors may flourish as a result of a change which is negatively experienced by others.

Defining Magnitude

Magnitude of social and community impacts is understood as a reflection of the ‘size’ or degree of change caused by Project impacts. Magnitude is a function of one or more of the following characteristics which are applied when analyzing impact:

- Extent;
- Duration;
- Scale;
- Frequency; and
- Likelihood (for unplanned events only).

Designation of magnitude is depicted in Table 40.

Table 40 Magnitude of Change

Designating Magnitude	Description
Negligible	Change remains within the range commonly experienced within the household or community.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of households and is of short duration.
Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional, and impact may be regional.
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the Area of Influence and/or persists over many years. The impact may be experienced over a regional or national area.
Positive	In the case of positive impacts, magnitude is not assigned.

12.1.4 Impact Significance

Once vulnerability and magnitude have been characterized, significance is assigned for each impact as seen in Table 41.

Table 41 Impact Significance

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

12.2 LIST OF IMPACTS

The following impact has been assessed in this impact assessment.

- Economy and Livelihoods Impacts
- Impacts to fisheries-based livelihoods; and
- Positive economic benefits arising from increased activity at the port.

Community Health and Safety Impacts

- Community injuries and fatalities due to road traffic accidents;
- Community injuries and fatalities due to accidents at the Port Project site and in offshore shipping routes;
- Increased prevalence of communicable diseases, malaria and other vector borne diseases and HIV/AIDs and sexually transmitted infections; and
- Increase in untreatable health issues due to pressure on health services.

12.3 AREA OF INFLUENCE

Three separate but interlinked social studies were prepared as part of the Social Impact Assessment for the Project. The studies included a Socioeconomic Household Survey, a Land Tenure Study and a Health Baseline. Based on information gathered from the Scoping Study and initial conversations with stakeholders during the Stakeholder Engagement exercise, the directly impacted population for the China Union Mine Expansion Project (Port component) have been defined as communities within 1 km of the Port area as presented in Map 8-1.

12.4 EXISTING SOCIO-ECONOMIC ENVIRONMENT AT THE PORT

The Freeport Area was originally inhabited by the Kru people from Grand Kru that migrated there to work in the port and to fish; however, the Port Area has drawn many other populations with the promise of employment. The island has a thriving real estate sector and new houses are still being built. Due to the relatively low-lying land on Bushrod Island, it is difficult to dig wells, and those that were dug cannot be used for drinking water due to flood water contamination. The population relies on water from pipes and reservoirs from the municipality that often only supply water for a few hours a day. The surrounding swamps provide important farm and gardening land in the dry season.

12.5 OVERALL VULNERABILITY ASSESSMENT

Based on the baseline data collected and key informant interviews, an understanding was developed of how the proposed project will affect social, economic and health status of the PAPs in the Port Area. Their relative vulnerability was assessed in terms of their relative access to different forms of capital (Figure 27).

The analysis indicated that nearly all of the population in the Port Area lack access to livelihood assets/ capital across one of the five components:

- Economic Capital: Communities in the Port Area generally have good access to economic capital. The Port Area has drawn many other populations with the promise of employment and thus has a thriving real estate sector. The economy in residential areas surrounding the Port is based in petty trade in farm/garden produce, fish, charcoal and many other items,

bolstered by a casual labour market for employment. The largest income generating activities in the area come from a mix of government, retail, wholesale, remittances, and fishing. Receptors in the Port Area are not considered vulnerable in this livelihood category; however, certain groups such as females, children, and the elderly may be more economically vulnerable sub-groups.

- **Natural Capital:** The communities living in the Port Area have good access to natural resources; however, due to the relatively low-lying land on Bushrod Island, it is difficult to dig wells. The population relies on water from pipes and reservoirs from the municipality that often only supply water for a few hours a day. The livelihood dependency on water increases peoples' vulnerability in this category should they lose access to it.
- **Physical Capital:** Those living in the Port Area have good access to community facilities and services. The average walking time for Port Area communities to nearest facilities and services (schools, health clinics, markets) is five minutes to the nearest primary school, 12 minutes to the nearest police station, and seven minutes to the nearest clinic. The population is therefore not considered particularly vulnerable with respect to access to physical capital in the Port Area.
- **Human Capital:** Communities in the Port Area have good access to skills, education, health and human capital in the form of labour and human capacity. There is good and regular supply of skilled and unskilled labour. Women and girls however may be particularly vulnerable sub-groups with respect to access to human capital, especially in terms of their relative access to education.
- **Social Capital:** Communities in the Port Area have relatively strong social capital in terms of social and community networks and religious and cultural organizations. There is high community participation in church groups, youth groups, and political parties. All members of communities in Port Area can be considered to have low vulnerability with respect to access to social capital.

Based on the above assessment the overall vulnerability rating of the Port Area is considered to be Low.

12.6 IMPACTS ON ECONOMY AND LIVELIHOODS

Key economy and livelihood baseline characteristics of the Port Area are described below.

This zone comprises a sizeable population who are within the Monrovia urban district but outside the city proper. They are not simply spread in a neat and measurable radius around the city hinterland but extend particularly along and near the main roads. They are semirural in that they have land on which they produce at least vegetables if not also a little cassava, and they commonly keep poultry. But their economy is more or less completely defined by the city: they sell vegetables and chickens to it, they perform casual employment in it, and they are part of the chain of petty trade in farm/garden produce, fish, charcoal and many other items. Above all, the staples they eat, especially rice, are purchased. Fishing is fifth largest income generating activity behind government, retail, wholesale, and remittances.

12.6.1 Impacts to Fisheries based Livelihoods

Background

Construction activities such as excavation and fabrication, as well as the operation of moving equipment such as vehicles and conveyors will be required to prepare the existing infrastructure at the Port for the Project. Dredging of the Port will also take place throughout construction and maintenance dredging will continue during the life of the Project, though on a smaller scale than during construction. The exporting of the iron ore will also increase vessel traffic to and from the Port.

The increased noise and vibration levels associated with Project activities in the Port Area will act in combination with dredging activities to potentially repel fish species from the surrounding waters. The degradation of water quality due to wind-blown dust, ballast discharges or storm water/ waste water discharges could result in the marine habitat becoming unsuitable for marine species and shipping discharges may result in contamination of the water column and introduction of alien species.

The activities described above are anticipated to affect the availability of fish, potentially resulting in impact to the food gathering and income generation abilities of local communities who may in part depend on fisheries-based livelihoods (including both those undertaking fishing and those who sell fish).

Fishermen utilizing piers to fish at Monrovia Free Port are not expected to be impacted by the Project, as the China Union Port is located within a gated area and is inaccessible to those without authorization.

Magnitude

The potential decrease in income generating shore-based livelihood activities will be a locally felt impact on the communities who conducting fishing in and around the Port Area. For those economically displaced the impact will be long term in duration, as vessel activity and other Project activities within the Port will be elevated throughout construction and operation and will not be reduced until, or for some time after, the mine has been decommissioned.

The degree of change to livelihoods affected by such a change will likely be on a small scale, as alternative locations to undertake fishing activities could feasibly be sought, alternative sources of livelihood are more easily accessible and the numbers of those potentially affected are expected to be low. The impact could however affect a medium degree of change if measures to mitigate in shore pollution arising from Project activities in and around the Port are not implemented. In most cases, given it is a change that is initiated during construction and the affected areas in and around the Port are not likely to be remediated, the impact will occur only once and will be constantly felt.

These factors will result in an impact with a medium overall magnitude.

Impact Significance

The combined low vulnerability of the majority of receptors and medium magnitude of the impact and the pre-mitigated impact is considered to be of Minor significance.

Recommended Mitigation Measures

In order to mitigate the impacts to fisheries-based livelihoods China Union will:

Develop a needs-based assessment through community consultation which will take into account production activities by men, women, and youth. For the fishing programme, studies will specifically:

- Determine the fishery resource, catch effort and value.
- Establish options for alternative fisheries and /or livelihood; and conduct annual wet and dry season monitoring of the fish species, fishery, seabed sediment and water quality.
- Implement a fisheries management plan.

Residual Impact Assessment

It is anticipated that with the implementation of these mitigation measures the Project will assist communities with accessing alternative resources to conduct fishing and restore any livelihoods which are potentially lost, thereby slightly reduce the impacts of economic displacement. As a result, the significance of the residual impact on fisheries-based livelihoods is expected to reduce to Minor to Negligible during construction and operations.

Table 42 Impacts to fisheries-based livelihoods

Criteria	Impact Pre-Residual	Comment mitigation impact
Impact- Impacts to Fisheries Based Livelihoods		
Nature	Negative	Direct impacts will be experienced through the potential deterioration of fish populations around the Port due to Project related activities.
Type	Direct	Project activities which may result in the deterioration of fish populations will occur throughout the Project life cycle, including for some time after mine decommissioning
Duration	Long Term	Impact will be locally limited to the Port area.
Extent	Local	Constant Impact will occur during construction, and throughout the operational life of the Project and Port.
Frequency	Constant	Alternative locations to undertake fishing Medium activities could feasibly be sought and only a small number are likely to be affected, with fishing making up only part of their livelihood. The degree of change to livelihoods is likely to be small provided mitigation measures are applied which prevent excessive pollution taking place in and around the Port, and ensure alternative options are accessible for fisheries/other livelihoods
Scale	Small to Medium	Alternative locations to undertake fishing Medium activities could feasibly be sought and only a small number are likely to be affected, with fishing making up only part of their livelihood. The degree of change to livelihoods is likely to be small provided mitigation measures are applied which prevent excessive pollution taking place in

		and around the Port, and ensure alternative options are accessible for fisheries/other livelihoods
Magnitude	Medium	Medium/Low The reduction in the degree of change to community livelihoods through mitigation efforts will reduce the magnitude of the impact
Receptor Vulnerability	Low	The communities in the Port Area have a low vulnerability to impacts to fisheries-based livelihoods, given that the majority possess the means to generate income and subsistence from other sources.
Significance		
	Minor	Minor to Negligible

12.6.2 Economic Benefits from Increased Activity at the Port

The Project construction activities at the Port, and the subsequent increase in the throughput of goods could result in a marginal intensification of the informal and formal trade and service industries occurring in the vicinity. Although the Project will offer few opportunities for direct employment at the Port, as workers are likely to travel to and from Freeport from their homes in different parts of Monrovia, a small increase in economic opportunities may arise for those who are already involved in the trade and service industry in the areas surrounding the Port. Those with businesses or trades (both formal and informal) selling products required by the Project and its workforce may benefit from an increase in demand (for example for basic building materials to the construction supply chain, for the provision of foodstuffs, beverages and other goods, or the provision of cleaning services) outside the Port gates and in the commercial areas surrounding the Port.

Magnitude

The positive impact will be locally felt by those involved in petty trade and services industry around the Port. The impact will be temporary, as it is most likely to occur during construction only, and potentially for some time during operation although the size of the Port workforce will become insignificant once construction is complete. The degree of livelihood change within affected communities is likely to be small since the majority of workers will probably be provided with accommodation, food, and other services by the port contractors and local spending will be limited. The impact will occur more often during Project construction but may also occur occasionally during operation.

The above factors have the potential to result in a Minor positive impact on the trade and service industry around the Port.

Recommended measures to enhance the positive impact

- In order to enhance positive impacts on the local economy the Project will:
- Conduct needs assessments to understand local demand, supply and community priorities; and

- Establish relevant capacity building initiatives to support the local business and service industry's ability to meet the Project requirements, based on audit results and needs assessments.

Residual Impact Assessment

With the application of the above enhancement measures it is anticipated that the significance of the positive impact for the communities of the Port Area will remain Minor positive.

Table 43 Economic benefits from increased activity at the Port

Criteria	Impact Pre-Residual		Comment mitigation impact
Impact – Economic Benefits from increased activity at the Port			
Nature	Negative		Direct impacts will be experienced through the potential deterioration of fish populations around the Port due to Project related activities.
Type	Direct		There is the potential for positive impacts to be felt from the direct procurement of goods and services relating to the Project, and indirectly from the provision of goods and services outside the Port gates as a result of the Project’s presence in the area.
Duration	Short Term	Short Term	Given that the demand for goods and services, and spending induced by the Project is already low, the impact will likely occur predominantly during construction, when Project demands will be highest. With enhancement measures measures the positive impact could also be extended throughout the Project’s operational life.
Extent	Local	Local	If economic benefits do arise, they will be locally felt close to the Port Area.
Frequency	Constant		Alternative locations to undertake fishing Medium activities could feasibly be sought and only a small number are likely to be affected, with fishing making up only part of their livelihood. The degree of change to livelihoods is likely to be small provided mitigation measures are applied which prevent excessive pollution taking place in and around the Port, and ensure alternative options are accessible for fisheries/other livelihoods
Scale	Small to Medium		Alternative locations to undertake fishing Medium activities could feasibly be sought and only a small number are likely to be affected, with fishing making up only part of their livelihood. The degree of change to livelihoods is likely to be small provided mitigation measures are applied which prevent excessive pollution taking place in and around the Port, and ensure alternative options are accessible for fisheries/other livelihoods
Magnitude	Medium		Medium/Low The reduction in the degree of change to community livelihoods through mitigation efforts will reduce the magnitude of the impact
Receptor Vulnerability	Low		The communities in the Port Area have a low vulnerability to impacts to fisheries-based livelihoods, given that the majority possess the means to generate income and subsistence from other sources.
Significance			
	Minor (+VE)	Minor (+VE)	

12.7 IMPACTS ON COMMUNITY HEALTH AND SAFETY

12.7.1 Introduction

Key community health and safety characteristics of the Port Area are described below:

- Community boats that utilize the Port Area may be paddle or sail powered and therefore limited in speed and maneuverability or use unreliable outboard motors;
- Amongst vehicle users and pedestrians there is poor road safety awareness and limited enforcement of traffic rules. Children are generally considered to be at particular risk due to a lack of awareness of road traffic safety issues;
- The average walking time to the nearest hospital is 29 minutes and the average walking time to the nearest clinic is seven minutes.

12.7.2 Injuries and Fatalities due to Road Traffic Accidents

There will be an increase in Project traffic on access roads around the Port Area during construction and operations due to the following factors:

- Transport of construction equipment and materials using large trucks heavy plant and machinery; and
- Transport of operational goods and personnel including trucks, light duty vehicles, buses and cars.

The Project could also lead to increases in traffic on public roads as a result of increased employment (direct and indirect), and increased movements associated with other small businesses and movements of migrants. Increased road traffic, the likelihood of poor adherence to road traffic safety measures by Project vehicles, combined with poor community safety awareness will increase the risk of road traffic accidents occurring. This has the potential to result in injuries or fatalities to road users and pedestrians.

Magnitude

Accidents could occur involving Project vehicles along the road networks within Monrovia. The duration of potential safety impacts from a traffic accident will be long term throughout the operational life of the mine and Port, with a more concentrated period of risk during the construction of the Port. The scale of the impact is considered to be high where severe cases of injuries sustained lead to death or permanent health problems that affect livelihood activities or lead to a fundamental change in the way of life for an individual. The weak capacity of local hospitals to deal with trauma patients further adds to the risk of permanent and severe injuries that can be sustained by those without access to appropriate medical attention. Expected level of frequency is often and accidents are likely to occur at least once a month in the absence of mitigation

These factors will result in a potential impact with a large overall magnitude.

Impact Significance

The combined low vulnerability of receptors and large magnitude of the impact gives the potential, prior to mitigation for an impact of Moderate significance.

Recommended Mitigation Measures

In order to mitigate safety impacts to community members related to traffic accidents, China Union will:

- Educate local communities (targeting children) on road traffic laws and road safety in partnership with local authorities and the police.
- Promote road safety amongst Project personnel through roll out of a compulsory road rules and driver safety awareness training at induction, for all staff driving vehicles and operating machinery.
- Strictly enforce drug and alcohol policies in relation to Project drivers and undertake regular and random.
- Test drivers in response to suspicious behavior;
- Require Project drivers to be trained in defensive driving and provided regular refresher courses.
- Develop a Traffic Management Plan covering vehicle safety, driver and passenger behavior, use of drugs and alcohol, hours of operation, rest periods and accident reporting and investigations.
- Install signage using accessible language and or symbols on the approach and at the entrance and within the Port Area indicating speed limits, junctions and crossing points where required.
- Establish preparedness and response capabilities to deal with any road traffic or other accidents that may occur including multiple casualty events.

Residual Impact Assessment

The implementation of the above measures will ensure that the Project minimizes the risk of road accidents occurring in the Port Area.

Despite the implementation of the above mitigation, the potential for accidents resulting in casualties or fatalities remains; however, the frequency decreases from often to rarely. As such the significance of the residual impact is considered to reduce from Moderate to Minor as depicted in Table 44.

Table 44 Community injuries and fatalities due to road traffic accidents

Criteria	Impact Pre-Residual	Mitigation Impact	Comment
Impact – Community injuries and fatalities due to accidents on the Port Project site and offshore shipping routes			
Nature	Negative		
Type	Direct/Indirect		

Duration	Long-term	Long-term	There will be potential for accidents during the entire project life cycle.
Extent	Local	Local	The impact will only occur around the Port area.
Frequency	Often Rarely	Reduced due to safety	Awareness training, traffic management planning and community education.
Scale	Medium	Low	Scale is reduced significantly due to improvements in hospital capacity to handle casualties and trauma cases.
Magnitude	Medium Low		Reduced after mitigation measures, which target scale and frequency
Receptor	Low	Low	Awareness of traffic already high in an urban area, however, risk remains high for children.
Significance			
	Moderate	Minor	

12.7.3 *Injuries and Fatalities due to Accidents at the site onshore and offshore*

Background

Onshore

The Project will involve a rapid increase in the use and transportation of heavy plant, equipment and machinery and construction materials in the Port onshore area. Accidents related to site trespass at the Port could lead to trauma related injuries and fatalities associated with heavy machinery and equipment onshore.

Offshore

In addition, the Project will introduce a new and diverse range of maritime activity to the area including small and large shipping and maritime engineering work such as maintenance dredging work. These kinds of Project activities will be outside the scope of experience of many local water users.

Smaller boats/commuter vessels have the potential to come into contact with Project vessels. Such accidents affect not only fishermen in canoes and other boats but also ferries and boats used to transport goods. Accidents are possible assuming the following for local boats:

- Local fishing and other vessels are unlikely to be operated by crew formally trained in accordance with the standard maritime ‘rules of the road’ as covered by the International Regulations for Prevention of Collisions at Sea, or with formal harbour pilotage schemes such as IALA buoyage systems.
- Boats are frequently overloaded (with people, goods or fish).

- Small boats or canoes may go further out to sea where the conditions are more hazardous.
- Motors have a tendency to break down leaving boats without means of propulsion when out at sea.
- Smaller vessels are unable to haul anchor or maneuver quickly.
- Many boats are paddle or sail powered and therefore limited in speed and maneuverability or use unreliable outboard motors.
- Smaller boats are also vulnerable to sea state and their crews are generally poorly equipped and not formally trained.
- Fishing activities may require boats to temporarily anchor, or trawl nets or lines which may further reduce speed and maneuverability.
- They may not recognize hazard warning lighting configurations used by vessels
- Local vessels are also less likely to be equipped with radar or radar reflectors, communications systems such as VHF Radio or effective lighting at night

These likely impacts are compounded by the fact that the larger Project related vessels:

- Will be slow but may still move at a greater speed than small local paddle or sail craft.
- Have a restricted ability to maneuver due to draft, slowing distances and large turning circles, or may be engaged in dredging operations and will also have restricted visibility.
- Closer to shore large vessels will commonly be under tow which may involve the use of heavy cable between the tug and the vessel under tow. This can create hazards to other shipping and marine activities such as local fishing.

Magnitude

Accidents could occur on site at the local level within the Port area or offshore.

The duration of safety and health impacts will be long term throughout the operational life of the mine and port. The scale of the impact is considered large in severe cases where injuries sustained lead to death or permanent health problems that affect livelihood or lead to a fundamental change in the way of life for an individual. The weak capacity of the local health services to deal with trauma patients further adds to the risk of permanent and severe injuries that can be sustained by those without access to appropriate medical attention. Expected level of frequency is occasional for accidents in and around the Port, since the area will be fenced and security patrolled, but often for accidents in offshore shipping routes.

These factors have the potential to result in an impact of Medium to Large overall magnitude.

Impact Significance

The combined low vulnerability of receptors and medium to large magnitude of the impact, gives the potential, prior to mitigation for a Minor to Moderate impact to community members during the construction and operations phases.

Recommended Mitigation Measures

To mitigate community safety impacts related to injuries and fatalities occurring on the Port Project site both onshore and offshore, China Union will:

- Maintain manned security-controlled access to the Port area.
- Take reasonable measures to discourage entry by the public into operational areas.
- Implement site safety and security measures such as signage; access control and security patrolling of high-risk operational areas at the Port.
- Roll out community marine safety awareness and education in the Port Area regarding the marine operations, vessel movements and risk. This will run throughout the duration of construction and during the initial years of operation. These sessions will be aimed at fishermen and all other receptors that use the Port and offshore areas and will highlight the dangers of being in the vicinity of marine activities. It will include sessions aimed at school children as well as community events.
- Undertake all maritime operations in line with International Maritime Law and safe practice including measures such as:
 - Use of patrol vessels to enforce work area zones of managed vessel traffic around structures or vessels; and
 - Announce entry of large vessels and advise fishermen to vacate the area when necessary; and
 - Demarcate approach channels with buoys and navigation aids to warn fishermen using the channels;

Residual Impact Assessment

The implementation of the above measures will ensure that the Project minimizes the risk of community injuries and fatalities due to accidents at the Port Project site and in offshore shipping routes. Despite the implementation of the above mitigation, the potential for accidents resulting in casualties or fatalities remains; however, the frequency decreases from often to rarely. The scale is also significantly reduced with investment and improvements to hospital facilities in the area, so that if trauma does occur as a result of community injuries and fatalities due to accidents at the Port Project site and in offshore shipping routes measures can be taken to reduce severity of health outcomes including death. As such the significance of the residual impact is considered to reduce to Minor as depicted in Table 45.

Table 45 Community injuries and fatalities due to accidents at the Port project site and in offshore shipping routes

Criteria	Impact Pre-Residual	Mitigation Impact	Comment
Impact – Community injuries and fatalities due to accidents on the Port Project site and offshore shipping routes			
Nature	Negative		
Type	Direct	Direct	No change

Duration	Long-term	Long-term	Throughout construction and operations
Extent	Local	Local	No change
Frequency	Often Rarely	Reduced due to safety	Awareness training, traffic management planning and community education.
Scale	Often/Occasional	Rarely	Reduced due to safety awareness training, community education, security measures, and undertaking maritime operations in line with International Maritime Law and safe practice
Magnitude	Medium Low		Medium Reduced after mitigation measures, which target scale and frequency
Receptor Vulnerability	Low	Low	Awareness will increase with community safety education and with Project presence over time.
Significance			
	Moderate	Minor	

12.7.4 Increased Prevalence of Communicable Diseases, Malaria and other vector borne diseases and HIV? AIDs and Sexually Transmitted Infections

Background

The Project presence with increased numbers of China Union staff and seamen can potentially impact on community health in the Port Area by causing an increase in prevalence of the following:

- Malaria and other vector borne diseases; and
- HIV/AIDS and STIs.

Project workforce recruitment policies and associated Project induced immigration may lead to an increase in the prevalence and rate of spread of communicable diseases. This is largely due to:

- Potential interactions between the construction workforce and local communities; and
- Work seeking in-migrants (including temporary visitors such as seamen) to the area bringing new diseases or varying disease profiles compared to the existing community.

The presence of a foreign workforce has the potential to increase the transmission of existing communicable diseases such as Tuberculosis and introduce new diseases into the area (e.g. pandemic influenza and meningococcal meningitis). The risk of transmission of diseases is greatest if some of the workforce is sourced from countries with a higher prevalence of certain communicable diseases.

The Project has the potential to impact, as well as be impacted by Malaria and other vector borne diseases (through worker ill health). Modifications to the environment during construction and

operations activities can create small water pools offering new mosquito breeding grounds, leading to both increased vector density and increased human vector interaction.

In-migration, the transport (by road, rail or air) of people, goods and equipment to and from the Port Area may play a role in bringing infected larvae or eggs into the area especially concerning Yellow Fever, where infected mosquito eggs have the ability to survive desiccation for long periods of time, allowing eggs to be easily spread to new locations. In the case of Yellow Fever, a single case should be considered as an epidemic risk.

Maritime activities can contribute to an increase in transmission and prevalence of sexually transmitted infections (STIs) and HIV/AIDS. The Project is likely to impact on transmission of HIV/AIDS as a result of the following:

- Seamen and transport drivers, who typically have higher rates of HIV/AIDs or STIs than the general population, may engage in casual high-risk sexual activity in the Port Area;
- In-migration resulting in the mixing of people with higher HIV/AIDs or STI prevalence rates than the host community may promote the transmission of the disease;
- A mainly male workforce with disposable incomes may engage in high risk sexual activities with commercial sex workers both in the local community and on transit routes to / from site;
- In-direct economic activities may result in other men in the community having increased disposable incomes to partake in forms of transactional sex. This is a particular risk for girls and women who may be unaware of the potential impacts of such activities or who due to existing levels of poverty may see this as a way to earn an income or access goods; and
- Commercial sex workers may come from other areas of Liberia or other countries due to an increased demand for sexual services and may have higher rates of HIV/AIDs and STIs.

Magnitude

The extent of the spread of communicable diseases associated with the Project can occur on a local, regional, national and international level. Tuberculosis, skin diseases, and Malaria and other vector borne diseases, will likely occur on a local level, whereas HIV/AIDs and STIs will have a reach throughout the region and greater Liberia. Untreated communicable diseases contracted by the workforce whilst on site, can spread internationally upon their return to their countries of origin. The duration of the impact will be long term throughout construction and operation of the project. The scale of the impact is considered to be large with respect to quality of life as illness can substantially affect livelihoods and the ability of individuals to generate income, and thereby lead to a fundamental change in the way of life for an individual and household, especially in the case of fatalities. The expected frequency of this impact is constant and will be likely to occur throughout the duration of the mine life.

These factors have the potential to result in an impact with a large overall magnitude.

Impact Significance

The combined low vulnerability of receptors and large magnitude of the impact gives the potential, prior to mitigation for an impact of Moderate significance.

Recommended Mitigation Measures

In order to mitigate health impacts to affected populations related to increased exposure to Malaria and other vector borne diseases, China Union will:

- Implement measures to reduce the presence of standing water onsite through environmental controls and source reduction to avoid the creation of new breeding grounds for mosquitos.
- Develop and implement a vector control programme covering all relevant vectors to reduce the risk of transmission at source, avoid the creation of vector breeding grounds and reduce the transportation of vectors due to the movement of people or goods.
- If warranted based on entomological surveillance, undertake larvaciding.
- Monitor the incidence of Malaria using available data, most notably the number of workforce cases that occur.
- Conduct space spray fogging and implement other measures to reduce the potential for mosquito-human interactions in worker accommodation, office space and other buildings.
- Work with relevant partners (health authorities, NGOs, development agencies) to develop community-based Malaria and vector control campaigns and activities to be implemented throughout the life of the Project.
- Develop and implement a risk-based assessment and procedures to identify working condition-specific vaccination and prophylaxis needs for Project personnel.
- Ensure that all Project personnel will be vaccinated against Yellow Fever.

In order to mitigate health impacts to affected populations related to increase exposure to HIV/AIDs and STIs, the Project will:

- Develop an HIV/AIDS and STI management strategy.
- Ensure that local health services have sufficient capacity and capability to implement the company's strategy. Recommended Mitigation Measures for Increase in untreatable health issues due to increased pressure on health services).
- Ensure that all Project personnel (including subcontractors, temporary staff, drivers, etc) are trained in the disease awareness and are given specific HIV and STI prevention training.
- Provide awareness, counselling and testing (ACT) for all Project personnel, including voluntary testing and counselling for STIs and HIV/AIDS in pre-employment and on-going health screening. (Workers will not be denied employment or discriminated against in any way based on their HIV status).
- Provide care and treatment of HIV-positive employees and nominated dependents.
- Ensure there is access to free condoms (including female condoms) at the Project site and at all worker accommodation (including subcontractors).
- Undertake information, education and communication campaigns around safe sexual practices and transmission of STIs and HIV/AIDS as well as condom distribution (including female condoms) at the Port Area and along stopping locations on key transport routes targeting commercial sex workers and truck drivers.

- Monitor the success of community programmes by regular surveys of awareness of HIV/AIDS.
- Support women's and girl's education programmes to promote rights and safe sexual practices (including the use of condoms and female condoms).
- Support development of alternative livelihoods for women and girls to minimize the risk of sex in exchange for cash or gifts.

Malaria and Other Vector Borne Diseases

The combination of disease awareness and prevention programs and campaigns will ensure prevention and early recognition of disease symptoms, thereby reducing the scale of the impact by limiting fatalities or long-term health issues that affect livelihoods. Frequency of illness and death will reduce substantially with reduction in vector transmission, rapid detection of disease, and access to appropriate medicine. The possibility still remains; however, of outbreaks occurring. Disease outbreaks could result in ill health including fatalities, throughout the Port Area especially due to the endemic nature of Malaria; however, it is expected that the overall burden of disease will decline.

Therefore, the significance of the impact after the implementation of mitigation is considered to be reduced from Moderate to Minor.

Table 46 Increase in malaria/vector borne related diseases and fatalities

Criteria	Impact Pre-Residual	Mitigation Impact	Comment
Impact: Increase in Malaria/vector borne related diseases and fatalities			
Nature	Negative		
Type	Direct	Direct	No change
Duration	Long-term	Long-term	Throughout the life of the mines
Extent	Local	Local	No change
Frequency	Often Rarely	Reduced due to safety	Campaigns and improved education on Malaria transmission and prevention, reduction of the presence of standing water onsite and source reduction to avoid the creation of new breeding grounds for mosquitos as well as larvaciding, will reduce frequency of vector bites therefore decreasing the likelihood of contracting the disease

Scale	Large	Small	Early detection and improved access to health infrastructure and medication will reduce fatalities and reduce comorbidity with other diseases such as anemia
Magnitude	Medium Low		Medium Reduced after mitigation measures, which target scale and frequency
Receptor Vulnerability	Large	Low	Changed to positive after mitigation measures, which target frequency and scale and improve the health of the community over baseline conditions, offsetting negative impacts
Significance			
	Moderate	Negligible	

Sexually Transmitted Infections and HIV/AIDs

Monitoring of workforce health and education measures on transmission and prevention of disease should minimize the risk of workers contributing to disease transmission throughout the Port Area. There is still a high likelihood of the number of cases of STIs and HIV/AIDS increasing; however, community education campaigns and alternative livelihood practices for females should reduce the scale and frequency of the impact. Early diagnosis and retroviral treatment for HIV positive staff will also help assure the disease is not spread. Even with the provision of treatment, infection with HIV/AIDS results in life long ill health and commonly early death, and those infected are likely to be discriminated against at least in the short term due to existing taboos and perceptions around HIV/AIDS.

13 UNPLANNED EVENTS

13.1 INTRODUCTION

An unplanned event is defined as ‘a reasonably foreseeable event that is not planned to occur as part of the Project, but which may conceivably occur as a result of Project activities (e.g. accidents), even with a low probability’. Unplanned events may occur during any phase of the Project. This chapter describes the potential unplanned events associated with the Project at the Port and provides a high-level assessment of the potential impacts on the receiving environment.

The nature of these events means that often specialist skills in risk assessment and risk management are required, therefore, the assessment provided here identifies potential issues that will require further work to be mitigated.

Furthermore, an Emergency Response Plan (ERP) will need to be developed by China Union to be implemented if an unplanned event was to occur. These measures all serve to reduce the likelihood, extent and duration of adverse impacts resulting from an unplanned event.

Most of the foreseeable unplanned events associated with the Port and nearshore components would be readily handled by these management measures, reducing the risk of an event occurring or the significance of any impact should an event occur.

13.2 UNPLANNED EVENTS OVERVIEW

The unplanned events that have been assessed in this Chapter include:

- Contamination caused by leaks and/ or spills or major tank failure;
- Major hydrocarbon spills; and
- Traffic accidents.

13.3 CONTAMINATION CAUSED BY LEAKS AND SPILLS OR TANK FAILURE

13.3.1 *Potential Impacts*

As described in Chapter 2, two (2) fuel storage tanks, one 26,500 m³ containing Heavy Fuel Oil (HFO) tank and one (1) 3 000 m³ diesel tank will be used at the Port. The diesel will be used on site for various uses including generators and other machinery and as such there will be other smaller diesel storage facilities around the Port site. The HFO is delivered via ship to the Port for transport to the Mine via the Railway for power generation. Both the HFO and diesel tanks are existing from the BMC operations in excess of 30 years ago. The tanks have been refurbished.

There will always be the potential for leaks or spills from the tanks during dispensing of fuel to the generators, machinery or vehicles. There is also the potential for spills or leaks from the generators themselves or from locomotives that are delivering ore concentrate to the Port for storage before export, as well as a number of other vehicles that will be accessing the site for various reasons. These spills have potential to impact on the soil, groundwater and potentially the marine environment near the Port.

In a worst-case scenario, there may be complete tank failure which could potentially release a significant volume of hydrocarbon into the Port area and potentially into the shoreline or marine environment.

Surface Water/ Marine and Coastal Environment

As there is minimal land-based surface water in terms of rivers or streams at the Port, impacts on surface water are not assumed to be significant. However, if there is complete tank failure, in particular the 26,500 m³ tank, if runoff does occur towards the coastal area there could be significant contamination of the marine and coastal environment. Should a large spill not be properly dealt with though, there is the potential for far reaching and long-term impacts.

Groundwater

Groundwater levels are reportedly shallow in the Port area, although no water level data is currently available. Water flow is towards the coast with a high level of connectivity with the ocean predicted. The area between the sea and Project area is owned by China Union and there are no down gradient groundwater users.

There is existing hydrocarbon contamination in some areas of the site and soil sampling around the site reported highly elevated concentrations of hydrocarbons. As the hydrocarbon contamination is likely to have been present for over 30 years it is likely that groundwater underlying the site is also contaminated. In addition, there is evidence of damaged historic septic tanks on the site and it is possible that the groundwater has at times been contaminated by sewage water.

There is potential for further groundwater impacts associated with leaks and spills or tank failure.

Soil

As discussed above, the soils at the Port have been contaminated by various users in the past and the soil is no longer in a pristine condition. Further impacts on soils could be caused by leaks and spills or tank failure associated with the storage of HFO.

13.3.2 Recommended Mitigation Measures

As mentioned above diesel and HFO will be stored at the Port. It is important that various mitigation measures and management plans are developed and implemented in order to minimize the risk of leaks or spills resulting in what could be extensive impacts.

The recommended mitigation measures for surface/ coastal waters, groundwater and soil contamination are aimed at reducing spills and leaks at the source and as such the mitigation measures are the same for all three.

An Emergency Preparedness and Response Plan needs to be developed to include all the management measures required to prevent and manage any potential leaks and spills. This Plan should include the following management, amongst others:

- The refurbished HFO and diesel tanks will be tested according to a suitable standard method and signed off by an appropriately qualified engineer to ensure the tanks are fit for purpose.
- Tanks containing fuels shall be situated on a smooth impermeable surface base with a bund to contain any possible spills and prevent infiltration of fuel into the ground. The bund shall be able to contain 150 percent of the total capacity of all the storage tanks within the bunding area.
- Any hydrocarbons, fuels, lubricants and chemicals to be used will be stored in bunding and lockable storage tanks, with hoses and gauges kept within the bund. Regular checking and maintenance of all plant and machinery must be carried out to minimize the risk of fuel or lubricant leakages.
- All surface water or other contaminated water which accumulates in the bund shall be removed by manually controlled positive lift pumps and not by means of a gravity drain.
- The removal and disposal of fuel from the sump will be carried out by an appropriately licensed waste disposal contractor.
- Bulk fuel storage and bunding areas shall have overhead cover to prevent rain from entering the bunding area.
- Training and equipping relevant staff in safe storage and handling practices, and rapid spill response and clean up techniques should be undertaken.
- In the event of a hydrocarbon spill, the source of the spillage shall be isolated, and the spillage contained. The area shall be cordoned off and secured and clean-up procedures implemented.
- Fuel spill kits and granules are to be made available at the storage and refueling locations.
- A Waste Management Plan (WMP) will be developed to include the appropriate storage of clean-up materials in containers (e.g. drums) and will be managed according to the WMP if they cannot be reused or recycled.
- No refueling of vehicles or machinery is to take place outside of this demarcated area.
- In the case of spills of contaminants to soil, the spill site will be remediated, and remediation verified by a suitably trained professional.
- The Project shall ensure that all spills are documented and reported to relevant government authority wherever required in line with applicable regulations.
- Fuel shall be secured and under lock and key at all times.
- No smoking shall be allowed in the vicinity of the stores. The product contained within the tank shall be clearly identified.
- Areas for storage of fuels and other flammable materials shall comply with standard fire safety regulations.
- The Contractor shall ensure that there is adequate fire-fighting equipment on site.
- Automatic spill prevention devices and overfill protection should be installed in equipment.
- Stormwater channels with oil water separators should be installed surrounding any areas where diesel is stored or dispensed and where vehicles are parked for any period of time.
- Effluent and groundwater monitoring should be undertaken within the vicinity of the tanks to detect if any contamination is occurring.

- Access to the Port should be security controlled as required.

13.4 MAJOR OIL SPILLS

13.4.1 Potential Impact

Due to the expected increase in shipping activity in the harbour there is a chance, of a major oil spill occurring through a vessel collision, possibly releasing fuel oil, or via a refueling accident releasing diesel fuel.

In the event of a spill a large volume of HFO or diesel could be lost to the marine environment. These hydrocarbons are highly toxic to marine life and can have smothering effects on organisms in the path of the spill, on the sea surface and in the water column. Also diving birds that are fishing in the area can be rendered flightless due to their feathers being completely smothered by oils as well as potential poisoning due to ingestion of contaminated water.

Impacts could extend from an onsite scale to a regional or international scale, based on material spilled, volumes/location/sea conditions and similar factors. As such, any major spills in the ocean could result in significant impacts. Potential sensitive receptors include:

- Seabird populations: Species that may be at risk from spilt HFO include pursuit diving and/or birds that may alight on the sea surface such as tropical frigate birds and terns.
- Coastal mangroves: Mangrove stands are recognized internationally as important biodiversity resources. There are none in the vicinity of the harbor but spills occurring outside the harbor could potentially be washed over long distances in the direction of mangrove stands.
- Marine turtle populations: Because of the lack of avoidance behavior it is possible that turtles may be exposed to a short-lived spill at sea. The primary agents for lethal effects on turtles are complete covering by thick oil for juveniles or the ingestion of tar balls (Milton et al. 2008) (1). Neither should be caused by diesel as it does not emulsify (water content = 0%). Sub-lethal effects may occur with prolonged exposure (days) which may generate respiratory-linked pathologies such as reduced dive times and foraging success, and increased risks of starvation.
- Cetaceans: Whales and dolphins may be affected by a spill either due to effects on mating/courting behavior or on their food sources (e.g. fish for dolphins). In most cases these species will tend to move away from the affected area and would not suffer long-term effects.
- Manatees: The West African Manatee is found in coastal estuarine and river systems of Liberia. They may be affected by a spill due to the loss of mangrove and estuarine habitat which provide their food sources.

13.4.2 Recommended Mitigation Measures

The objective of the implementation of mitigation measures is to prevent spills from happening and in the event, one does to respond appropriately.

The mitigation measures that are recommended are:

Mitigation hydrocarbon spills takes two forms: spill prevention and spill response. The primary mitigation measure for avoiding the impacts of a spill is to prevent any such spill taking place in the first place. This is done through the application of technology and operational controls. The Project will implement systems to respond, contain and clean up all spills. These systems will be designed with the capacity to handle various types and volumes of spills, in line with good industry practices.

- An Emergency Response Plan (ERP) needs to be developed to include procedures for response to hydrocarbon spills. The following should be considered as part of the ERP:
- Incorporate oil spill prevention measures into operational procedures on ore carriers.
- Inform the National Port Control should any spills occur and deploy oil protection booms when possible.
- The Project will conduct a detailed technical Risk Assessment. Such a risk assessment would include modelling and consider: o the location, e.g. in the vicinity harbour; the event, e.g. a collision with another vessel; of the spill type and volume; and of the pathway or location affected, e.g. direct to sea.
- A detailed consequence analysis will be undertaken following spill modelling to determine the potential environmental and socio-economic impacts. The analysis will focus on the spill size, type(s) of material spilled and potential spill location(s). Results will be incorporated into the ERP.
- Follow appropriate guidelines such as those produced by the United Nations Environment Programme (UNEP). The following specific measures should be incorporated into the plans:
 - Incorporate hydrocarbon spill prevention measures into operational procedures for construction, operation and decommissioning;
 - Use reinforced hosing for fuel transfers and use shut-off valves to reduce losses to sea should rupture occur;
 - Where possible and practical, refuel or dispense HFO cargo only in calm weather and sea conditions and during daylight;
 - Standard communication (constant bridge watch and radio contact) and navigation systems (lighting and signaling systems) must be used on all vessels; and
 - If required, apply only biodegradable dispersants that have previously been approved by the relevant authority in Liberia.

13.5 TRAFFIC ACCIDENTS

13.5.1 *Potential Impact*

As discussed previously there will be 22 trains travelling in each direction every day between the Port and #1 Station. This section of the Rail is currently not separated by any fencing and the right of way has been significantly encroached upon with numerous people setting up markets along the length of the rail outside the Port. This represents a significant risk to community safety near the Railway line at the Port.

There is expected to be only minor changes to road traffic near the Port as a result of the Project and it is anticipated that conformance with Liberian road rules will be sufficient to manage that risk.

13.5.2 *Recommended Mitigation Measures*

In order to ensure that the risk to people is minimized a Community Health and Safety Plan needs to be developed and implemented. This Plan needs to assess and include the following:

- Establish an Emergency Preparedness and Response Plan with capabilities to deal with any road traffic or other accidents that may occur including multiple casualty events.
- Community training should be held in order to teach people about the dangers of fast-moving traffic on the roads. This training should be rolled out at all schools in the vicinity as well to educate children about the dangers.
- Ensure that clear signage is displayed along the length of the railway line in the city limits warning people of the dangers of the trains.
- Trains must obey strict speed regulations when travelling within the city limits.
- The right of way should be clearly marked and fenced or similar in order to keep people out of danger.
- Where required, crossings will need to be erected so that people can safely cross the line when necessary.
- At night the area should be well lit with directional lighting so as not to cause further visual impacts.

14 CUMULATIVE IMPACTS

14.1 INTRODUCTION

The China Union project has potential to interact with other existing and planned projects in the area resulting in a combined impact of greater significance than of any of the projects separately; this is referred to as a cumulative impact. For this study the IFC Performance Standard 1 (2012) has been used as guidance for defining cumulative impacts. These have been defined as follows:

Impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.”

Examples include incremental contribution of gaseous emissions to an airshed, reduction of water flows in a watershed due to multiple withdrawals, increases in sediment load, and increases in traffic congestion and accidents due to increases in vehicular traffic.

This Chapter assesses cumulative impacts for the Project at the Port.

14.2 BACKGROUND TO IMPACTS

The Freeport of Monrovia is located within the capital city of Liberia, in Monrovia. The Port is already active and is located within a busy industrial and residential area. Further developments are planned for the Port, in line with the NPA’s vision for the Port. Therefore, the potential for activities to take place at the same time is high. Table 47 summarizes the key projects within the local port area that have the potential to result in cumulative impacts.

Table 47 Identified concurrent projects that have potential to create cumulative impacts

Name	Location	Status
APM Terminal	Located just adjacent to WCL Monrovia Port Area	In Operation phase
WCL (Western Cluster Limited) Port	Located just adjacent to the China Union project at the Monrovia Port	In permitting phase
LEC (Liberia Electricity Corporation)	Located approximately 500 m north east of WCL Port Area	In Operation Phase
Liberia Petroleum Refining Company	Located approximately 800 m southeast of WCL Port Area	In Operation Phase
CEMENCO (Portland cement production)	Located approximately 50m North East of WCL Port Area	In Operation Phase

14.3 RESOURCE/ RECEPTORS THAT WILL NOT HAVE CUMULATIVE IMPACTS

The potential for cumulative impacts was assessed for all biophysical and social receptors or resources. In many instances no cumulative impacts will occur as the impacts from the sites do not interact. Those resources and receptors that are predicted to not have cumulative impacts are summarized in Table 48.

Table 48 Resource/receptors predicted to have no cumulative impacts

Resource/ receptor	Justification
Groundwater/ surface water/ aquatic/ Soil and aquatic ecology	The impacts on soil, water, terrestrial ecology and aquatic ecology are considered insignificant due to the distance of the Port to the resources and receptors or due to their highly degraded nature of their baseline conditions.
Air and Noise	The impacts on air quality and noise levels from Port operations are expected to be minor and for the most part confined within the site boundary. However, as dust levels around the Port area are potentially high, this cumulative impact could be of a moderate to major significance.
Livelihoods	The Port site is located within an existing busy port area surrounded by other industrial operations. There are currently numerous small businesses in operation around the Port site. The China Union and WCL projects will increase the number of workers at the port. This has potential to impact on livelihoods by increasing economic activity. However, the increase in the work force due to both projects is considered minor and no cumulative impacts on livelihoods are expected.
Community Health and Safety	The Project will only result in a minor increase in road traffic and no cumulative impacts will occur with respect to road accidents. The increase in occurrence of vector borne or STIs is considered minor due to the small increase in the work force at the Port and no cumulative impacts will occur.
Socio-cultural	No change in the socio-cultural baseline is anticipated due to the Project and therefore there will be no cumulative impacts.
Cultural Heritage	There are unlikely to be any cultural heritage resources at the Port so no cumulative impacts will occur.

14.4 CUMULATIVE IMPACT ASSESSMENT

14.4.1 Impacts on Marine Water and Sediment Quality and Ecology

The operations at the Port have potential to impact on marine water quality, sediment quality and ecology. This is due to:

- The runoff from the stockpiles containing iron ore discharging to the marine environment; and Wind-blown dust from the stockpiles depositing on the shoreline or onto the ocean.

These impacts are considered Minor prior to mitigation and Negligible after mitigation. The WCL project will also have iron ore stockpiles and has the potential to impact on the marine environment in the same way; this could potentially result in cumulative impacts on the marine environment. However, the WCL project is of a similar scale as the China Union project and assuming that there will be similar mitigation at the WCL port the cumulative impact is not considered to be significant.

14.4.2 Introduction of Alien and Invasive Species

Bulk ore carriers will enter the harbour under ballast and will then discharge the ballast water whilst being loaded with ore at the export berths. Ballast water discharges bring the risk of releasing organisms entrained in source ports into the receiving harbour environment. Once released into ports, alien species can become invasive through the establishment of populations and disrupt ecological processes.

In view of the globally recorded negative effects of alien species transfers the International Maritime Organization (IMO) considers their introductions to new environments via ship's ballast water, or other vectors, as one of the four greatest current threats to the world oceans. This impact is considered to be of Major significance as a result of the China Union Project prior to mitigation and of moderate significance after mitigation. The other projects operating or planned at the Port will impact the marine environment in a similar way and it is likely that, even with effective management of ballast water, the significance of cumulative impact will be greater than that of the China Union Project alone. All projects will need to adhere to guidelines provided by the IMO to minimize the introduction of alien and invasive species.

14.4.3 *Increase in Offshore Accidents*

There will be a significant increase in the number of vessels entering the port due to both the China Union and WCL projects. This has potential to increase the number of accidents that will occur at sea, predominately due to collisions with smaller boats. The impact due to the China Union project alone is considered of minor significance after mitigation. However, there is likely to be a cumulative impact due to WCL project and there will be greater potential for accidents to occur. Currently the planned increase in vessels due to the China Union and WCL projects is unknown and it is not possible to assess the significance of the cumulative impact. Both projects should undertake all maritime operations in line with International Maritime Law and safe practice.

15 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

15.1 INTRODUCTION

This document provides the Environmental and Social Management Plan (ESMP) for the Bong Mine Rehabilitation Project (Project). This document covers Phase 2 Construction and Operational activities for the Port.

The purpose of this ESMP is to specify the standards and controls required to manage and monitor environmental and social impacts during the Phase 2 of the Project. To achieve this the ESMP identifies potential adverse impacts from the planned activities and potential unplanned events and outlines mitigation measures required to reduce the likely negative effects on the physical, natural and social environment.

The Environmental Management Plan actions contained hereunder are legally binding on authorization of the ESMP by the Environmental Protection Agency (EPA).

15.1.1 Overview and Scope

The aim of the ESMP is to minimize the likely number of environmental and social impacts to the limits established in the MDA Sections 8.1 to 8.3 in the Mining Law and applicable Liberian Laws.

The ESMP is intended to cover those activities described in Chapter 2 of this ESIA report. The ESMP does not include measures for activities related to equipment and facility fabrication being done offsite. Provision will be made for updating the outline ESMP once the detailed project design is complete and for adapting the ESMP to relevant project stages.

The plan details the mitigation and enhancement measures China Union has committed to implement through the life of the Project and includes project commitments; performance indicators; targets or acceptance criteria; and timing for actions and responsibilities. China Union will have principal responsibility for all measures outlined in the ESMP, but may delegate responsibility to its contractors, where appropriate. In cases where other individuals or organizations have responsibility for mitigation measures, this is clearly indicated within the ESMP table.

Capacity building and training requirements are also described, where these relate to specific skills required to deliver the ESMP action in question. General training, which will be provided to staff (and contractors' staff as appropriate), is not indicated in the plan.

15.1.2 ESMP Objectives

The ESMP is essential for successfully implementing the Project's social and environmental performance throughout the life of the Project. Having this framework in place ensures a systematic approach to bringing environmental and social considerations into decision making and day-to-day operations. It establishes a framework for tracking, evaluating and communicating environmental and social performance and helps ensure that environmental risks and liabilities are identified, minimized and managed. The ESMP will be a living document and will continue to develop during the design and construction phase to enable continuous improvement of the Project's social and environmental performance.

The objectives of this ESMP are:

- Ensuring compliance with regulatory authority stipulations and guidelines which include local, national and international;
- Ensuring that there is sufficient allocation of resources on the project budget so that the scale of ESMP-related activities is consistent with the significance of project impacts;
- Verifying environmental performance through information on impacts as they occur;
- Periodically update this ESMP as project activities progress;
- Responding to unforeseen events; and
- Providing feedback for continual improvement in environmental performance.

15.2 ROLES AND RESPONSIBILITIES

The organizational structure for environmental management for China Unions Bong Mine Project is illustrated in Figure below and is subject to change depending on staffing allowance and budgets and will be reviewed on an annual basis to ensure that effective environmental management is accomplished. The key roles and responsibilities are outlined in the sections that follow.

15.2.1 *Environmental and Social Management Organizational Structure*

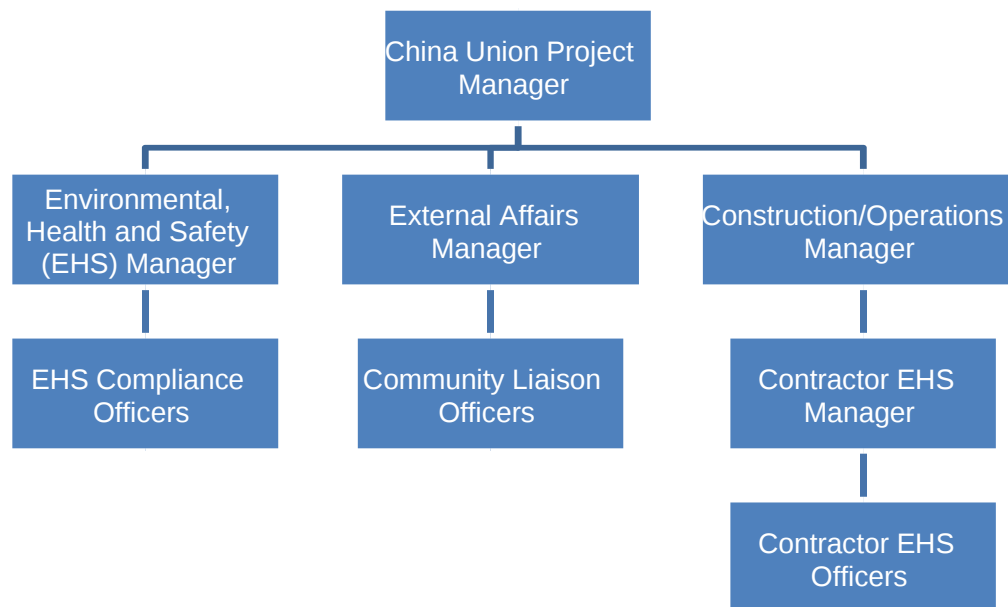
China Union will have an Environmental, Health and Safety (EHS) department with dedicated EHS staff, competent on the basis of appropriate education, training, and experience, which will manage and oversee the EHS aspects of the Project.

Supervision of engineering, final design work, construction, start-up, and commissioning will occur through the China Union engineering department

The China Union Liberia-based organization will be staffed by knowledgeable staff on assignment from the China Union organization in addition to staff hired locally. The Project team will operate out of an office in Monrovia and at the site. Project staff residing in Liberia will perform the primary tasks associated with overseeing and monitoring the in-country activities of workers and contractors to ensure that contractual obligations regarding construction quality, regulatory compliance, environmental protection, and social commitments are being satisfied.

Also included on the organization are external affairs professionals that form the Community Relations department. These professionals are crucial to the success of the environment and social monitoring process and the continuation of the stakeholder consultation process. They also have responsibility with regards to resettlement activities.

Figure 29 Environmental and Social Management Organizational Structure



15.2.2 China Union Project Manager (CU PM)

The CUPM will be responsible for:

The implementation of the approved ESMP, its overall development and periodic monitoring in order to provide continuous improvement during the execution of construction, operational and decommissioning phases.

Designate suitable EHS Manager.

15.2.3 EHS Manager

The EHS Manager will be responsible for the day to day environmental management. Supervision of subcontractor activities will be conducted by the EHS Manager during construction and operations. The EHS Manager is responsible for implementing the monitoring programmes and maintaining the monitoring databases as well as the reporting of these results to the CU PM. Other important responsibilities of the EHS Manager include:

- Undertake internal environmental compliance audits;
- Coordinate external compliance audits;
- Draft and implement action plans following audits;
- Obtain all company EHS permits and approvals;
- Ensure that all documentation and records required comply with procedures that are current, available and auditable, and are properly executed in accordance with project quality assurance requirements;
- Reviews and recommends approval status of subcontractors EHS documents that are intended to be incorporated on the project;
- Keeps abreast of applicable national and international requirements as per the projects tracking process;

- Undertake internal impact assessments and inspections in combination with the EHS Compliance Officers; and
- Develop environmental training and awareness programmes.

15.2.4 EHS Compliance Officers

The EHS Compliance Officers reports to the EHS Manager. Responsibilities of the EHS Compliance Officers on site include:

- Undertake the necessary daily, weekly and monthly inspections of project activities;
- Compile checklists and report results to the EHS Manager;
- Inspect and report on any environmental incidents, non-compliances and complaints;
- Ensure that non-conformances, incidents and complaints are recorded;
- Check that the necessary corrective and preventative actions have been undertaken;
- Liaise with the Contractor EHS officers regarding performance and problems and attend weekly EHS meetings;
- Oversee the implementation of the Rehabilitation Trials, and monitor the success of the various treatments in combination with the consultants;
- Undertake required monitoring as specified in the ESMP;
- Record weather data (rainfall, temperatures etc); and
- Undertake environmental training and awareness under instruction from the EHS Manager.

15.2.5 External Affairs Manager

The external affairs manager will:

Communicate EHS policies to interested parties.

- Work with managers to ensure appropriate actions/management programs are built into the annual action/business plans to achieve community related objectives and targets, and review (and as necessary revise) these actions/management programs annually to ensure progress toward meeting the objectives and targets.
- Obtain monitoring results from managers and use these to evaluate whether the community related objective and targets are being accomplished on at least a monthly basis.
- Determine whether new or modification of current internal documents based on significant aspects and impacts, job experiences, corrective action reports, audit findings, legal requirements, new or modified operations, and/or any other activities is required, and assign personnel to do this where necessary.
- Prepare a document that provides a list of which roles hold responsibility for controlling different types of records related to community issues.
- Work with the CU PM and EHS Manager to maintain an ESMP Document Register and Record Register.
- Review community-related documents and records annually to determine whether they can be destroyed or whether they should be retained.

15.2.6 Community Liaison Officer (CLO)

The CLO will:

- Work closely with communities and will be the first line of engagement with those directly affected.
- Be on the ground for the majority of the time and will therefore play a key role in keeping abreast of stakeholder expectations, perceptions and concerns – over and above the stakeholder feedback received through formal engagement mechanisms and will compile monthly reports detailing any findings in this regard.
- The CLO will be the first port of call for anyone in the project area who has a grievance. All grievances to be forwarded to the Grievance function.
- Have a working knowledge of all the project management plans, such that any breaches against commitments can be identified and reported immediately to the External Affairs Manager.
- Attend community meetings, and where necessary community forums.

15.2.7 Contractor Staff

All contractor staff will:

- Read and understand the requirements contained in this ESMP;
- Attend EHS training as required;
- Responsible for observing measures for their own safety and for others who may be affected by their acts or omissions;
- Co-operates with China Union management on health and safety related measures;
- Adheres to safety rules at all times;
- Specific responsibilities as defined by the ESMP;
- Seeks out hazards and reports them for correction;
- Intervenes when they come across unsafe work / conditions and shall use right/obligation to stop work, unless act/condition is safe; and
- Adheres to EHS rules at all times.

15.3 TRAINING AND AWARENESS

China Union will identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse impact upon the environment or social conditions. The project recognises that it is important that employees at each relevant function and level are aware of the Project's environmental and social policy; potential impacts of their activities; and roles and responsibilities in achieving conformance with the policy and procedures.

This will be achieved through a formal training process. Employee training will include awareness and competency with respect to:

- Environmental and social impacts that could potentially arise from their activities (including dust, biodiversity and soil/water contamination);
- Necessity of conforming to the requirements of the ESIA and ESMP, in order to avoid or reduce those impacts; and

- Roles and responsibilities to achieve that conformity, including those in respect of change management and emergency response.

The EHS Manager is responsible for coordinating training, maintaining employee-training records, and ensuring that these are monitored and reviewed on a regular basis. The EHS Manager will also periodically verify that staff are performing competently through discussion and observation.

Employees responsible for performing site inspections will receive training by drawing on external resources as necessary. Training will be coordinated by the EHS Manager prior to commissioning of the facilities. Upon completion of training and once deemed competent by management, staff will be ready to train other people.

Similarly, the Project will require that each of the subcontractor's institute training programmes for its personnel. Each subcontractor is responsible for site EHS awareness training for personnel working on the job sites. The subcontractors are also responsible for identification of any additional training requirements to maintain required competency levels.

The subcontractor training program will be subject to approval by the China Union Project Manager and it will be audited to ensure that:

- Training programs are adequate;
- All personnel requiring training have been trained; and
- Competency is being verified.

15.4 COMMUNICATION

China Union will maintain a formal procedure for communications with the regulatory authorities and communities. The EHS Manager is responsible for communication of EHS issues to and from regulatory authorities whenever required. Meetings will be held, as required, between China Union and the appropriate regulatory agency and community representatives to review EHS performance, areas of concern and emerging issues. Dealings will be transparent, and stakeholders will have access to personnel and information to address concerns raised.

The CLO will be responsible for disseminating information and coordinating community communications through the course of the Project.

The Project will develop and implement a grievance mechanism whereby community members can raise any issues of concern. Grievances may be verbal or written and are usually either specific claims for damages/injury or complaints or suggestions about the way that the Project is being implemented. When a grievance has been brought to the attention of the Project team, it will be logged and evaluated. The person or group with the grievance is required to present grounds for making a complaint or claiming loss so that a proper and informed evaluation can be made.

Where a complaint or claim is considered to be valid, then steps are required to be undertaken to rectify the issue or agree compensation for the loss. In all cases the decision made and the reason for the decision will be communicated to the relevant stakeholders and recorded. Where there remains disagreement on the outcome then an arbitration procedure may be required to be overseen

by a third party (e.g. government official). Local community stakeholders will be informed on how to implement the grievance procedures.

15.5 OPERATIONAL CONTROL PROCEDURES

Each potentially significant impact identified in the ESIA will have an operational control associated with it that specifies appropriate procedures, work instructions, best management practices, roles, responsibilities, authorities, monitoring, measurement and record keeping for avoiding or reducing impacts. Operational control procedures will be reviewed and, where appropriate, amended to include instructions for planning and minimizing impacts, or to at least reference relevant documents that address impact avoidance and mitigation.

15.6 EMERGENCY PREPAREDNESS AND RESPONSE

China Union will prepare plans and procedures to identify the potential for, and response to, environmental accidents and health and safety emergency situations and for preventing and mitigating potentially adverse environmental and social impacts that may be associated with them.

Emergency preparedness and response will be reviewed by the China Union on at least an annual basis and after the occurrence of any accidents or emergency situations to ensure that lessons learnt inform continuous improvement. Emergency exercises will be undertaken on a regular basis to confirm adequacy of response strategies. Investigations of accidents or incidents will follow formal documented procedures.

15.7 MANAGING CHANGES TO PROJECT ACTIVITIES

Changes in the Project may occur due to unanticipated situations. Adaptive changes may also occur during the course of final design, commissioning or even operations. The Project will implement a formal procedure to manage changes in the Project that will apply to all project activities.

The objective of the procedure is to ensure that the impact of changes on the health and safety of personnel, the environment, plant and equipment are identified and assessed prior to changes being implemented.

The management of change procedure will ensure that:

- Proposed changes have a sound technical, safety, environmental, and commercial justification; Changes are reviewed by competent personnel and the impact of changes is reflected in documentation, including operating procedures and drawings;
- Hazards resulting from changes that alter the conditions assessed in the ESIA have been identified and assessed and the impact(s) of changes do not adversely affect the management of health, safety or the environment;
- Changes are communicated to personnel who are provided with the necessary skills, via training, to effectively implement changes; and
- The appropriate China Union person accepts the responsibility for the change.

As information regarding the uncertainties becomes available, the Project ESMP will be updated to include that information in subsequent revisions. Environmental and social, as well as

engineering feasibility and cost, considerations will be taken into account when choosing between possible alternatives.

15.8 DOCUMENTATION

China Union will control EHS documentation, including management plans; associated procedures; and checklists, forms and reports, through a formal procedure. All records will be kept on site and will be backed up at several offsite locations (including secure cloud storage facilities). Records will be kept in both hard copy and soft copy formats. And all records will be archived for the life of the project.

Furthermore, the document control procedure will describe the processes that the Project will employ for official communication of both hardcopy and electronic (through the internet) document deliverables. In addition, it will describe the requirement for electronic filing and posting and for assignment of document tracking and control numbers (including revision codes).

The EHS Manager is responsible for maintaining a master list of applicable EHS documents and making sure that this list is communicated to the appropriate parties. The EHS Manager is responsible for providing notice to the affected parties of changes or revisions to documents, for issuing revised copies and for checking that the information is communicated within that party's organization appropriately.

The subcontractors will be required to develop a system for maintaining and controlling its own EHS documentation and describe these systems in their respective EHS plans.

15.9 CHECKING AND CORRECTIVE ACTION

Checking includes inspections and monitoring as well as audit activities to confirm proper implementation of checking systems as well as effectiveness of mitigations. Corrective actions include response to out-of-control situations, non-compliances, and non-conformances. Actions also include those intended to improve performance.

15.9.1 Inspection

EHS inspections will be conducted weekly on an ad hoc basis and formally at least once every two months and will be undertaken by the EHS Compliance Officer. The results of the inspection activities will be reported to the EHS Manager to be addressed.

15.9.2 Monitoring

Monitoring serves to supply information to create a better understanding of the operations impact on the environment so that adequate management actions can be taken to reduce liability at the operational phase and at closure.

Monitoring must be kept to a manageable task and therefore must target the most important instructions in the ESMP, where the risk of environmental damage is the greatest. Monitoring must include both a routine aspect and allow for erratic or unpredictable events, such as floods or human caused incidents (spills, etc.). Some monitoring can be done at varied intervals (eg alien vegetation observations), but other monitoring requires regular sampling to allow easy analysis of the results.

Monitoring should cover the following:

- Monitor the higher risk activities/areas more frequently;
- Regular collection of samples for scientific analysis;
- Routine observations of behaviours and practices;
- Noting of unusual events, incidents and accidents (natural and human triggered);
- Trending changes in results over time;
- Brief statement whether or not conditions of the ESMP are being met; and where it is reportable to authorities;
- Data analysis by competent personnel;
- Possible reasons why conditions are not being met;
- Corrective action plans; and
- Monitoring results from corrective action plans.

Table 15.1 provides details of the monitoring programme as part of this ESMP. This must be periodically reviewed.

15.9.3 Auditing

China Union will conduct regular audits to monitor compliance with the project EMSP. The scope will cover the major project activities including the overall EMSP requirements throughout the life of the project. The Contractors' performances towards meeting these requirements will also be assessed. These audits will be undertaken in conjunction with relevant regulatory agencies.

The audit will be conducted bi-annually during construction and start-up and every five (5) years during operations. The audit shall be performed by qualified staff and the results shall be reported to China Union to be addressed. The findings from these audits will be reported to the EHS, and corrective action plans will be developed and followed-up for performance improvement.

The audit will include a review of compliance with the requirements of the ESIA and ESMP and include, at a minimum, the following:

- Completeness of HES documentation, including planning documents and inspection records; Conformance with monitoring requirements;
- Efficacy of activities to address any non-conformance with monitoring requirements; and
- Training activities and record keeping.

15.9.4 Corrective Action

Investigating a 'near miss' or actual incident after it occurs can be used to obtain valuable lessons and information that can be used to prevent similar or more serious occurrences in the future.

China Union will implement a formal non-compliance and corrective action tracking procedure for investigating the causes of, and identifying corrective actions to, accidents or environmental or social non-compliances. This will ensure coordinated action between China Union and the Contractor(s). The EHS Manager will be responsible for keeping records of corrective actions and for overseeing the modification of environmental or social protection procedures and/or training programs to avoid repetition of nonconformances and non-compliances.

15.10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

15.10.1 Overall ESMP (Construction and Operation)

Reference	Potential Impact	Project Phase	Project Commitment	Specific Action(s)	Performance Indicator/ Documentation	Monitoring Requirement(s)	Timing/ Frequency	Responsibility
MARINE WATER QUALITY, SEDIMENT QUALITY AND ECOLOGY								
M1	Degradation of water quality due to iron ore run-off from stockpiles	Operation	Control stormwater run-off from stockpiles	A stormwater management plan will be developed for the stockpiles, the following will be considered: The construction of collection ditches around the stockpiles. The construction of a pollution control dam the drains the collection ditches. The pond will be designed to allow sufficient settling time to reduce suspended sediment concentrations to below 50 mg/L. A slow release overflow system will be built to allow settled water from the pollution control dam to a pipe that discharges to the Marine environment.	Weekly Inspection Report TSS in discharge less than 50 mg.	Visual inspection Sampling results for TSS	Weekly Monthly	EHS Compliance Officer
M2	Runoff of contaminated water from industrial areas including the works shops, generator rooms, train unloading stations, vehicle fuel storage areas.	Construction and Operation	Development of stormwater management plan	A stormwater management plan will be developed to minimize contaminated runoff: All runoff from hard stand industrial areas including the works shops, generator rooms, train unloading stations, vehicle fuel storage areas. will be collected in pollution control dams and treated or disposed of in a way that there is no impact on surface water, groundwater or soil resources. All clean water will be diverted around the areas listed above. There will be no releases direct releases of water from the pollution control dams to the environment.	Visual inspection of stormwater management equipment	Visual records.	Monthly during the dry season, weekly during the wet season	EHS Compliance Officer

				Oil and water separators will be used to reduce the hydrocarbon content of runoff from industrial areas. All stormwater management infrastructure will be designed to accommodate a 1/25-year 24-hour recurrence event and 1/100-year 24-hour event for permanent structures.				
M3	Degradation of water quality and sediment quality and water quality on the shoreline and marine environment due to increased wind-blown iron ore dust particles.	Operation	Manage dust emissions	The following dust control measures will be undertaken: Unloading ore from trains will be undertaken in an enclosed environment therefore emissions will be negligible. Conveying of material from train to stockpile area/ship, stockpile area to ship etc. will be within an enclosed process therefore emissions will be negligible. The use of water sprays to help reduce emissions of fugitive dust/PM10 from the handling of material e.g. wheel and bucket reclaimers used to stack and reclaim ore from stockpiles. The use of water sprays to help reduce emissions of fugitive dust/PM10 from the stockpiles themselves. Damping of bulk earthworks areas; Dust suppression with water in combination with chemical suppressants if required to reduce dust generated by trucks traveling on roads.	Weekly Inspection Report	Visual inspection	Weekly	EHS Compliance Officer
M4	Ballast water discharge and alien species introduction	Operation	Follow guidelines to prevent the discharge of untreated ballast water and reduce the probability of successful alien species invasions.	IMO to Management of Ballast water Ensure strict adherence to the IMO regulations by all ships entering the Port of Monrovia that are linked in any way to the proposed ore export development Ensure all ore carriers are to be early adopters of revised and additional ballast water treatment procedures as may be advised by the IMO in the future.	IMO Regulations Ballast Water Treatment Procedures	Documentation review	On-going	EHS Compliance Officer

AIR QUALITY								
AQ1	Increase in dust and PM ₁₀ , SO ₂ and NO ₂ concentrations	Operation	Manage air emissions to control exposure to communities and workers	Management of emissions Management for dust and PM ₁₀ is described in M3 above. No further management is anticipated for SO ₂ or NO ₂ Air quality monitoring will be undertaken at receptor sites around the port for dust, PM ₁₀ , NO ₂ and SO ₂ Dust deposition and visual monitoring will be undertaken weekly to determine the spread of iron ore dust at and around the Port site, buildings will be visually assessed for red iron ore dust colouration	Compliance with PM ₁₀ the IFC Environmental, Health and Safety General EHS Guidelines: Environmental: Air Emissions and Ambient Air Quality (2007). Visual assessments of buildings and outside surfaces will be made to see if fine iron ore dust is sticking to these surfaces. Should it be found that fine dust is adhering to surfaces or is wide spread further management options will be investigated and implemented to reduce the impact of iron ore dust deposition.	Monitoring of dust PM ₁₀ , SO ₂ and NO ₂	Monthly	EHS Compliance Officer
NOISE								

N1	Increase in noise levels	Operation	Reduce impacts to sensitive receptors	Noise impacts around the port are not anticipated to be significant, however, the following will be implemented to maintain noise levels as minor at receptors: Locate plant (e.g. generators) as far from the nearest potential sensitive receptors as possible and use on-site structures and terrain to screen sensitive locations wherever practicable. Enforce strict speed limits for all vehicles moving around the port area and maintain road surfaces to avoid increases in noise from vehicles travelling over uneven ground. Regularly maintain noisy equipment and vehicles in accordance with manufacturers specifications. Plan vehicle routes to minimize the need for reversing and use audible reversing alarms only when necessary for health and safety. Consider noise performance in the selection of equipment and vehicles. Construct a noise barrier along the eastern boundary, shielding those receptors situated immediately adjacent to the Port facility from all the noise sources.	Vehicle/Equipment Maintenance Schedule and Records Noise Monitoring Report	Noise Monitoring	Biannually	EHS Compliance Officer
SOCIAL DEVELOPMENT PLAN								
SD1	Increased economic activity around the Port - positive impact	Construction and Operation	Enhance local business development	Enhancement of local business by: Provide incentives to Project contractors procure materials and resources locally. Conduct a needs assessment to understand local demand and community priorities. Establish relevant training and capacity building initiatives to support the local service industry's ability to meet the Project requirements, based on audit results and needs assessments. Establish relevant capacity building initiatives to support the local business and service industry's ability to meet the Project requirements, based on audit results and needs assessments.	Tender documents to include local procurement criteria Needs Assessment Training Program	Review of Contract or agreements Review of training records	Bi-annual	External Affairs Manager
COMMUNITY HEALTH AND SAFETY								

CHS1	Increased incidence of HIV/AIDS and other STIs.	Construction and Operation	Manage the incidence of HIV/AIDS and other STIs	Develop an HIV/AIDS and STI prevention strategy: Ensure that health services have sufficient capacity and capability to implement the company's strategy. Ensure that all Project personnel (including subcontractors, temporary staff, drivers, etc) are trained in the disease awareness and are given specific HIV and STI prevention training. Provide awareness, counselling and testing (ACT) for all Project personnel, including voluntary testing and counselling for STIs and HIV/AIDS in pre-employment and on-going health screening. (Workers will not be denied employment or discriminated against in any way based on their HIV status). Provide care and treatment of HIV-positive employees and nominated dependents. Ensure there is access to free condoms (including female condoms) at all worker camp sites and accommodation.	Statistics on HIV/AIDS and STI infection rates. Review of availability of condoms and testing. Availability of treatment options. Records of educational programs.	Statistics on infection s, number of patients treated and documentation for attendance of education programs	Monthly	Community Liaison Officer
				Undertake information, education and communication campaigns around safe sexual practices and transmission of STIs and HIV/AIDS as well as condom distribution (including female condoms) at stopping locations on key transport routes targeting commercial sex workers and truck drivers. Monitor the success of community programmes by regular surveys of awareness of HIV/AIDS. Support women's and girl's education programmes to promote rights and safe sexual practices (including the use of condoms and female condoms). Support development of alternative livelihoods for women and girls to minimise the risk of sex in exchange for cash or gifts.				

CHS2	Increased prevalence of malaria and other vector borne diseases	Construction and Operation	Prevent or minimise the spread of vector borne disease amongst communities and the project workforce	Management of vector borne disease Implement measures to reduce the presence of standing water onsite through environmental controls and source reduction to avoid the creation of new breeding grounds for mosquitos. Develop and implement a vector control programme covering all relevant vectors to reduce the risk of transmission at source, avoid the creation of vector breeding grounds and reduce the transportation of vectors due to the movement of people or goods. If warranted based on entomological surveillance, undertake larvaciding. Monitor the incidence of Malaria using available data, most notably the number of workforce cases that occur. Conduct space spray fogging at worker camps and implement other measures to reduce the potential for mosquito-human interactions in worker accommodation, office space and other buildings. • Work with relevant partners (health authorities, NGOs, development agencies) to develop community-based Malaria and vector control campaigns and activities to be implemented throughout the life of the Project. • Develop and implement a risk-based assessment and procedures to identify working condition-specific vaccination and prophylaxis needs for Project personnel. • Ensure that all Project personnel will be vaccinated against Yellow Fever.	Effectiveness of Programs Health and Safety Awareness Campaign Records of hygiene inspections, worker screening, training records, health programme statistics	Visual inspection Health screening	Monthly	EHS Compliance Officer
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CHS3	Onshore and offshore accidents.	Construction and operations	Minimize onshore and offshore accidents	Management of site related accidents: Take reasonable measures to discourage entry by the public into operational areas. Implement site safety and security measures such as signage; access control and security patrolling of high-risk operational areas at the Port. Roll out community marine safety awareness and education in the Port Area regarding the marine operations, vessel movements and risk. This will run throughout the duration of construction and during the initial years of operation. These sessions will be aimed at fishermen and all other receptors that use the Port and offshore areas and will highlight the dangers of being in the vicinity of marine activities. It will include sessions aimed at school children as well as community events. Undertake all maritime operations in line with International Maritime Law and safe practice including measures such as: -use of patrol vessels to enforce work area zones of managed vessel traffic around structures or vessels. -announce entry of large vessels and advise fishermen to vacate the area when necessary; and -demarcate approach channels with buoys and navigation aids to warn fishermen using the channels;				
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CHS4	Accidents traffic and at port site			Traffic accidents around the Port site Educate local communities (targeting children) on road traffic laws and road safety in partnership with local authorities and the police. Promote road safety amongst Project personnel through roll out of a compulsory road rules and driver safety awareness training at induction, for all staff driving vehicles and operating machinery; Strictly enforce drug and alcohol policies in relation to Project drivers and undertake regular and random; Test drivers in response to suspicious behavior; Require Project drivers to be trained in defensive driving and provided regular refresher courses; Develop a Traffic Management Plan covering vehicle safety, driver and passenger behavior, use of drugs and alcohol, hours of operation, rest periods and accident reporting and investigations; Install signage using accessible language and or symbols on the approach and at the entrance and within the Port Area indicating speed limits, junctions and crossing points where required; establish preparedness and response capabilities to deal with any road traffic or other accidents that may occur including multiple casualty events;				
WASTE MANAGEMENT								
W1	Waste generation resulting in contamination of soil, water or air, or becoming a health and safety risk to communities	Construction and Operation	Develop a waste management plan based on best practice	A waste management plan will be developed in line with the following principals: Waste will be disposed off in accordance with the waste management hierarchy: Cleaner production - operational activities at the site will be reviewed to look for opportunities prevent or minimize waste generation Recycle - where possible waste materials will be reused or recovered. Treat - If waste cannot be prevented or recycled treatment will be used to minimize the potential impact of the waste. This may include physical, chemical or destructive methods.	Visual assessment of site waste management.	Visual waste management plan	Monthly	EHS Compliance Officer

				Disposal - as a last resort waste will be disposed of in a suitably designed facility. Measures will include: The use of appropriate technologies, reuse and recycling of materials will be applied to achieve the efficient use of natural resources and other materials. Methods of safe handling and transport of waste will be defined. General waste and hazardous waste will be segregated and handle in an appropriate way. The treatment method for waters will be defined.				
W2	Waste generation resulting in contamination of soil, water or air, or becoming a health and safety risk to communities	Construction and Operation	Recycle as far as possible	The potential to recycle site wastes will be investigated the following will be undertaken: Where appropriate, waste oil will be recycled on site, returned to suppliers for recycling or burned using appropriate methods. The empty oil or chemical storage drums/containers will also be returned to suppliers for recycling or reuse. Plastic or glass containers shall be re-used wherever possible. Food waste will be used as compost and used to grow crops on site. The potential for supporting a commercial, community or school recycling initiatives will be investigated.	Recycling investigation report	Report	Monthly	EHS Compliance Officer
W3	Waste generation resulting in contamination of soil, water or air, or becoming a health and safety risk to communities	Construction and Operation	Waste disposal	Waste will be disposed of in the follow ways: General waste will be disposed of in a municipal [al land fill. Hazardous waste will be disposed of in a facility designed to manage such wastes and to prevent contamination of soil, water or air and such that it does not represent a risk to community health and safety.	Waste Register Waste Program Waste Receipts Training of Transfers	Review of documents	Monthly	Monthly

16 SUMMARY AND CONCLUSIONS

16.1 BACKGROUND

The ESIA identifies a number of potential impacts associated with the Project. The impacts were identified and assessed in accordance with the impact assessment methodology described in Chapter 5 and are designated as being of Minor, Moderate or Major impact significance.

Mitigation measures and enhancement measures were then identified to be implemented as part of the Project design, construction, operation and decommissioning phases. The impacts were then reassessed, with the implementation of the mitigation measures and a residual significance was assigned to each impact.

Table 49 provides a summary of the impact assessed in this ESIA. The premeditated impact and residual impacts are presented.

Table 49 Impact summary pre and post mitigation

Topic	Description	Impact Direction	Before Mitigation	With Mitigation
Degradation of water quality	Marine	Negative	Minor	Negligible
Introduction of Alien/Invasive	Negative	Negative	Minor	Negligible
Degradation of Sediments on the Shoreline	Negative	Negative	Major	Moderate
Impacts on Human Health	Air Quality	Negative	Negligible	Negligible
Air Quality	Noise	Negative	Negligible to Major	Negligible
Noise Impacts on Sensitive	Noise	Negative	Minor	Negligible
Receptors During Operations	Noise	Negative	Negligible to Major	Negligible
Impacts to Fisheries based	Livelihood	Positive	Minor	Minor to Negligible

16.2 KEY FINDINGS

The Port is currently a highly disturbed area and as such the receptor sensitivities are considered low for all receptors near the Port. In addition, there is likely to be at most a moderate scale change over background conditions for both social (livelihoods, community health and safety) and biophysical receptors (soil, water etc). Therefore, all but one of the impacts (introduction of alien species) are considered negligible to moderate prior to mitigation and negligible to minor after mitigation.

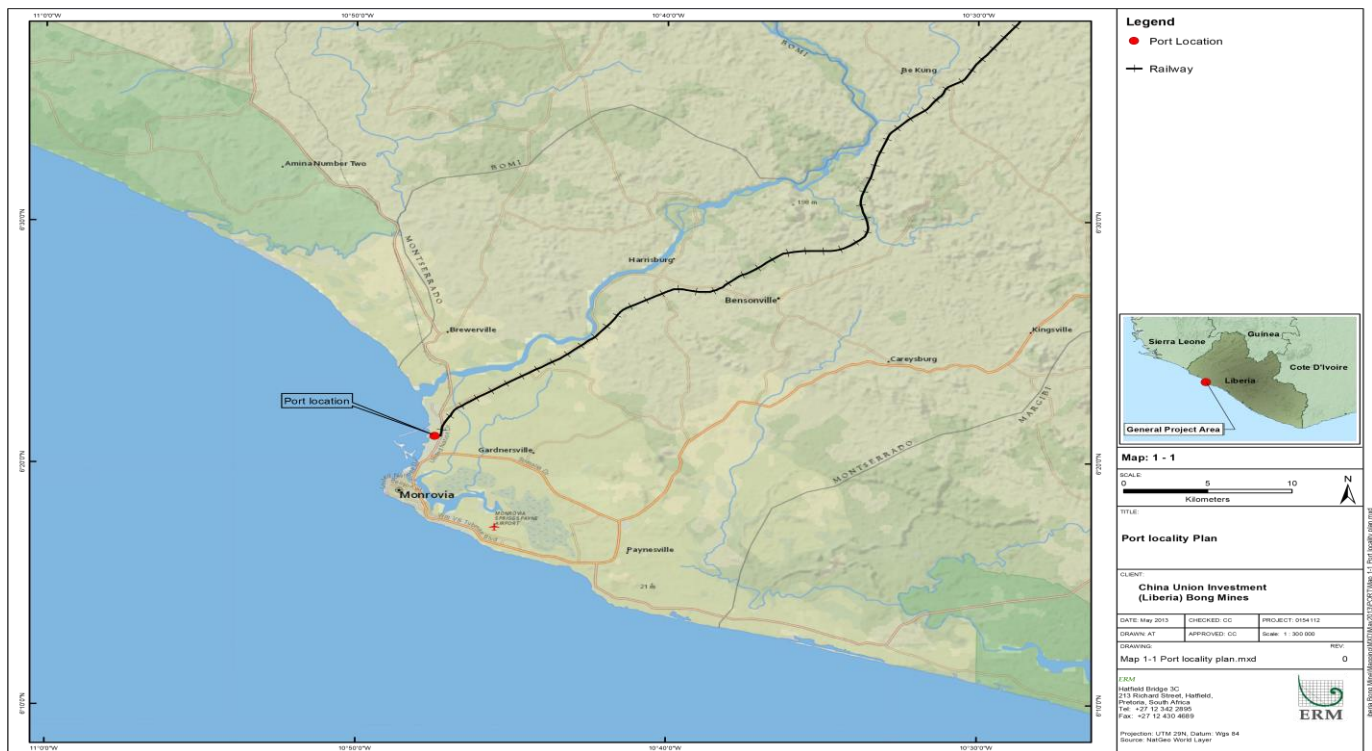
Introduction of Alien or Invasive Species

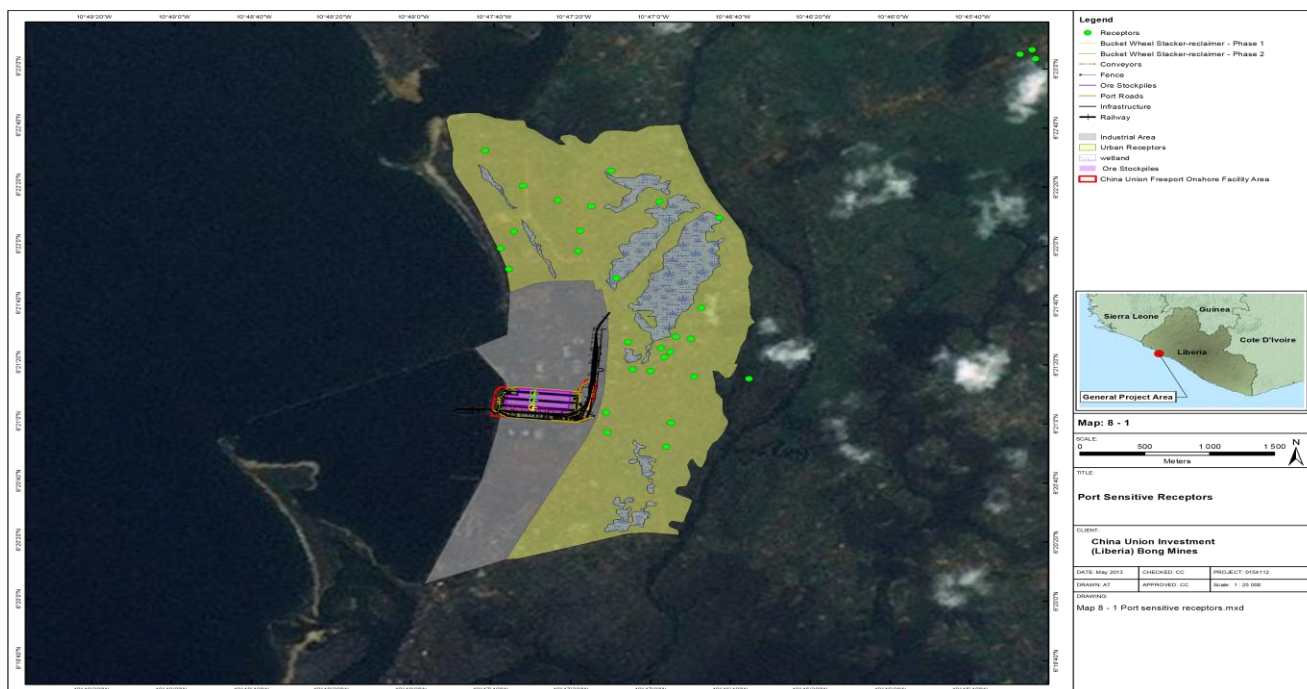
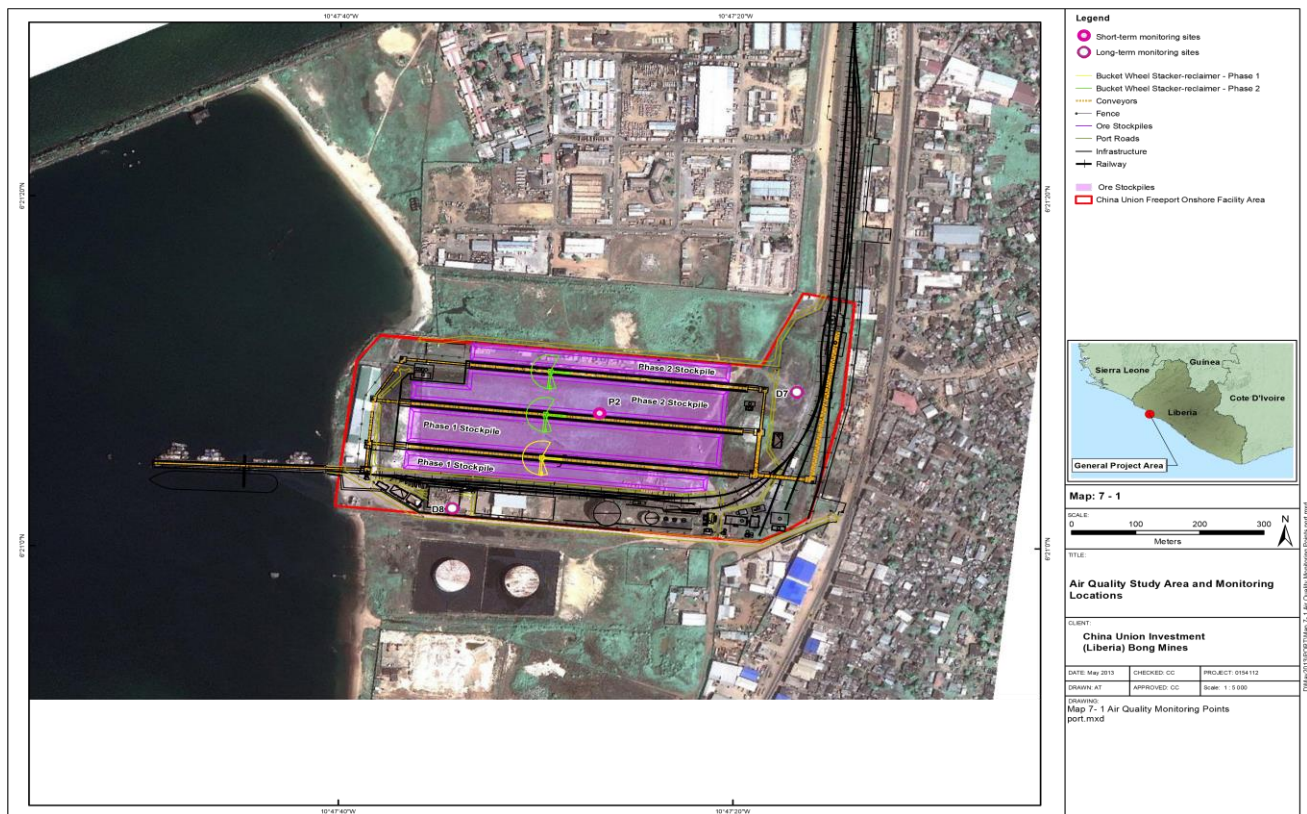
The introduction of alien species is considered a major impact prior to mitigation. This impact can be far reaching and the International Maritime Organization (IMO) considers the introduction of alien species to new environments via ship's ballast water, or other vectors, as one of the four greatest current threats to the world oceans.

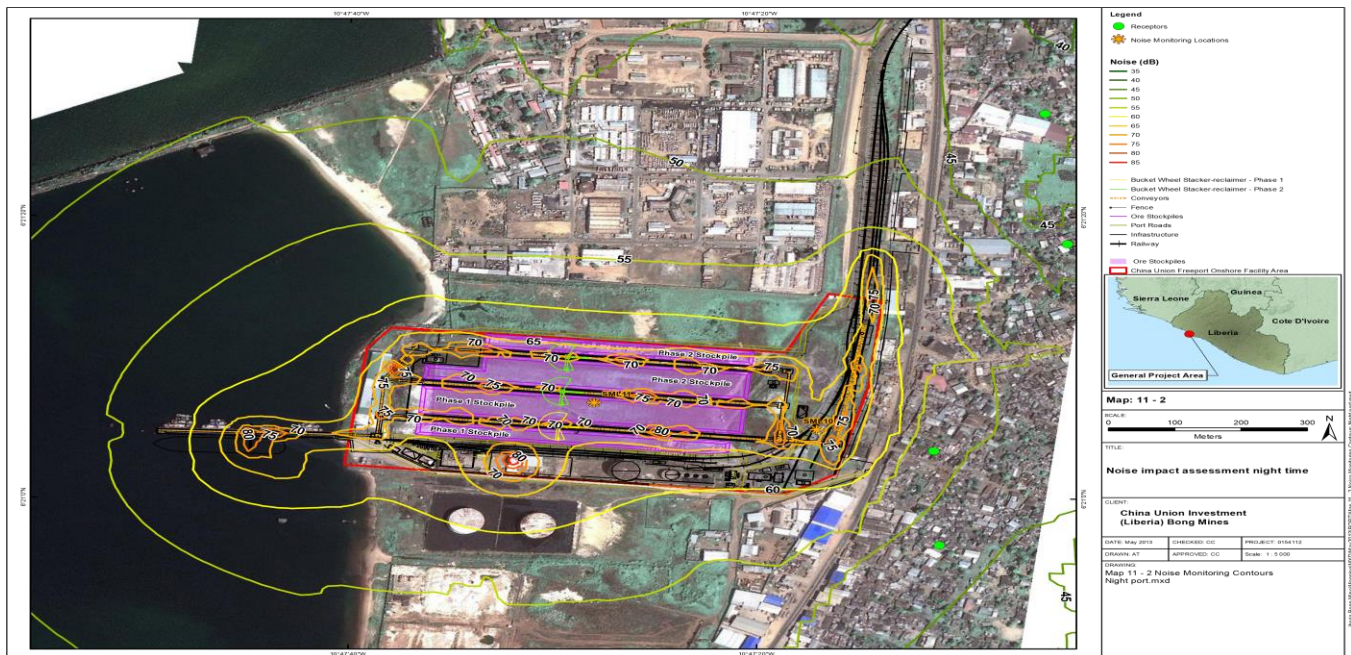
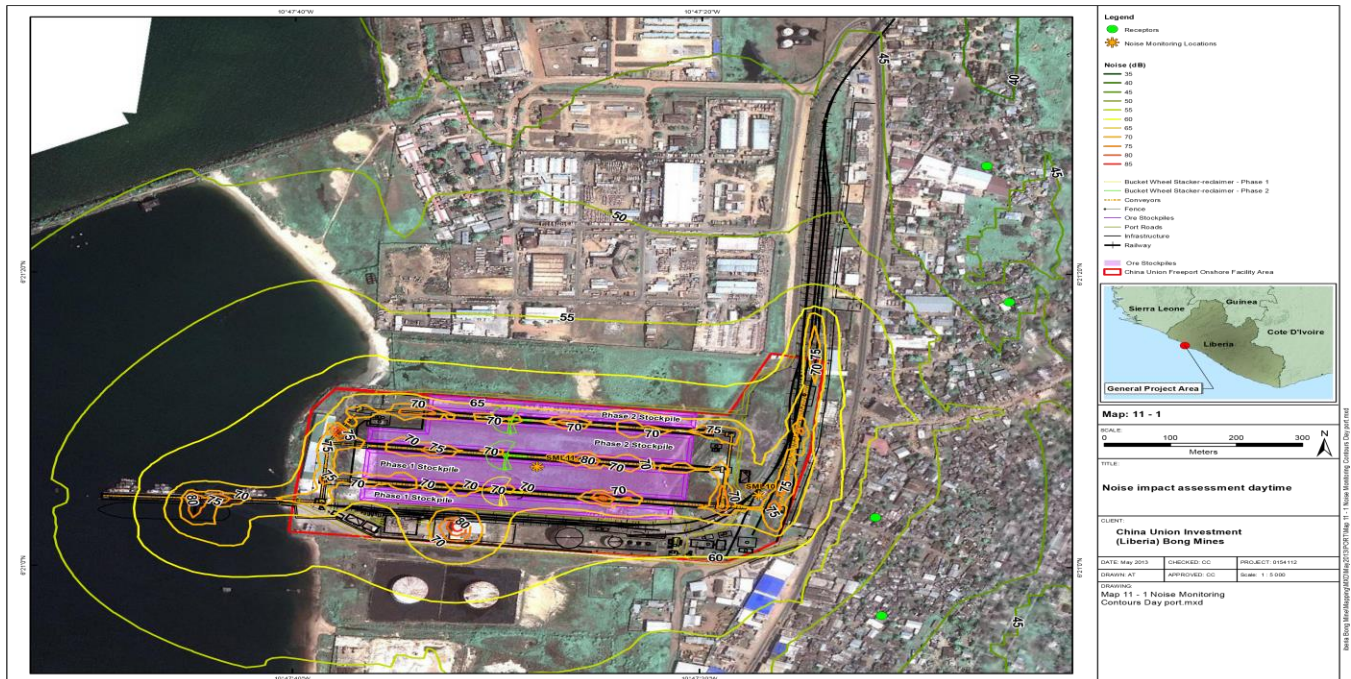
The IMO has specific guidance on the management of ballast water (the transfer mechanism for invasive species). These guidelines will be implemented, and the residual impact will be moderate.

16.3 CONCLUSION

The EIA process was intended to inform project planning and disclose project plans to stakeholders. The assessment identified a number of associated impacts as well as potential risks as discussed above. Mitigation and management measures have been developed to avoid, reduce or offset the impacts. China Union will need to ensure that mitigations and management measures are implemented during Project implementation and operations and monitor the biophysical and social environment to ensure that these mitigations are effective.







ANNEXURES

ANNEX 1 STAKEHOLDER ENGAGEMENT

Stakeholder Engagement Plan (SEP): *China Union Bong Mines Project, Liberia*

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1 INTRODUCTION

1.1 BACKGROUND

China Union Investment (Liberia) Bong Mines Company Limited (referred to as CU) commissioned Environmental Resources Management (ERM) to conduct an Environmental and Social Impact Assessment (ESIA) for its Bong Mining Project (the Project) in Liberia. In turn, ERM appointed EarthCons, now trading under the name Earth Environmental Consultancy Limited (EEC), as its local partner for the ESIA preparation. Furthermore, ERM contracted IDL, an international group with extensive experience in Liberia, to assist with the preparation of the socio-economic baseline study.

China Union has independently contracted EEC to prepare individual Resettlement Action Plans (RAPs) for managing physical and economical resettlement of PAPs induced by the Project. Consultation may have been conducted independently by the EEC team responsible for the RAPs preparation. The outcome of such consultation activities was not shared with ERM at the time of drafting this SEP.

Stakeholder consultation is a key component of the ESIA in order that the opinions and concerns of stakeholders affected by the Project are incorporated into the project programme and addressed prior to (or during) front-end planning. As part of the ESIA deliverables, a Stakeholder Engagement Plan (SEP) has been developed to guide the stakeholder engagement activities of the ESIA study.

The key objectives of the stakeholder engagement programme are to:

- Identify interests, problems, concerns and needs of key stakeholders;
- Inform stakeholders about the Project;
- Obtain feedback;
- Learn from local knowledge and understanding;
- Evaluate alternatives;
- Promote ownership and enhance social acceptability;
- Avoid conflicts and misunderstanding about the Project;
- Demonstrate commitment and involvement by the project owners, and accountability in addressing information gathered by consultation; and
- Establish long-term stakeholder engagement programme throughout the project life (planning, implementation and disclosure).

Effective stakeholder engagement is essential to deliver a project's "social license to operate". Proactive communication with stakeholders and effective consultation and disclosure will form an integral part of project development and should be designed to meet national regulations and international good practice, whilst respecting local cultural norms and project constraints. This Stakeholder Engagement Plan (SEP) outlines the consultation and disclosure activities that have been and will be undertaken by the project team during the ESIA study and recommends future consultation activities for the Project.

1.2 THE PROJECT CONTEXT

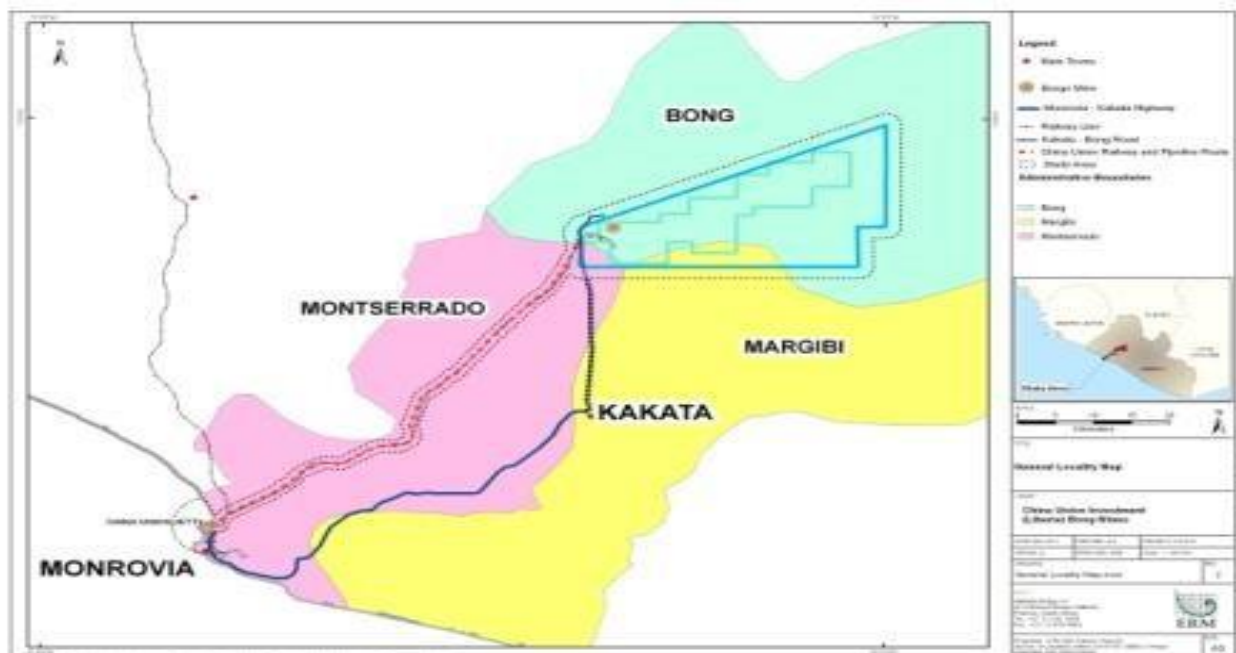
1.2.1 Overview

The Bong Range iron ore reserves were originally mined by the Bong Mining Company (BMC) from 1965 to 1990. Mining at the Bong Mine ceased in 1990 in part due to the Liberia armed conflict. In early 2008, following the end of the conflict and in the course of the revival of Liberia's economic resources, the Government of Liberia published a general solicitation for bid proposals for the Bong Range Concession Area. Through an international competitive bidding process, China Union's bid was accepted and on 19 January 2009, China Union's subsidiary companies China Union (Hong Kong) Mining Company Limited and China Union Investment (Liberia) Bong Mines Company Limited signed a 25-year Mineral Development Agreement with the Government of the Republic of Liberia (GoL) for the exploration and mining of iron ore in the Bong Range of Liberia.

The Project spans three counties in Western Liberia: Bong County, Margibi County and Montserrado County. Within these, seven districts are affected by Project Components.

China Union Investment (Liberia) Bong Mines Company Limited is now proposing a Project to re-commence mining. The main aspects of the Project entail the restoration, reconstruction, and expansion of the previously existing infrastructure, principally a raw ore processing plant, a heavy-oil fired power plant, the former BMC export jetty in the Port of Monrovia, and the Bong Mine Railway that links the mine to the jetty (Figure 1).

Figure 30: Overview of the Project Area



1.2.2 Project Project Schedule

The Project will be developed in two phases.

- In Phase 1, the Mine will be restored to a 1 Mtpa capacity which will involve rehabilitation and upgrading of the existing infrastructure as well as installation of new equipment and construction of new facilities at the Mine, Port and Railway.
- In Phase 2, the Mine will be expanded in order to produce 10 Mtpa of iron ore through expansion of the excavation and processing operations and handling capacity of the Port.

The current proposed schedule for the Project is shown in Table 1 below:

Table 50 Project Schedule

Project Element	Phase 1 Construction and Commissioning	Phase 2 Construction (Expansion)
Timeframe	2010 to 2013 (currently on-going)	2013 to 2015
Mine	Mining and processing of 1 Mtpa of iron ore	Expansion of the Processing plant and power plant and the pit
Port	Storage and export of 1 Mtpa of iron ore.	Expansion power generators, ore conveyers, ore stackers and stockpile area
Railway corridor	Redevelopment and reconstruction of the existing railway and the construction of auxiliary facilities at the stations.	Construction of one additional unloading line at the Port, two departure/arrival lines at the #1 Station, one additional departure line at the Bong Peak Station to achieve transportation capacity of 11.82 Mtpa

1.3 STRUCTURE OF THIS DOCUMENT

The remainder of the SEP is structured as follows:

- Section 2: Regulatory Review
- Section 3: Overview of Stakeholder Engagement Process
- Section 4: Stakeholder Engagement Context
- Section 5: Outcomes and Next-Steps
- Section 6: Grievance Mechanism
- Annex A: Stakeholder Consultation Record
- Annex B: Public Consultation Summary

2 REGULATORY REVIEW

2.1 LIBERIA LEGISLATION

2.1.1 *The Environment Protection and Management Law of the Republic of Liberia*

The Environment Protection and Management Law establishes the legal framework for the sustainable development, management and the protection of the environment by the Environment Protection Agency (EPA) in partnership with regulated Ministries and organization and with the people of Liberia.

One of the key objectives of the law is to encourage and ensure maximum participation by the people of Liberia in the management and decision-making processes of the environment and natural resources.

2.1.2 *The EIA Procedural Guidelines (2022)*

The EIA Procedural Guidelines include socio-economic requirements which specify the need for integrated public consultation on socio-economic and other biophysical project-related issues.

The EIA permitting process in Liberia is subject to a public review and involves the following procedure:

If an EIA is considered to be required, the project proponent shall carry out public consultation termed ‘scoping’. The Terms of Reference contained for preparation of the Environmental Impact Statement must take into account results of these consultations.

Following publication of the EIA, the Agency will invite comments from the public, within thirty days of the publication of the notice. Once public comments have been received, the agency will hold a public hearing if five or more persons submit written requests for a hearing or if the Agency determines that controversy about the project makes a public hearing necessary. The public hearing is required to be held at a venue that is convenient to communities specifically affected by the project.

2.1.3 *Summary of National Legislative Requirements on Stakeholder Engagement*

Key national legislative requirements on ESIA and stakeholder engagement is summarized in Table 2.

Table 51 National Legislative Requirements

Law/Policy	Summary
<i>The Environmental Protection and Management Law (2003)</i>	Four key principles guide the legislation including the principle of sustainable development and the principle of public participation. It regulates for the use of participative public consultation and disclosure during the environmental permitting process to ensure inclusive engagement and protect the

	right of the public to influence the design process at an early stage in the project cycle.
<i>The Mineral Policy of Liberia (2010)</i>	The exploitation of mineral resources should be underpinned by broad based sustainable growth and socio-economic development objectives.
<i>Community Rights Law (2008)</i>	Provides communities access, use and management rights of community and traditional (customary) lands and forest resources on them.
<i>Land Rights Policy Statement (Draft)</i>	The policy statement does not address existing land concessions, but it does lay the foundations for a legal framework protecting people with customary land rights.
<i>Liberian Labour Law (1989)</i>	Regulates the protection of the workforce in providing guidelines and restrictions relating to recruitment, wages, hours of work and general conditions of employment.
<i>Liberian Public Health and Safety Law (1956)</i>	Regulates occupational health and safety standards in the workplace as well as on environmental sanitation.
<i>Liberian law on Resettlement</i>	A resettlement process must ensure that households are justly compensated based on an evaluation of current market value, for loss of property; and if land is in public use at the time it is revoked, the Government should replace it with land of commensurate value.

2.2 INTERNATIONAL STANDARDS, GUIDELINES AND CONVENTIONS

2.2.1 IFC Performance Standards

The International Finance Corporation (IFC) has released a set of Performance

Standards on Social and Environmental Sustainability (January 2012). These Standards replace the IFC Safeguard Policies and are used to evaluate any project seeking funding through the IFC.

Since the Project is a private sector development that is not seeking external financing, it is referring to the requirements of the Performance Standards on a voluntary basis only and may not adhere to them all in full. The IFC Performance Standards are listed in Figure 2.

Figure 31: IFC Performance Standards

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

The Performance Standards require clients to engage with affected communities through disclosure of information, consultation, and informed participation, in a manner commensurate with the risks to and impacts on the affected communities. Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts) contains clear requirements for community engagement and as such is a key source of guidance for the Developers' engagement activities. The key objectives of Performance Standard 1 are detailed in Figure 3.

Figure 32: Objectives of Performance Standard 1

- To identify and evaluate environmental and social risks and impacts of the project;
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment;
- To promote improved environmental and social performance of clients through the effective use of management systems;
- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately; and
- To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts) states:

“Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project’s environmental and social impacts. Stakeholder engagement is an ongoing process that may involve, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination

of information, consultation and participation, grievance mechanism, and ongoing reporting to Affected Communities. The nature, frequency, and level of effort of stakeholder engagement may vary considerably and will be commensurate with the project's risks and adverse impacts, and the project's phase of development."

"The client will develop and implement a Stakeholder Engagement Plan that is scaled to the project risks and impacts and development stage and be tailored to the characteristics and interests of the Affected Communities. Where applicable, the Stakeholder Engagement Plan will include differentiated measures to allow the effective participation of those identified as disadvantaged or vulnerable. When the stakeholder engagement process depends substantially on community representatives, the client will make every reasonable effort to verify that such persons do in fact represent the views of Affected Communities and that they can be relied upon to faithfully communicate the results of consultations to their constituents."

The IFC Stakeholder Engagement Handbook provides detailed guidance on managing stakeholder relationships in a dynamic context, where unexpected events do can and do occur. The guidance focuses on stakeholder groups external to the core of the operations of the business e.g. affected communities, local governments, and None Government Organizations (NGOs).

2.2.2 World Bank Group Safeguard Policies

The objective of the World Bank's Environmental and Safeguard Policies is to prevent and mitigate undue harm to people and their environment in the development process. Safeguard policies provide a platform for the participation of stakeholders in project design and have be an important instrument for building ownership among local populations.

Relevant World Bank Group policies with provisions for public consultation are listed in Figure 4.

Figure 33 World Bank Group Operational Policies and Public Consultation

☐	Operational Policy 4.12: Resettlement;
☐	Revised Draft Operational Policy 4.10: Indigenous People (replaces Operational Directive 4.20 on Indigenous Peoples);
☐	Operational Policy 14.70: Involving Non-Government Organizations in Bank-Supported Activities.

The World Bank Group requirements focus on:

- Early consultation with affected people and NGOs;
- Early information disclosure; and
- Providing information in a way that allows informed consultation with stakeholders.

All key principles of the Operational Policies have been incorporated into the new IFC Performance Standards. There are, however, some slight differences between the guidelines (see Error! Reference source not found.). Of particular relevance to this project is the move away from a requirement to consult ‘at least twice’ during the assessment to an ongoing and iterative consultation process throughout the life of the project. In addition, the need for broad community support and the establishment of a grievance mechanism are additional to the requirements of OP 4.01.

Figure 34 Comparison of Safeguards and Performance Standards

Distinction between the Safeguards Policies and Performance Standard 1 (Social and Environmental Assessment and Management System), January 2012.
PS 1 goes beyond assessment to address implementation through the use of social and environmental management systems;
PS 1 broadens the scope of assessment to cover a broader geographic and time horizon – third party actions are considered;
PS 1 requires clients to prepare and disclose an Action Plan derived from consultation;
PS 1 requires comprehensive and on-going information disclosure and consultation with affected communities of all projects at a level commensurate with the project’s risks and impacts;
PS 1 requires free, prior and informed consultation and informed participation of affected communities for projects with significant adverse impacts on them; and □ PS 1 requires clients to establish a grievance mechanism.

2.2.3 Other International Conventions

In addition, Liberia has signed up the following international conventions which obligations and commitments are relevant to the ESIA (Table 6).

Table 52 Main International Conventions and Agreements Signed by Liberia

Convention	Key Objectives
<i>UN International Covenant on Economic, Social and Cultural Rights</i>	The granting of economic, social and cultural rights to individuals, including rights to adequate health, education and living standards.
<i>UNESCO Convention Concerning the Protection of the World’s Cultural and Natural Heritage</i>	To protect cultural and natural heritage of national and international value.
<i>Extractive Industries transparency Initiative (EITI)</i>	Strengthen governance by improving transparency and accountability in the extractives sector. LEITI requires that companies involved in extracting natural resources must publish what they pay, and the Government must report on what they collect from the companies.

<i>The Kampala Convention, Article 14 (1)</i>	To protect and assist internally displaced persons. Article 10 creates an obligation on states to prevent development-induced displacement. If the development goes ahead, the State is responsible for ensuring that the stakeholders concerned will explore feasible alternatives, with full information and consultation of persons likely to be displaced by projects. An assessment of alternative sites needs to be included in the ESIA.
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2.3 CORPORATE REQUIREMENTS

Wuhan Iron and Steel Company (WISCO), which owns a 60% stake in China Union Investment Company is listed on the Shanghai Stock Exchange (SSE). In 2008, the SSE released the Shanghai Corporate Social Responsibility (CSR) Notice and the Shanghai Environmental Disclosure Guidelines on strengthening listed companies' application of social responsibility. Listed companies that promote CSR are offered incentives like priority election into the Shanghai Corporate Governance Sector, or simplified requirements for examination and verification of temporary announcements. The SSE has also developed the concept of social contribution value per share (SCVPS) to measure a company's value creation. The Shanghai Environmental Disclosure Guidelines allow for the SSE to take "necessary punishment measures" against companies for violations of the disclosure rules.

As WISCO is a state-owned enterprise, it is subject to a rapidly evolving strategic framework established by State-owned Assets Supervision and Administration Commission of the State Council (SASAC). Under this framework, State-Owned Enterprises (SOEs) are expected to focus on becoming internationally competitive and internationally listed corporations, signaled by securing Global Fortune 500 status. In 2008, SASAC published a set of CSR guidelines for SOEs. The guidelines emphasize the importance of the 'principle of human-oriented and the Scientific Outlook on Development' to establish 'a "responsible" public image by Chinese enterprises and more internationally influential, or significant for China to spread an image as a responsible nation.' The Chinese Government has outlined a fourfold set of corporate obligations for SOEs which include:

- To run businesses that are successful over the long term;
- To pay taxes and behave ethically;
- To safeguard workers' rights and interests; and
- To protect the environment and to contribute to social welfare through philanthropic spending

China's Ministry of Commerce and Ministry of Environmental Protection further published Guidance on Protection of Overseas Investment Environment on February 18th, 2013. The guidance requires companies that invest overseas to:

- Target for sustainable development in host county;
- Respect local residents' religion, cultural tradition, and national customs of host countries, protect labours' legal rights, and provide trainings and job opportunities to affected residents;

- Promote the harmonious development of local economy, environment, and community, and cooperate with host countries based on the principles of mutual benefit and reciprocity; and
- Consider the project impacts on historical and cultural heritage, scenic spot, local tradition and customs, and take mitigation measures.

3 OVERVIEW OF STAKEHOLDER ENGAGEMENT PROCESS

3.1 OVERVIEW

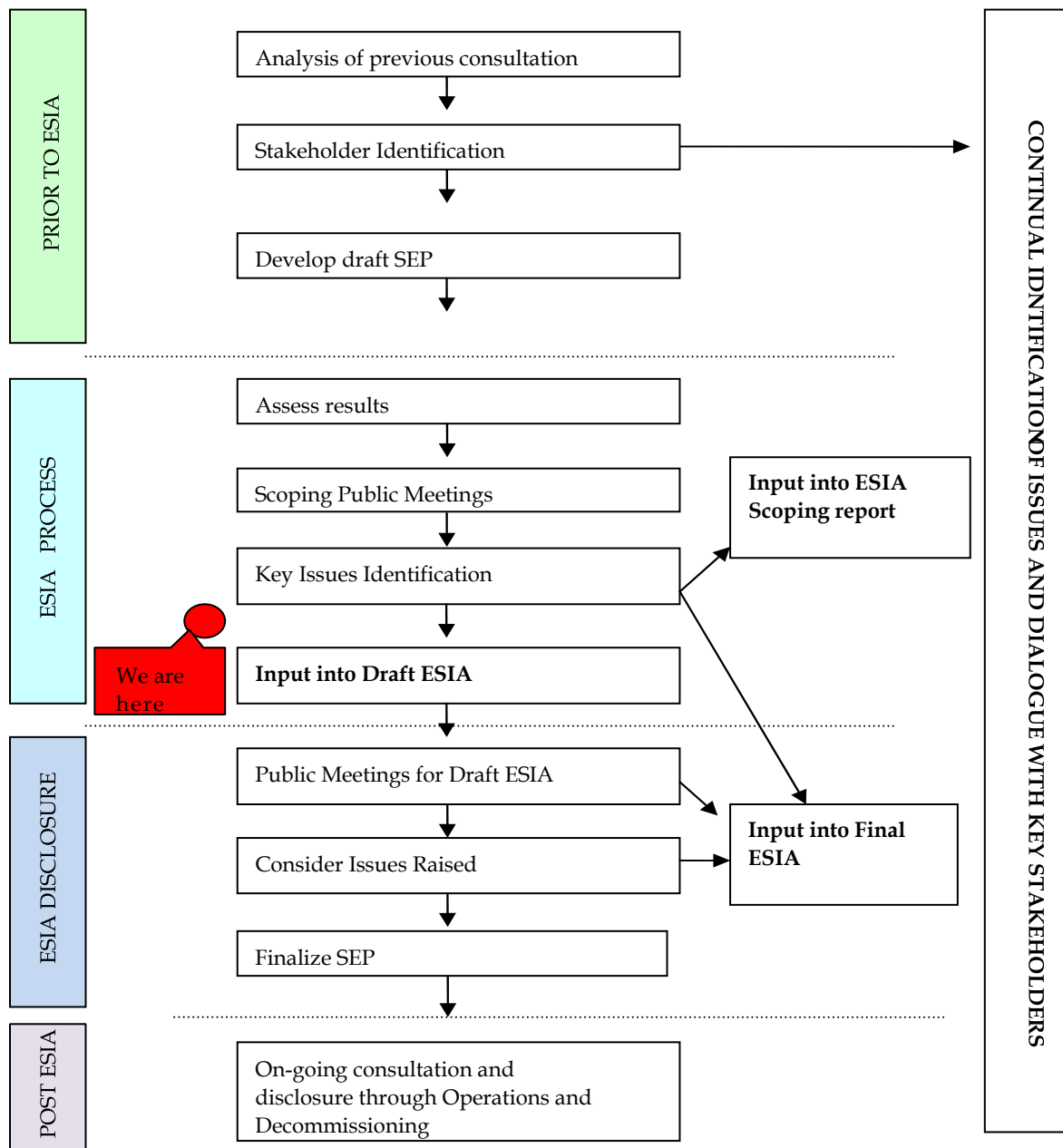
Stakeholder engagement has been conducted and planned for major phases of the ESIA process and has focused on specific topics using different engagement strategies and methods. These activities are summarized by phase in Table 4 below:

Table 53 Stakeholder Engagement Activities

Project Phase	Key Issues for Discussion	Engagement Strategy	Outputs
ESIA Scoping Phase	- Project description - Biophysical and socioeconomic characterization of the selected site - Potential impacts - Fatal Flaws - Main issues to be followed on in detailed studies - Stakeholder engagement process to be followed	- Publication of a Notice of Intent - Background Information Document available before and during meetings - Agency and Focus group meetings in Monrovia, Montserrado, Margibi, and Bong Counties	Scoping report & TOR's
ESIA Phase	- Final description of the project - Final Biophysical and socioeconomic characterization of the selected site - Identified impacts and mitigation measures - Environmental and Social Management Plan (ESMP) - Way forward	- Focus group meetings in Monrovia, Montserrado, Margibi, and Bong Counties - Open meetings in Faumah District; Kakata District; Todee; Careysburg; Commonwealth; and Greater Monrovia - Surveys/Questionnaires	- ESIA draft report - SEP draft report
ESIA Disclosure Phase	ESIA report and ESMP SEP	Draft ESIA & Nontechnical summary available before and during meetings Written comments Web-site disclosure (EPA website)	- ESIA Final Report - SEP Final Report
Project Phase	Key Issues for Discussion	Engagement Strategy	Outputs
Post-ESIA Phase (Construction, Operation and Decommissioning)	Project information disclosure, including monitoring reports of management plans, project benefit opportunities. Addressing community grievances	Information disclosure On-going engagement of key project stakeholders, including routine community meetings. Grievance redressing	Updated SEP Report Monitoring Report of Environmental and Social Plans (ESMP) Resettlement Monitoring Report

Since the ESIA Scoping Phase, the China Union Project has established a stakeholder engagement programme. The goal of the stakeholder engagement during the ESIA phase is to build upon the work already undertaken, and to develop a strategy that provides opportunities for all stakeholders to contribute to the development throughout the project life cycle. Figure 36 illustrates the stakeholder engagement flowchart for the Project.

Figure 35 China Union Bong Mine Stakeholder Engagement Flowchart



Tasks of each phase of stakeholder engagement are detailed in Table 5.

Table 54 Engagement Activity of Each Phase

Phase	Engagement Activities
Phase 1 Prior to ESIA	Scoping to introduce the Project, gain feedback on the main issues of concern and breadth of stakeholders to be consulted. Consultation during this step is mainly with decision makers. In addition, a project profile document is developed for distribution during the Phase 2.
Phase	Engagement Activities
Phase 2 ESIA Preparation	Development of the ESIA during which the key objectives are to provide information on the Project, obtain baseline information, consult on impacts and mitigation measures and identify areas where partnerships with different stakeholders can be beneficial to the Project and the region. Information is widely disseminated, and project views are obtained from a wide range of stakeholders. The greatest consultation effort during development of the ESIA is with those who will be directly affected by the Project.
Phase 3 ESIA Disclosure	Finalization of the ESIA report through disclosing the ESIA report and SEP to the affected stakeholders and incorporating their comments into the final report. The consultation will be arranged by the EPA, seeking input from line ministries and potentially arranging Public Consultations in affected communities on the mine site, alongside the railway corridor and in the vicinity of the Freeport exBMC yard.
Phase 4 Post ESIA	The project developers will take ongoing engagement forward during the project activities. Information disclosure will be one major part of the on-going engagement. Comments from stakeholders will be collected and incorporated into development and implementation of mitigation measures, i.e. Environmental and Social Management Plans (ESMP). The participation of stakeholders is fundamental to the success of some of the mitigation measures and rapid stakeholder feedback will be a critical component in monitoring the success of all mitigation measures. Monitoring reports of the ESMPs will be disclosed to affected communities to keep them updated and sort for their input. In addition, grievance procedures will be followed to collect, and address community grievances associated with the project development.

The SEP should be a living document that identifies and addresses emerging stakeholder concerns and issues. At the time that this SEP is prepared, key engagement activities for the ESIA process's Phase 1 and Phase 2 have been conducted and are summarized in the next sections.

As part of the ESIA disclosure (Phase 3), the following consultation activities may be conducted upon submission of the draft ESIA reports for the Bong Mine Project. These are driven by regulatory requirements and are to be arranged by the relevant authorities, led by the EPA.

Once the EPA has conducted its internal review for the adequacy of the ESIA reports, it will share these with the various stakeholders (relevant Line Ministry, any other relevant public agencies and local governments) for comment in the format of full ESIA (ref. Environmental Management and Protection Law of Liberia (2002), Section 16, Item 1). Within the same period the ESIA outcomes will also be shared with the community and the concerns and comments will be collated, in the format of Non-Technical Summaries for the broader stakeholder base (ref. Environmental Management and Protection Law of Liberia (2002), Section 16, Item 2). The final ESIA reports will be updated accordingly.

Once the ESIA is finalized and approved (Phase 4), focus of the project stakeholder engagement will be disclosure of project information and addressing community grievances.

Post-ESIA engagement activities include but not limited to:

- Report to the stakeholders on the implementation of various ESMPs and other project commitments via formal and informal reporting channels, e.g. disclosure of project monitoring reports, routine government reporting, public meetings, and site tours etc;
- Disclose and discuss project benefit opportunities and social investment initiatives with government and community stakeholders via forums, meetings, workshops and community liaison communications.
- Establish effective communication and consultation platform during the project implementation to collect and address community grievances, this may include effectively using Community Liaison Offices, assigning Community Liaison Officers and applying Grievance Procedures. It is particularly important to have such mechanism in place when project resettlement is conducted, and communities may have the most grievances.
- Engage broader stakeholders including communities along the railways and include them into consultation process.
- Carry out on-going disclosure and engagement to all stakeholders throughout the project construction, operation and decommissioning.

3.2 ENGAGEMENT APPROACH

To date, engagement has been conducted through the following three major approaches:

- Public meetings with community and village representatives; and
- Face-to-face meetings with government authorities, institutions, individual specialists and any NGOs identified; and

Household surveys of randomly selected Project Affected People (PAPs). Household surveys are a fundamental component of an ESIA as it provides the socioeconomic baseline information of the Affected Communities and a chance for the ESIA project team to discuss with the PAPs for the development of management and mitigation measures that are appropriate to the local conditions.

Public Meetings

The aim of public meetings is to inform the affected communities of the Project including the planned ESIA and to gain a good understanding of the socio-economic issues in the local communities and how the project may impact on them.

Face-to-face Interviews

Consultation with government stakeholders, institutions, individual specialists and NGOs are conducted through formal face-to-face interviews.

The interviews take the form of semi-structured interviews in which a simple introduction about the project and the ESIA was made, followed by discussions about:

- The role and responsibilities of the stakeholders in general;
- Its specific role in relation to the project activities;
- Any requirements in relation to the project activities;

- Opinions about the positive and negative impacts of the project activities;
- Concerns over current development; and
- Suggestions for the project owner.

Household Questionnaire Survey

Household questionnaire survey is the most efficient manner to undertake information disclosure and community engagement. The survey seeks information about the level of awareness of the Project and is also used to obtain a basic understanding on the socio-economic profile of local communities. Such survey serves four major objectives:

- Meet the China Union stakeholder engagement policies and guidelines;
- Inform local community the project information;
- Identify any concerns raised by the project affected people; and
- Collect local baseline information for the development of management and mitigation measures that are appropriate to the local conditions.

4 STAKEHOLDER ENGAGEMENT CONTEXT

4.1 STAKEHOLDER PROFILES

The following main stakeholder groups are mapped out during the engagement activities:

- **Government authorities:** government representatives of importance to the Project and the ESIA process at a state, regional, county and district level.
- **Affected communities:** communities at a local level that will directly be impacted (positive and/or negative) by the project.
- **Traditional authorities:** chiefs and elders of the Affected Communities at district, town and village level.
- **NGOs** (local, national and international): these are local environmental, social development, and women's NGOs and other civil society organizations with potential interests in the project. NGOs may also have useful data or insights into the local and national issues raised by the project.
- **Multilateral agencies and international organizations:** these comprise organizations based within and outside Liberia with an interest in the Project.
- **Academic institutions:** these are universities, colleges and research organizations which may have an interest in the project and may be able to provide useful baseline information related to the culture, history, or environment of the area.
- **Economically interested parties:** organizations, businesses and individuals with direct interest in the project e.g. running businesses or providing services and supplies to the project. Other mining sector companies: mining companies based within and outside Liberia with an interest in the Project.
- **Other interest groups:** these comprise, for example, media (both national and international), and political parties/groups, religious organizations.
- **China Union internal stakeholders,** including management and engineers.

Table 4 presents a list of identified stakeholders.

Table 55 List of Identified Stakeholders

Stakeholder Group	Stakeholder	Level
Government Authorities	Ministry of Land, Mines and Energy	National
	Environment Protection Administration Agency	National
	Forestry Development Administration	National
	Land Commission	National
	Centre for Development and Resettlement	National
	Bureau of Regional Planning	National
	Montserrado County Government	County
	Margibi County Government	County
	Bong County Government	County

Stakeholder Group	Stakeholder	Level
	Kakata District Government	District
	Fuamah District Government	District
	Paramount Chief of District Influence	District
Affected Communities	Bong County Community Liaison	County
	Community police in Bong Mine Town	Community
	Bong Mine Community	Community
	Johnson Town Community	Community
	King Peter Town Community	Community
	Caldwell Community	Community
Traditional authorities	Clan chiefs of Yarboyan, Zaweahkomu and Golorhama Clans	Clan
Religion leaders	Zhoos and spiritual leaders	Community
NGO	Rights and Rice Foundation	National
	Flora and Fauna International	International
	Sustainable Development Institute	National
	Green Advocate	National
Multilateral agencies and international organizations	GIZ (that is running an extractive resource governance programme)	International
	The World Bank	International
Academic institutions	Liberia Forestry Initiative	National
	Environmental Law Institute – Liberia	National
Mining sector companies and other operators	CHICO	International
	Western Cluster Limited	International
	LONGDA	National
	64 MW Mount Coffee Hydropower Plant, Liberia	National
Economically interested parties	Charcoal producers along the railway	Community
	Railway cart owners	Community
	Artisanal quarry miners along the railway	Community
	Traders who attend the markets along the railway	Community
	Fishermen in the dams	Community
	Farmers in the dams	Community
Contractors	RB Group	International
	Genesis Liberia Trucking Company	Regional
China Union internal stakeholders	Engineers, Management team	Internal

4.2 ENGAGEMENT STRATEGY AND ACTIVITIES

4.2.1 Engagement Strategy

Stakeholder engagement strategies are listed in Table 7.

Table 56 Stakeholder Engagement Strategy

No	Stakeholder Group	Engagement Strategy
1	Government authorities	Telephone interview, face-to-face meeting
2	Communities	Public meetings, household survey
3	Community leadership, Traditional authorities, and religious leaders	Informal face-to-face interview
4	NGOs	Telephone interview, face-to-face meeting
5	Multilateral agencies and international organisations	Telephone interview, face-to-face meeting
6	Academic institutions	Telephone interview, face-to-face meeting
7	Mining sector companies	Telephone interview, face-to-face meeting
No	Stakeholder Group	Engagement Strategy
8	Economically interested parties	Telephone interview, face-to-face meeting
9	Media	Telephone interview, face-to-face meeting
10	Contractors	Telephone interview, face-to-face meeting
11	China Union internal stakeholders	Telephone interview, face-to-face meeting

4.2.2 Engagement Activities

During the ESIA phase, the engagement activities have been conducted including public meetings, face-to-face meetings and household surveys.

Public Meeting

Four public meetings were held for the ESIA study and over 300 local affected persons attended the meetings. Table 8 presents the details.

Table 57 Four Public Meetings

Location of the Meeting	Community Group	Detailed Sitting of the Meeting Venue	Number of Participants
Bong Mine	Concession Area Bong Town Area	Including communities from within the Non-Goma Deposits Area.	96
Johnson Town	Rural residents in other smaller towns of Concession Area	Located approximately a third of the way down the railway towards Monrovia.	32
King Peter Town	Railway Buffer Zone	Along the railway on the outskirts of Monrovia	80

Caldwell Town	Freeport Area	Where the first dwellings are located, crossing the road from where the railway enters Freeport before reaching the BMC Pier.	104
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During the public consultations, a structured group work approach was used which gave all participants the opportunity to express their views. The public meetings provided opportunities for stakeholders to comment on the ESIA study and to suggest ways in which they would like to receive feedback. In addition, the public meetings introduced community stakeholders to personnel from China Union (and vice versa) and provided a platform for both sides to express their expectations and concerns for the future. The community concerns are further discussed in the SEP.

Face-to-face Interviews

Consultation with government stakeholders, institutions, individual specialists and NGOs were conducted through formal face-to-face interviews.

The key issues and concerns raised by the stakeholders were recorded for consideration in the ESIA and management plan. In total 18 consultation interviews were conducted during the ESIA study, including government authorities and NGOs.

Household Questionnaire Survey

A total of 279 random samples were selected for the household survey within the four major community stakeholders, as presented in Table 9.

Table 58 Household Survey

Community Group	Name of the Community	Estimated Number of Affected Households	Number of Samples
Concession Area Bong Town Area	Bong Town Community	1,362	60
Rural residents in other smaller towns of Concession Area	Johnson Town	1,195	91
Railway Buffer Zone	King Peter Town	400	59
Freeport Area	Caldwell Town	22,895	69

Data Source: Environmental and Social Impact Assessment of China Union Bong Mine, Phase 1 Social Baselines, IDL, December 2012.

4.3 STAKEHOLDER IMPACTS

Based on the stakeholder consultation and assessing their potential interactions with the project, the specific impacts caused by the project on the stakeholder groups are identified and assessed in Table 10.

Table 59 Stakeholder Impact Analysis

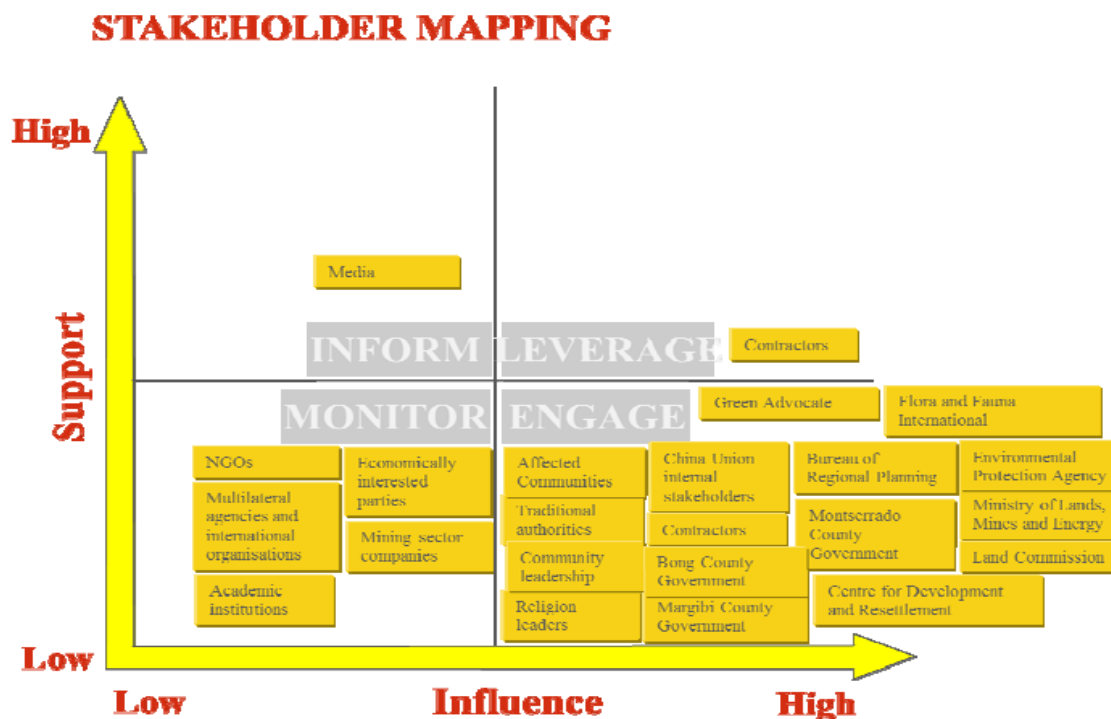
Stakeholder	Interaction with the project	Impacts
Government authorities	National, regional and local government authority individuals of primary political importance to the Project with permitting requirements that must be met by the Project.	□ Concerns on resettlement, compensation, and monitoring. □ Requirements for project compliance, information disclosure, and collaboration between the relevant ministries and local government.
Affected Communities	Households and communities that will experience impacts (positive or negative) as a result of the Project.	□ Loss of land and housing. □ Livelihood status may be affected, and income may decrease. □ Requirements for information disclosure.
Community leaders, Traditional authorities, and religious leaders	Traditional authority individuals whose chiefdoms are affected by proposed project activities.	□ Concerns on project potential impacts on living conditions, public utilities and infrastructure, community relationship, and resettlement.
NGOs	Organizations with direct interest in the Project and that are able to influence the Project directly or through public opinion.	□ Have useful data and insight may be able to become partners to the Project in areas of common interest; □ Can lead to project reputational issues if not appropriately engaged.
Multilateral agencies and international organizations	International in-country organizations with interest on the project performance.	□ May scrutinize the Project as a major international funded mining project. Can help the Project to perform according to international best practice.
Academic institutions	Other international, regional and local groups with direct interest in the Project.	□ Have useful data and insight may be able to become partners to the Project in areas of common interest; Can lead to project reputational issue if not appropriately engaged.
Mining sector companies	Other mining companies in the vicinity of the project or in the country.	□ Cumulative environmental impacts; □ Shared resources requirements including human resources, vessels; □ Requirements for information disclosure and communication.
Economically interested parties	Individuals or organization with direct economic interest in the Project. This may be through gaining contracts with the Project or due to economic impacts caused by the Project. They may also be potential business partners and finance institutions.	□ Requirements for information disclosure and communication. □ Project opportunities and benefits. □ Compliances.

Media	Media organizations with direct interest in the Project. They are able to influence the Project through public opinion.	Positive report can build a good image and reputation of the project owner; however, negative report may lead to project failure.
Contractors	Contractors working on the Project.	Good understanding of the project environmental, health, safety and social requirements can lead to project success; on the contrary, misunderstanding may lead to financial loss or reputational risk.
China Union internal stakeholders	China Union management, engineers, workers, and etc. working on the Project.	- Comprehensive understanding of the project and potential impacts - Consistency of project information disclosure

4.4 SWOT ANALYSIS

The stakeholder groups are analyzed according to their influence and interest in the project and classified into four groups to determine management actions: Informing, Leveraging, Monitoring, and Engaging (see Figure 7).

Figure 36 SWOT Analysis on the Stakeholder



5 STAKEHOLDER ENGAGEMENT OUTCOMES AND NEXT STEPS

5.1 STAKEHOLDER ENGAGEMENT ACTIVITIES

The stakeholder groups engaged to date include government authorities, affected communities, traditional authorities, NGOs, and affected residents as shown in Table 11.

Table 60 Consultation Activity Conducted to Date

Date	Major Task	Activities	Major Concerns / Suggestions
2011	ESIA Scoping Consultation	Government and community consultation	☐ Limited project information has been disseminated to the affected community.
April to October 2012	Government consultation	In total 18 interviews were conducted including government, NGOs and traditional authorities.	☐ The information disclosure and communication with government is not sufficient. The collaboration between the relevant ministries and local government is insufficient. The new resettlement payment scheme should be used. ☐ The resettlement process shall be monitored by a third party. ☐ Minister for Mines would like the ESIA to include guidance on how to manage ASM (this is relevant to the new gold fields which have been opened up in the north east of the Concession Area). ☐ China Union should take measures to ensure that there is no acidification in the water around the mine sites.
27th to 30th August, 2012	Public meetings, Household surveys	Four public meetings were conducted and over 300 local affected persons attended the public meetings. 279 household surveys were conducted.	☐ Lack of information disclosure and communication to local communities. Complaints on China Union's working conditions and low compensation. ☐ Local communities hope China Union to get fully involved in resettlement plans, establish and keep good relationship with local communities.

5.2 OUTCOMES OF STAKEHOLDER ENGAGEMENT

5.2.1 Concerns raised by Community Stakeholders

Broadly, China Union has the goodwill of many local stakeholders who appreciate the company's effort to re-start the mine. However, expectations among communities in the concession area are high and this brings risks, particularly as people expect China Union to deliver on a range of government responsibilities such as healthcare, education and roads.

The key issues collected from the affected communities through the interviews, public meetings and household survey are summarized in Table 12.

Table 61 Issues Raised by Communities

Issues	Description
Information Disclosure and Communication	The project information is not readily accessible to affected communities due to lack of engagement. - Local communities are not adequately informed of the resettlement information, e.g., resettlement schedule, compensation standard, whether they are covered in the resettlement scope etc. - The extent of house resettlement required along the railway track is not disclosed to local communities.
Work Conditions and Compensation	Local communities complained about the low salary, poor health care facilities, and poor conditions of working safety management.
Crisis of Confidence and Community Relationship	Communities do not trust that the Government will implement resettlement plans effectively and hope that China Union will become fully involved. China Union shall establish and keep good relationships with local communities.
Infrastructure Conditions and Restoration of the Damages	Local communities grumble over the bad infrastructure conditions, such as lack of health clinic, water system, toilet, market and flood control facility.
	Communities are worried about the damages to local infrastructure caused by CU and the restoration of damages. China Union shall take the responsibility to restore.
Environment Pollution	Communities complain that the drinking water has been damaged and are worried whether the Bong Mine development will make it worse.

5.2.2 Concerns raised by Government Stakeholders

The key issues collected through the interviews and consultations with government authorities are summarized in Table 13.

Table 62 Issues raised by Government

Issues	Description
Information Disclosure and Communication	The information disclosure and communication with government is not sufficient.
Participation in the Process of Granting Concessions:	People living in the communities are not consulted before or during concession negotiations, which may produce problems.
Collaboration between Ministries and Government	The collaboration between the relevant ministries and local government is insufficient, and there being a lack of internal coordination within the governments at all levels.
Resettlement and Monitoring	The new resettlement payment scheme should be used. The compensation and resettlement process shall be monitored by an independent third party.
ESIA Monitoring	The whole ESIA process shall be monitored by the Environmental Protection Agency.

Other mining company	The Director for Mines would like the ESIA to include guidance on how to manage Acid Sulphate Mining (ASM) alongside Grade a mining (this is relevant to the new gold fields which have been opened up in the north east of the concession area).
Water discharge	China Union shall take measures to ensure that there is no acidification in the water around the mine sites.

5.2.3 Recommendations and Suggestions

The stakeholder engagement activities conducted to date collected the following specific recommendations and suggestions as listed in Table 14.

Table 63 Recommendation and Suggestions

Issues	Suggestions and Recommendations
Information Disclosure and Communication	Prepare and implement a Stakeholder Engagement Plan to build collaborative relationships involving Government, civil society and company staff at all levels. Adequate and capable resources should be allocated.
	Engage with other communities along the railway and arrange public meetings
	Arrange a follow-up meeting to inform local communities of the consultation summary reports.
	Offer a programme of tours of the mine site for the communities around the mine.
	Seek details of compensation payments from the relevant Government departments and share these at the follow-up public meetings.
	Prepare a short, readable summary of the MDA for wide dissemination across the concession area.
	Plan a schedule of regular meetings and inform local communities.
	Simplify the reports before disseminating to the communities.
Collaboration between Ministries and Government	Engage an individual or organization to support China Union in a Government liaison function.
	Engage the county-level government officers and local government officers in any survey to identify which households need to be resettled.
Resettlement and Monitoring	Engage the Centre for Development and Resettlement Initiatives (CDRI) to act as monitoring party to verify a sample of the resettlements along the railway.
	Engage the local leaders in the resettlement process because the local leaders can easily talk with their people and find replacement land for them.
Work Conditions and Compensation	Engage more closely with sub-contractors to ensure that working conditions at the mine are in line with best practice in Liberia.
Infrastructure Conditions	Engage with the government to renovate the BMC camps, upgrade the school and hospital.

5.3 PROJECT INFORMATION DISCLOSURE

The stakeholder engagement outcome proves that there is emerging and increasing need for systematic project information disclosure to avoid misunderstanding and minimize negative project impacts to stakeholders. A project disclosure plan is therefore outlined in Table 15.

Table 64 Project Disclosure Plan

When	What	Measures	Who	Status
Prior to ESIA	Analysis for previous consultation, stakeholder identification, draft SEP preparation.	Desk-top research, document review, stakeholder consultation, meetings	ERM, EarthCons	Done.
ESIA Process	Results assessment, scoping public meetings, key issues identification, draft ESIA preparation.	Focus group meetings, interviews, flyers, Project Information Disclosure Brochure	ERM, EarthCons	Done.
ESIA Disclosure	Simplify the reports before disseminate to the communities for public meetings.	Public meetings, interviews, flyers (e.g MDA), newsletters, letters,	China Union and ESIA team to support EPA	To be done.
	Engage with other communities along the railway	Public meetings, interviews	China Union and ESIA team	To be done.
	Arrange a follow-up meeting to inform local communities of the consultation summary reports	Public meetings, interviews, flyers	China Union and ESIA team	To be done.
	Seek details of compensation payments from the relevant Government departments and share these at the follow-up public meetings	Public meetings	China Union and the RAP contractor	To be done.
	Prepare a short, readable summary of the MDA for wide dissemination across the concession area	Flyers, brochures	China Union	To be done.
	Set up routine meetings with affected communities	Community meetings	China Union	To be done.
Post-ESIA Phase (Construction)	Disclose project ESMP implementation information, including monitoring reports, routine reports, and resettlement monitoring reports.	Company website, hard copies available in the Community Liaison Office, dissemination to affected communities.	China Union	To be done.

	Prepare a short, readable summary of the MDA for wide dissemination across the concession area	Flyers, brochures	China Union	To be done.
When	What	Measures	Who	Status
	Disclose Project Information Disclosure Brochure	Brochure	China Union	To be done.
	Disclose project information to affected communities, including construction schedules, contractors, contact details	Letters, public meetings, interviews, flyers brochures, media	China Union, construction contractor	To be done.
	Disclose community grievance procedure	Public meetings, brochures, flyers	China Union	To be done.
	Disclose project employment and procurement plans, social investment plans, and infrastructure plans	Public meetings, brochures, flyers, CLO office	China Union	To be done.
Post-ESIA Phase (Operation)	Disclose project ESMP implementation information, including pollutant emission monitoring reports, routine reports, ESMP monitoring reports, RAP monitoring report	Company website, hard copies available in the Community Liaison Office, dissemination to affected communities.	China Union	To be done.
	Disclose Project Information Disclosure Brochure	Brochure	China Union	To be done.
	Disclose project information, including operation plans, management plans, new initiatives related to communities.	Public meetings, brochures, flyers	China Union	To be done.
	Disclose community grievance procedure	Public meetings, brochures, flyers	China Union	To be done.
	Disclose project employment and procurement plans, and social investment plans.	Public meetings, brochures, flyers, CLO office	China Union	To be done.
Post-ESIA Phase (Decommissioning)	Disclose Project plans for decommissioning	Public meetings, brochures, flyers	China Union	To be done.

As the Project proceeds, China Union will need to tailor its project disclosure measures to a local context and incorporate stakeholder concerns.

5.4 NEXT-STEP ENGAGEMENT

It is understood that the ERM ESIA subcontractor IDL group conducted major stakeholder engagement activities during the ESIA course, with administrative and logistic support from China Union. The next step of engagement was led by China Union to build up a good relationship with major stakeholders and gain broader community support.

Table 16 Summarize consultation activities recommend on next step actions for further stakeholder engagement.

Table 65 Next Step Engagement Actions

When	Stakeholder Group	What	How	Who	Remarks
ESIA Process	Stakeholder groups that have not yet been consulted to date.	Information disclosure, consultation and impact assessment.	Telephone interviews, face-to-face meetings.	China Union, with support from IDL group	To be done. (Multilateral agencies and international organizations, academic institutions, mining sector companies, economically interested parties, media, China Union internal stakeholders and contractors)
ESIA Disclosure	All identified stakeholders	Public meetings organization, SEP finalization	Letters, public meetings, interviews	China Union, with support from ESIA Team	To be done.
	Other communities along the railway	Public meetings organization, SEP finalization	Letters, public meetings, interviews	China Union, ESIA team	To be done.
Post-ESIA Phase (Construction, Operation and Decommissioning)	All stakeholders	On-going consultation and disclosure	Letters, meetings, interviews, flyers	China Union	To be done.
	Government authorities	Reporting and Legal compliance	Project monitoring reports, routine reporting and meetings, letters, workshops	China Union	To be done.

	Government authorities	Engage an individual or organisation to support China Union in a Government liaison function	Routine reporting, coordination and communication	China Union	To be done.
	Government authorities	Resettlement coordination	Setting up a steering committee for resettlement, routine meetings on resettlement issues	China Union, Resettlement consultant	To be done
When	Stakeholder Group	What	How	Who	Remarks
	Affected communities	Information disclosure and on-going consultation	Mine site tours, Opening Day, other means of disclosure (see Table 5.5)	China Union	To be done.
	Affected communities	Resettlement coordination	Setting up a resettlement committee, routine and <i>ad hoc</i> meetings on resettlement issues	China Union and resettlement consultant	To be done
	Affected communities	Grievance redressing	Grievance procedure and reporting	China Union	To be done.
	Affected communities	Social Investment Plans (SIP) related to community development	Setting up a Committee responsible for consulting on SIPs	China Union	To be done
	Traditional leaders	Disclosure and consultation	Routine visits, workshops and meetings	China Union	To be done.
	Economic interest groups	Disclosure of opportunities, training, collaboration, grievances on compensation	Workshops, training programme, routine meetings	China Union	To be done.

	Contractors and suppliers	Company ESMP training, SEP training, supervision of implementation	Training programme, supervision and monitoring, meetings	China Union	To be done.
	Other mine developers	Discussion of issues, lessons and experiences, collaboration	Workshops, forums, routine meetings	China Union	To be done
	NGOs, multilateral organizations, media, academic	Information disclosure, seeking advices, addressing issues	Workshops, development programmes, forums, meetings, interviews	China Union	To be done
	Other stakeholders	Information disclosure	Reporting, brochures, flyers, website	China Union	To be done

6 GRIEVANCE MECHANISM

Grievances are any complaints or concerns regarding the way a project is being implemented. They may take the form of specific complaints for damages/injuries, concerns about routine project activities, or perceived incidents or impacts. It is identified by public community meetings that local communities require a grievance mechanism available to voice their opinions. Identifying and responding to grievances supports the development of positive relationships between projects and the communities, and other stakeholders.

A grievance redress mechanism therefore provides a formal and ongoing channel through which stakeholders can engage with the company, whilst the monitoring of grievances acts as a risk management tool, signaling any potential escalating conflicts or disputes.

6.1 MANAGEMENT OF GRIEVANCES

The management of grievances is a vital component of stakeholder management and an important aspect of risk management for a project. Grievances can be an indication of growing stakeholder concerns (real and perceived) and can escalate if not identified and resolved. The Project has the potential to affect people to varying degrees and identifying grievances and ensuring timely resolution are tasks that pose challenges.

As a general policy, China Union project team will work pro-actively towards the prevention of grievances through the implementation of impact mitigation measures and community liaison activities that enable China Union project team to anticipate and address potential issues before they become grievances. Nevertheless, should grievances emerge, the China Union project team is committed to addressing these in a timely and effective manner in accordance with Liberian Law, international best practice and the Company's Internal Grievance Procedure.

The primary objective is to ensure that people affected by the project can present their grievances to the China Union project team for consideration and correction if appropriate.

The Grievance Procedure will be free, open and accessible to all and comments and grievances will be addressed in a fair and transparent manner. The local community stakeholders and all affected parties will be informed of the intention to implement the grievance redress mechanism, and the procedure will be communicated and disclosed during the phase of the ESIA via:

- Posters (at the Project affected communities and project location);
- Newspaper Announcements (both at regional and local levels); and
- A dedicated slide presentation in the Project affected communities and locations

At all times, the complainant will be able to seek other legal remedies available to them in accordance with the laws of Liberia. The grievance procedure will be used and updated with the project development.

6.2 RESPONSIBILITIES

Community Liaison Officers (CLOs) will manage the grievance process and will be responsible for collating written complaints and coordinating responses to all complaints. All responses to complaints will be in writing.

6.3 GRIEVANCE LOG

Each complaint will be assigned an individual number, to ensure that it is appropriately tracked, and recorded actions will be completed. The grievance log will contain a record of the person responsible for an individual complaint, and will also record dates for the following actions:

- Date the complaint was made;
- Information on proposed corrective action sent to complainant (if appropriate);
- The date the complainant was closed out; and
- Date response sent to complainant.

6.4 PROCEDURE

The grievance procedure will follow the following key steps:

- a) Identification of grievance through personal communication with the ESIA team, directly through the China Union team via telephone, letter, grievance form, during meetings, or another route.
- b) A grievance is recorded and classified in the 'Grievance Log' (written and electronic) by the CLO. The log will be kept in a shared drive, and accessible to the CLO and Public Relations/Grievance Manager in the Monrovia office, and the EHS and Community Manager in the Monrovia project team office.
- c) Grievances are formally acknowledged through a personal meeting, phone call, or letter as appropriate, within 5 working days of submission. If the grievance is not well understood or if additional information is required, clarification will be sought from the complainant during this step.
- d) The CLO will inform the Public Relations Officer at China Union as appropriate and where required. The CLO will support the Project team
- e) in deciding who should deal with the grievance and determine whether additional support is necessary.
- f) The China Union Public Relations Officer formally delegates grievance in writing to the relevant department(s)/personnel /contractor for development of an appropriate response.
- g) A response is developed by the delegated team and Public Relations Officer with input from the Senior Management and others, as necessary. Should the need arise the Project will consider the establishment of a conflict resolution "committee" for the management of complex grievance issues.
- h) Required actions are implemented to deal with the issue, and completion of these is recorded on the grievance log.
- i) The response is signed-off by the appropriate manager. The sign-off may be a signature on the grievance log or in correspondence which should be filed with the grievance to indicate agreement and referenced in the grievance log.
- j) The response is communicated to the affected party; the CLO and Public Relations Officer ensure that a suitable approach to communicating the response to the affected party is agreed and implemented.
- k) The response of the complainant is recorded to help assess whether the grievance is closed or whether further action is required. The CLO will use appropriate communication

channels, most likely face to face meetings or telephone, to confirm whether the complainant has understood and is satisfied with the response. The complainant's response will be recorded in the grievance log.

- l) The grievance is closed with sign-off from the CLO who determines whether the grievance can be closed or whether further attention and action is required. If further attention is required, the EHS and Community Manager will return to Step 3 to re-assess the grievance and then take appropriate action.
- m) The feedback mechanism through China Union. China Union should establish an efficient mechanism for giving feedback information face to face to the affected key community leaders or CLOs.

ANNEX 1-2 STAKEHOLDER CONSULTATION RECORD

Names of Organization	Contact Person (Name) and Title	Date	Key Issues, Concerns and Suggestions
Environmental Protection Agency	Varney Conneh, Head of Compliance Morris Gontor, Assistant Coordinator, ESIA	4.10.12	• Contact with the EPA: There are many consultants working on different ESIA's; the EPA needs to streamline its contact on each ESIA. For China Union Bong Mine, the EPA requests that all contact with the EPA re the ESIA should be done through the Liberian partner i.e. EarthCons. • Monitoring the ESIA process: The EPA also expressed an interest in sending an EPA representative with the SIA team so that they could monitor the approach. The IDL group said that they would be happy to facilitate their monitoring for the remaining parts of the SIA. It was agreed that EarthCons would bring this to ERM's attention and would liaise with EPA to organize it. • Concern with RAP compensation: The new payment scheme introduced by the MoA should be used – EarthCons confirmed that this had been used.
Ministry of Lands, Mines and Energy	Mr Hines Williams, Assistant Minister, MLME Aagon Gwaikolo, Director of Mines	4.10.12	• Resettlement: The Deputy Minister believed that the compensation and resettlement process has been somewhat of a 'segmented exercise' and that it wasn't holistic enough. He expressed that there wasn't enough engagement with the different departments within government and the MLME would have preferred more communication from EarthCons. The Assistant Minister asked EarthCons to send a copy of the compensation price structure. The Assistant Minister expressed a preference for EarthCons to take responsibility for finding a new location for Bloom, Beamu, James Kaine Town, Sekou Town and Glayla PAPs and that China Union should pay for this. The Assistant Minister also expressed a concern that there was no 3rd party monitoring of the compensation process. The Assistant Minister would like this to be an international body. • Artisanal mining: The Director for Mines would like the SIA to include guidance on how to manage ASM alongside Grade A mining (this is relevant to the new gold fields which have commenced operations in the north east of the concession area). The MLME does not have an outright non-issuance of small scale mining licenses within the Concession Areas as long as the small-scale mining does not interfere with the large scale mining.
Land Commission	Cecil T.O. Brandy, Chairman	4.10.12	• Ambiguous legal position of customary land: There is ambivalence regarding the definition of customary land. A new policy on user rights which has just been produced by the Land Commission which recognizes the importance of FPIC. • Lack of participation in the process of granting concessions: People living on the land are not consulted before or during concession negotiations. If the Government doesn't pay attention to this, Liberia will start to have problems. He expressed that the young people who are getting frustrated with the way things are being done.
Centre for Development and Resettlement	John Saah Nyumah, Director	4.10.12	• No independent monitoring of resettlement process at China Union: Centre for Development and Resettlement Initiative (CDRI) believe that they have a role to play in the resettlement programme at China Union.

Flora and Fauna International	Hon. Janslund Hanson, Director	5.10.12	Pyrites: What measures are China Union taking to ensure that there is not an acidification problem in the water around the mine site?
Green Advocate	Alfred Brownell, President	5.10.12	Lack of consultation: The president of Green Advocate, Albert Brownell complained about a lack of consultation during the scoping phase. Lack of communication of results of different studies: Mr Brownell pointed out that most of the local level stakeholders are illiterate and therefore project information must be designed with this in mind. Reports need to be simplified before being disseminated to the community.
Bureau of Regional Planning	Sedekie B Kamara	5.10.12	Mr Kamara discussed the regional development plans for the Bong Area. Thought that it would be good to facilitate a coordinated discussion on how the Bong Mine rail could best be used to benefit the region.
Montserrado County Government	Hon. Grace-Tee Kpaan, County Superintendent Montserrado	5.10.12	- Lack of collaboration between the relevant ministries and local government: In particular, the County Superintendent had not received any communication from MLME re the imminent relocation of households located along the railway. The county land surveyor, county land commissioner, county inspector and the county engineer should have been involved in any survey to identify which households need to be resettled. - Squatters: The recent history of Liberia means that squatters should not just be thrown out of the buildings they are living in. They need to be provided with an alternative location to live. Allocation of the Social Development Fund (SDF) and source of funding for resettlement: The SDF should be combined with the County Development Fund. Money will be needed for resettlement, not clear where this is going to come from.
Margibi County Government	Hon. John Z. Buway, County Superintendent Margibi	9.10.12	Lack of collaboration between the relevant ministries and local government: In particular, the County Superintendent had not received any communication from MLME regarding the development. Allocation of the SDF and source of funding for resettlement: Margibi receives USD 875,000 from China which forms the county Social Development Fund.
Bong County Government	Hon. Selena P. Manpay, County Superintendent Bong County	17.10.12	Lack of collaboration between the relevant ministries and local government: In particular, the County Superintendent had not received any communication from MLME re the allocation of the SDF: China Union now pays USD1.75million to the county social development fund. 20% should be used for the affected areas. The money was used to construct a school and a road in Fuamah Sanoyea Districts. China Union should renovate the BMC camps, upgrade the school and hospital and employed more locals.
Local Government	Omega M. Sawyer, District Commissioner Kakata	03.10.12	- Commissioner Sawyer complained that the Central Government leaves the local authorities out of the resettlement and payment process. According to him, during BMC time all local authorities were present during the resettlement process. - China Union tend to liaise with central government and not with the regional and local representatives - Out of the 45 households that were compensated, only two were able to show land deeds - China Union promised to clear the area, once a new location had been found for the resettled towns. However, this agreement is not in writing, it is a 'gentleman's agreement'.

			• Commissioner Sawyer has told the General Town Chief of Blomoh to find an area and they will help arrange with the land owners for the people to settle there. • 20% of the SDF should be for the affected areas. The Commissioner plans to use some of the SDF for the resettled communities
Local Government	Hon. Mulbadh Garter Clan Chief Yarboyan Clan	01.10.12	• There are some land issues in the area. It's hard for strangers to get permission to plant trees (rubber). There is some disagreement about the boundary between Fuamah and Margibi. People in Gbwamu have been planting live trees (rubber) and rice in Fuamah (Gbwamu is in Margibi). The Yarboyan people brought the issue to the District Commissioner and the Paramount Chief. It was decided that the place is for them. • There were divisions between Popota and Bong Mine Town during the war – Popota supported Taylor while UNIMO held Bong Mine Town. There are good connections now between the two towns.
Local Government	Hon. Bondo P.Z. Dennis Clan Chief Giamusu Clan	10.10. 12	• Is concerned that Giamusu Clan be informed of any resettlement. Most of the negotiations are done with Hon. Tati Joseph who does not represent the Giamusu Clan
Local Government	Madam Kar Gibson, Paramount Chief for Kakata Chiefdom	09.10.12	• The government needs to include the local leaders in the resettlement process because the local leaders can easily talk with their people and find place for them

Bong Mine Community	96 community members including the Commissioner of Foamah District, the Town Chief of Bong Mine.	27.08.12	- Debts owed by the old BMC Company: Payments are still to be made – expectation that CU would pay this before doing anything else. <i>This is a Ministry of Labor issue, and they are being considered to be slow in resolving this.</i> - Education: Scholarships were ‘promised for our children’ but so far nothing has been heard regarding this. <i>US\$3.5m is paid each year by CU to GoL, US\$200,000 of this is for allocated for scholarships; CU can ask whether any of this is being spent locally.</i> There is no sign of a technical college or industrial training institute – will this be forthcoming? <i>There are plans in the pipeline, but CU are waiting for GoL to agree on the use of existing Government buildings.</i> - Resettlement: People want to know the amount that will be paid for crops, buildings, etc. in the case of damage or resettlement. <i>There has been a schedule of payments prepared by the Government, this can be shared with people when we receive feedback.</i> Who is going to be resettled next – those who were surveyed? <i>Four communities are being resettled right now. There are no plans for any more resettlement at this stage, but we do not know about the future.</i> - Environmental pollution: What happens if drinking water is damaged by the company? <i>That’s why we need accurate data at this stage so we can measure any impacts that are felt at a later date.</i> - Infrastructural development: Will the electricity and water infrastructure be extended to people beyond the mine? <i>It will be extended to the public hospital, school and a government building – beyond that we have no plans as that is a matter for Government to solve.</i> There was a call for support for agriculture – this had not been prioritised. <i>This was not addressed at the meeting other than suggesting much of what was being asked about was a matter for GoL</i> Much of what the company has built so far is sub-standard. <i>This was not addressed at the meeting.</i> - Employment: Will local people be employed at the mine? <i>That is the intention, but CU employs very few people as most are hired by contractors.</i> Will the people be employed properly and not just on short term contracts? <i>In the long</i>
Johnson Town Community	32 community members	28.8.12	- School and education: There are 3000 boys and girls not attending school in this district, will there be improvements here? <i>CU is giving USD 4 million per year to GoL and local government should apply for some of these funds. CU will do more for the communities when they have started to transport iron ore.</i> - Employment and training: Will CU hire local people to work along the railway? And will CU provide training for local people so they can apply for jobs? <i>CU will hire more local people later on when needed, and will consider training local people. CU also has plans to start a technical college in Bong town.</i> - Resettlement: How much time will we be given before we have to move after we have received compensation? <i>You can expect to have approximately a three-month notice before having to relocate. What will happen to our property in Johnson Town? The houses which will have to be resettled have been marked and agreed upon. Other houses will not have to move.</i> - Infrastructural development: We are in lack of a) a health clinic, b) water system, c) toilet, d) market. <i>CU is giving 4 million USD per year to GoL and local government should apply for some of these funds. CU will do more for the communities when they have started to transport iron ore.</i>

			• Train and transportation: Will the train also be able to carry passengers when it is finished? <i>Yes the train will also be for passenger transportation. Will there also be a road alongside the railway? No, the width is for a pipeline to transport iron ore. When will the track be finished? As soon as possible, CU plans to start transporting iron ore by the beginning of next year, however two bridges need repairing and this takes time.</i> Corruption: We have been fooled by the government in the past by corruption, what mechanism is in place to stop the citizens from being robbed? <i>Things have improved and not all government officials are corrupt. CU may also look into hiring a watchdog organisation.</i>
King Peter Town Communities	80 community members including the Commissioner, the Town Chairman and an envoy from the Representative's	28.08.12	1. • Resettlement: When will be the actual time of demolition? <i>Most probably within the next six months. This will have to be confirmed. When our properties are compensated and paid for how much time until we will be required to move? There will be a grace period of at least 3 months after compensation is paid before you have to move. How much will we be compensated for our crops, such as rubber, orange, cola etc.? There is a schedule for this decided by GoL. We will respond with the numbers. What will be the compensation for tenants when their house is demolished? GoL</i>
Caldwell Community	104 community members	30.08.12	<i>will require confirmation. How many feet on each side of the railway track will be affected by the resettlement? 82 feet ¼ inches (25 meters) on each side of the railway track will be affected by the resettlement plan. The government has marked houses that are 96 feet from the railway line, but agreement says 82 feet (25 meters), why is this? This is new information which will be checked with the government. What will happen to institutions such as churches, clinics, mosques, and what will be done for the people using these institutions? It is GoL's responsibility to relocate all buildings, there is a payment schedule for all structures. What will happen to the market places along the railway? It is GoL's responsibility to relocate the market places. What will be the benefit for people who only have land with crops and trees and no buildings? GoL will compensate for crops and trees, the Ministry of Agriculture has a schedule outlining these payments. We have no land to purchase or move to following compensation. Who will relocate us? GoL is responsible for the compensation package, including relocation. When can we expect to receive payments for affected property, and will there be a grace period between actual payments and the time when we have to move? There will be a 3-month grace period after actual payment of compensation. GoL has a schedule for valuation and payment, but we have checked the dates for this. Will payment of compensation be done to principal owners or to squatters? Principal owners will receive compensation. The status of squatters will have to be checked with GoL. Illegal squatters with no papers or permits will only be compensated for the structures they live in; squatters with permits from their local authority may be compensated for the land they have planted as well. Will compensation payment be done directly to landowners? It is GoL's responsibility to pay compensation directly to landowners. How will it be assured that house owners will be rightly paid? GoL is responsible for the proper payment of compensation. CU is considering hiring a local organisation to assure just payment from GoL. It is recommended to please keep us informed in writing about your plans and schedules.</i> • Social impact assessment: After the survey what will be the citizen's benefit? <i>There are no direct benefits to individuals from the survey. The purpose of the survey is to have a basis for future comparisons so that the</i>

			local population can be aware if living conditions have changed for the better or worse. This information can be used as 'proof', i.e. accurate data to hold CU and GoL accountable. • Government survey: What was the purpose of the first survey done by the Government? <i>The purpose of this survey was to define how many households, properties and buildings would be affected by the resettlement, and to estimate the cost of compensation of relocation. This should not be confused with the SIA, which is a survey of the people and their livelihoods.</i> • Railway restoration: How will CU rebuild the railway tracks? <i>CU will start with repairing the parts of the track that are in bad condition. This work has already started.</i> • Education: Will students along the railway line receive scholarships for their education? <i>CU is granting GoL US\$4 million every year for a Social Development Fund. The local community should apply for some of these funds through their representatives.</i> • Employment: Will the building of the railway track create employment for the citizens of Caldwell? <i>When CU starts production of iron ore at the beginning of next year there will be a lot of job opportunities and communities living in CU's concession area (including those who are being resettled) will be prioritised.</i>  Infrastructure development: Who will take care of damage to infrastructure caused by CU in the future? <i>Damage</i>
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ANNEX 1-2B PUBLIC CONSULTATION SUMMARY

Community Consultation Meeting with the Bong Mine Community

Date: 27th August 2012

Venue: Bong High School

Attendance: 96 community members including the Commissioner of Foamah

District, the Town Chief of Bong Mine, Joey Wang and Atta Barclay (China Union) and Paul Vare, Henning Kristoffersen, Mamie Forkpa and Joe Weulleh (IDL team).

Summary:

Town Chief, John Togbah, opened the meeting at 9.45am with prayers led by Rev. Anthony T Fargbon. A local translator assisted throughout. Paul Vare introduced the forthcoming Social Impact Assessment (SIA), which is to take place among the communities surrounding the mine.

The SIA will take place in September; it will include three aspects:

Household survey

A team of Liberian researchers led by international consultants will visit a random selection of households to gather data on livelihoods, family size, education, belongings, crops, water supply and so forth. The data gathered will be used as a baseline for living conditions in 2012. A similar survey in the future should be able to determine whether things have improved, in which case initiatives should be implanted to enhance such improvements, or whether things have worsened. If conditions have deteriorated efforts to mitigate the effects or possibly compensate for the damages caused should be implemented. It is therefore very important that the data is accurate. There is no advantage for households selected to partake in the survey; the sample is purely random.

Health assessment

This component will be led by a doctor and two research assistants. Their task will be to identify the prevalent diseases within the community. This data can also be compared against information on local health conditions gathered in the future.

Cultural or spiritually important Site Survey

This will involve an international expert visiting the concession area to determine if any sites of cultural or spiritual significance are likely to be affected by the Bong Mine development.

The SIA is being carried out by independent consultants (ERM/IDL) and this data could be used in future to hold China Union or the Government accountable.

Questions/Discussion

The meeting then broke into two groups (one representing the Bong Mine community, the comprising members of communities ‘behind the mine’). Participants were asked to discuss

whether they had any questions, concerns or suggestions in relation to the SIA. The groups actually reported a wide range of concerns in relation to the Bong Mine development itself, the SIA was hardly mentioned (see table of ‘issues raised’ below). We therefore moved onto the presentation from China Union as this covered many of the issues raised.

The Bong Mine Development

Joey Wang talked through the construction process and the infrastructure that would require construction including crushers to the beneficiation plant (which would separate out the iron ore from waste rock) and a 10km railway extension into the mine. China Union had planned to commence producing iron ore by the end of the year, but this is more likely to occur early next year. Progress on all fronts is not quite as fast as hoped due to social and environmental factors including heavy rainfall and delays in resettlement programmes.

In answer to requests for schools, clinics and other infrastructure, China Union is giving the Government US\$4million per year for a Social Development Fund which should focus on communities in the concession area. Communities should therefore press their representatives to ensure that the Government has appropriately spent this money to respond to their development needs.

Joey said he enjoyed talking with the people and looked forward to improved communication and more collaboration in the future:

“We are your friends. We are family. A friend in need is a friend indeed.”

Paul Vare summed up the point about collaboration by drawing a triangle with industry, government and communities at each corner. Each had their part to play in the development of Liberia and the roles should not be confused – each sector should work to its strengths. However, they should work in collaboration and not against each other. The key is communication that keeps each of the sectors in touch with the others. This will build trusted relationships based on a deeper knowledge of each other.

Fuamah District Commissioner, Hampton B Giddings, called for China Union to have a proper communication strategy in order that the people are kept informed and can maintain dialogue with the company.

Joey Wang thanked the people and conveyed that he looked forward to more meetings like this in the future.

Finally, people were asked how they would like to receive feedback from the meeting, on the SIA and in general. Suggestions included community radio and meetings like this one, but the strongest support appeared to be for clan meetings. China Union should send a community relations liaison to these meetings on a regular basis.

Community Consultation Meeting at Johnson Town

Date: 28th August 2012

Venue: Palava House, Johnson Town

Attendance: 32 community members signed the attendance sheet although others were present. The meeting was also attended by Joey Wang and Atta Barclay (China Union) and Paul Vare, Henning Kristoffersen, Mamie Forkpa and Joe Weulleh (IDL team)

Summary:

The Town Chief, Mr Johnson opened the meeting at 10.45am; prayers were said by Rev. Dixon; translation was provided by a locally appointed translator and Mr Atta Barclay.

Paul Vare introduced the forthcoming Social Impact Assessment (SIA), which is to take place among the communities surrounding the mine and a selection of communities along the railway track including those around Johnson Town. The SIA will take place in September; comprising three aspects:

Household survey

A team of Liberian researchers led by international consultants will visit a random selection of households to gather data on livelihoods, family size, education, belongings, crops, water supply and so forth. The data gathered will be used as a baseline for living conditions in 2012. A similar survey in the future should be able to determine whether things have improved, in which case initiatives should be implanted to enhance such improvements, or whether things have worsened. If conditions have deteriorated efforts to mitigate the effects or possibly compensate for the damages caused should be implemented. It is therefore very important that the data is accurate. There is no advantage for households selected to partake in the survey; the sample is purely random.

Health assessment

This component will be led by a doctor and two research assistants. Their task will be to identify the prevalent diseases within the community. This data can also be compared against information on local health conditions gathered in the future.

Cultural or spiritually important Site Survey

This will involve an international expert visiting the concession area to determine if any sites of cultural or spiritual significance are likely to be affected by the Bong Mine development.

The SIA is being carried out by independent consultants (ERM/IDL) and this data could be used in future to hold China Union or the Government accountable.

Questions/Discussion

For the question/discussion session the meeting split into two groups dividing themselves between those from Johnson Town and those residing further up the track. In fact they stood together and prepared similar submissions to read back to the plenary session that followed. Most of the issues related to wider development concerns (see table of 'issues raised' below).

The Bong Mine Development

Joey Wang talked through the construction process and the infrastructure that would require construction including crushers to the beneficiation plant (which would separate out the iron ore from waste rock) and a 10km railway extension into the mine. China Union had planned to commence producing iron ore by the end of the year but this is more likely to occur early next year. Progress on all fronts is not quite as fast as hoped due to social and environmental factors including heavy rainfall and delays in resettlement programmes.

In answer to requests for schools, clinics and other infrastructure, China Union is donating US\$4million per year to the Government for a Social Development Fund which should be used to aid communities in the concession area. Communities should therefore press their representatives to ensure that the Government spends this money appropriately to respond to their development needs. In response to Joey's comment, "China Union will try to do more for our local communities," he received a spontaneous round of applause.

Joey said he enjoyed talking with the people and looked forward to improved communication and further collaboration in the future.

Paul Vare summed up the point about collaboration with a diagram showing a triangle with industry, government and communities at each corner. Each had their part to play in the development of Liberia and their roles should not be confused – each sector should work to its strengths. However, they should also work in collaboration and not against each other. The key is communication which maintains connection between each of the sectors. This will build trusted relationships based on a deeper knowledge of each other.

The meeting concluded with a question about the best method to communicate with the community. It was suggested that China Union return and have another meeting. The community also expressed that they wanted China Union to appoint a Community Liaison Officer (CLO) from Johnson Town to convey messages. Asked whether they

would prefer a male and female PRO one woman thought this was a good idea while a number of men called for there to be only one PRO for the community. The men suggested that the PRO should be Rev. Dixon.

Joey Wang followed this up by thanking the people and saying he looked forward to more meetings like this in the future.

Community Consultation Meeting at King Peter Town

Date: 29th August 2012

Venue: Lutheran School, King Peter Town

Attendance: 75 people signed the register of attendees although there were well over 80 people who attended. Attendees included the Commissioner, the Town Chairman and an envoy from the Representative's office. China Union was represented by Mr Tan Jun, Rebecca and Mr Seko (an ex-BMC worker who is in charge of construction at the BMC pier site in Freeport). The IDL team was comprised of Paul Vare, Henning Kristoffersen, Mamie Forkpa and Joe Weulleh.

Summary:

The Town Chairman, Oliver Saydenueh, opened the meeting at 4.30pm; prayers were said by Mr. Moses, a local lay preacher; translation was provided by Mr. Seko.

The Social Impact Assessment

Paul Vare introduced the forthcoming Social Impact Assessment (SIA), which is to take place amongst the communities surrounding the mine and a selection of communities along the railway track including King Peter Town. The SIA will take place in September and will comprise of three different aspects:

Household survey

A team of Liberian researchers led by international consultants will visit a random selection of households to gather data on livelihoods, family size, education, belongings, crops, water supply and so forth. The data gathered will be used as a baseline for living conditions in 2012. A similar survey in the future should be able to determine whether things have improved, in which case initiatives should be implanted to enhance such improvements, or whether things have worsened. If conditions have deteriorated efforts to mitigate the effects or possibly compensate for the damages caused should be implemented. It is therefore very important that the data is accurate. There is no advantage for households selected to partake in the survey; the sample is purely random.

Health assessment

This component will be led by a doctor and two research assistants. Their task will be to identify the prevalent diseases within the community. This data can also be compared against information on local health conditions gathered in the future.

Cultural or spiritually important Site Survey

This will involve an international expert visiting the concession area to determine if any sites of cultural or spiritual significance are likely to be affected by the Bong Mine development.

The SIA is being carried out by independent consultants (ERM/IDL and Earth Environmental Consultancy) and this data could be used in future to hold China Union or the Government accountable.

Questions/Discussion

The participants were divided into five groups; the groups required 30 minutes to complete the task of discussing and writing down their issues and suggestions.

Many of the themes recurred among the group presentations with most concerns being expressed about the timing of demolition and the amount and process of compensation. There were several questions about who was in charge of the resettlement process and the China Union team explained that this was a Government-led process.

Paul Vare responded to questions about the status of the SIA, in particular explaining that it is quite separate from the survey of buildings being carried out by the Ministry of Lands, Mines and Energy. Many other questions were covered by the China Union presentation (refer to the table of ‘issues raised’ below).

The Bong Mine Development

Tan Jun presented for China Union with Rebecca translating and Seko translating into Liberian English as required. Mr. Tan explained that the development had three parts, the mine itself, the railway (including a 10km extension into the mine) and the port. It had been hoped that production would commence by the end of the year but due to some difficulties, production would be more likely to start next year.

A clear message was given regarding safety on the railway – as a result of the improved railway conditions, the trains will be travelling faster therefore the local community, particularly children, should stay well away from the track.

In answer to requests for schools, clinics and other infrastructure, China Union is donating US\$4million per year to the Government for a Social Development Fund which should focus on communities in the concession area. Communities should therefore press their representatives to ensure that the Government spend this money appropriately to answer their development needs.

Paul Vare summed up the point about collaboration with a diagram showing a triangle with industry, government and communities at each corner. Each had their part to play in the development of Liberia and their roles should not be confused – each sector should work to its strengths. However, they should also work in collaboration and not against each other. The key is

communication which maintains connection between each of the sectors. This will build trusted relationships based on a deeper knowledge of each other.

When the community was asked what the best way was to communicate with everybody following the meeting (e.g. how best to give feedback on the SIA), participants foremost suggested another meeting in the same location. A last question from the Commissioner regarding sorting out the drainage and building a road beside the track led to a great deal of discussion. In the end, Rebecca said they would respond to the community regarding the drainage following verification with their engineers. The Chairman closed the meeting and the Commissioner gave a closing prayer.

Community Consultation Meeting at Caldwell

Date: 30th August 2012

Venue: Commissioner's HQ, Caldwell

Attendance: 104 plus Tan Jun, Rebecca and Seko (China Union) and Paul Vare, Henning Kristoffersen, Mamie Forkpa and Joe Weulleh (the IDLgroup Team).

Summary:

The meeting started at 2.25pm with a welcome from the Town Clerk, Richard M Tucker, followed by prayers. A local translator, Darius, relayed the main points in Liberian English.

The Social Impact Assessment

Paul Vare introduced the forthcoming Social Impact Assessment (SIA), which is to take place amongst the communities surrounding the mine and a selection of communities along the railway track including King Peter Town. The SIA will take place in September and will comprise of three different aspects:

Household survey

A team of Liberian researchers led by international consultants will visit a random selection of households to gather data on livelihoods, family size, education, belongings, crops, water supply and so forth. The data gathered will be used as a baseline for living conditions in 2012. A similar survey in the future should be able to determine whether things have improved, in which case initiatives should be implanted to enhance such improvements, or whether things have worsened. If conditions have deteriorated efforts to mitigate the effects or possibly compensate for the damages caused should be implemented. It is therefore very important that the data is accurate. There is no advantage for households selected to partake in the survey; the sample is purely random.

Health assessment

This component will be led by a doctor and two research assistants. Their task will be to identify the prevalent diseases within the community. This data can also be compared against information on local health conditions gathered in the future.

Cultural or spiritually important Site Survey

This will involve an international expert visiting the concession area to determine if any sites of cultural or spiritual significance are likely to be affected by the Bong Mine development.

The SIA is being carried out by independent consultants (ERM/IDL) and this data could be used in future to hold China Union or the Government accountable.

Questions/Discussion

Participants were split into six groups to discuss for nearly half an hour. There was a great deal of overlap between the groups' concerns with many of the issues relating to the forthcoming resettlement (refer to the table of 'issues raised' below).

Paul Vare responded to questions about the status of the SIA, in particular explaining that it is quite separate from the survey of buildings being carried out by the Ministry of Lands, Mines and Energy (MLME).

The measurement of 25 metres in feet and inches is in fact 82.02 feet (82 feet ¼ inch). It was not possible to explain why MLME surveyors had marked houses that were 96 feet from the railway – this requires further investigation.

The Bong Mine Development

Tan Jun presented for China Union with Rebecca translating and Seko translating into Liberian English as required.

Mr. Tan explained that the development had three parts, the mine itself, the railway (including a 10km extension into the mine) and the port. It had been hoped that production would commence by the end of the year but due to some difficulties, production would most likely commence next year. A clear message was given regarding safety on the railway – as a result of the improved railway conditions, the trains will be travelling faster therefore the local community, particularly children, should stay well away from the track.

When it was explained that the relocation process was entirely the responsibility of the Government, participants expressed deep concern that the process may not be carried out effectively. The possibility of engaging a watchdog organization to oversee the resettlement process was mentioned.

It was expressed that demolition would take place over the next six months and that people would be given a grace period of three months. Questions about institutions such as schools, churches and mosques could not be answered, and it was not possible to say what the cut-off point was for partially built structures.

In answer to requests for schools, clinics and other infrastructure, China

Union is donating US\$4million per year to the Government for a Social Development Fund which should focus on communities in the concession area. Communities should therefore press their representatives to ensure that the Government spend this money appropriately to answer their development needs. As for employment opportunities, when the mine starts production there will be a large number of jobs available and priority will be given to people living in or near the China Union concession area.

Paul Vare summed up the point about collaboration with a diagram showing a triangle with industry, government and communities at each corner. Each had their part to play in the development of Liberia and their roles should not be confused – each sector should work to its strengths. However, they should also work in collaboration and not against each other. The key is communication which maintains connection between each of the sectors. This will build trusted relationships based on a deeper knowledge of each other.

When the participants were asked what the best way to communicate following this meeting (e.g. how best to give feedback on the SIA) meetings were suggested as the preferred option over any other medium: *“You come, you see me, and I see you.”*

The Town Clerk raised a last question regarding the drainage and rechanneling the standing water to the St Paul River. Rebecca said that China Union would speak to their engineers regarding this prior to responding.

ANNEX 3

Social Baseline

Social Baselines for the Environmental and Social Impact Assessment of China Union Bong Mine, Phase 1

19th December 2012



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Environmental and Social Impact Assessment of Union Bong Mine, Phase 1

Social

19th December 2012

Authors

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Social Baselines for the Environmental and Social Impact Assessment of China Union Bong Mine, Phase 1

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1. INTRODUCTION

1.1. BACKGROUND TO THE PROJECT

The Bong Range iron ore reserves were originally mined by the Bong Mining Company (BMC) from 1965 to 1990. Mining at the Bong Mine ceased in 1990 in part due to the Liberia armed conflict. In early 2008, following the end of the conflict and in the course of the reviving of Liberia's economic resources, the Government of Liberia published a general solicitation for bid proposals for the Bong Range Concession Area. Through an international competitive bidding process, China Union's bid was accepted and on 19 January 2009, China Union's subsidiary companies China Union (Hong Kong) Mining Company Limited and China Union Investment (Liberia) Bong Mines Company Limited signed a 25-year Mineral Development Agreement with the Government of the Republic of Liberia (GoL) for the exploration and mining of iron ore in the Bong Range of Liberia.

China Union Investment (Liberia) Bong Mines Company Limited (referred to as CU) is now proposing a Project to re-commence mining. The main aspects of the Project entail the restoration, reconstruction, and expansion of the previously existing infrastructure, principally a raw ore processing plant, a heavy-oil fired power plant, the former BMC export jetty in the Port of Monrovia, and the Bong Mine Railway that links the mine to the jetty (Figure 1).

The Project components comprise three development areas which are referred to in this report as:

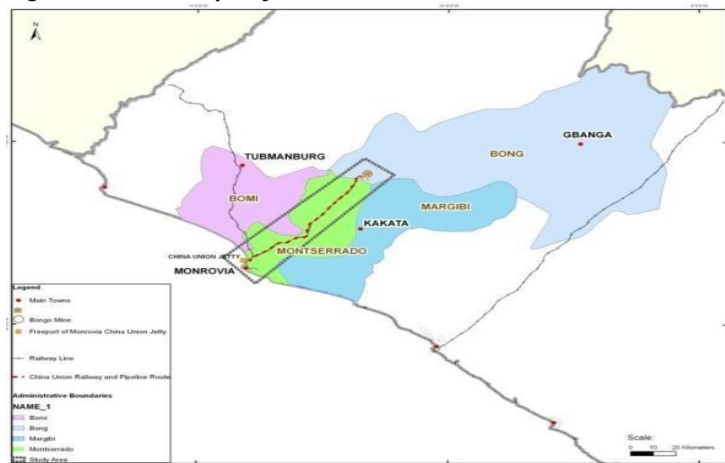
- The Mine, including associated infrastructure;
- The Port, including associated infrastructure; and
- The Railway, including the transport corridor as well as the proposed slurry pipeline.

The Project will be developed in phases. In Phase 1, the Mine will be restored to its former capacity which will involve rehabilitation and upgrading of the existing infrastructure as well as installation of new equipment and construction of new facilities at the Mine, Port and Railway. In Phase 2, the Mine will be expanded in order to produce 10 Mtpa of iron ore through expansion of the excavation and processing operation and of the capacity of Port. In this phase the iron ore will be transported from the Mine to the Port via a slurry pipeline installed in the Railway right of way.

1.2. STUDY AREAS

The Bong Mine Project spans three counties in Central Liberia: Bong County, Margibi County and Montserrado County, within which, a total of seven districts are likely to be directly affected by Project Components.

Figure 37 Location of Project



Three separate but interlinked social studies were prepared for ERM as part of the Social Impact Assessment for Phase 1 of Chin Union Bong Mine. The studies included a socio-economic household survey, a land use study and a rapid health impact assessment were carried out. The directly impacted population were defined as:

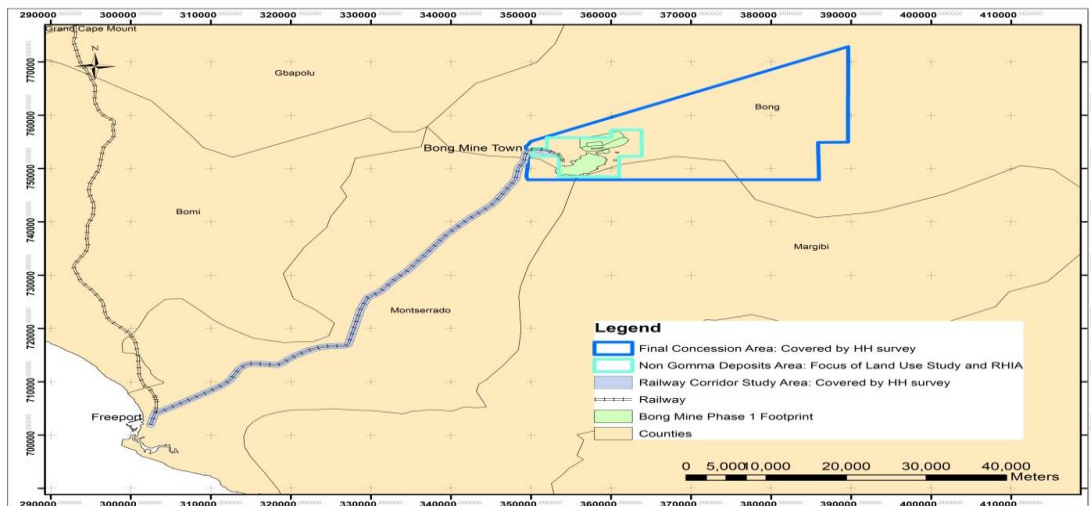
Those living within Final Concession Area - Although Phase 1 will focus on the Non Gomma Deposits Area, the Final Concession area has been chosen for analysis for the household survey as impacts will be registered across the concession area making a true baseline for the Gomma Deposits area difficult to establish at a later stage during the ESIA process. The Land Use study focused on land tenure dynamics within the Non Gomma Deposits Area as that is the area where most agricultural land will be taken during Phase 1.

Those living in Bong Mine Town - Bong Mine Town was developed during the operation of Bong Mining Company (BMC) and although only half of the communities in Bong Mine Town are located within the Final Concession Area, Bong Mine Town and surrounding communities was defined as directly impacted as the majority of Liberian workers at China Union currently live in Bong Mine Town and it is already experiencing an influx of young men from Monrovia and beyond seeking employment. Furthermore, much of the farmland belonging to the town is within the concession area, especially around the old BMC dams.

Those living within 500m of the railway - the railway corridor runs 72km from Bong Mine Town to Monrovia Free Port. The population 500m either side of the railway were defined as directly impacted as those households were likely to be either resettled, lose land or lose access to transport facilities on the railway.

Those living within 2km of the China Union Jetty, Freeport - Based on advice from ERM noise and air specialists, a 2km buffer zone around the China Union Jetty was identified as the potentially affected area at Freeport.

Figure 38 Study Areas for the Social Baseline Studies



2. METHODOLOGY

2.1. SOCIO-ECONOMIC BASELINE

The principle methodology used to establish the socio-economic baseline was a statistically representative household survey. The aim of the socio-economic household survey is to provide statistically representative baseline data from which it will be possible to assess and mitigate potential future impacts of China Union operations in Liberia. Directions and rates of change can be measured through second and subsequent repeats of the same survey. Ideally the socio-economic baseline survey should have been conducted before the commencement of any activity associated with the mine development to produce a more accurate picture of the pre mining situation.

A survey was designed to include questions on key socio-economic characteristics of the populations including demographic information, income, expenditure, economic activity of household members, education levels, access to key resources/community infrastructure and social capital. As the areas defined as directly impacted feature distinct socio-economic characteristics, it was important to build in a predetermined level of precision into the household survey sampling methodology to capture trends in these different socio-economic groups.

The sampling unit for the baseline survey was the household (HH). Three major socio-economic groups were determined as the preliminary strata for sampling; urban, peri urban and rural. Further stratification was necessary to optimize random sampling within each main stratum. A list of HH was not available for any stratum; therefore, random sampling was carried out indirectly at different levels. Different methods were used for each stratum.

2.1.1. Sampling Strategy for the Concession Area

The latest topographical maps for the Concession Area date from 1968 and, in many cases, the towns and villages identified on these maps have been destroyed or moved during the war. New towns have also since developed. Due to the inaccuracy of the topographic maps, the random selection of towns was subject to error. This was mitigated by consulting with community leaders about towns in their areas. Using this approach, it was estimated that there are approximately 107 settlements within the Final Concession Area, which feature about 2,900 HHs.

Out of this 2,900 HHs, about 1,200 HHs live in the Bong Mine Town, and the rest lived in small and medium towns (1-100 HH). Simple random sampling at the level of the town would have resulted in an over representation of small villages in the sample. To control for this, stratification was carried out based on settlement size. Two strata were considered: 1) Bong Mine Town, including different communities around Bong Town 2) Concession Area, including rest of the towns in the concession area.

There was a trade-off between the number of settlements included in the sample, and the number of households selected from each settlement. It was decided to survey 1/3 HHs in every settlement. The team managed to reach most of the selected town but in some cases, villages could not be found, either because they were destroyed, abandoned, or had moved. A number of reserve villages in each regional area were selected as substitutes when this was the case.

Table 66 Number of Households Estimates in Bong Mine Town and the Concession Area and the Corresponding Sample Size

Stratification by size	Est. HH number	Minimum SS ¹ for 90% Confidence and 10% margin of error
Bong Mine Town	1200	65
Concession Area	1700	65
Sum	2900	130

Households were selected at random at the town level using two methods. If there were five or less HHs in the town, the town leader was asked to draw up a list of HHs in the presence of a witness and the required number of HHs were then selected at random by drawing names from a hat. If there were more than five HHs in the town, the centre of the town was located. A pen was dropped to randomly determine a direction. The researcher then walked or drove, depending on the size of the town, out to the edge of the town, recording the time it took to get from the central to the edge. The time it took to travel out to the edge of the town was divided by the number of HHs to be surveyed in that town to get a length of time 'n'. The researcher then surveyed each nth HH until he or she reached the central of the town.

2.1.2. Sampling Strategy for Railway Corridor

For the purpose of this assessment, a buffer zone of 500m along the railway track was assumed. Using topographic maps dating from 1968, a number of settlements along the railway were identified. According to the Demographic and Health Survey (DHS) conducted in 2003, 290 HHs lived in these settlements. After taking account of population growth which has been in average 3.27 % in the last nine years (CIA world Factbook 2012), it was estimated that about 400 HH live in the railway corridor. Since there was no updated list of communities along the railway, one of the team members travelled along the railway and recorded the list of coordinates of various settlements along the railway. Since we did not have any given data about the population, maximum variance is assumed. The minimum sample size needed in order to achieve the conventionally used confidence level of 90% ($z = 1.645$) with a corresponding 10% margin of error ($e=0.1$) was calculated to be 58 HHs. Twelve settlements were randomly selected, and it was decided to survey one third of HHs in each settlement to be able to get a good coverage of settlements along the railway. The same method of random sampling at the town level that was used in the Concession Area was used along the railway.

2.1.3. Sampling Strategy for the Freeport Area

According to air and noise assessments, it was estimated that the population living within 2km of the port (China Union Jetty) should be included in the baseline. Bushrod Island and the railway corridor in Caldwell were identified as the initial assessment areas. The sampling area was further modified to exclude areas in the south that are potentially more influenced by other organizations' marine activities rather than that of China Union. Using the information provided in 2008 Census,

the total number of HHs in the directly impacted area was estimated to be approximately 19,120. Since we did not have any given data about the population, maximum variance is assumed. The minimum sample size needed in order to achieve the conventionally used confidence level of 90% ($z = 1.645$) with a corresponding 10% margin of error ($e=0.1$) was calculated to be 70HHs.

Table 67 Number of Households surveyed in each of the Study Areas

	Est. Number of HH in the affected area	Min sample size needed for 90% Confidence and 10% margin of error	No of HHs sampled
Concession Area Bong Town Area	1362	65	60
Other smaller towns	1195	65	91
Railway buffer zone	400	58	59
Freeport Area	22895	69	69
Total	25852	236	279

2.2. LAND USE AND CULTURAL HERITAGE STUDY

The findings presented on land use are based on a field visit from the 11th September to 1st October 2012 plus a rapid review of some key literature. The unavailability of key data in advance (e.g. recent high-quality satellite imagery, settlement maps, detailed hydrological maps and population data) imposed significant constraints on the amount and quality of data that could be collected.

Fieldwork priority was given to the mine area where a total of 14 fieldwork days were spent compared to 4 along the railroad. Within the mine area, it was decided to focus work on the area directly impacted by Phase 1 of the Mine Development.

The methodology employed was to visit as many communities as possible in the immediate vicinity of the mine site for Phase 1 and primarily through a community mapping exercise attempt to understand the extent and use of their surrounding lands. A large scale laminated aerial photograph of the Non Gomma deposits area, which was thought to have been taken in 2010, was provided by China Union and helped identify areas in the mapping exercise in some communities. In total, 23 community sketch maps were drawn (though sometimes more than one community was included on one map) showing the major water courses on their lands, neighboring settlements and key landscape features such as hills, roads and culturally significant areas. Copies of these were left in each community. After the mapping exercise questions were asked when time permitted about the history of the communities and their land use practices. In a few instances, visits to parts of the community land were also made. In addition to the 23 mapped communities, several other settlements were also briefly visited (see Figure).

Survey work along the rail corridor was very cursory and was conducted over four days using a pushcart from Bong Mines town to Siamaku, approximately 8 km from the port terminal: time and the state of the tracks prevented continuation to the end. During the journey, notes and GPS points were taken on land use visible on both sides of the tracks and occasional stops made to discuss

Figure 39 Towns sampled and mapped during the Social Baseline Studies in the Concession Area and Bong Mine Town

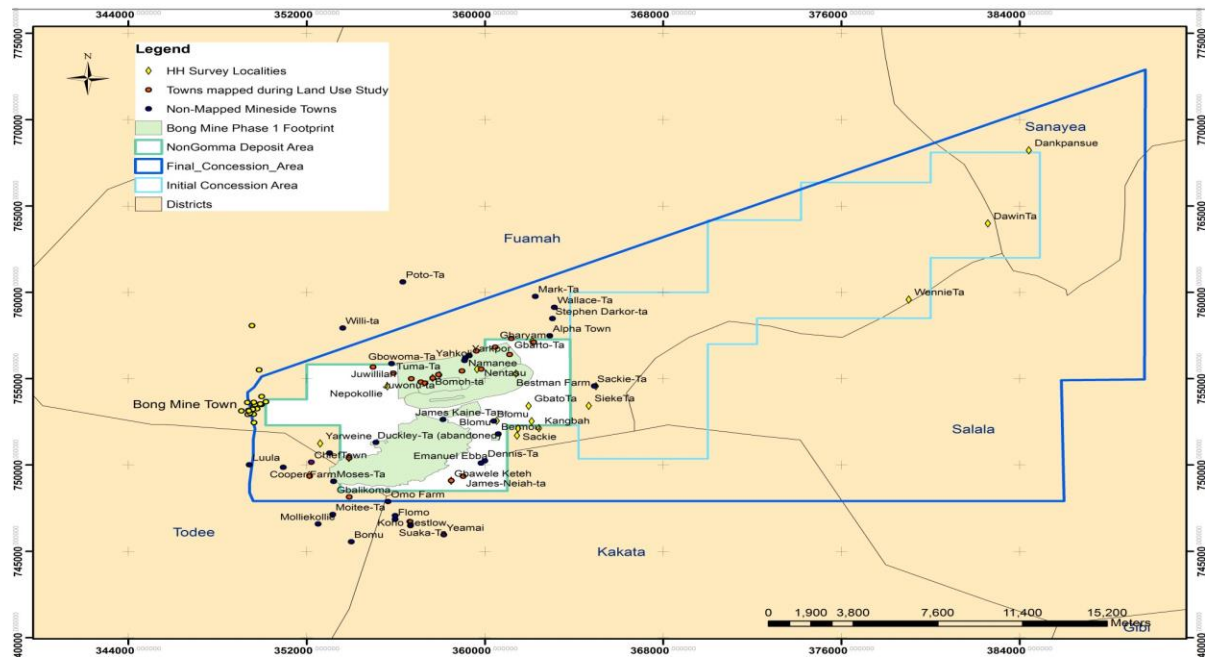


Figure 40 Communities sampled during the Social Baseline Studies in the Freeport Area

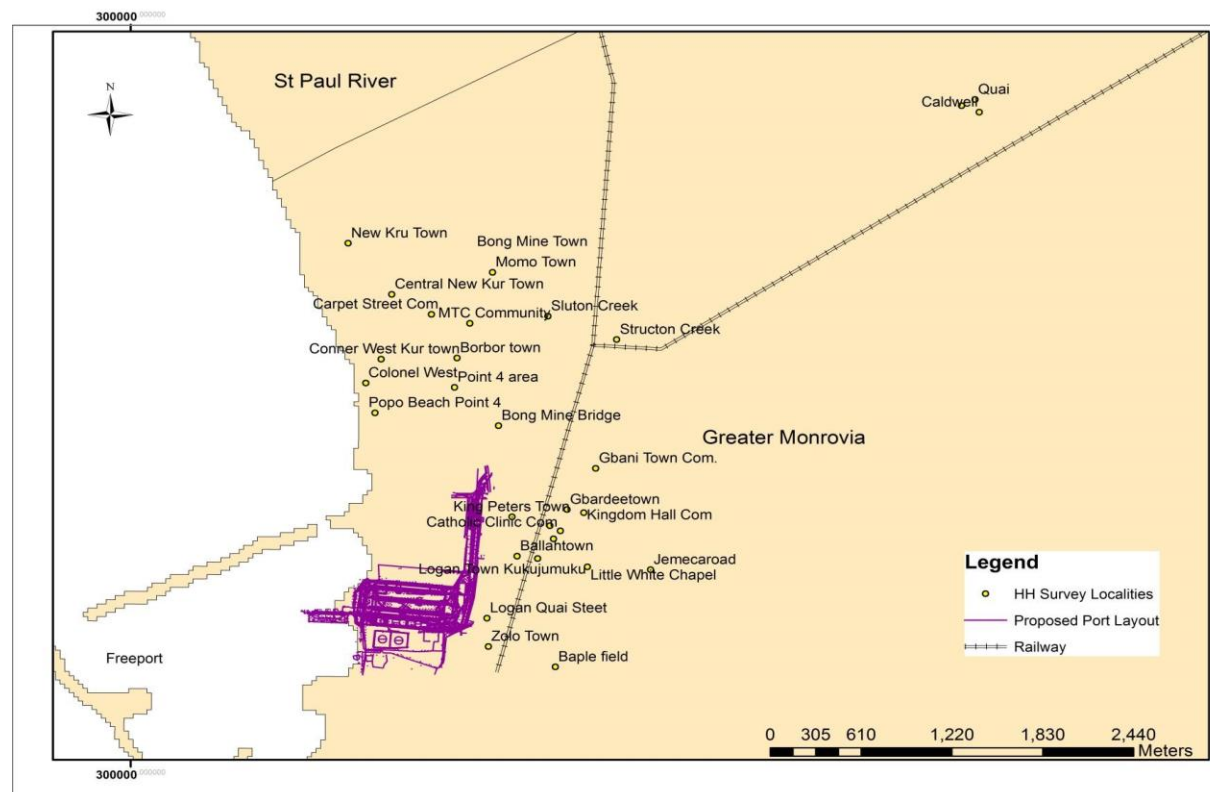
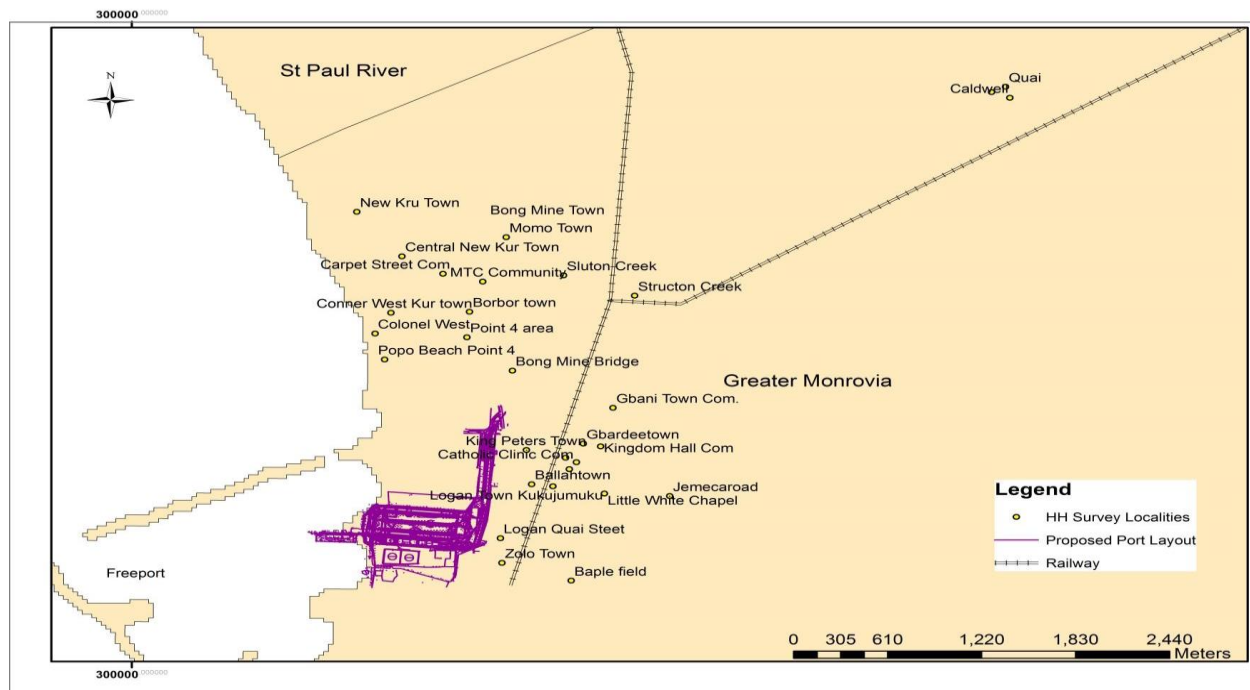


Figure 41 Communities sampled during the Social Baseline Studies in the Freeport Area



2.3. HEALTH STUDY

The purpose of the rapid Health Impact Assessment (RHIA) was to establish a preliminary baseline of key health indicators for the population living in the China Union Bong Mine Final Concession area, along the railway and around the China Union port and jetty areas. Due to time constraints, all clinics in the areas of interest could not be visited but a selection was surveyed across all areas. A mixed methods approach was employed to capture as accurate as possible a rapid baseline within the limited time-frame.

Secondary quantitative data consisting of patient records were gathered from Yeamai, Haindi and Bong Mine Hospital (Bong Mines Hospital) master ledgers, where all patients visiting the clinics are registered. Patient gender, age and diagnosis for visits recorded during one dry season month (March) and one wet season month (September) were collected to capture seasonal variations. The full two-month records for Yeamai and Haindi were analysed. Due to time constraints and high number of recorded patients, the analysis for Bong Mines Hospital was limited to the first two weeks of March and September respectively. Names and other means of identification were omitted from the analyses in order to protect patient confidentiality. Secondary data on available health services and systems at each facility, gathered through the accreditation overseen by the Ministry of Health and Social Welfare (MoHSW) was also obtained to enable analysis of the current health service capacity. Primary qualitative data was gathered from clinics, traditional healers and pharmacies to enable triangulation and thorough investigation of selected issues. Staff at selected clinics were interviewed regarding the current state of services and facilities to enable triangulation with secondary accreditation data. Data gathered through key informant interviews with stakeholders was immediately analyzed to enable findings from interviews to inform

subsequent data gathering. This iterative approach ensured sensitivity to local contexts and flexibility as information emerged.

The baseline health indicators that were established, as recommended by the International Council of Mining & Metals (ICMM), measure incidence in health conditions where mining operations in general have been found to have an impact:

- Incidence of infectious diseases among the population of interest: malaria, HIV and influenza.
- Incidence of chronic diseases among the population of interest: heart disease, cancer, bronchitis and asthma.
- Incidence of nutritional disorders among the population of interest: malnutrition, vitamin deficiencies and obesity.
- Incidence of physical injury accidents, heavy metal and chemical poisoning and community violence among the population of interest.
- Mental health and wellbeing: incidence of suicide, depression, stress and anxiety among the population of interest.

The main limitation that should be considered is the potentially unreliable diagnosis at the clinics and hospitals due to lack of clinical expertise and/or capacity to verify diagnosis. Whilst the more obvious diagnoses can be made (ARI, Gastritis, Malaria, Thrush, Trauma and Injury) there are many categories that have unusually low numbers (HIV for example). This may reflect the lack of available resources in order to confidently diagnose such conditions and also a reticence of the local populace to come forward to have their symptoms checked. Low incidence may thus reflect lack of ability to detect disease ahead of low prevalence of disease and highlights a need for more sophisticated health monitoring systems and resources.

It should also be noted that unreported cases were addressed qualitatively in consultation with traditional healers, medical health professionals and community members. Estimating the proportion of patients that fall ill but do not seek medical care is by definition impossible to do with accuracy.

3. SOCIO-ECONOMIC CHARACTERISTICS OF THE IMPACTED AREAS

3.1. OVERVIEW OF THE IMPACTED AREAS

The Concession Area

The Final Concession area includes lands from three counties; Bong, Margibi, and Montserrado and measures 613km². The Initial Concession Area is mainly defined by the Bong Range. Small towns nestle close (referred to by residents as living ‘under the mountain’) to the mountain on both the northern and southern side of the range. In all parts of the Concession Area, agriculture dominates as a source of income, but the type of agriculture varies. The southern areas are dominated by large-scale rubber and sugar cane farms, whereas in the eastern and northern parts of the Concession Area, more rice is grown, and the rubber and sugar cane operations are somewhat smaller in scale.

Bong Mine Town

Bong Mine Town is inhabited by a heterogeneous mix of people including migrants from the surrounding counties who fled to Bong Mine Town for safety during the war, traders from Guinea, and migrants from Monrovia and beyond who seek work at China Union. The town is principally a trading town, receiving goods from Monrovia via rail and road. The market at Bong Mine Town operates daily and trades in a range of goods, from imported shoes, clothes and chicken to locally-produced vegetables and fish.

The town is an urban centre for the surrounding area with a large high school, court, police depot and hospital. The district headquarters are located in Haindi. Around Bong Mine Town, there are rice farms to the north, most of which fall outside of the concession area, and to the east which are located on the old BMC tailings facility. The main road and transport link to the next big town, Kakata and Monrovia leaves to the South of Bong Mine Town.

The Railway Corridor

The Railway Corridor is as the primary transportation link between hundreds of villages along the 72 km stretch from Bong Mine town and Monrovia. From 2001 to 2009, Geo services provided a subsidized passenger service four times a week. A brisk trade in charcoal, vegetables and fruit developed along the railway as many towns started to supply markets in Monrovia and its suburbs. Since the cessation of the commercial train service two years ago, the main mode of transportation for goods along the railway is with handmade wooden carts called ‘Make-a-Ways’ which can be pushed up and down the track using ball bearings as wheels. Make-a-Ways are mainly used to transport charcoal to Monrovia but are also used to transport the sick to hospitals. In many places, land beside the track is intensively farmed, including large scale rubber and sugar cane farms.

Freeport

The Freeport Area is defined as the area in the immediate vicinity of Freeport, i.e. Bushrod Island in Monrovia. The area was originally inhabited by the Kru people from Grand Kru that migrated there to work in the port and to fish. However, the port area has drawn many other populations

with the promise of employment. The island has a thriving real estate sector and new houses are still being built. Although farming is not as common in this study area, the surrounding swamps provide important farm and gardening land in the dry season. Due to the relatively low-lying land on Bushrod Island, it is difficult to dig wells, and those that were dug cannot be used for drinking water due to flood water contamination. The population relies on water from pipes and reservoirs from the municipality that often only supply water for a few hours a day.

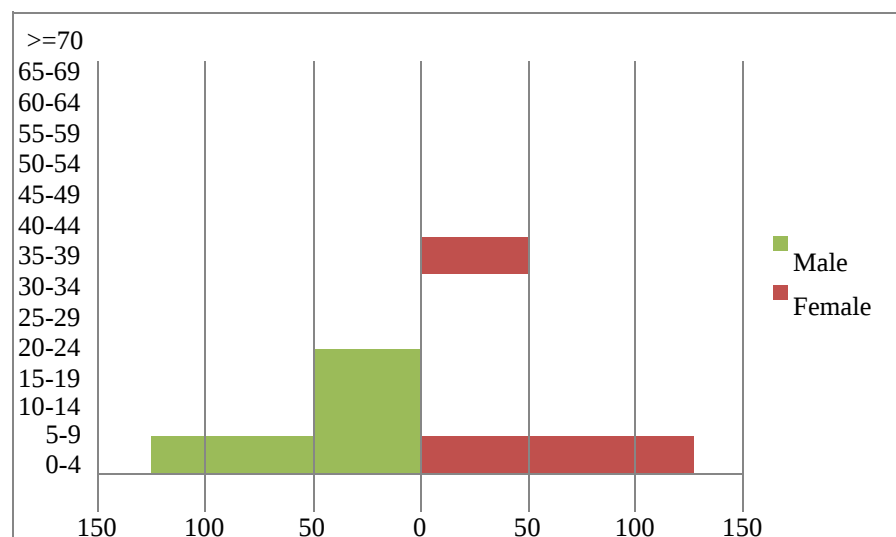
3.2. DEMOGRAPHY

The data on demography is taken from the household survey. As the household survey used a statistically representative sample, the data presented here can be understood as representing the population in each of the study areas.

The total sample size for the household survey was 279 HH, or, 1479 individuals, including 721 males, and 758 females.

Figure 6 depicts the age structure of the entire sample. Information about the age of 23 individuals, including ten males, and thirteen females, was not available, and thus were excluded from this analysis. Similar to other areas in Liberia, the population is generally young. 51% of males and 49% of females are eighteen, or younger. Very few people were reported to be aged more than 70. The average age for males, and females were 23.2 and 22 respectively which is slightly higher than the country median age (18 for males, and 18.3 for females).

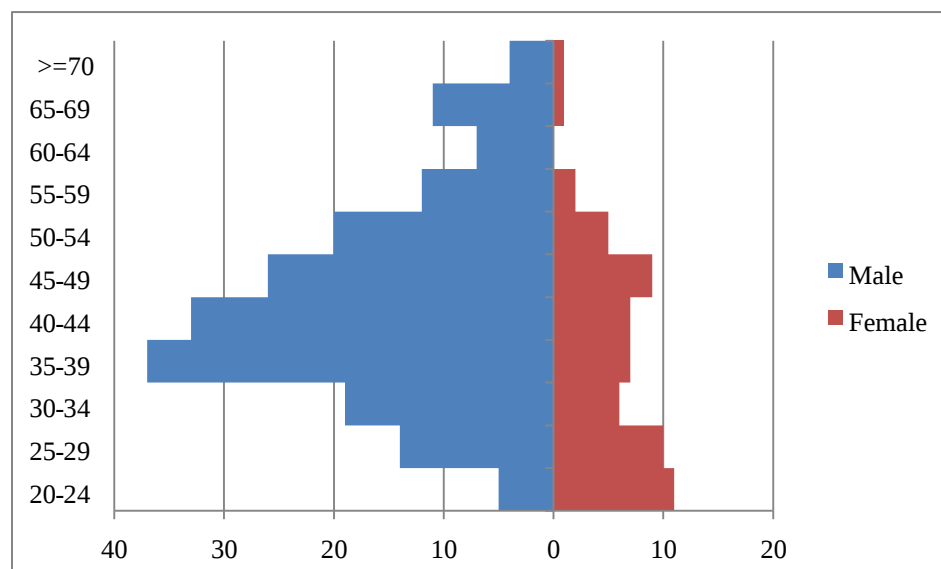
Figure 42 Population Pyramid for the Entire Sample



Surveyed heads of households reported a total of 63 deaths during the 12 months preceding the survey. The crude death rate for the sampled population consequently is 41 in every 1000. This is significantly higher than reported average death rate in Liberia which was estimated at 10.2/1000 in 2009 (United Nations Population Division, 2009). This could be due to a particularly high death rate in these areas, or a recall bias as people may remember deaths as being more recent than they actually are. This rate does not vary much across all the strata, except Bong Mine Town area, where the death rate is only 17/1000.

The average size of surveyed HHs is 5.3. In many families, more than one member contributes to household expenses (on average 1.7 per household). The average dependency ratio for the whole sample is 1:3, i.e. every individual who earns money, on average, should support three other individuals in the household. Dependency ratio in Bong Mine Town area is 1:3.3 which is the biggest among the surveyed strata. The majority of HHs surveyed (75.6%) attributed household headship to a male family member. Despite this general trend, many young females between the ages of 20-30 considered themselves as the head of household. The highest proportion of female household heads was found in the 20-25-year age group (68%) followed by the 25-30 age group (41%).

Figure 43 Age composition of male and female headed households



3.2.1. Ethnicity

The ethnic composition of the population is presented by study area. Table 3-1 shows the distribution of ethnicities in Bong Mine Town. Kpele people, followed by Kissi and Lormu constitute the majority of people in this area. 49% of surveyed population in Bong Mine Town were Kpele, 17% Kissi, and 12% Lormu.

Table 68 Breakdown of ethnic groups in Bong Mine Town (N=335)

Ethnicity	Male	Female	Total	Ethnicity	Male	Female	Total
Kpele	79	84	163 (49%)	Mano	3	2	5 (1%)
Kissi	27	31	58 (17%)	Kru	2	2	4 (1%)
Lormu	21	20	41 (12%)	Mendi	2	2	4 (1%)
Gbero	11	14	26 (8%)	Bella	2	1	3 (1%)
Bass	5	7	12 (4%)	Gio	1	0	1 (0.3%)
Bandi	2	4	6 (2%)	Vai	1	0	1 (0.3%)
Gola	2	4	6 (2%)	DK	4	1	5 (1%)

Table 3 shows the distribution of different ethnicities in the Concession Area. Kpele people are predominant in the area (88%), followed by small minorities of Bass, Lormu and Fula among others.

Table 69 Breakdown of ethnic groups in the Concession Area (N= 471)

Ethnicity	Male	Female	Total	Ethnicity	Male	Female	Total
Kpele	199	216	415 (88%)	Gbero	0	2	2 (0.4%)
Bass	10	7	17 (4%)	Kissi	1	1	2 (0.4%)
Lormu	7	7	14 (3%)	Mendi	1	1	2 (0.4%)
Fula	3	4	7 (1%)	Kru	0	1	1 (0.2%)
Gola	6	0	6 (1%)	Mandingo	0	1	1 (0.2%)
Mano	1	2	3 (1%)	Bandi	1	0	1 (0.2%)

As shown in Table 4 above, the majority of the population along the railway were also Kpele (around 67%), with Gola (10%), Lormu (6%), and Basso (5%) were the ethnicities comprising the other big ethnic groups.

Table 70 Breakdown of ethnic groups along the Railway Corridor (N= 332)

Ethnicity	Male	Female	Total	Ethnicity	Male	Female	Total
Kpele	101	116	217 (69%)	Mano	3	3	6 (2%)
Gola	18	14	32 (10%)	Kissi		3	3 (1%)
Lormu	12	8	20 (6%)	Gio	3	0	3 (1%)
Basso	12	3	15 (5%)	Gbero	1	1	2 (1%)
Kru	3	5	8 (3%)	Mendi	1	1	2 (1%)
Fula	3	3	6 (2%)	Bandi	1	0	1 (0.3%)

A much higher ethnic diversity was observed in Freeport. Kru people constitute 27% of surveyed population, followed by Basso People (14%), Lormu (11%), Gbero (11%), Kpele (10%) and Kissi (5%).

Table 71 Breakdown of ethnic groups in the Freeport Area (N= 352)

Ethnicity	Male	Female	Total	Ethnicity	Male	Female	Total
Kru	40	54	94 (30%)	Gio	4	2	6 (2%)
Basso	23	26	49 (16%)	Mendi	4	2	6 (2%)
Lormu	16	25	41 (13%)	Bandi	5	2	7 (2%)
Gbero	22	18	40 (13%)	Mandingo	2	2	4 (1%)
Kpele	19	17	36 (12%)	Gola	3	1	4 (1%)
Kissi	7	10	17 (5%)	Fula	0	1	1 (0.3%)

Mano	3	3	6 (2%)				
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3.2.2. Migration

Individuals who had migrated to their current place of residence at some point during their lives were categorized as migrants. Migration status could not be determined for 48 individuals in the sample, who were therefore excluded from the analysis. Migration data indicated that migrants constitute 48.3% of the population in the sample population. This rate indicates that the surveyed population have a relatively high mobility. Migrant population ratio varies in different strata. This ratio is highest in the Freeport Area (60.4%) and the lowest in the rural areas of Concession (39%), which suggests that people in the rural areas of the Concession are more tied to their land.

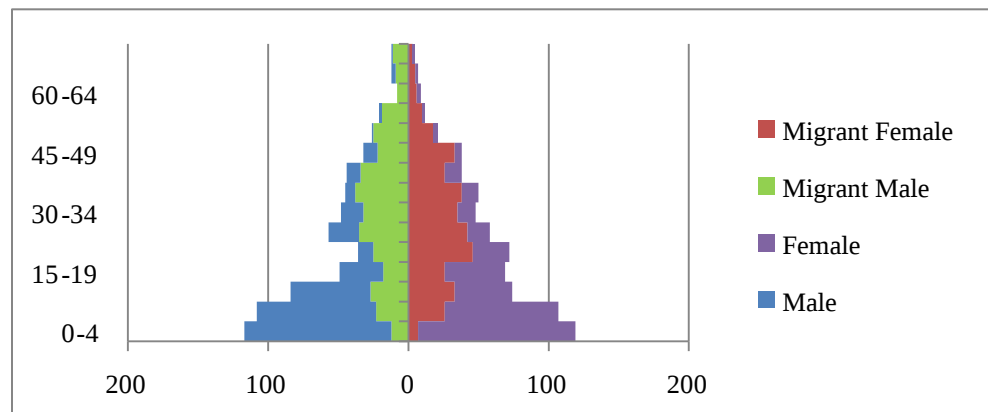
Table 72 Migrant population by gender across the strata

	Bong Mine Town	Concession Area	Railway	Freeport
Migrant Population	47 %	39 %	50 %	60.4 %
Male	46.2%	42.3%	48.7%	59.4%
Female	47.2%	36%	51.2%	62.9%

In the sample as a whole, women are as likely to move as men in the sample, with 48% of both men and women having migrated at some point. The number of migrants varies by gender slightly in different strata, but the difference is not significant.

Migrants are distributed across age-groups with higher probability among older individuals. In particular there is a jump in the proportion of migrant population older than 20 with 63% of female and 69% of male of that age group having moved from their birthplace.

Figure 44 Population Pyramid for Migrants compared against the Population Pyramid for the Entire Sample



3.3. LIVELIHOODS

3.3.1. Livelihood Zone

A useful starting point to understand the livelihoods in the Concession Area and along the rail corridor is to use the nine livelihood zones (LZ) that have recently been distinguished across the country (FEWS NET, 2011). The livelihood zoning exercise was based on a nation-wide classification at the clan level, the smallest administrative territorial unit. As clans vary in size and

population, these zones must be understood as indicative only. As shown in Figure 3-4, the China Union Concession Area and Railway Corridor fall across three of these zones. The three zones covered by the concession are described as follows (FEWS NET, 2011):

Livelihood Zone 1: Rice Inter-cropped with Cowpeas and Groundnuts and Palm Oil

Rice grown on rainfed upland fields is the major staple, but cassava is an important secondary staple. Although larger farmers are able to market rice, this is not a major surplus area (there is currently no such area in the country) and smaller farmers commonly finish their rice stocks long before the next harvest and then buy (mostly imported) rice on the market. During the ‘hunger’ period between July and September the less preferred cassava becomes particularly important.

Before the war, cocoa and some coffee were widely grown as cash crops, but there has been little reinvestment since the end of the conflict. People trust far more in annual crops, of which rice, cowpeas and groundnuts are the most important. Cultivated palm trees are rare and marketed palm oil comes essentially from wild trees. Vegetables such as bitter ball, chilies and okra are an important source of income. Early vegetable harvest sales are important to bolster expenditure on the Christmas festival and school fee payments in January.

Livelihood Zone 8: Rubber and Charcoal with Food Crops

Rubber has defined this zone since the 1920s and an important percentage of the rural population work on the big rubber plantations at Firestone and Salala. Small, private plantation owners and smallholders also grow rubber independently, selling the latex to the bigger companies. Rubber is tapped across the year, and private planters employ local tappers and thus rubber is by far the most important income source in this zone. Both cassava and rice are grown largely for home consumption, but the vast majority of staple food is purchased. A few better off farmers have small shops giving credit to concession workers, whilst more generally the private/smallholder rubber producers make further cash by selling vegetables and charcoal: this zone is near to the Monrovia conurbation and linked to it by a good road (and rail) network.

Charcoal is made far and wide in Liberia but in this zone, there is a particular combination of the Monrovia market and old, abandoned rubber trees that is at the root of what might be called a sub zone or minority population whose economy is based on charcoal. This road (and rail) oriented population put the greater part of their labour into charcoal, whether on their own production or working for better off neighbours. A bag of charcoal may sell for the equivalent of US\$3, a good daily wage in rural areas. Like smallholders who grow rubber in this zone, charcoal producers are also smallholders and farm in a reduced way, growing cassava, vegetables, beans and enough rice for at least a few months’ consumption before going to the market for imported rice.

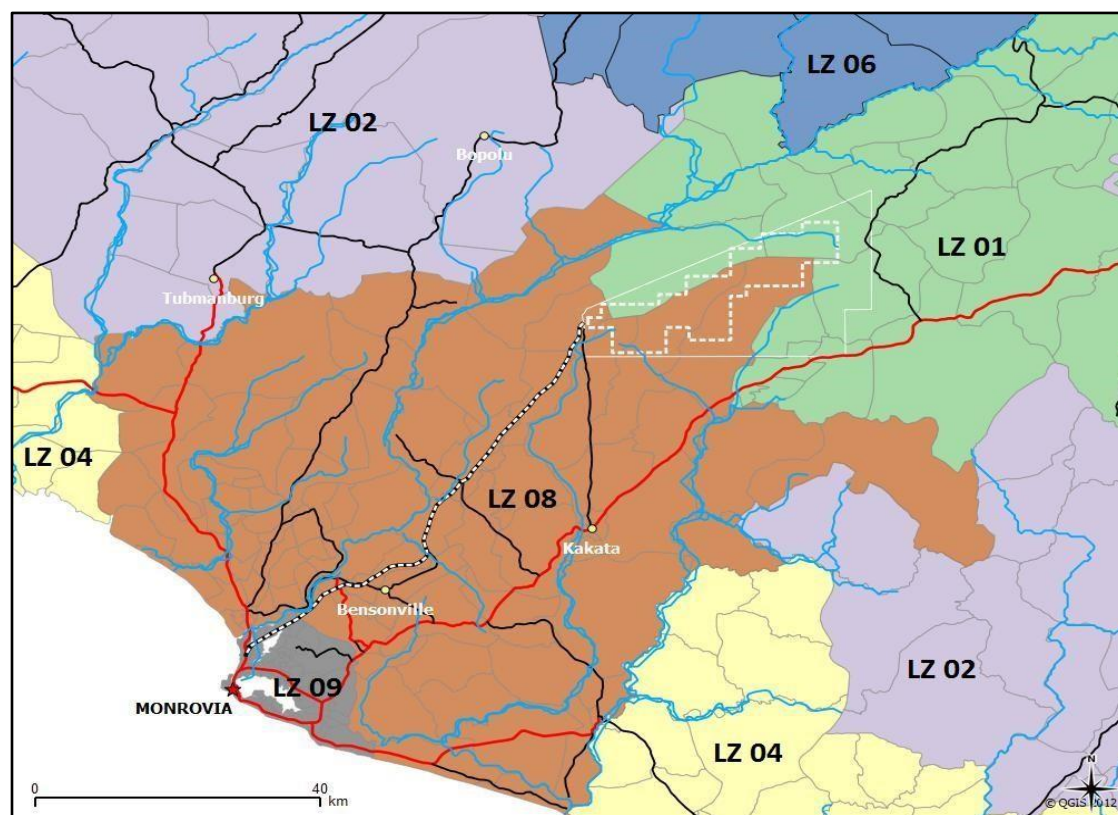
Livelihood Zone 9: Monrovia Peri-Urban: Petty Trade, Market Gardening and Casual Employment

This zone comprises a sizeable population who are within the Monrovia urban district but outside the city proper. They are not simply spread in a neat and measurable radius around the city hinterland but extend particularly along and near the main roads. They are semirural in that they have land on which they produce at least vegetables if not also a little cassava, and they commonly

keep poultry. But their economy is more or less completely defined by the city: they sell vegetables and chickens to it, they perform casual employment in it, and they are part of the chain of petty trade in farm/garden produce, fish, charcoal and many other items. Above all, the staples they eat, especially rice, are purchased. This population is distinct from a minority of wealthy owners of large houses in this zone whose earnings are from salaried work, commerce or plantations or as domestic staff.

Figure 9 shows the geographic location of the Concession Area and Railway Corridor in relation to the main national transport artery in red, the Monrovia to Kakata highway that continues on to Gbarnga, Ganta and the Guinea border. To put this road in some economic perspective, it is the primary conduit for connecting the Greater Monrovia population, which represents over a third of Liberia's population, with the rest of the country. Though the China Union rail corridor is something of a unique means of access to Monrovia which will be discussed in more detail later, access and proximity to the Kakata highway is currently probably more critical in shaping livelihood opportunities and constraints in most communities around the mine.

Figure 45 China Union Concession Area and Railway Route and their relevant Livelihood Zones



3.3.2. Frequency and Profitability of Livelihoods in the Study Areas

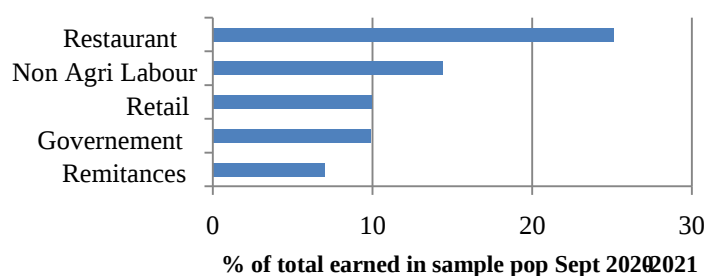
Although it is a commonly held view that most people in rural economies of sub-Saharan Africa are subsistence farmers, the household survey findings show that, in fact, there are a plethora of economic activities both in rural and urban settings. The most important thing to be remembered in the section below is that the numbers shown depict main economic activities. In fact, most

people have more than one economic activity; 65% of the working age economically active population reported having more than one income generating activity.

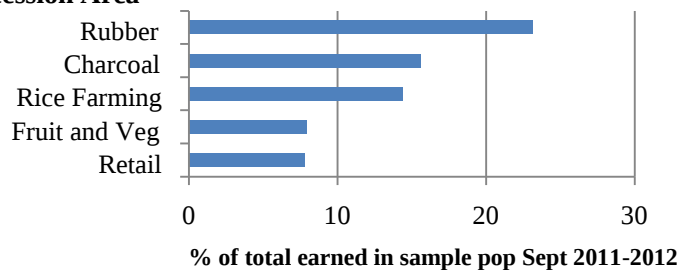
People engaged in different economic activities (a) and the average income people earned from those economic activities. As mentioned above, most people are involved in two or more livelihoods. As can be seen from the graph the three major livelihoods that most people use to earn money include remittances, rice farming and retail trade. The livelihood with the highest average income is wholesale followed by fishing.

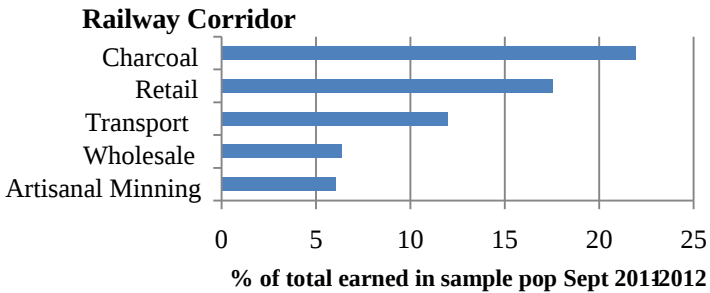
Livelihoods are ranked in terms of amount of money estimated as earned from this activity in the preceding 12 months for each of the Study Areas. In Bong Mine Town, the restaurant business generates the largest amount of income compared with other livelihoods. As this amount was generated by only 5 restaurant owners, it was easily one of the most lucrative businesses in Bong Mine Town. In comparison, while non-agricultural labour is the 2nd largest income generating activity indicating the growing numbers of people who are working for China Union, it is not the most lucrative; 16 people generated this total monetary wealth. In the Concession Area, the largest income generating activities rely directly on land and water access; rubber production, charcoal, rice farming and fruit and vegetable production. Along the Railway Corridor, the major income generating activity is charcoal production. The charcoal economy is dependent on Make a Way carts pushed along the rail track to transport it into Monrovia. In Monrovia the largest income generating activity is Government employment. Interestingly, income earned from fishing accounted for 5.8% of the total income earned in the Freeport Area, indicating a high reliance on an unpolluted ocean. China Union's activities do not seem to have yet had a real impact on the economy in the Freeport area as non-agricultural activity only accounted for 0.59% of the total income generated in the Freeport area compared with 14% in Bong Mine Town.

Figure 46 Income generating activities in the Study Areas – which generates the most income?

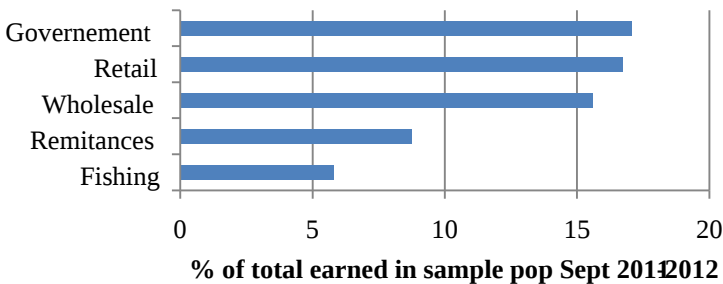


The Concession Area





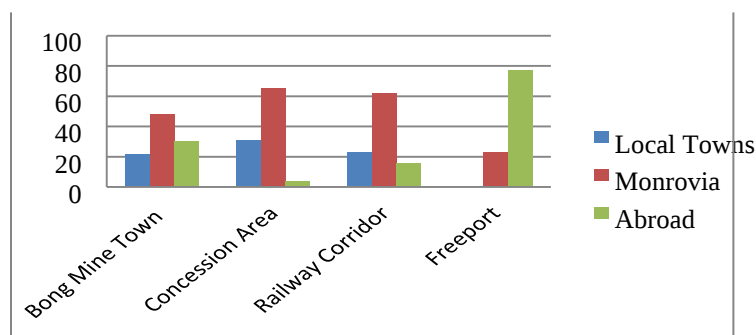
Freeport Area



3.3.3. Remittances

12% of the population receives remittances and Figure 10 indicates that remittances are the 4th and 5th largest income generating activity in the Freeport Area and Bong Mine Town respectively. The origins of the remittances were classified as originating from ‘another local town’, ‘Monrovia’ and ‘abroad’. The data indicates that remittances in the interior tend to come from Monrovia while remittances in Monrovia tend to come from abroad (77 % of its remittances in the Freeport Area were from abroad and averaged at \$1495 per year). The survey focused on monetary remittances which gives the impression that people in Monrovia do not receive anything from the interior. In fact, qualitative interviews indicated that people in Monrovia and in the large towns receive a lot of agricultural goods from the interior. Overall, average remittances are the highest along the Railway Corridor at \$808 followed by the Freeport Area at \$720, Bong Mine Town at \$490 and finally the Concession Area at \$221. The amounts received tend to be higher when the remittance is from abroad.

Figure 47 Origin of Remittances by Study Area (%)

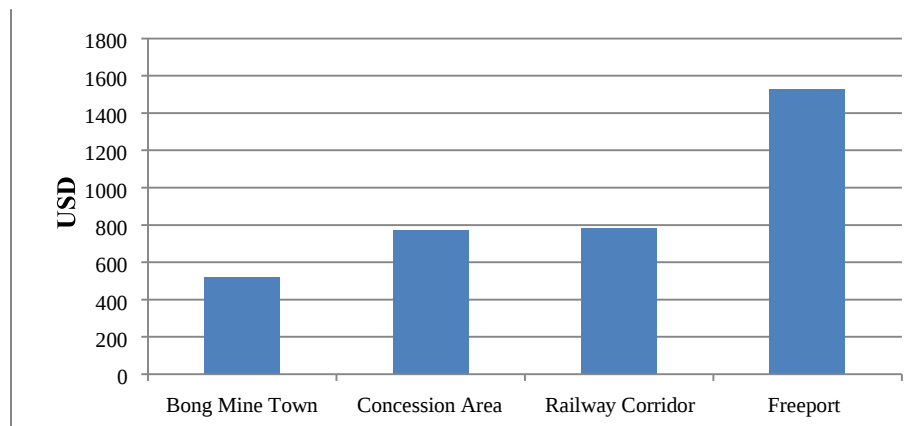


3.4. VARIATION IN INCOME

The average income per capita of the sampled population (total income recorded divided by number of individuals in the sample) was \$896. High variation was found in incomes with the highest income recorded at \$54,400 and the lowest at \$257. The average income per capita recorded is 2.5 times higher than that reported in the UN Human Development Index (\$360).

The relatively high average income is due to the high average income in Freeport (\$1527). The average per capita income in Bong Mine Town (\$518) is closer to the UN Human Development Index as well as the results (\$498) from a similar survey conducted in Grand Bassa, Bong and Nimba Counties. Higher incomes were recorded in the Concession Area (\$772) and along the Railway Corridor (\$784).

Figure 48 *Average Per Capita Income earned from September 2011 to 2012 by Study Area*



3.5. AGRICULTURAL AND NON-AGRICULTURAL LABOUR MARKETS

Both agricultural and non-agricultural labour markets play a significant role in rural and urban economies. China Union has the potential to have a positive impact on local communities through providing wage labour employment. However, changes in the non-agricultural labour market can have adverse impacts on agricultural labour markets. As an interviewee along the Railway Corridor explained; “we can only burn [char]coal when we find people to work, no one wants to brush”. If more people are employed in nonagricultural work, agricultural production can suffer.

There are two main types of rural labour recruitment, contract labour and kuu labour. Kuu is a system of agricultural labour exchange which was historically based on mutual aid within a town for the more labour intensive farm work such as clearing the forest. Although the kuu system is still in place, the tradition of mutual aid in addition to feeding the kuu group has been modified so that individuals can hire the entire kuu group to work on their land if the employer is not in the kuu themselves or if they require additional work on their land. This tends to happen in places where farms are not of equal size and in particular where there is one large farm among smaller farms. The second system is contract labour through which labour is hired on a weekly or daily basis. Both the kuu and contract labour are at times paid in-kind with food or in cash or a combination of the two. In terms of expenditure, as can be seen in Figure 13, the kuu is more likely to be paid in Bong Mine Town whereas in the Concession Area and along the Railway Corridor,

most of the paid labour is done by contract labour. As more people were found to be members of kuu groups in the Concession Area than in Bong Mine Town, this does not reflect the quantity of people working for or in the kuu. As can be seen below in the Participation in Community Activities section, 28% of adults in the Concession Area are part of the kuu. What it shows is that people working in the kuu in the Concession Area and along the Railway Corridor rely more on mutual labour exchange instead of paying extra for the kuu. The majority of contract labour in the Concession Area and along the Railway Corridor is paid for in goods. This may be an effort by employers to keep wages down as it is more cost effective to pay their workers in food which they may produce themselves or buy in bulk. The high numbers of contract labourers along the Railway Corridor and in the Concession, Area indicate the presence of large farm holdings such as rubber and sugar cane plantations as well as the brushing required for charcoal production.

Figure 49 Expenditure on Farm and Non-Farm Labour by Study Area

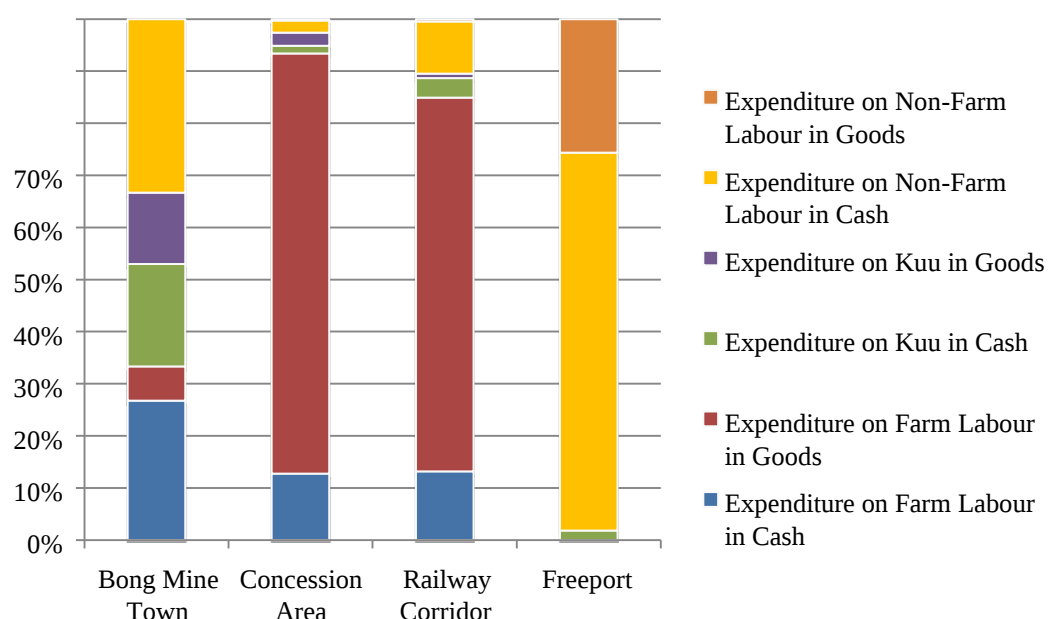
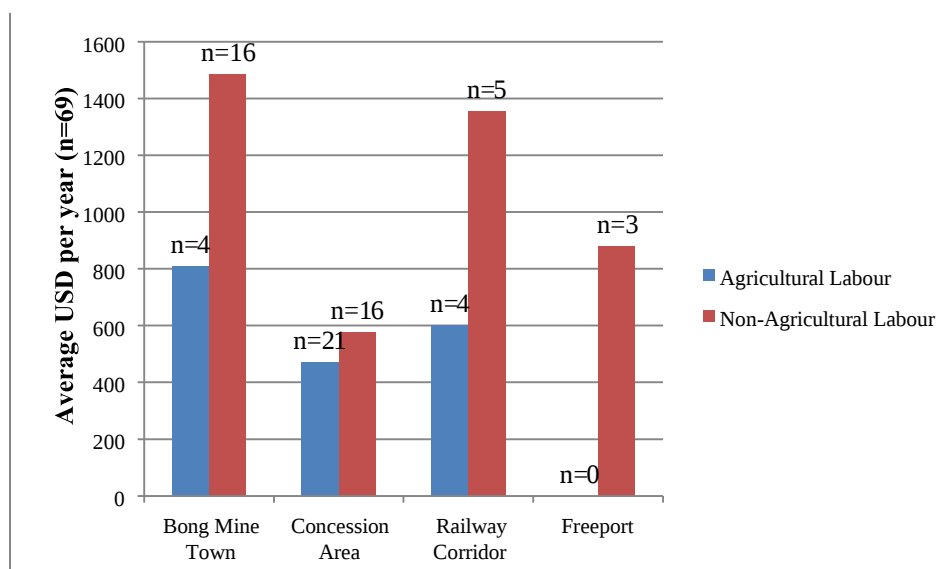


Figure 14 shows the different average incomes per annum from agricultural and non-agricultural labour. Agricultural labour here is defined as all labour relating to agricultural production of crops which includes clearing the forest for charcoal burning. Non-agricultural labour refers to contract work that is not related to agricultural production. This can range from skilled labour such as masonry or machine operators to unskilled clearing of the forest for construction works or road maintenance. As can be seen from the chart, non-agricultural labour is better paid than agricultural labour in all study areas. This probably relates to the activity of China Union and shows a positive impact in terms of income generation. The precise activity of those interviewed and their employer were not recorded, but it can be deduced that the higher average incomes for non-agricultural labour reflects the incomes earned by skilled workers in Bong Mine Town such as drivers, and machine operators.

In the Concession Area however, the difference in incomes for non-agricultural labour (\$ 577) and agricultural labour (\$ 471) is small. The small difference in wages between agricultural and nonagricultural labour in the Concession Area indicates that the positions that people in the Concession Area are achieving with China Union are predominantly unskilled labour with a wage of no more than \$3/day.

Figure 50 Average Income per Annum for Agricultural and Non-Agricultural Labour by Study Area



3.6. UTILITIES

3.6.1. Water Sources

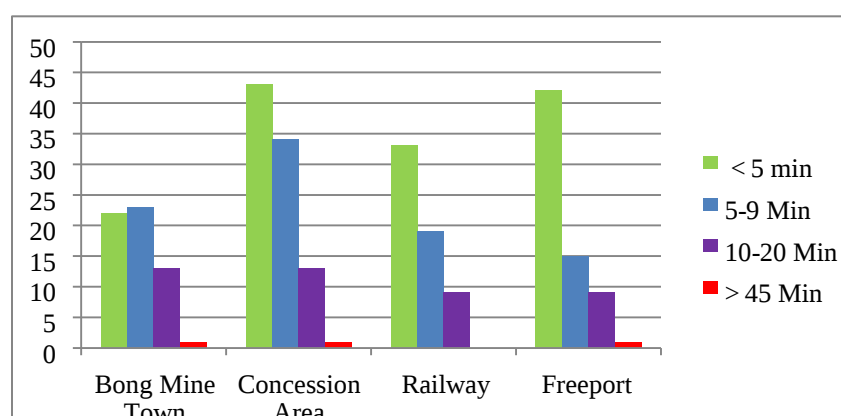
In the household survey, household heads were asked about their source of water they use and the distance from their house. In Bong Mine Town, almost half of the surveyed population used hand pumps, and the other half used wells for their drinking water. In the Freeport Area, more than 92% had access to hand pumps, while the remaining population used springs/streams. Some of the households had access to piped water provided by the government. Households living in the Concession Area and along the railway had much less access to hand pumps and wells. More than 61% of the surveyed households in the Concession Area, and about 40% of communities in the Railway Corridor used either springs or rivers for drinking water. Table 8 summarizes this distribution. This number however is not evenly distributed among different towns in the Concession Area. Only bigger settlements had access to hand pumps or wells. Out of 16 communities that were surveyed in the Concession Area, 10 used rivers, 4 used springs (or streams), and only 1 town used a hand pump, and 1 used well for drinking water.

Table 73 Percentage of Population using Different Water Sources across the Four Study Areas

Water Source	Bong Mine Town	Concession Area	Railway Corridor	Freeport
hand pump	50.9	25.0	29.5	92.4
river	-	26.1	14.8	-
spring	-	35.2	24.6	7.6
well	49.1	13.6	31.1	-

Figure 15 shows the distribution of distance to water source in the different strata. In Bong Mine Town, about 37% of the households were located less than five minutes from a water source. Except for one household at the edge of Bong Mine Town, every other household was within 20 minutes walking distance to a source of water. In the Concession Area, around 47% of the households were just less than 5 minutes from a water source. Every other household, except one, were located within 20 minutes from a water source. About 54% of households along the railway could source their water from within 5 minutes walking distance, and no household needed to walk more than 20 minutes. Finally, 63% of households in the Freeport area had access to a water source within 5 minutes walking distance. The level of underground water in Freeport area is unusually high, hence water taken out from well is contaminated and is not suitable for drinking. This means that those living in the Freeport Area are forced to source their drinking water either from local market, or from pipes installed by the government in certain areas. Water does not run through the pipes regularly though, and as a result many households try to source their drinking water from the market.

Figure 51 Average Walking Distance to Water Sources in the Four Study Areas



3.6.2. Sanitation

Most people living in the Concession Area or along the railway used the bush as a toilet (about 70%). About 25% of surveyed HHs in these areas used pit latrine toilets and the remaining 5%

used a mix of river, bucket, and flush toilet. In Bong Mine Town, 57% used a flush toilet facility. This unusually high ratio of flush toilet is mainly due to the number of houses built by BMC two decades ago which used to have a functioning flush toilet, however they are now mostly operate with buckets. In Bong Mine Town, 22% used the bush, 11% used pit latrines, and the remaining 4% used communal toilets. In the Freeport Area, pit latrines (32%), flush toilets (28%), and septic tanks (26%) were the most common toilet systems.

3.6.3. Cooking Fuel

Charcoal and firewood were identified as two major sources of cooking fuel with charcoal predominating in urban settings and firewood in rural areas. Almost all the surveyed population in the more urban settings, i.e. Bong Mine Town (98%) and Freeport, reported charcoal as their main cooking fuel. In the Concession Area, 93% of households reported firewood as their main source of fuel. The high use of firewood is due to several factors including the abundance of firewood (which could be collected for free), the significant distance to the local markets and the cost of charcoal. Along the railway, usage was more mixed, with 51% using charcoal. As charcoal production is a big business along the railway, it is likely that the higher use of charcoal in rural areas along the railway is due to people producing charcoal for the market and using some of that for domestic consumption.

Within Bong Mine Town, people sourced charcoal from an average of 10 minutes walking distance. In the Concession Area, firewood could be collected on average 13 minutes walking distance from the village. Households along the railway who use charcoal source it within 9 minutes walking distance. The remaining 49% of households along the railway who use firewood source it on average 15 minutes walking distance from their houses. Finally, in the Freeport Area, everyone had access to charcoal, and they source it within 5 minutes walking distance. Table 9 summarizes these statistics.

Table 74 Average Walking Time to access Cooking Fuel in each of the Study Areas

Average Walking Distance(min)	Bong Mine Town	Concession Area	Railway	Freeport	Grand Total
Cooking Fuel	10	14	12	5	10 min
Firewood	1	13	15	-	14 min
Charcoal	10	24	9	5	8 min

3.6.4. Community Infrastructure

Community leaders were asked to identify the distance of their town/community to the closest institutions, such as schools, hospitals, police depot. Residents of Bong Mine Town and the Freeport Area enjoyed relatively good access to all these public facilities, whereas households living in the concession area, or along the railway, generally, had much more problems in accessing public facilities.

Table 75 Average Walking Time to access Key Institutions in each of the Study Areas

Walking distance (mins)	Bong Mine Town	Concession Area	Railway	Freeport
Elementary School	5	73	80	5
High School	5	172	390	10
Clinic	15	178	165	7
Hospital	15	186	180	29
Herbalist	5	22	180	6
Police Depot	12	More than 6 hours	More than 6 hours	12
Local Market	5	176	57	10
Main Market	5	180	115	12

3.7. EDUCATION

37% of adults aged 15 and over (n = 853) in the directly impacted areas have never been to school. Women were more likely than men to miss out on school; 47% of women aged 15 and over (n=449) had never been to school compared with 27 % of men (n=400). A literacy test was conducted at the end of the survey, and household heads were simply asked to write their opinion about survey. Out of 205 household heads, 91 or 44 % could write. This data indicates that a higher proportion of people in the area were illiterate (56%) compared the national average of 12 % (UNICEF, 2008).

Table 76 Illiteracy rates across the Study Areas

Adult Illiteracy %	Bong Mine Town	Concession Area	Railway	Freeport
School Record	31.4	54.1	45.5	16.1
Writing test	43.3	72.0	75.0	25.0

11% children aged between 6 and 18 (n=441) had never been to school. Girls were less likely to be registered in school than boys but only marginally; 12.3 % for school age girls (N=220) and 9.6 % school age boys (n=218).

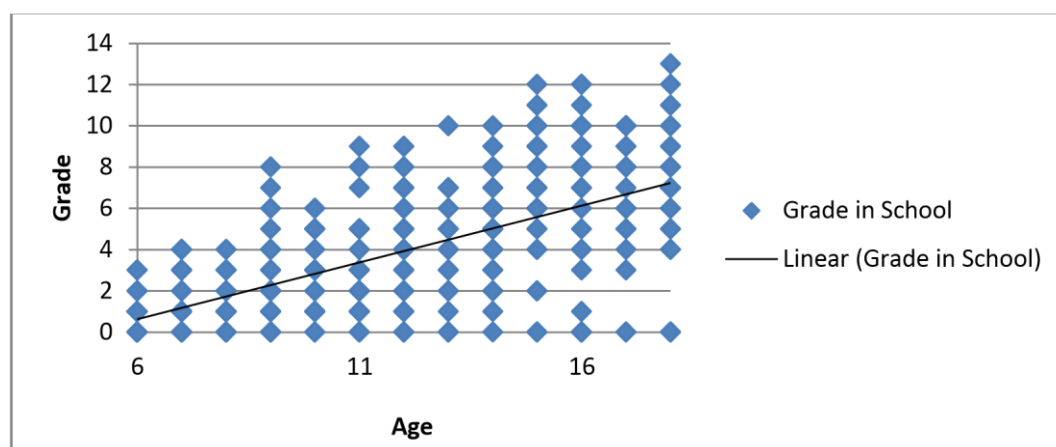
45% of the sample aged 15-18 had started high school education. The data shows that girls are as likely to enter high school as boys. The rate of high school entry, however, varies in different strata. Freeport area enjoys the highest rate of high school entries (76.5%), whereas Concession Area has the lowest high school entry (25.8). Table 3-10 shows the details.

Table 77 Enrolment in Secondary Level Education in each of the Study Areas

	Bong Mine Town	Concession Area	Railway	Freeport
High School Enrolment	42.1	25.8	29.4	76.5

In an ideal education system, with minimum student drop out, one expects that a child's age and education are highly correlated (close to 1). The correlation between age and education in the surveyed population was 0.66 which suggests a relatively healthy education system. However, as is shown in the scatter chart below (Figure 16), data variance is relatively high ($R^2=0.43$). This suggests that many students do not follow the normal progression, and drop out of education after grade 6, or less.

Figure 52 Relationship between age and grade across the Study Areas



3.8. SOCIAL CAPITAL

17.1.1 3.8.1. Participation in community activities

By far the most common and popular community groups were church groups. There was a church group in almost every town. If there was no church group, people joined a church group in a nearby town. Overall, 58% of sampled individuals aged 15 and over were reported to be a member of a church group. This proportion was slightly lower in the Concession Area (56%) where more towns did not have a church within their town. Women were slightly more likely to be members of church groups. 63% of women sampled ($n=449$) were participating in church groups, compared with 53% of men sampled ($n=400$).

Poros/Sande groups were the second most popular community groups in all the strata, except in the Freeport Area. 24.3% of sampled individuals aged 18 and over in Bong Mine Town, 36.4% in the Concession Area, and 39.6% along the railway were members of these secret societies.

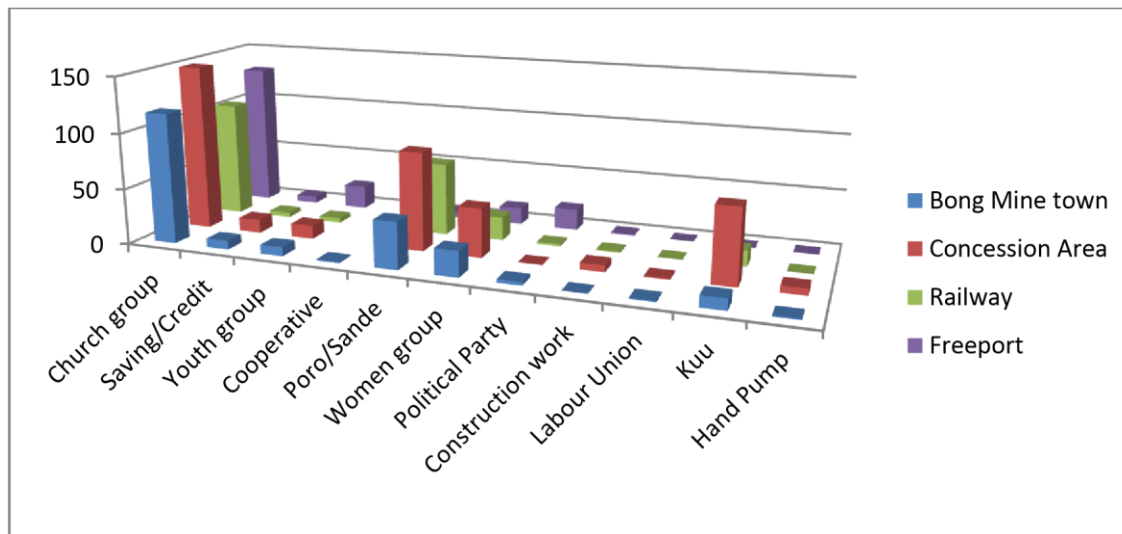
Women's groups were relatively active in all strata. 25% women aged 18 and over in Bong Mine Town, 35% in the concession area, 24% in the railway communities, and 15% in the Freeport reported participation in a women's group.

Youth groups were not as prevalent as women's groups in most of the strata, except in the Freeport Area where 25.6% of youth aged 15 to 25 were members of a youth group. This proportion was 13% in Bong Mine Town, 16% in the Concession Area, and 9.1% in communities along the railway.

Kuu groups are well established groups in the rural areas, and both male and female contribute equally to these groups. In the Concession Area, 28% of adults reported to be a member of a kuu

group. Kuu groups are less active in other strata. 8.5% in the communities along the railway, and 5.8% in Bong Mine Town were participating in a kuu group. No one in the sample population in Freeport was found to be involved with kuu groups. Instead, more people were involved in a political party in Freeport (about 10% of all adults), more than any other strata. Finally, about 4% of the whole sample reported being a member of a local saving/credit (Susu) club. Women were more active in Susu clubs than men.

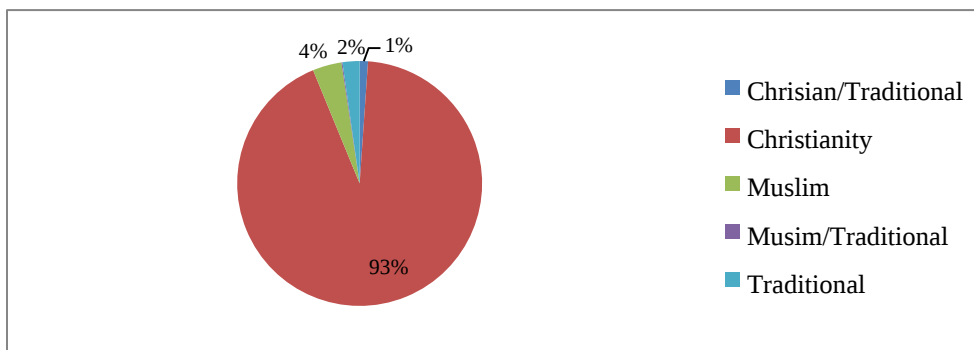
Figure 53 Participation rates in community groups in each of the Study Areas



3.9. RELIGION

The majority of the sample was Christian (93%). About 4% of the population practiced Islam, and 2% held traditional beliefs. Another 1% mentioned that they practiced a mixture of traditional beliefs and Christianity. The number of people who identified themselves as practicing traditional beliefs may not reflect the actual numbers, as many of the traditional belief systems practiced in Liberia involve secrecy.

Figure 54 Religions practiced in the Study Areas



3.10. CULTURAL HERITAGE

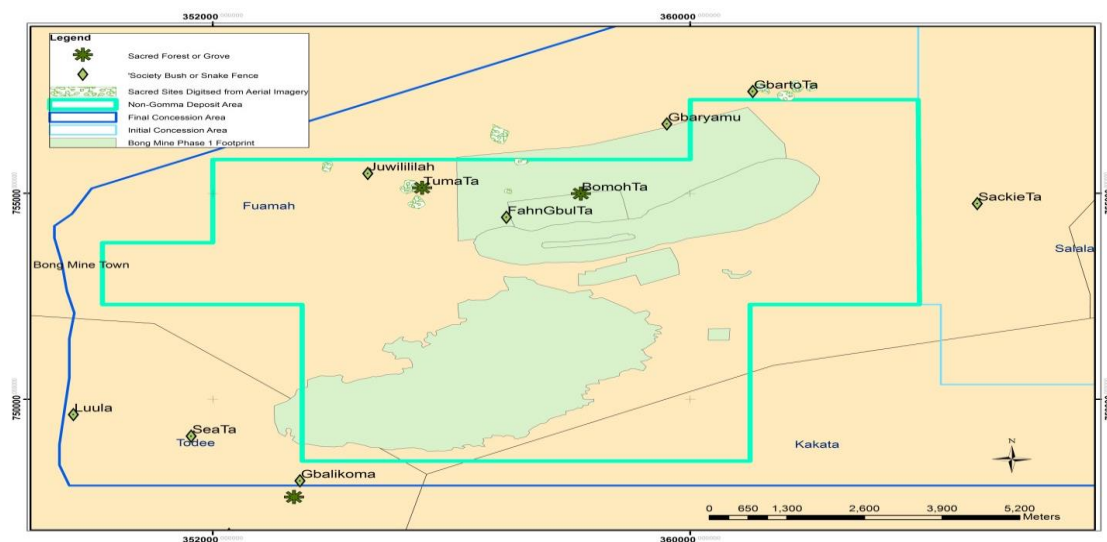
During the baseline's studies, several culturally significant areas in the landscape were either indicated during the community mapping exercises or reported in visits to other towns. Figure 3-15 indicates the towns associated with these sites. No attempt was made to understand the use and significance of these sites, but many are linked to societies.

Aerial photography for the Non Gomma Deposit Area was also used to identify sacred sites; sacred sites tend to have notably denser and taller tree cover as they are typically never cleared for farming. Some of the culturally important sites indicated on the map may remain un-farmed for reasons other than being used by the secret societies. They are nevertheless very much part of the local cultural landscape as memorials and/or abodes of spirits.

Great care must also be taken to avoid damaging or desecrating graves, something which has not apparently been respected at Bemou, one of the towns being displaced. Graves are typically placed beside towns but given the frequency of settlement displacement (see Annex 2), old towns dot the landscape around the mine area and are likely to contain graves that remain significant to people still alive. Old town spots of themselves are also important places of memory in the cultural landscape.

This map is not definitive, and it is strongly advised that more research is done to establish the significance of each of the sites indicated. This map is intended to be used by China Union as a pointer for further engagement with the communities. China Union must take adequate precautions when planning their operations to identify all such areas in advance and plan to avoid them. If avoidance is impossible, discussions about their use and any relocation possibilities must be handled with the utmost cultural sensitivity and people with the pre-requisite knowledge to do so, such as the clan and chiefdom ritual specialist heads (zoos) in the case of society bushes, will need to be engaged to lead these discussions.

Figure 55 Locations associated with Sacred Sites



The Poro is a very significant social institution that outsiders generally refer to as a secret society. Membership in places like the villages around Bong Mines would in the past have been universal for all men. Initiation for boys takes place in the Poro groves (typically called 'society bushes' in Liberian English) which are also meeting places for the society. Non-members are prohibited from entering these groves.

The Sande society is for women and is analogous to the Poro and the two are very entwined. It has separate groves from the Poro for its initiation and society business which are likewise closed to nonmembers.

The snake society (kali-sâle) is involved in healing snake bite victims. Membership is relatively simple compared to the Poro and Sande and involves, upon arrangement, entering the snake fence for a short initiation to learn the secrets of the medicines (kali).

3.11. COMMUNITY HEALTH

3.12. OVERVIEW OF HEALTH IN LIBERIA

Liberia has a total population of 3,994,000, according to latest available estimates. Life expectancy at birth is 57 years for females and 54 years for males, which is slightly higher than the regional average (56 for females and 52 for males) but below the global average of 71 years for females and 66 years for males. The under-five mortality rate is 103 per 1,000 live births, which is close to the regional rate (109 per 1,000) but above the global average of 57 per 1,000 live births. Liberia has one of the highest maternal mortality ratios in the world, 770 per 100,000 live births, exceeding both the regional (480 per 100,000) and global ratios (210 per 100,000).

HIV prevalence remains below the regional average, 15 per 1,000 adults aged 15 to 49 are estimated to be infected with the virus in Liberia – the equivalent regional average is 47 per 1,000 adults. HIV incidence among pregnant women has been estimated at 5.7% in major urban areas in 2006 and 4.3% in non-urban areas in 2003.

Liberia has a relatively high level of tuberculosis prevalence, with 476 per 100,000 people infected, superseding both regional (332 per 100,000) and global (178 per 100,000) averages.

Leading causes of death for children under 5 include malaria (18%), pneumonia (14%) and other diseases (13%). Communicable diseases account for 82% of years of life lost in the population overall. Risk factors present amongst those aged more than 25 years of age, include raised blood glucose (9.3% of females and 8.4% of males); raised blood pressure (35.7% of females and 38.5% of males); obesity (7.7% of females and 3.1% of males); and tobacco use (14% of males) – all slightly below the corresponding regional averages.

The Liberian medical sector currently offers 1 physician for every 100,000 individuals – that is 4% of the regional average which is 22 for every 100,000 individuals. Nurses and midwives are also in relatively short supply, with 27 for every 100,000, less than a third of the regional average which is 90 for every 100,000. Availability is even lower for rural and/or poorer sections of the population – 32% of births in rural areas are thought to be attended by skilled health personnel,

compared to 79% in urban areas. Out of the poorest quintile, only 26% of pregnant women are assisted by health personnel, compared to 81% of the wealthiest quintile.

Contraceptive prevalence is low by regional standards, 11% of adults use contraception in Liberia, compared to 24% of adults in the region.

3.13. HEALTH, SOCIAL CARE AND PUBLIC SERVICE PROVISION IN LIBERIA

Public health services in Liberia are overseen by the Ministry of Health and Social Welfare (MoHSW) via County Health Teams located in county capital cities. Private healthcare is also provided by practitioners largely operating in or near urban centres.

Primary, secondary and tertiary care centres are accredited by MoHSW inspectors who visit each facility and assess available services and systems against the ‘Essential Package of Health Services’ framework, which operationalizes the National Health Policy and Plan by specifying minimum standards that should be met at each level.

Selected indicators are summarized in Table 13 to highlight the current capacity of health facilities assessed during the Health Impact Assessment. The accreditation data provided by the MoHSW included a vast range of indicator questions of which 64 were selected as most efficient in measuring capacity within 14 categories including facilities, minor surgery, diarrhea, ante natal care, vaccinations, pharmacy, education & health, malaria, Acute Respiratory Infection (ARI), trauma, Human Immunodeficiency Virus (HIV), Sexually Transmitted Infection (STI), tuberculosis (TB) and alcohol & drugs. The indicators were selected based on the prevalence of certain conditions and health needs which were detected during the Health Impact Assessment, as well as indicators on which mining operations are known to have an impact. Each assessed facility was scored on each of the 64 indicator questions, before the composite score was calculated within each of the 14 areas. It should be noted that the accreditation process fails to assess whether staff have the skills necessary to operate certain equipment – e.g. ultrasound – or whether they have received adequate training to handle trauma cases.

Figure 20 depicts the number of public and private health facilities by county. Of the three counties Montserrado has the highest concentration of private health facilities and a correspondingly low proportion of health care provided free of charge to the public.

Figure 56 Number of Public and Private Clinics by County

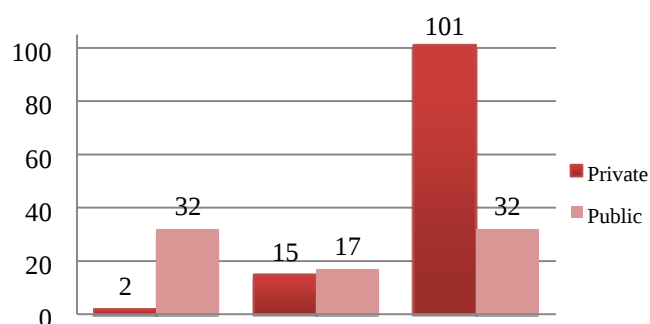


Table 78 Level of facilities in Medical Centres and Health Clinics across the Study Areas

FACILITY	BEDS	FACILITIES	MINOR SURGERY	DIARRHEA	ante natal care	VACCINATIONS	PHARMACY	EDUCATION & HEALTH	MALARIA	ARI	TRAUMA (ATLS)	HIV	STI	TB	ALCOHOL & DRUGS
Bong Mines Medical Centre	74	89%	100%	100%	100%	100%	67%	25%	100%	100%	100%	33%	100%	86%	67%
Haindi		44%	100%	100%	100%	50%	67%	25%	40%	50%	29%	0%	80%	14%	100%
Yeamai		44%	100%	33%	100%	50%	33%	25%	20%	50%	43%	0%	60%	14%	33%
Wonjah Smith Memorial		44%	67%	67%	67%	50%	0%	25%	40%	50%	29%	0%	60%	14%	67%
Crozierville		33%	100%	0%	100%	50%	33%	25%	20%	50%	14%	17%	60%	14%	33%
Bensonville	25	67%	100%	100%	100%	50%	67%	100%	100%	100%	57%	67%	100%	100%	33%
Nyehn	12	67%	100%	100%	100%	100%	33%	75%	100%	100%	29%	50%	100%	100%	33%
Koon Town		22%	100%	67%	100%	100%	67%	25%	20%	50%	14%	0%	60%	14%	33%
Zanna Town		33%	100%	67%	100%	50%	33%	25%	20%	50%	43%	0%	80%	29%	33%
Clara Town	16	33%	100%	67%	67%	100%	33%	75%	60%	50%	57%	33%	80%	57%	33%
Redemption	200	100%	100%	100%	100%	100%	67%	100%	100%	100%	86%	100%	100%	100%	67%

Public health care facilities across all three counties are either fully funded by the MoHSW, or jointly funded by MOH alongside non-governmental organizations (NGO), including faith-based organizations, Africare, Save the Children, Medecins du Monde (MDM), MERCI, Merlin, MTI and private benefactors.

Each facility is required to report monthly to MoHSW on a range of diseases including HIV, TB and Malaria. This data, which would have enabled the establishment of a comprehensive, year-long, baseline of incidence across all areas of China Union operations, was unfortunately not made available to the Health Impact Assessment team during the research by MoHSW. Hence the baseline data presented here is limited to a two-month period across selected health facilities.

3.13.1. Case Study of Bong Mines Medical Centre (Hospital)

As Bong Mines Hospital is the hospital that China Union, according to the MDA, is required to support, it is useful to examine in more detail its capacity. Before China Union operations began, Bong Mines Hospital was jointly funded and supported by MoHSW and the NGO Africare. The outpatient department was funded by the NGO while MoHSW supported the inpatient department, including emergency services. Prolonged negotiations between China Union and MoHSW over the future of Bong Mines Hospital have at times left the hospital without any support for the inpatient department – a situation which became critical during June & July 2012 when the hospital was left without life-saving drugs and equipment for almost a month. China Union is perceived to have refused to provide support for the hospital in the absence of a Memorandum of Understanding (MoU) detailing the company's obligations. According to hospital staff, MoHSW are similarly refusing to provide support, arguing that a MoU is unnecessary as China Union's obligations are detailed under the Mineral Development Agreement (MDA).

Some support has been provided by China Union, including 50 gallons of diesel and a generator delivered in early 2012 in addition to a delivery of drugs in July. Africare continues to run the outpatient department which is open Monday to Friday, while 24-hour emergency services are provided by the inpatient department. The inpatient department also provides a laboratory facility, where all tests required by outpatients are conducted free of charge.

The current Medical Director (Medical Director), Dr. Augustus G. Quiah joined Bong Mines Hospital (Bong Mines Hospital) in January 2012, thus enabling the hospital to handle critical cases which previously had to be referred to Kakata or Monrovia.

Bong Mines Hospital hosts an on-site pharmacy which was, until the recent disagreement between China Union and MoHSW, supplied by the country-wide National Drug Services (NDS) – the state owned pharmaceutical supplier that supports all public health services. A common complaint raised by pharmacists consulted during the Health Impact Assessment was that NDS are unable to meet demand, leaving all health facilities with incomplete orders. Antibiotics and pain medicines were highlighted as drugs that are often supplied in insufficient quantities.

Other medical items including intravenous fluids, syringes, needles, gloves, catheters and dressing materials were also said to be in short supply. The pharmacy reported that it supplied the Africare-operated Out Patients Department with drugs on an almost daily basis, as the Out Patients Department struggled to meet patient demand. The unreliable supply channels had prompted the

Medical Director to initiate a credit arrangement with a pharmacy in Monrovia, which he turns to when essential supplies run low.

The inpatient department admitted 202 patients in September 2012, with an average stay of 4.6 days. According to the Clinical Supervisor in charge of inpatient admissions, the most common conditions suffered by admitted patients were malaria, anemia, hernia, acute respiratory infections (ARI) and hypertension. The NGO ‘German Emergency Doctors’ had supported Bong Mines Hospital during 2003 – 2005 through renovations, provision of staff and provision of equipment. Unfortunately, a range of equipment, including X-ray, ultrasound, EKG, oxygen and blood chemistry analysis machines, have been left in disuse following break-downs where replacement parts could not be located and lack of operational skills amongst staff. Bong Mines Hospital had repeatedly contacted the NGO for assistance without success. The Medical Director highlighted lack of an on-site blood bank and X-ray machines as major obstacles in treating life-threatening injuries, a short-coming that he predicted would have dire consequences for any workers sustaining serious injuries at Bong Mines. He also highlighted lack of reliable transport as another major problem. The ambulance available at the hospital was donated by Medecin Du Monde and often breaks down. In an operational plan submitted to China Union, the Medical Director has listed all staff and equipment that remains outstanding in order to fulfill the standard of care demanded from a hospital-rated facility according to the EPSH framework. China Union were reported to have assessed hospital facilities on several occasions and staff had expected further action and improvements to be undertaken for several months but there has been no action to date. The report is included in Annex 3.

Table 79 Use of Herbal versus Contemporary Medicine during the preceding year

	Bong Mine Town (n=60)	Concession Area (n=91)	Railway (n=59)	Freeport (n=69)
Herbalist	12	14	2	1
Contemporary Medicine (at health clinic or hospital)	11	22	5	29

Mobile Clinics

Several ‘mobile’ pharmacies operate around Bong Mines, consisting of health professionals who visit communities offering diagnosis and treatment in return for payment. One nurse assistant consulted had been visiting villages around Bong Mines Bong Mines for more than 4 years, often following requests from patients. Common diagnosis included malaria but also hypertension and peptic ulcer disease (PUD) – which is perceived to be correlated with factors including alcohol, smoking and lack of food. The most popular treatment options included painkillers, malaria tablets, antibiotics and iron supplements which both mobile and regular pharmacies consulted purchased from Monrovia at wholesale prices.

Self-medication

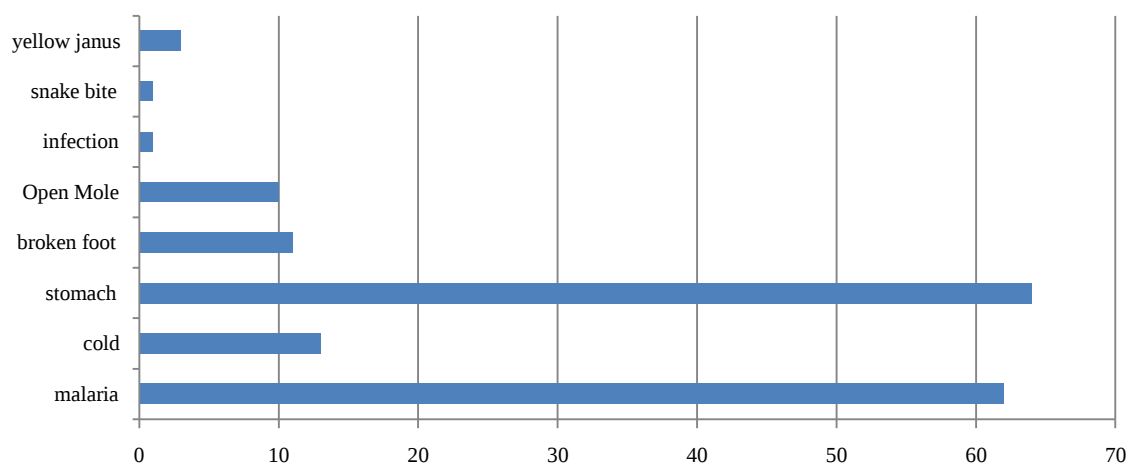
The numbers of people who reported using pain killers and herbal medicine from the bush to treat an illness is much higher than the number of people who reported attending a herbalist or health clinic/hospital for a health problem (see Table 3-13). Cost could be a factor, but it is likely that in the absence of either contemporary or traditional health services, people self-medicate.

Table 80 Use of Herbal Remedies and Pain Killers for Self-Medication

	Bong Mine Town (n=60)	Concession Area (n=91)	Railway (n=59)	Freeport (n=69)
Using herbs for medical	23	60	32	13
Pain killers	45	73	48	33

When asked where interviewees gather medical plant, 50% reported that they accessed the bush for medical herbs. People used bush for many different medical conditions. The majority used it for malaria and stomach problems (about 37% and 39% respectively), and to a lesser extent for healing colds, broken bones, and open mole. Figure 21 summarizes these statistics.

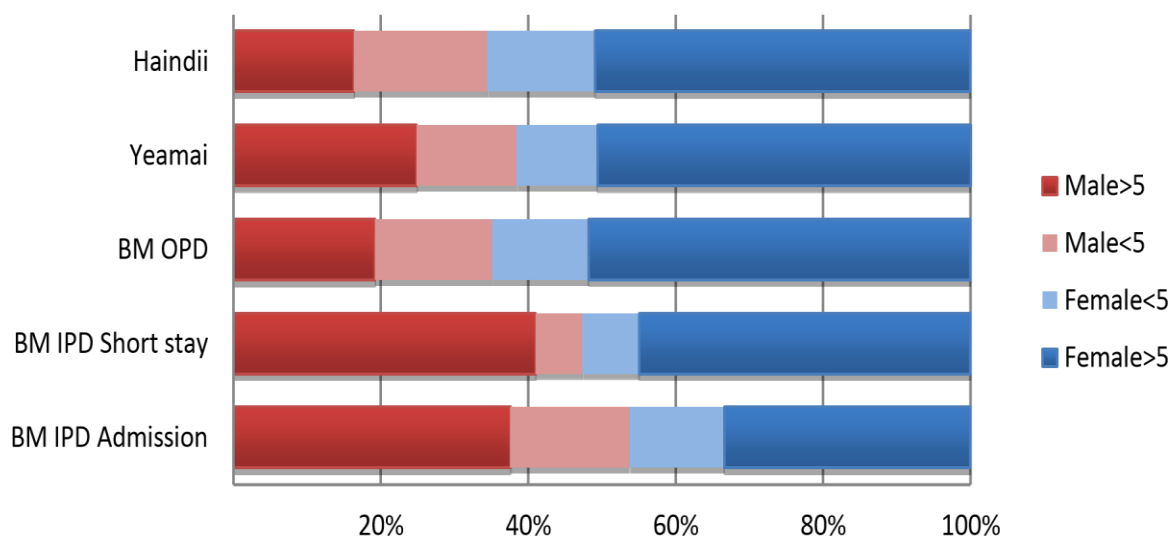
Figure 57 Diseases reported as treated with Herbal Medicine in the preceding year (Frequency of disease reported as % of total diseases reported as treated)



3.14. HEALTH AND WELLBEING PROFILE

The individual diagnosis ledgers analyzed at Bong Mines Hospital, Yeamai and Haindi, provided a snapshot of the demographic distribution across the clinics. It is notable that the inpatient department has a relatively equal distribution of male and female patients, compared to the outpatient departments where females are seen in greater numbers. However, the outpatient departments are visited by pregnant women seeking ante natal care, a practice which has been heavily promoted by MoHSW due to the country's high level of maternal mortality.

Figure 58 : Proportion of patients treated in selected clinics serving the Concession Area by gender and age



In the HH survey, people were asked about whether there was a trained mid wife present at the birth of infants born to the HH in the preceding year. 100% of infants born in Bong Mine Town and Freeport Area, 78% of infants born along the railway, and 57% of infants born in the Concession Area were born in hospital, or in the presence of a trained midwife. Despite a relative existence of support for giving birth, the infant mortality- during the first year of life- remains high, especially in Bong Mine Town, and Freeport Area (16 %). Infant mortality rate in the Concession Area and along the railway interestingly was 8.1 % and 5.6% respectively which is much lower than the other two strata. More research is needed to assess why child mortality in Bong Mine Town and the Freeport Area is double that in the Concession Area or along the Railway.

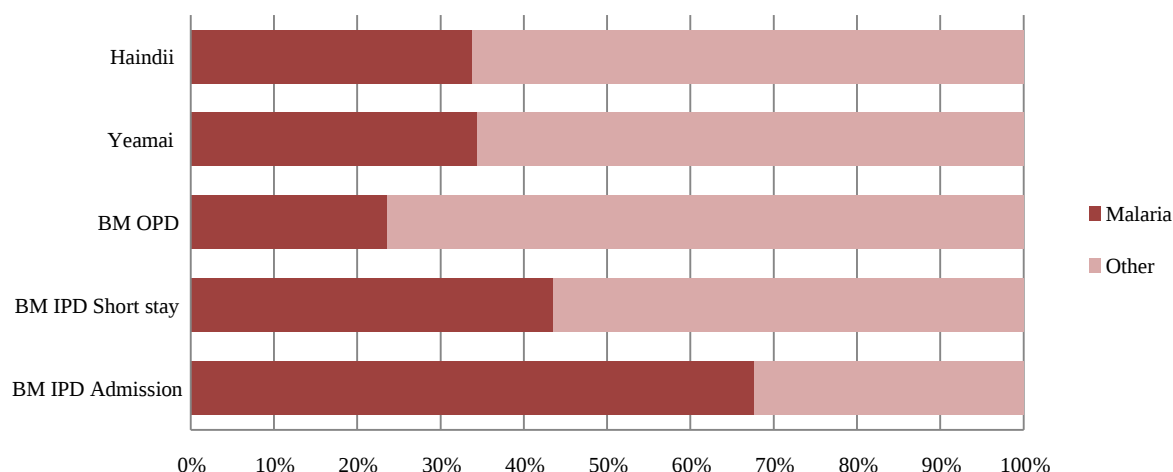
3.14.1. Communicable Diseases

Vector borne diseases

Malaria overwhelmingly dominates as the primary health concern across all surveyed areas – it is also the only vector borne disease found to be diagnosed. China Union officials estimated that at least 50% of the current work force had at some point required treatment for malaria. The number of malaria cases in China Union workers seen at Bong Mines Hospital has decreased since an in-house doctor started practicing at the China Union staff quarters in March 2012.

Mobile and regular pharmacists, in addition to hospital staff and patients, reported that the vast majority of malaria cases remain undiagnosed by medical health professionals. Those afflicted were said to, in most cases, rely on self-medication using anti-malarial obtained directly from pharmacies, or herbal medicine or to abstain from treatment altogether, while only seeking modern medical care in severe cases. The reported malaria cases, which dominated patient records across all clinics, can therefore be assumed to only represent a fraction of the actual prevalence and only represent the most severe cases. Malaria was also considered a major cause of death at the two surveyed facilities that reported any deaths on site; Bong Mines and Redemption hospitals.

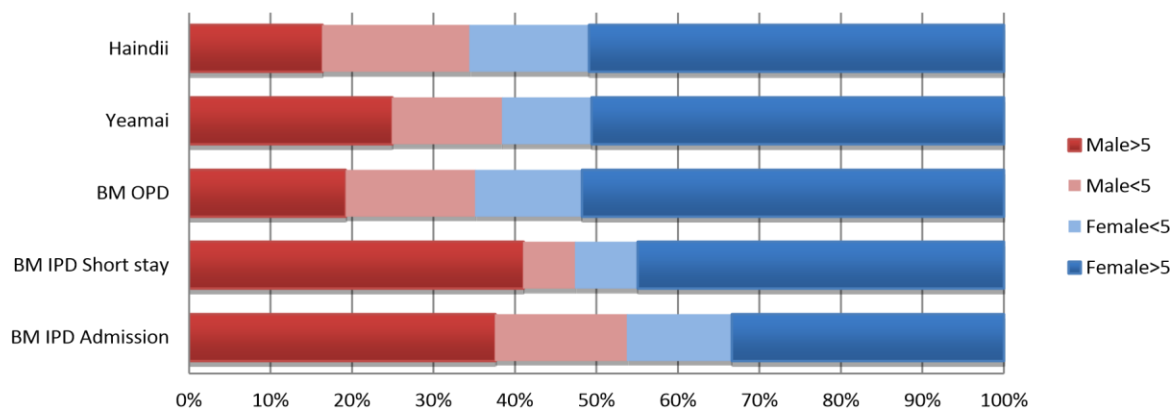
Figure 59 Proportion of patients diagnosed with malaria during March and September 2012 at selected clinics and hospitals serving the Concession Area



While women and girls over 5 years of age represented the largest proportion of malaria patients at Yeamai, Haindii and Bong Mines outpatient clinics, male patients were commonly processed at the inpatient department at Bong Mines, which handles patients that are considered too critical to pass through the Outpatients Department. This discrepancy cannot be explained by ante natal care as the vast majority of ante natal care patients do not present with malaria. It may therefore rather be the case that the smaller proportion of male outpatients reflect a tendency for males to only seek medical care when illness reaches a critical stage or that females are more susceptible to disease overall.

It should also be noted that malaria was often diagnosed alongside other conditions, including Acute Respiratory Infection (17% of malaria patients) and pneumonia (9%).

Figure 60 Proportion of Malaria Cases diagnosed in March and September 2012 in selected clinics/hospital serving the Concession Area by gender and age



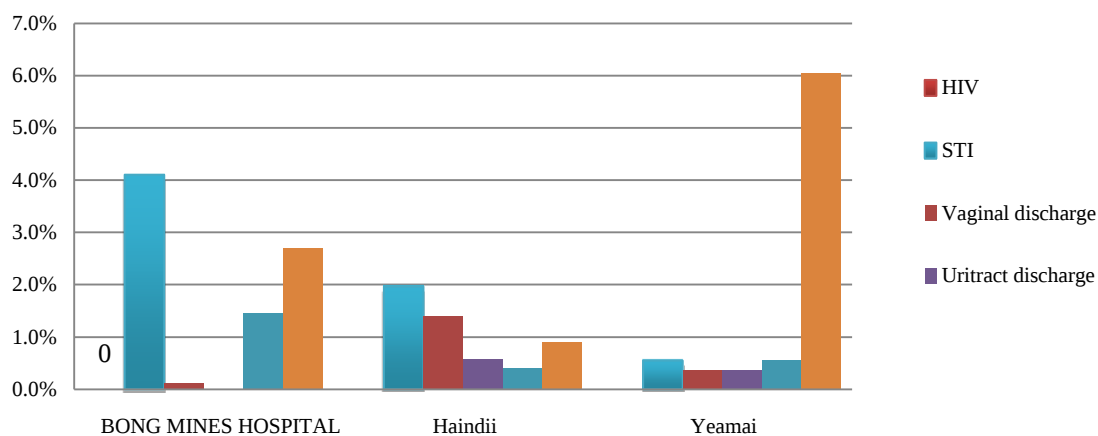
Sexually Transmitted Infections and HIV/AIDS

All clinics apart from Koon town, Wonjah Smith Memorial and Haindi conducted HIV testing. Nyehn reported one positive case in 2012. Redemption Hospital reported that 10% of all HIV tests conducted at the hospital are positive, with on average of 100 new cases confirmed every month. In 2011, the hospital recorded 1,009 HIV positive tests. Clara town health centre reported 15 new cases during the first week of October 2012. At Wonjah Smith Memorial, 2 new cases of HIV had been recorded since October 2011. No HIV positive cases had been confirmed at Yeamai and Zanna clinics since October 2011. STIs however, were one of three major health concerns at Zanna town.

As pregnant women who seek ante natal care are screened for HIV, they provide a relatively reliable indicator of HIV incidence in the population overall. Test results from Bong Mines Hospital below show the total number of women tested along with the number found to be infected. These latest available figures indicate that the confirmed HIV incidence among pregnant women in the Bong Mines area is 1.2%. This is considerably lower than the nonurban incidence of 4.3% which may reflect the relatively low availability of accessible ante natal care in the area rather than a particularly low incidence of HIV.

The below graph displays the proportion of patients visiting Bong Mines Hospital, Haindi & Yeamai that were diagnosed with HIV, STI or with symptoms and diseases indicative of an STI. The difference between clinics is likely to be due to differing capacity to diagnose conditions.

Figure 61 Proportion of patients diagnosed with HIV and STI Indicators in March and September 2012 in selected clinics/hospital in the Concession Area

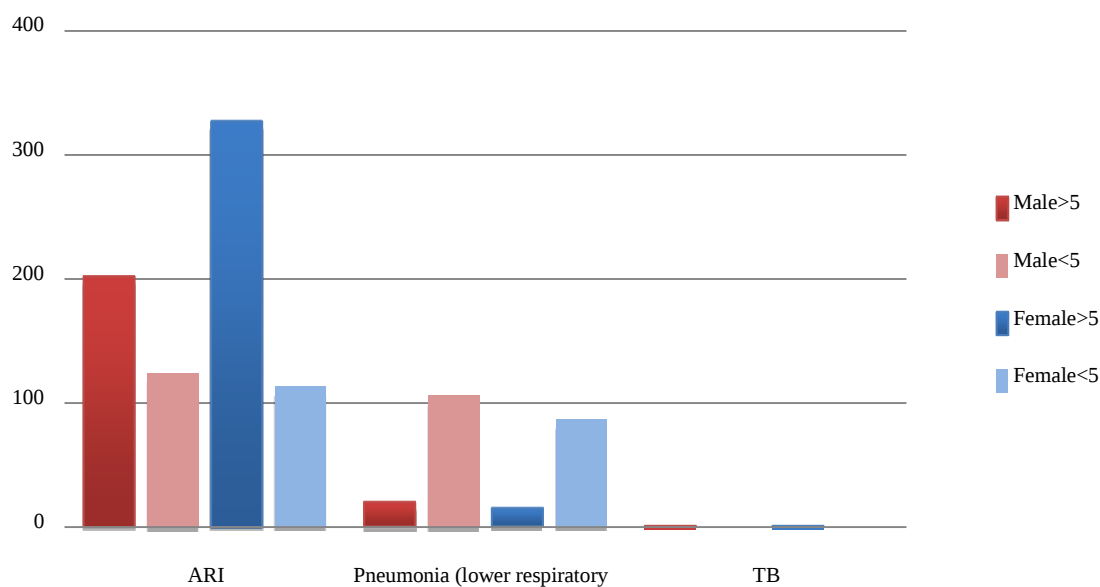


Although urinary tract discharge and infection in sexually active males is very likely to be caused by an STI, none of the 24 males diagnosed with UTI at the three clinics was confirmed with an STI. Vaginal discharge is also most likely caused by an STI, although urinary tract infection in females can also be caused by bacterial infections. It is notable that more women are diagnosed with an STI – some are identified during ante natal care (11 out of 88 diagnosed with an STI) – but this discrepancy may also indicate that the drive to encourage partners to get tested is failing.

3.14.2. Respiratory Diseases

Confirmed cases of influenza were not reported at any of the surveyed facilities. Two cases of Tuberculosis (TB) were reported at Yeamai clinic in 2011 but none had been confirmed during 2012. Less than 5 cases had been recorded in Haindi since October 2011. Three suspected TB patients had been referred from Koon town clinic during 2012. Redemption hospital reported 470 new cases of TB in 2011 and Wonjah Smith Memorial reported 2 new cases since October 2011. Acute Respiratory Infection (ARI) was one of three major health concerns in Zanna town. At Redemption hospital – one of the few facilities that reported any deaths on site – ARI was stated as a leading cause of death. Pneumonia was rarely used as a diagnosis at some clinics but is likely to have been diagnosed in less specific terms as an ARI.

Figure 62 Number of patients diagnosed with respiratory diseases in March and September 2012 in selected clinics/hospital in the Concession Area



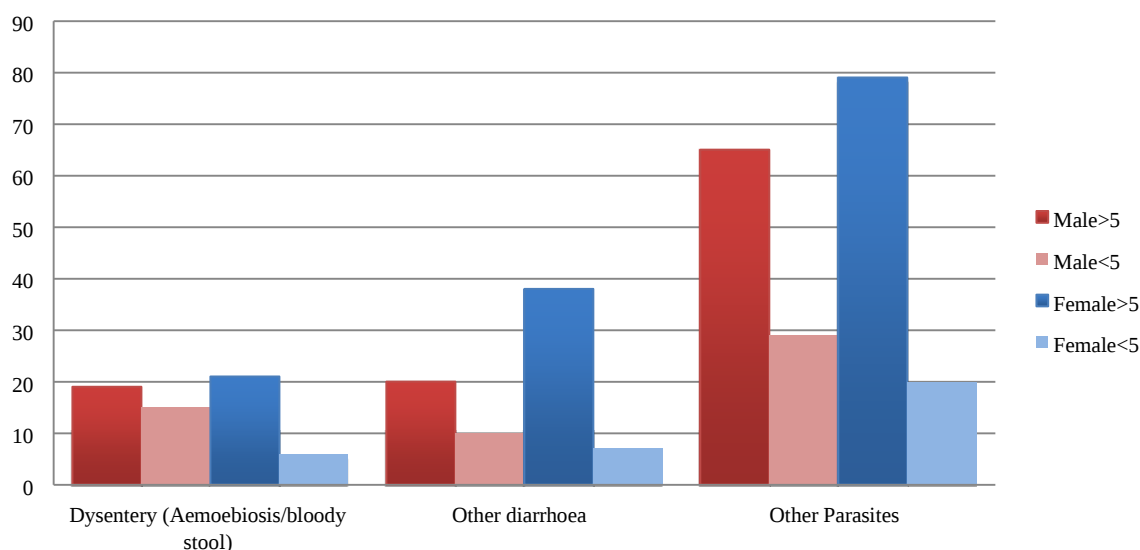
3.14.3. Faecal-Oral Diseases

Yeamai clinic staff and community members reported an increase in diarrhea cases during the dry season when the only functioning hand pump in the town dries up for three months (January until March), forcing the population to seek alternative, less clean water sources.

Koon town clinic staff reported frequent cases of diarrhea, with only 2 functioning handpumps out of 6 in the area, which often lead community members to source water from the surrounding creeks – again seen as a main cause of diarrhea.

Parasites that were specifically diagnosed included 7 cases of schistosomiasis at Bong Mines Outpatients Department – a figure which is likely to represent a small proportion of the actual infected population, as this is a common parasite related to poor sanitation and contaminated water.

Figure 63 Patients diagnosed with faecal-oral diseases in March and September 2012 in selected clinics/hospital serving the Concession Area by gender and age



Other diseases associated with poor sanitation and overcrowding

Scabies was reported to be the most common skin disease in Yeamai, Koon town and Bensonville, where ring worm was also frequently cited. It is notable that impetigo is found in Bong Mines, Haindi and Yeamai clinic data as this is a highly contagious skin infection spreads easily through contact and is hence a good indicator of overcrowding. Similarly, scabies may be relied on as an indicator of overcrowding as it only spreads through the sharing of beds. Dehydration was particularly noted in Yeamai during the dry season when the community struggles to find safe drinking water.

3.15. NON-COMMUNICABLE DISEASES

3.15.1. Cardiovascular Disease

Hypertension and cardiovascular disease was reported in the Bong Mines, Haindi and Yeamai clinic records. The relatively larger proportion of women diagnosed with hypertension is likely due to preeclampsia (during pregnancy). The China Union clinic reported 1 case of heart disease since March 2012. Bensonville hospital reported more than 10 cases of hypertension per year and Clara town health centre sees on average 10 cases of hypertension per month.

3.15.2. Cancer

Bong Mines Hospital Outpatients Department report 1 case of cervical cancer during September 2012 and Haindi clinic had recorded one case since October 2011. No cases were reported at Yeamai but the China Union clinic had recorded one case of liver cancer since March 2012 and Redemption hospital reported up to 50 cases since October 2011. Chronic Hepatitis B infection is a leading cause of hepato-cellular cancer and can hence be useful as an indicator. It is more likely to develop the earlier in life hepatitis B is contracted.

3.15.3. Chronic Respiratory Diseases

No cases of bronchitis were confirmed at the surveyed clinics. Bong Mines Hospital Outpatients Department reported that lack of equipment made diagnosis impossible which left suspected cases are diagnosed as ARI.

Asthma

Yeamai clinic cited one asthmatic patient that had died in 2010 after refusing to visit hospital for treatment. Haindi clinic had recorded 1 case of asthma since October 2011. Bong Mines Hospital had seen one case in September and reported that more cases were seen during the dry season. Crozierville reported seeing one asthma case since October 2011 and Redemption hospital reported asthma patients returning on a regular basis when suffering attacks instead of using inhalers which were said to be prohibitively expensive. Clara town health centre also reported receiving on average 5 asthma patients every month and Wonjah Smith Memorial reported on average 3 monthly cases of asthma.

Diabetes

Even though very few patients were diagnosed with diabetes (only one confirmed in analyzed Bong Mines, Haindi & Yeamai data), data from Bong Mines Hospital revealed 11 patients diagnosed with hypoglycaemia. This is likely to be correlated with type 2 diabetes but can also be a sign of liver failure. For the purpose of the Health Impact Assessment, hypoglycaemia is useful to note as a possible indicator for diabetes.

3.16. NUTRITIONAL DISORDERS

3.16.1. Malnutrition

Yeamai reported three cases of malnutrition in August and Haindi also cited malnutrition amongst conditions seen on a monthly basis. Bong Mines Hospital Bong Mines Outpatients Department sees on average one case per month.

Koon town staff highlighted malnutrition among children in particular as a major health concern in the area. Large rubber and palm plantations are occupying land to an extent where very little is available for farming of food crops. Household access to food was allegedly further aggravated by the low salaries paid by the cash crop farms, which were too low to cover average household food costs.

Nyehn health centre had for the past two years been providing corn meal supplied by the World Food Programme (WFP) to pregnant women and children aged between 6 months and 2 years old, which had greatly reduced the number of malnutrition cases seen at the clinic. Redemption Hospital receives malnutrition cases referred from clinics across the country, with 10-15 new cases every month. Clara town receives around 40 cases of children with malnutrition every month which are referred to Redemption after WFP ended its feeding programme at the health centre in July 2012.

3.16.2. Vitamin Deficiencies

Bong Mines Hospital Outpatients Department said scurvy is diagnosed every couple of days, but this was not reflected in the analyzed clinic records.

3.16.3. Obesity

The only clinic visited that reported cases of obesity was Redemption hospital – even here the staff highlighted that patients never sought medical treatment for obesity, as being overweight is in general seen as a positive condition but rather visited the clinic due to related illnesses such as diabetes or hypertension.

3.17. TRAUMA & INJURIES

3.17.1. Physical Accidents

Bong Mines Hospital staff recalled that physical injuries from artisanal mining used to occur regularly. Mining injuries sustained by China Union workers are seen on a regular basis. Bong Mines Hospital Outpatients Department said minor injuries seen were often due to farming. Yeamai reported up to 15 injuries due to accidents per year.

Figure 64 Trauma and Injuries reported at selected health clinics/hospital serving the Concession Area during March and September 2012

Trauma and injuries	Male>5	Male<5	Female>5	Female<5
Bong Mines Inpatients Department Admission	2		2	
Bong Mines Inpatients Department Short stay	21	1	6	3
Bong Mines Outpatients Department	9		6	
Haindi	10	5	14	
Yeamai	11	2	6	

Zanna clinic receives road traffic accidents (RTA) regularly and reported one ‘Make A Way’ passenger (adult male) who had broken his leg on the Make A Way cart in January 2012. Bensenville hospital staff also reported receiving injuries caused by Make A Way collision. Non-transport related injuries were received most frequently during the farming season.

Koon clinic staff reported receiving frequent cases of injuries due to road traffic accidents (RTA), with an estimated 35 seen since October 2011. Nyehn health centre also reported frequent RTA injuries, around 20 cases from motorbike accidents and 10 cases from car accidents every month. Bensenville hospital and Crozier Ville clinic also receive RTA injuries frequently, again mostly due to motorbike accidents. Redemption hospital similarly reported frequent trauma cases and one death at the port since October 2011 where an APN terminal worker had drowned. Clara town sees on average 5 cases of RTA injuries every month, mainly due to motorbike accidents. Wonjah Smith Memorial reported on average 15 RTA injuries per month, again mostly due to motorbikes.

3.17.2. Community Violence

No domestic violence cases were reported at Yeamai clinic. Haindi had seen 2 sexual assault cases this year in addition to bruises and lacerations which were seen almost every day, many of them due to domestic violence.

Bong Mines Hospital Outpatients Department reported around one case of injury due to violence per year. Nyehn health centre reported receiving injuries caused by violence on a monthly basis. Bensenville received monthly injuries due to violence, including domestic violence, which were particularly frequent around Christmas and other holiday periods. Redemption Hospital reported seeing on average 2 to 3 cases of injuries due to violence and sexual violence respectively on a daily basis. Clara town health centre sees on average 2 cases of sexual violence every month. Wonjah Smith Memorial reported on average 7 cases of injuries due to violence every week, but staff said domestic and sexual violence cases tend not to report to their clinic.

3.18. HEAVY METAL AND CHEMICAL EXPOSURE – AIR, WATER AND SOIL

Clinic staff and community members at Yeamai in Bong County complained that the nearby Yeamai River had been polluted since BMC initiated mining activities at Bong Mines in the 1960s. At its worst, the river ran red from iron ore and was blamed for the death through severe diarrhea of 7 people for one week. The water had subsequently been declared unusable by BMC who installed two hand pumps in the village to provide alternative drinking and washing water. The pumps have since broken and village members complained that the river water continued to cause diarrhea when ingested and rashes on sticky, itchy skin followed by hot sweats and nausea if used for washing.

Skin rashes were also reported at Haindi, mostly on children, where these were blamed on St Paul's river – 3 out of the 4 cases in the data analyzed were recorded at Haindi (two females aged 8 and 1 years old and one 3-year-old male), and the fourth case was a 42-year-old female in Yeamai. All cases were recorded during March (dry season).

Pharmacist Robert Davies at Irvin Store in Bong Mines recalled that air pollution had been correlated with respiratory problems during BMC days. Thick, black smoke had lingered over the town but cleared once mining operations ceased.

Bensenville hospital staff reported that air pollution had been a health concern until recently due to NDS operating an incinerator in the town. Air quality had improved since last year when the incinerator was abandoned.

3.19. MENTAL HEALTH & WELLBEING

3.19.1. Suicide

No known cases of suicide were cited by any of the medical professionals consulted during the assessment apart from at Wonjah Smith Memorial where a 21 year old female had reportedly attempted to commit suicide by drinking chlorine during 2011.

Depression, stress, anxiety and other psychiatric disorders. No mental health cases were reported at Yeama but Haindi reported one known case of depression in the surrounding community (male adult) and 5 cases of anxiety in adult females had been recorded at Bong Mines during March and September. Bensenville hospital also cited one known case of depression. Redemption Hospital had opened a mental health unit in September 2012 which received cases from around the country, with 5 cases of depression admitted so far, leaving depression the most common cause of referral. Clara town sees on average 2 cases of anxiety every year.

3.19.2. ALCOHOL & DRUGS

Alcohol, tobacco and other intoxicant consumption were not reported at any of the surveyed clinics apart from one case of a 45-year-old male with alcohol intoxication who was admitted to Bong Mines Hospital.

3.19.3. Mortality

Two facilities visited reported deaths on site – Bong Mines Hospital and Redemption hospitals. Redemption reported 499 deaths during 2011 – 363 of which were children and adolescents and 136 which were adults, including 32 maternal deaths. Bong Mines Hospital reported 41 deaths in total during the same period. Staff at Wonjah Smith Memorial complained that critically ill individuals are sometimes left to die even though medical care is available.

4. LAND USE

4.1. HISTORICAL EVENTS THAT HAVE SHAPED LAND USE IN THE NON GOMMA DEPOSITS AREA

In this section, land use in the Non Gomma Deposits area is described. Before considering the major factors shaping land use around the Non Gomma Deposits area, a very brief historical note is required. Though detailed research has not been possible, and these notes are not intended to cover the rail corridor, it is impossible to understand contemporary land use dynamics around the mine without being cognizant of the following three inter-locking historical currents:

- A slow reversal of Gola expansion into former Kpelle territory south of the St. Paul river in an area known as "Ding Gola" which began around the early twentieth century (d'Azevedo, 1969: 12) . This was completed by territorial reorganization under President Edwin Barclay that saw the creation of Fuama as an independent Kpelle chieftaincy (d'Azevedo, 1970-71: 106) with the late Botoe Barclay as head.
- The rubber boom around Kakata in 1940-50. Kakata grew out of a terminus built in 1920 on the first road from Monrovia into the interior and in time became a strategic meeting point between the coastal elites and the interior administration (Marguerat 1985: 130). The 'big men' of Monrovia following the example of nearby Firestone, acquired three-quarters of the land and planted it under rubber (ibid: 131).
- Mining of the Bong Range starting 1964. This led to both population influx and the displacement of several communities in the tailings dams and underneath the northern scarp.

4.2. CUSTOMARY AND STATUTORY LAND TENURE IN THE PROJECT AREA

Before looking at some of the specifics of land use around the mine, it is important to contextualize the tenure setting in which it occurs. Liberia has two systems of land tenure, customary and statutory. The latter was imported from the USA by the settlers and has been imposed to varying degrees on the customary system of the indigenous population and the relationship between the two systems is still evolving. The mine area is a particularly interesting case study of this coexistence, so a brief description of each is merited.

4.2.1. A Brief Explanation of Customary Land Tenure in the Project Area

A simple though useful way of understanding customary land tenure in Liberia is to conceive it in terms of a complex and dynamic web of social relationships that link—or can be crafted to link—individuals to land access. Typically the 'right' to provide land access to others is invested in the first comers (often referred to as the town or chiefdom 'owners') and their heirs. In frontier regions, such as around the mine 50-60 years ago, but arguably still today, first comers typically welcomed newcomers after them in order to establish their authority over the area and newcomers in turn, if unrelated to the founders, would seek to improve their local position through marriages with the founding lineage. Histories and their interpretations are therefore pivotal in defining land access possibilities. The complexities of the social relationships in relation to land in a Kpelle Chiefdom

are admirably described by Murphy & Bledsoe (1987). A key element of this complexity is how land history is culturally partitioned into separate narratives according to a specific territorial level:

“At the highest level are narratives about the chiefdom as a whole and its early settlers. At each succeeding lower level, history deals with a district [clan], a village, a quarter, each settled by later arrivals who—though latecomers to the territory as a whole—are seen as first comers in their respective sections” (ibid: 124-5).

These territorial levels are particularly important around the mine because the Bong Range is the intersection of various territorial units (see Figure 4-1). The definition of the boundaries of several of these units are still contested and fluid territorial definitions are a typical feature of the social dynamics shaping customary tenure: histories can be re-told, settlements abandoned and moved to new areas thereby reconfiguring land relationships and the political spaces for negotiation.

Another important layer of customary land tenure relevant to the concession areas is the opaque roles of the ritual offices of the dominant secret societies. Murphy & Bledsoe (1987: 124) assert that these offices are controlled by the 'land-owning' (founder) lineages in their study Kpelle chiefdom, but it would be inadvisable to generalize this (Bellman, 1980). Understanding the roles and functions of these societies in land matters is complicated not only by their inherent secrecy but also by the social transformations stemming from the years of civil conflict (along with other social currents) which disrupted 'normal' society operations and the expected initiation of all youth into them. In brief the major secret societies referred to here are the male Poro (known in Kpelle as p l ŋ) and the female Sande (sàneŋ), but there are other related secret societies—see later. The Poro and Sande in Kpelle areas reportedly have ritual specialist heads (zoo) at the clan level who in turn are governed by a supreme chiefdom-wide zoo (ibid. 127).

The four clans intersecting in this area are shown in mauve, but their boundary lines are not very accurate— Nentasu, Gbanditasue and Gbaryamu are for example actually in Giamasu. These clans are administratively organized as follows:

CLAN	DISTRICT	COUNTY
Yarbayon	Fuama	Bong
Giamasu	Kakata	Margibi
Golorhama	Kakata	Margibi
Zaweakomu	Fuamah	Bong

[illegible]

4.2.2. A Brief Overview of Statutory Land Tenure in Liberia

15

their work, a very abridged review of the evolution of the statutory tenure situation is necessary (see Box 4-1):

Box 4-1 Abridged Overview of the Evolution of Statutory Land Tenure in Liberia

The Hinterland Era: 1923-1956

During this period, and for various reasons, the Liberian government, rather uniquely in Africa, provided collective legal ownership entitlement in commonhold to the 'aborigines', the legal term in use at the time for the indigenous population. The legal basis for this was the Hinterland Laws and Administrative Regulations which were issued and revised in 1905, 1923, 1929, 1936 & 1949.

The Appropriation Era: 1956 to the present

Starting in 1956 some subtle, but very significant word changes were made to tenure aspects of the Hinterland Laws when they were brought into full statutory force as Title 1 Aborigines Law in the Liberian Code of Laws (1956-58). Whereas previously the indigenous people were recognised as having land ownership, they suddenly became only lawful occupants of land belonging, by default, to the State. The implication of this was that if communities wanted secure simple rights to their customarily owned land, they had to buy them back from the government. The means of doing this was through the Public Land Sale process outlined in the same Code of Laws and revised in various iterations, notably in 1972-3 and enshrined in the 1974 Land Registration Law. In brief, this process starts with an applicant requesting a Tribal Land Certificate from the customary authorities (town clan and paramount chiefs). If they agree that the desired plot may be, in effect, sold by the government, their signatures permit a survey to proceed. This signed certificate then has to be counter signed by the County Land Commissioner who may need to inspect the land and then signed by the County Superintendent. The applicant next has to pay for the land to be surveyed. After which, with a Certificate of Survey in hand, a fixed acreage fee needs to be paid at the Revenue Office. There are then several other stages before the application finally gets to the President of the Republic for the authorising signature, after which the deed must be registered with the Probate Court and sent to the National Archives.

Source: Wily, 2007

Figure 66 An example of a 'Soap Tree' Boundary Marker near Sea-Ta



Though local chiefs are not theoretically in a position to gain financially from issuing TLCs since the land is not legally theirs to dispose of—Fuamah could however be an exception here, since the paramount chief holds it in trust for the district—they play a pivotal role in their issuance which is unlikely to go unrewarded. Whether motivated by reward or under political pressure, the first chief of Giamasu Clan, Gbomo Kollie, as well as his successor, Seley Smah, reportedly issued numerous TLCs in the 1960s and 70s in the northern interior of the clan up to and over the Bong Range, in what was then a probably sparsely inhabited, inaccessible area. To understand who was acquiring land in this area and why brings us to the third important historical current in the area.

The installation of BMC significantly changed the local economy and behind the jobs and business opportunities came an increased interest in land acquisition. Bledsoe (1980: 35) has described how around the mine in 1974, land formerly used for rice farming was being bought up by entrepreneurs for cash crops such as rubber, oranges and coffee and the resulting squeeze on land available for rice farming was being felt as far as Haindi by 1978. Those who acquired TLCs at this time seem to have been a mixture of better paid BMC employees and those in successful businesses or local government. How many were local as opposed to in movers is impossible to say, but it is likely that the marriages of some of the latter group, who were without much doubt in the majority (*ibid.* p.38), to local women facilitated their acquisitions.

Starting around 1974, BMC's operations started to encroach on areas held under both customary tenure and TLCs within their concession. Peter Clarke, the head surveyor at BMC in the 1980s, reports (discussion 1st October 2012) that land under TLCs required by the company was bought by them and copies of sale documents sent to the Ministry of Finance. Though accounts of people differ as to whether there was actually any land payments, the TLCs surveyed by BMC were mapped by Peter Clarke and copies sent to their headquarters in Düsseldorf, where copies may still exist. This is not simply a minor historical point since with the subsequent changes in some of these areas, Article 24, section (iv) of the Liberian Constitution (1986) is potentially significant to former landowners:

“that when property taken for public use ceases to be so used, the Republic shall accord the former owner or those entitled to the property through such owner, the right of first refusal to reacquire the property.” (Wily, 2007: 299)

Fast forwarding to the present through the intervening years of turmoil, the departure of BMC and the re-occupation of some of the lands acquired by them (but not necessarily by their original occupants), the 24th September 2012, marks a significant date in the history of statutory land tenure. As Annex 5 illustrates, the Land Commission has initiated the first steps in sorting out the national confusion with TLCs that has been compounded by the frequent loss of documents during the conflict. How long this process will take is unclear, but the key point is that there is now official support for legitimatizing a form of land tenure that has been shaping, in tandem with customary tenure practices, local land use around the mine for more than 60 years.

4.3. LAND USE IN THE NON GOMMA DEPOSITS AREA

4.3.1. Settlement Pattern

Given the paucity of information available at the start of fieldwork, a key objective was determining the nature and distribution of all settlements around the Non Gomma deposit area, as a pre-requisite to examining land use. Once again, history is a key guide to understanding the settlement patterns encountered.

Annex 2 provides a brief summary of the basic settlement histories of the 'towns' around the mine. These it must be stressed require more detailed research and different interpretations of the founding events may emerge. Nonetheless, a general reading of them indicates some important similarities and differences between the three clans:

- Golorhama clan probably has the two oldest towns in the area (Sia-Ta and Gbalikoma) and has experienced some land sales but also lost a lot of land to the tailings dams which displaced at least one town and several landowners.
- The oldest towns in the part of Giamasu Clan area under consideration are probably Sackie-Gbeyallah, Bemou and Gbaryamu. While the latter town has probably been particularly instrumental in border politics (see below), the other two have experienced considerable land sales around them. South of the Bong Range, there has been a lot of land lost to the BMC tailings dams and four towns here are currently being removed by China Union²⁹. One small town (Line-Ma) on the north side of the ridge was abandoned because of water pollution caused by BMC mining on Bong Peak in the last years of its operation³⁰.
- The oldest currently inhabited settlement in Yarbayon clan area is Barclay-Ta which dates from 1945. Given this date, the town's name and its border location, its foundation is probably entwined with the territorial claiming processes instrumented by Botoe Barclay: encouraging in-movers on one's territory is a typical frontier strategy reported in the area (Murphy & Bledsoe, 1987). There seems to have been less land sales in this part of Yarbayon compared to Giamasu, perhaps because of the district wide 'mother' deed. BMC mining has displaced several towns below the ridge.

The surveyed settlements in the Non Gomma deposit area are small clustered towns consisting of around 7 households (an approximate median figure: a complete population data set was not obtained) with the two largest settlements (Gbaryamu and Gbarto-Ta) made up of only about 35 households each. The predominance of small towns is probably a reflection of the settlement process over the last 50-60 years and particularly the physical occupation of acquired land parcels. However, the impact of out-migration linked to war-time population scattering and the search for improved opportunities elsewhere cannot be discounted.

A notable feature of the settlement pattern is the frequency of displacements through force majeure. Many towns in the area have however voluntarily shifted over short distances (generally less than a few hundred metres) from old town spots which remain culturally significant sites linking the population to their deceased relatives. In one case these movements have seen three separate towns (Nentasu, Barclay and Yarkpasoma) co-locate but they still retain their individual

identity and specific linkages with particular parts of the surrounding landscape: it would be a mistake to apply any one of these names to the settlement as a whole, especially since one (Nentasu) is in a different clan to the other two. More frequently though are cases where one or more households have decided to move apart from their original settlement for various reasons such as disputes or a desire to live closer to a road. When the two settlements can be considered separated is often a source of contention and there was for example much discussion during our visit to Tomu-Ta as to whether it had indeed broken away from Gbawoma-Ta.

The critical point to bear in mind in terms of the settlement pattern is that regardless of whether towns are occupied or abandoned, the connection of particular people to parts of the landscape often remains embedded in local readings of it. To grasp the basis of these connections requires understanding how people have transformed the landscape from the original forest cover.

4.3.2. Rice Farming

Upland rice is the dominant staple crop grown around the Non Gomma Deposit Area with cassava playing an important but secondary role. Upland rice farming needs to be understood as more than a means of food production as it is also a significant socio-cultural activity that creates and cements social bonds through its high labour requirements. Table provides an indication of the tasks involved in upland rice farming, which because of low soil fertility need to be repeated year in year out as rice 'farms' (fields) are left in fallow for the bush to grow back after only one harvest (though cassava, peanuts etc. may be grown in them the following year) and thus a new spot needs to be sought out and cleared for the following year's rice farm.

Table 81 Simplified Breakdown of Upland Rice Farming Tasks by Gender and Month

Task	Gender													
Brushing*	men													
Felling	men									Bird-scaring				
Burning	men													
Cleaning	men													
Scratching**	women													
Fencing	men													
Weeding	women													
Harvesting	women													

* Brushing is the term used to describe the clearing of forest or bush for cultivation;

**Scratching is the term used to describe the light turning of the soil using small pick axes

Given the inter-annual shifts in the location of upland rice farms, understanding this significant land use requires consideration of three important factors: the size of the farms, the length of time they are left in fallow and other land uses. Each of these will be considered below.

Upland Rice Farm Sizes

Once a household has determined where it can make its next rice farm—a topic we will return to later—its size is set in relation to factors such as household labour availability, seed rice supply

and means to recruit additional labour. A surrogate measure for rice farm size used locally is the number of tins (called krune in Kpelle) of seed rice broadcast which can be converted to acreages through the rule of thumb that one tin of seed is used for one acre. On the basis of ad hoc questions about upland rice farms sown in 2012, a range of 0.2 to 3.2 ha with 1 ha as a median figure was revealed—see Annex 4 for more details. To put these in some perspective³¹, they compare reasonably well with county level data from the Minister of Agriculture's annual crop surveys are shown in Table 17.

Table 82 Rice Farm Sizes (ha) in three Counties

	Bong	Margibi	Montserrado
2008	1.3	0.9	0.9
2009	1.1	0.8	0.8

Though the acreage figures collected are not a representative sample, it is useful to note that the cited figures were higher in some towns such as Gbarto-Ta and Gbalikoma and smaller in others such as Bomoh-Ta or Barclay-Ta (see Annex 4). On one level, this is not unexpected as the available farmland around each town varies in size reflecting the unevenness of settlement foundation histories. Equally important though are differences in farm sizes between households within the same town. Though these may simply reflect labour availability and choice, potential farmland access for any household is differentially configured according to two broad factors:

- Where it is aligned in the dynamic social map of local tenure possibilities. Though the intricacies of this require detailed examination around the mine, indications suggest that different families are linked to particular areas of each town's territory. In other words, farming areas are not available to be randomly picked each year. Thus, depending on family histories, some families may have farming rights to larger areas than others. But, because of the annual nature of farming and the fact that people's participation in farming can fluctuate, for example through out-migrating or not farming some years³² a household aligned to a restricted family area may nevertheless still be able to make a large farm.
- The household's ability to navigate farming opportunities, some of which may be in neighboring areas. For example, though family farming rights are typically defined according to the patrilineage, marriages may provide other farmland access opportunities to the wife or mothers family land. Likewise, friendships may also provide such opportunities. The key point is that rice farming is transitory—in contra-distinction to tree crops—which enables an important degree of fluidity. Indications from the field suggest that at times the navigation of farming possibilities can be opportunistic, exploiting the sometimes-unclear interstices between towns or even between family lands ('cross-border' farming) with some households in more powerful positions than others to assert themselves in this manner.

Entwined in the above social dynamics is the important temporal factor of when an area is adjudged to have been sufficiently rested in bush fallow to be cleared again for farming.

Fallow Lengths

In shifting agricultural systems, as found across Liberia, fallow periods provide the essential means for soil nutrients to recover. All too often however, these systems tend to be generalized in terms of the ideal length of this period, with farming in shorter fallows often labelled as unsustainable. As several commentators have pointed out, these blanket generalizations ignore the complex realities of these farming systems, such as intrinsic differences in soil properties across sites and the variable composition and growth patterns of the fallow vegetation (e.g. Gleave, 1996 and Ickowitz, 2006). Leaving sustainability judgements behind it is nonetheless useful to look at the duration of fallows around the mine to see what they might reveal about land use intensities.

The ad-hoc data assembled in Annex 4 illustrates a significant range of fallow periods in 53 upland rice farms made in 2012, from 3 to 36 years with the median being 8.5 years. This range partly illustrates on one hand the very differentiated nature of rice farming opportunities and constraints around the mine, that for example there are still available for some people in some areas of old forest. On the other hand, it is important to contextualize these ages in terms of their different desirability's. Clearing older fallows (15-20+ years) requires more labour than a younger fallow and may also only be found at longer distances from town. Whilst for some households the potential for increased yields from such farms through their higher soil fertility and reduced weeds and pests, may be judged to outweigh these costs, other households may make different assessments.

Some households may have little choice over where they can farm and in what age bush. Making rice farms in short fallows of five years or less may be a reflection of limited or no male assistance within the household or only reduced means to acquire it from outside (brushing and felling are typically defined as tasks that only men can do). But, despite the increased weeding that is likely to ensue from farming in shorter fallows, the potential harvests as well the attendant social relations around the activity may be encouragement enough.

Furthermore, upland rice farming is not only about the rice harvest since it is typically interplanted with other crops such as cassava, bitter ball, chili, squashes and aubergines and some of these crops may even be planted after the rice is harvested.

Before moving on, it is useful to combine the preliminary figures presented above to get an impression of the amount of land currently under the upland rice bush fallow farming system. If the median figure for farm size per household (1 ha) is assumed to remain constant between years and that households are rotating their farming around the same fixed area every 8 years, each household will require 8 ha of land. In other words, 1 km² (100 hectares) could, under these assumptions, provide enough land for 12 households, all other things being equal. Despite the numerous weaknesses of such a figure, it is useful keep it in mind when looking at the settlement distribution pattern around the mine. Perhaps some fallows may be relatively short as a means of intensifying land use in response to reduced land availability? Though much more data is required

to properly examine this proposition, we can at least turn to consider the other land uses around the mine which would obviously need to be factored into any such analysis.

4.3.3. Rubber Farms

In terms of land coverage, rubber is probably second only to upland rice farming around the mine, but these two land uses are intimately related as the former essential removes land available for the latter. As we have seen earlier, rubber has been a major dynamic in the historical settlement of the region (see also Annex 2 in terms of its role in various town foundation histories) and current trends indicate that it is once again emerging as an important dynamic in local land use patterns, albeit in a different manner.

In every town where mapping was completed, some people either had old rubber and/or were planting new stock. This reflects something of a national trend that is particularly noticeable within Liberia's rubber corridor and periphery, where the mine is located. Several factors lie behind this rubber planting boom. The simplest factor to cite is the high prices that have been available in recent years, but this fails to take account of the accompanying changing attitudes towards rubber tapping. Pre-war there was reportedly a stigma attached to this work (Brown, 1989: 81) which was presumably linked to the various forms of coercion that often lay behind it. However, the war years seem to have changed attitudes and planting one's own rubber is seen as the future. For example, at Gbarto-Ta it was said that whereas the previous generation "threw cutlass" i.e. made rice farms, the next generation plan to use rubber to go to school. At Neiporlorkolli-Ta it was pointed out that rubber is the only way to get money every year, and there is no need to wait seven years for fallow then have the rice eaten by groundhogs.

The sizes of the areas being currently planted to rubber are not known, though much if not all is following in the footsteps of upland rice farms. As explained in the tenure section, not everyone however has the right to plant live crops such as rubber. In towns where the land is under a TLC, this right is retained by the owner and their heirs. In land outside statutory tenure, this right is generally dependent on family ties to the founding lineages. Rubber takes seven years before it is ready to be tapped and for some early planters, that time is now or soon approaching. To what extent the trees are or have been maintained in the interim is not known, but it will be far more interesting to see how they are managed when they come in to production. The Bong Mines area certainly has locational advantages in terms of access to buying stations, but latex prices will clearly have an important bearing on their future roles in local livelihoods, particularly in terms of how they compare to other income-generating opportunities such as working with China Union. Whatever happens, one important result of planting rubber has been evident for a while: the trees mark ownership claims to the land they are on, and this may be another major motivation behind the boom in some areas. A consequence of this has been an inevitable reduction in the land available for rice farming which has not gone unnoticed.

When people were asked where they would grow rice when all their lands are under rubber, the common reply was the swamps. Lowland 'swamp' rice farming is typically considered as inferior to upland rice, even though upland farms often include a small swamp section at the bottom of the catena to add useful varietal diversity. The development of swamp rice has frequently been considered a panacea for shifting farmers away from upland farming towards higher yielding, more

continuous productions systems. What is important to note however is that with the very notable exception of the swamp farms in the old tailings dam (see Box 2), the swamps on the northern side of the mine at least are not said to be amenable to continuous cropping under traditional management. They are nonetheless being exploited, and at Nyennah-Ta this year they were the only rice farms being made, but they require being left in fallow for 2/3 years or more. If they do indeed become the last resort for rice farming since they are more restricted in the landscape—and some towns such as Sackie Gbeyallah-Ta claim not to have any—competition for them could potentially increase, but since they are not conducive to inter-cropping, this may not happen.

4.3.4. Sugar Cane Farming

The future scenario that rubber will take over the land is somewhat simplistic as there are several other profitable alternate lands uses currently practiced around the mine. Of these, sugarcane production for the manufacture of 'cane juice' (rum) is probably the most profitable but there are two important conditions necessary to engage in this activity. The first is being within easy transport distance of the all-important grinder and steam mill needed for the distillation of the cane. Pre-war the north side of the mine along the banks of the Wedeah was said to have been an important distillation centre with around 10 mills in operation. Many of these were looted during the war and the high investment costs (>US \$5,000) has probably limited the return of the industry to its previous levels. There are however at least three mills in operation along the Wedeah today and at least one other exists along the Yia river on the southern borders of the concession. Sugar cane is said to grow best on clayey soils beside rivers and in such locations can be grown continuously and harvested 3-4 times a year in the same spot for 15-20 years. Prime sugar cane spots are presumably in high demand, but lower yields are also possible on some upland soils, but these require regular fallowing.

4.3.5. Vegetable Gardening

Another potentially profitable use of some types of river side land is vegetable gardening in the dry season (January to April). Though the lion's share of local vegetable gardening is produced on the old tailings dams which are conveniently located for either sale at Bong Mine Town or export to Kakata and beyond, at much smaller scales, other localities along some of the rivers and streams coming off the Bong Range are important such as the Suakoyah, a tributary of the Wedeah. Several of these upper Wedeah waterways it should be noted have been disturbed by previous mining activity which has impacted both on gardening activities and sugar cane production.

4.3.6. Cocoa and Oil Palms

Before drawing this discussion to a close, two outstanding tree crops need to be mentioned, cocoa and oil palms. Though they are of lesser importance than rubber, they are of more significance in local livelihoods than any of the remaining tree crops grown in the area such as citrus, coffee and kola. They are however distinctly different crops in several ways.

Bong Mine is not in the major cocoa growing region of Liberia but there was clearly some local production pre-war (Bledsoe, 1980: 40). Some of these old bushes are still producing and are typically found in a ring around towns both old and new where they benefit from the increased soil fertility of these sites. In a few towns, new plantings were reported, especially on the south eastern side of the concession. Here one huge new field, planted in 2012 by an absentee land owner, was

encountered south of Bemou and nearby another farmer had planted 150 trees. The Ministry of Agriculture has in recent years been trying to re-start the Liberian cocoa industry and perhaps these investments have been made with an eye towards this.

The oil palm (*Elaeis guineensis*) is conversely far more important in livelihoods than cocoa but is distinctly different in that, with the exception of the Makinto variety, which has a somewhat different end use, they are semi-wild and largely un-planted. The oil palm is a native, heliophilous (sunlight loving) tree that flourishes, given protection, under the shifting agriculture system found in area. The people who founded the towns to the north of the mine (and the same is very likely true to the south as well) reportedly only encountered the occasional oil palm, perhaps relics of earlier occupation. In the 50 or 60 years since, through purposeful protection during field clearance, natural fire tolerance and occasional scattering of seeds, they have multiplied. These oil palms in turn provide both a major cooking oil and trade in this is an important income source. The majority of towns have at least one 'palm factory' beside a creek where red oil is produced in a protracted process from the fruit. A higher value oil can also be produced from the left-over kernels back at town.

4.4. LAND USE ALONG THE RAIL CORRIDOR

The earlier review of livelihood zones in Liberia highlighted the national dominance of the greater Monrovia region in terms of population and economic influence. The 77km railroad from Bong Mines to the Freeport of Monrovia provides a unique transport artery to this market which has a significant bearing on land use within its corridor. As was pointed out under the description of the Monrovia Peri-urban Livelihood Zone (LZ9), its population tends to be distributed along the main arterial roads leading from the city. The uniqueness of the BMC railroad is that in the last 20 years it has provided a market access option to places where these arterial roads do not run. Heading inland from around Louisiana (chainage circa km 12 from the port) the railroad provides the only direct transport route north-eastwards as all of the very limited available roads to the left bank of the St Paul River beyond this point are indirect requiring a detour via the Kakata highway.

Figure 67 Make A Way” Push Cart along the BMC Railroad.



With the cessation of BMC mining activities coupled with war-time provisioning constraints it was not long before the transport opportunities of the railroad were exploited. The initial method of transport developed was ingenious and though the history of the “Make-A Way” push carts remains to be examined in detail, one version of events is that the two inventors put the first one into operation in 1992. No records are known to exist of how many of these carts have operated over the years but being relatively simple and cheap to construct and operate they were surely numerous as even in September 2012, around 80 could still be seen.

For several years Make A Way carts were probably the only transport option along the railroad but starting around 2002, Geoservices started to operate a commercial train service between the old mine and the port which offered the possibility of transporting larger volumes of goods. A study of Liberian markets in late 2006 and early 2007 examined the Bong Mines to Monrovia marketing chain and was able to acquire some illuminating figures on the volume of goods being transported by this train service as shown in Table 18. This study hints at the scale of the provisioning basin which was using the train service but makes no mention of the Make A Way carts which were providing an additional service along the length of the railway not just from the terminus. A detailed study of the functioning of this unique transport corridor in its entirety is clearly required, but in its absence, it is worth noting that a recent study for accelerating growth includes it among the five major corridors supplying Monrovia (MPEA, 2011).

Table 83 Commodities Transported on the Geoservices Train from Bong Mines to Monrovia

	Palm Oil	Palm Nuts	Cassava	Plantain/ Bananas	Charcoal
UNIT	Jerry cans	Bags	Bags	Bunches	Bags
Jan-Mar 05	8,395	1,566	571	5,988	71,835
Apr-Jun 05	7,619	1,299	1,584	3,478	65,422
Jul-Sept 05	2,777	2,084	1,783	2,804	85,405
Oct-Dec 05	3,172	2,036	442	4,400	60,843
Jan-Mar 06	20,194	8,559	913	20,321	202,117
TOTAL	42,157	15,544	5,293	36,991	485,622

Without detailed information on the scale of the proposed widening of the Bong Mine railway, it is difficult to contextualize land use within the narrow corridor beside the railroad that will be directly impacted by the proposed widening scheme. However, several observations can be made following a four-day tour of the track and its immediate vicinity from chainage km 9 to Bong Mine Town.

Agricultural land use beside the railroad is similar to that found around the mine: inter-annual shifting bush fallow farming of rice and cassava, some shifting rice swamp farming, longer duration sugar cane production and permanent tree crop plantations. In several places’ farms can be observed very close to the tracks (< 5m) which is probably within the operating distance

maintained by BMC (see later) but for the last 22 years, this is unlikely to have been an issue. Understanding why some people are farming so close to the tracks and the implications of removing further trackside land from the farm-fallow cycle requires a detailed analysis of the locally specific configuration of land use dynamics which has not been possible. However, the broad determinants can usefully be conceived in terms of a combination of land suitability, tenure and population pressure factors.

Not all land beside the railroad is suitable for the various types of farming but unfortunately the limited land suitability mapping that has occurred in Liberia, does not cover the railroad corridor. It is however probably safe to assume that not all the upland soils, particularly the sandier ones towards the coast, are suitable for all crops. Likewise, and also for hydrological reasons, not all the low-lying areas beside the tracks are suitable for swamp rice production. Though soil fertility constraints for various crops could potentially be overcome through the addition of fertilizer, this is beyond the means of the majority of farmers who are instead reliant on bush-fallowing. In this regard it is interesting to note that on travelling seaward from Bong Mine Town, the last upland rice farms are seen around chainage km 25, after which cassava dominates except in areas suitable for sugar cane. Though cassava has a higher tolerance of soil infertility than upland rice, it also has lower labour requirements and the availability of cheap imported rice may be another factor favoring its cultivation closer to Monrovia. It should be noted, that despite its soil infertility tolerance, cassava farms still need to be rotated in bush fallow.

In several areas along the rail corridor, sugar cane is a significant crop. Indeed, some of the oldest sugar cane growing areas of Liberia can be found in the fertile flood plains along the lower reaches of the St. Paul River around towns such as Crozierville, White Plains and Louisiana (von Gilinsky, 1968). With the possibility of several harvests a year and the relative ease of converting the produce to a high value, easily storable and transportable product (cane juice) coupled to easy market access, it is not difficult to see why sugar cane is popular in these areas.

As already discussed, the ability to plant tree crops is intimately tied up with land tenure, but before we discuss this issue along the rail corridor it is necessary to briefly mention some nonagricultural land uses that occur there. Along much of the rail corridor, and in particular closer to Monrovia, the oil palm is very common, and mention has already been made about its use in the production of red and kernel oils—and the transport figures in Table 4-3 further attest to this importance. How often the fruits of these track side oil palms are exploited and by whom is not known (the peak harvest time is in the dry season, i.e. outside of the fieldwork period) but requires examination. In at least one area (around German Town, Careys burg District) oil palms were also being tapped for palm wine and this use also needs further consideration (as it does for the piassava palms beside the tracks). The use and importance of other products from the farm-bush-wetland mosaic beside the tracks, such as poles, thatching material, fish and charcoal, should also not be overlooked. The latter product in particular has already been noted as a significant activity in Livelihood Zone 8 and numerous evidences of its production, stock piling and transportation can be seen along the tracks. The Make A Way cart operator continue to transport important quantities of charcoal into Monrovia as can be seen from Photo 3 and the implications of terminating this supply chain, which has lower transport costs than motor transport, requires investigation.

Figure 68 *The Saturday Charcoal Market at Crozierville, 29th September 2012*



Two similar but rather distinct land uses along the rail corridor are worthy of particular mention despite occupying relatively small areas, alluvial gold mining around the Koin Creek that runs between Todee and Careysburg Districts and artisanal quarrying southwest of Louisiana. Though several of the railside workings of the former activity have been or are in the process of being worked out, this activity—which has also resulted in diamond finds—has been pursued in the area sporadically for over 100 years (Schulze, 1973: 146) and new finds have the potential to be discovered in new localities in the vicinity. New artisanal mine workings can grow very rapidly and have important local economic impacts. In contrast, the quarrying activity near Louisiana (see Figure 4-5) is much more recent and static. When CICO (Chinese Investment Company) acquired its ten year lease of the industrial quarry, the resulting farmland loss reportedly encouraged some of the local people affected to start artisanal aggregate quarrying nearby on one side of the CICO site in 2009 and another group was apparently supported by local politicians to work the other side in 2011. In the dry season, when demand for rock for building increases, the combined number of people working both sites is said to be over 200, a figure that surpasses the number of people employed by CICO. Widening of the railroad at these two localities would effectively end these activities as there are reportedly no other suitable rock sources in the area to quarry.

Figure 69 *Artisanal Aggregate Quarrying Southwest of Louisiana*



Land tenure along the length of the rail corridor is a similar combination of statutory and customary forms as found around the mine, though it is almost certain, given the history of colonization, that customary succeeds to statutory closer to Monrovia. Two indicators suggest that in terms of total area, statutory tenure probably dominates. The first is the frequency of tree crop plantations, with some notably extensive rubber plantations around Todee that flank both sides of the railroad for several kilometers. The second set of indicators is less visible but is highly significant in terms of the historical precedence that has been set in terms of land acquisition. These are the BMC boundary markers illustrated in Photo 5. How frequent they are along the corridor is not known but they were reported at Louisiana in addition to the locality of Photo 5. What is more important is that they demarcate a width (said to be 40 ft. (12.19 metres) either side of the track but not measured) which is shorter than that required by China Union and most significantly, these areas were reportedly purchased by BMC and the landowner's deeds adjusted accordingly. Given that there is no cadaster in Liberia and that the long war years have complicated the picture even more than the usual rocky passage of property through sales and inheritances (e.g. destruction of documents, property seizures, falsification of documents and fraudulent sales) this exercise must be given due time. Furthermore, there is a palpable expectation among trackside landowners that the processes to acquire their land be handled correctly. To which should be added a strong distrust among some citizens about the Government of Liberia's ability to deliver in this regard.

Though the land acquisition processes dealing with titled land held under statutory tenure are formalized, this is not to disregard the vital importance of handling acquisition of customarily held land with equal thoroughness. Often times and particularly in areas of high population density and/or historical depth to the continuous occupation of the land, which is typical of the rail corridor, particular areas of the landscape are associated with particular families. Direct evidence for this can be seen in something of a unique study in Liberia that by chance was conducted beside the BMC railroad at Wuesenge and Zimbo towns in Mount Coffee Township, Todee District in 1968 (see Koch (1971) for an English summary). This map identifies annual rice farms to particular families over several years and a rapid visit in September 2012 indicates that the descendants of several of these families 44 years later are still farming around the same areas. It therefore cannot be assumed that any family losing land to railroad enlargement can simply and unproblematically shift their farming activities elsewhere in the local landscape as these areas are likely to be associated with other families. Though the land take for the corridor widening may not appear large, the losses for particular families need to be seen in terms of their particular land access opportunities and constraints.

By way of conclusion, it cannot be too strongly underlined that preparations for the planned developments along the rail corridor need to be given adequate time and resources. Not only do a large number of both statutory and customary land owners need to be identified for land take and land access negotiations—it is inconceivable that works can be confined to a 25m corridor—but other sensitivities need to be identified and negotiated. For example, the potential loss or damage to income generating resources such as palm trees, rocks for aggregates and watercourses for fishing and drinking water. To date numerous properties falling within the right-of-way have been marked for removal and the owners and occupants are awaiting negotiations. Concerns are high about the outcome of these as well as the future for other unmarked structures within the vicinity,

such as the graveyard at Robertsville. The rail corridor passes through areas of high population density, where there are many people who will not simply sit back and let their livelihoods be railroaded: if the project persist with its current, inappropriate timeline, the risks of project derailment are very high.

ANNEX 2: List of people interviewed for the RHIA

Facility / site visited	Type	Name	Role
BONG			
FUAMA DISTRICT			
China Union	Clinic	Chen Jin Long	Doctor
Bong Mines Medical Centre	Hospital	Augustus G. Quiah	Medical Director
		Joseph W W Jolopleh	Officer in Charge (OPD)
		Femata Kroma	Clinical Supervisor
		Michael Gboiah	Laboratory Technician
Haindii	Clinic	Teresa Gono	Certified Midwife
		Francis Collin	District Health Officer
Mawa	Health post	Giwanna Massalay	Officer in Charge (OIC)
		Victoria Tagbagoung	Trained Traditional Midwife
Irvin store (Bong Mines)	Pharmacy	Robert Davies	Store owner
John Hill (Bong Mines)	Pharmacy	John Hill	Store owner
MARGIBI			
KAKATA DISTRICT			
Yeamai	Clinic	Alfred S. Doe	Officer in Charge
		Kemah Kollie	President, Trained Traditional Midwives Association
MONTSERRADO			
CAREYSBURG DISTRICT			
Bensonville	Hospital	Anthony, Quayee	Officer in Charge (OIC)
Crozierville	Clinic	James Sumoimuo	Officer in Charge (OIC)
TODEE DISTRICT			
Koon Town	Clinic	Edward Fallah Chokpelleh	Officer in Charge (OIC)
Nyehn	Health Centre	Ofelia Brown	Certified Midwife
Zanna Town	Clinic	Rashida Rashik	Officer in Charge (OIC)
Whan ta	Town	Konah Lucky	Chief & traditional healer
GREATER MONROVIA DISTRICT			
Clara Town	Health Centre	Nicolas Blidi	Medical Director
Redemption	Hospital	Melvin P. Johnson	Nursing Director
Wonjah Smith Memorial	Private Clinic	Geneva Karnua	Resident Nurse

ANNEX 3 Preliminary Settlement History Summaries around the Non-Gomma Deposits

NB. Settlement order proceeds approximately clockwise round from the north. These histories are preliminary only and may require revision after more detailed research. Also, the data in the land deeds/papers column is not a definitive list of existence or otherwise of such paper: no paperwork was available for examination during fieldwork.

CC = Clan Code: Y = Yarbayan, Gi = Giamasu and Go = Golorhama

Town	CC	History	Land Deeds/Papers
Juwillilah	Y	Moved from Yuakola old town spot further west along road in Tubman time (1944-71) as BMC spoilt their water	Kolubah-Ta: large area from gover't. Dennis-Ta: 300 acres, from Botoe Barclay in 1970s
Tomu-Ta (& Gbawoma-Ta?)	Y	Tomu-Ta a new (2007) outpost of Gbawoma (destroyed 1995): split not complete	
Kpanah Kporlay-Ta	Y	Established 1986. Originally lived at Suanyeah-Ta up slope in 1981 but BMC destroyed their water	
Fahngbul-Ta	Y	Established 1980: moved from Nyanneh Ta by BMC: only paid crops and houses	
John Guagola	Y	Also came down from Nyanneh Ta but settled apart	
Juwon-Ta	Y	Unclear: either established when Tubman died (1971) or preBMC (<1960s)	
Bomoh-Ta	Y	NO DETAILS	
Neiporlorkolli-Ta	Y	Established 1965	Allen & Newman Farms
Barclay-Ta	Y	Established 1945: Came from Sackie-Gboklay Town on the Bong Mine-Kakata road because had no land as it was all being bought for rubber. Moved to the current town spot in 1988 because old place 'cold'.	?
Yarkpasoma	Y	1960s. A Loma man from Loffa married into family here. They lived in old Barclay town initially, but some dispute made them move to their town.	?
Gbarto-Ta	Y	'Owner' came from Todi in 1951 because all of his children were dying there at birth so wanted to make a family in a new place. Married a woman from Gbanditasue and some kind of split with uncle made them move to current site.	?
John Nyennah-Ta	Y	Came from Firestone in Tubman time (1944-71) as grandfather living in Barclay-Ta	?
Gbankpai-Ta (temporarily deserted)	Y	Came from Gbarnga in 1973 and planted rubber in 1975 on land given to him by his brother at Nyennah-Ta: the family share	?
Gotogbah-Ta	Y	NO DETAILS	

Watta-ta	Y	NO DETAILS	
Yah-Kollen & Namene	Y	NO DETAILS	
Yah Kpor	Y	NO DETAILS	
Netasu	Gi	Came from Firestone in 1930s as they took their land. First town site up the hill where they have rubber but moved from there when BMC started blasting in the early 1980s.	Got deed from Margibi, final payment made in 1978.

Town	CC	History	Land Deeds/Papers
Benson-Ta	Gi	Kollie Besolo, a stranger from Sherman Farm on the Bong Mine-Kakata road bought from clan chief. He apparently had no land there and came to brother here who helped him buy.	Kollie Besolo's children have paper: perhaps 300350 acres
Line-Ma (abandoned)	?	Originally lived in Barclay-Ta and area a farming spot. Bought land and lived there until BMC spoilt their water. The owner now lives in Gbaryamu. Name derived from its position on the old demarcation line between Gibi Territory and Bong County.	1 TLC, size unknown
Gbanditasue	Gi	Established 1957 by a Loma man but he was joined by more numerous Gbandi people hence name (lit; Gbandi inside)	
Gbaryamu	Gi	Established 1932 by a Loma man who came to do business	President E. Barclay signed Deed (1930-44)
James Kaine	Gi	Established 1988. James Kaine tapped rubber on the plantation owned by a family in Kakata who have all the land to the south. They let him be a caretaker of the area around their village.	Yes
Bermou (being moved by CU)	Gi	Old town: an old man born 1936 in this place. Bomoh Kollie, the first clan chief of Giamasu Clan who lived near Compound came to chief elder of Bermou, Mr Bowly and said sell land to people who need it, it is empty. So he did to the following people, many of them working for BMC out of Bermou land from the 1960s. These areas have or have had settlements attached to them, often bearing the name of the owner: 1. Junior Paye 2. Jonathan Walker 3. Mr Lowland 4. John Marvin 5. Mr Lahai 6. Willie Rick 7. Mr. Camara 8. Seckou Duckley 9. Fahnlon-ta (people there) 10. Dennis-Ta 11. Mr. Ray 12. Sam Lane 13. James Neiah (see below) 14. Gbaweke-Keteh (see below)	Many TLCs

Blomu (being moved by CU)	Gi	Here since Tubman time (1944-71). Came from Kakata to make rice farm and got paper after establishing the town.	Yes, but lost in war
James Neiah-Ta	Gi	Founder came from Firestone, married a local woman and bought land from Bamah Kollie in the 1980s [this may be an error in the chief's name or date]	1 TLC 275 acres
Gbaweke-Keteh	Gi	Mr. Massaquoi, a Sierra Leonean who worked for BMC and married a Kpelle woman, bought land from Seli Smah in 1979	1 TLC 250 acres
Sackie Gbeyallah-Ta	Gi	Founded by a hunter in President D. Howard time (1912-1919)	1 TLC, size unknown
Gbalikoma	Go	Old town: a lady c. 75 years old said she was v. young when she arrived here. Joe Davis & William Yeadoo bought land from this town as way back before Tubman (< 1944) the chief of Golorhama lived here and people would ask him for land and hence he gave areas around away.	Joe Davis & William Yeadoo have TLCs
Sia-Ta	Go	Old Town: may be older than Gbalikoma. Moses-Ta (see below) Fahn-Ta and Cooper Farm all used to be in Sia-Ta land...sold off	Possibly
Moses-Ta	Go	Moses Cooper, a Mano revenue collector (deceased) took a second wife from Sia-ta and stayed on after retirement in some	Originally 300 acres, reduced by BMC
Town	CC	History	Land Deeds/Papers
		kind of local 'chief' role. Land acquired was surveyed in 1963.	flooded to 120
Yarweine	Go	Original community called Gbargbarla was on the mountain to the north—cotton trees there: Gbagozila on 1:50K map? BMC got them to move in 1989 as their water was contaminated, but they themselves found this place—on the same family land.	Yes
Agro Village	Go	Established 2004 by an entity called Greenstar	
Duklay Ta (abandoned: NE of Yarweine)	Go	Duklay had 'deed' for 250 acres from Tolbert time (1971-80) When BMC made dam, paid for crops & houses, but not land.	Deed taken by BMC. NB: Others landowners nearby had papers

ANNEX 4 Report produced by China Union on Bong Mine Hospital

General Information of Bong Mine Hospital

YEAR: 2010

Room Number	Number of Beds	Number of Mattresses
SURGICAL WARD		
RM 1	3	3 Mattresses
RM 2	3	3
RM 3	3	3
RM 4	3	2
RM 5	4	4
ON CALL ROOM		
RM 1	1	2
RM 6	2	2
MEDICAL WARD		
RM 10	6	6
RM 16	6	5
RM 12	3	2
RM 13	3	3
RM 14	2	2
INTENSIVE CARE UNIT		
RM 1	8	8
LABOR WARD	OBSERVATION	ROOM
RM 1	3	3

DELIVERY	ROOM	
RM 1	2	2
RM 20	3	3
RM 21	6	6
RM 22	3	0
RM 23	3	0
RM 24	6	0
RM 25	6	0
CHILDRED WARD		
RM 1	2 beds	2 mattresses
RM 2	2	2
RM 3	3	3
RM 4	2	2
RM 5	3	3
RM 6	1	0
RM 7	1	1
RM 8	1	0
RM 10	2	2
EMERGENCY		
	ROOM	
RM 1	7	7
ISOLATION UNIT		
RM 1	1	1
RM 2	1	0
RM 3	2	0
RM 4	2	0
NUMBER OF		
	BATHROOMS	
ROOMS 40		
NUMBER OF		
	OFFICES	

ROOMS 32		
NUMBER OF	STOREROOM	
ROOMS 10		

TOTAL # MEDICAL ROOMS----- 35
 NUMBER OF STOREROOMS----- 10
 NUMBER OF OFFICES----- 32
 NUMBER OF BATHROOMS----- 40
 TOTAL ROOMS_____ 117

TOTAL # HOSPITAL BEDS----- 119

TOTAL # OF MATTRESSES----- 115

ANNEX 5 Ad hoc Data on Rice Farm Sizes and Fallow Ages

N.B. These data were collected by asking people present at the community mapping exercises about the size of their rice farms in 2012 and the age of the bush they were made in. It has therefore not been collected systematically—it was also not collected in all towns mapped—and hence why it is referred to as ad hoc.

1 krune = 1 tin of seed rice which is said to sow 1 acre.

Town	SIZES & BUSH AGE	Ranges for Upland Farm Sizes
Juwillilah	3 <i>krune</i> (9 yr) 1.5 <i>krune</i> (swamp) 3 <i>krune</i> (8 yr) 0.5 <i>krune</i> (8 yr)	0.5 to 3 <i>krune</i> 0.2-1.3 ha
Tomu-Ta	3 <i>krune</i> (18 yr) 7-8 <i>krune</i> (11-12 yr) 2.5 <i>krune</i> (4 yr) 2 <i>krune</i> (10 yr)	2 to 7.5 <i>krune</i> 0.8-3 ha
Kpanah Kporlay-Ta	2.5 <i>krune</i> (9 yr) 3 <i>krune</i> (swamp) 5 <i>krune</i> (7-8 yr)	2.5 to 5 <i>krune</i> 1-2 ha
Fahngbul-Ta	2 <i>krune</i> (6 yr) 2 <i>krune</i> (6 yr) 2.5 <i>krune</i> (8 yr) 2.5 <i>krune</i> (6 yr) 3 <i>krune</i> (age not known) 3.5 <i>krune</i> (age not known) 1 <i>krune</i> (swamp) 3 <i>krune</i> (age not known) 2.5 <i>krune</i> (age not known)	2 to 3.5 <i>krune</i> 0.8- 1.4 ha

John Guagola	3 <i>krune</i> (7 yr)	1.3 ha
Juwon-Ta	Only 2 HH making rice farms this year: 5.5 <i>krune</i> (14 yr) 2.5 <i>krune</i> (age not known)	2.5-5.5 <i>krune</i> 1-2.2 ha
Bomoh-Ta	2 <i>krune</i> (8-9 yr) 2 <i>krune</i> (10 yr) 2.5 <i>krune</i> (9 yr) 1.5 <i>krune</i> (10 yr) 1 <i>krune</i> (10 yr swamp) Most people 1-1.5 <i>krune</i> Have got enough land, but at least one person doing 'cross-border farming' in Juwon-ta area	1 to 2.5 <i>krune</i> 0.4-1 ha
Neiporlorkolli-Ta	1 <i>krune</i> (3 yr) 1.5 <i>krune</i> (3 yr) 3 <i>krune</i> (7 yr) Land small, some people just making cane farms. Range more like 3-5 <i>krune</i>	1 to 3 <i>krune</i> 0.4-1.2 ha
Netasu	3 <i>krune</i> (28 yr) 2.5 <i>krune</i> (15 yr) c.1 <i>krune</i> (36 yr)	
Barclay	2.5 <i>krune</i> (7 yr) 1 <i>krune</i> (c 8 yr) 1.5 <i>krune</i> (9 yr)	1-2.5 <i>krune</i> 0.4-1 ha
Yarkpasoma	2.5 <i>krune</i> (12 yr)	
Town	SIZES & BUSH AGE	Ranges for Upland Farm Sizes
Benson-Ta	1.5 <i>krune</i> (5 yr swamp) 2 <i>krune</i> (5 yr swamp) 3 <i>krune</i> (12 yr) 1.5 <i>krune</i> (12 yr) 1 <i>krune</i> (8 yr)	1-3 <i>krune</i> 0.4-1.2 ha
Gbanditasue	Only 1 person making rice farm this year a ½ <i>krune</i> swamp farm in 6 year bush (because of sand, such farms only good for one year, then need rest)	
Gbaryamu	4 <i>krune</i> (7 yr) 3.5 <i>krune</i> (10 yr) 2 <i>krune</i> (6 yr) 3.5 <i>krune</i> (8 yr) 1 <i>krune</i> (16 yr)	1 to 4 <i>krune</i> 0.4-1.6
Gbarto-Ta	5 <i>krune</i> (7 yr) 7 <i>krune</i> (15 yr) 7 <i>krune</i> (8 yr) 6 <i>krune</i> (7 yr) 7 <i>krune</i> (8 yr)	5 to 7 <i>krune</i> 2-2.8 ha

Nyennah-Ta	1 ½ <i>krune</i> (6 yr swamp) 2 ½ <i>krune</i> (2 yr swamp) 1 <i>krune</i> swamp with some upland (3 yr) 1 <i>krune</i> (3 yr swamp) No upland farms this year: resting.	
Yah-Kollen & Namene	Range 1 ½ to 4 <i>krune</i>	1.5 to 4 <i>krune</i> 0.6-1.6 ha
Yah Kpor	Largest 7 ½ <i>krune</i>	3 ha
Moses-Ta	7 <i>krune</i>	2.8 ha
Gbalikoma	5 <i>krune</i> (10 yr) 6 <i>krune</i> (forest): used power saw on some trees 6 <i>krune</i> (forest) 4 <i>krune</i> (6yr) 8 <i>krune</i> (c10 yr) 2 <i>krune</i> (7 yr) 5 <i>krune</i> (10 yr)	2 to 8 <i>krune</i> 0.8-3.2 ha
Sackie Gbeyallah-Ta	3 <i>krune</i> (age not known) 3½ <i>krune</i> (10) 5 ½ <i>krune</i> (9 yr) 6½ <i>krune</i> (11 yr): largest this year No swamps here	3 to 6.5 1.2-2.6 ha
James Neiah-Ta (Nah-ta)	5 <i>krune</i> (7 yr) 8 <i>krune</i> (9 yr)	5 & 8 <i>krune</i> 2 & 3.2 ha

ANNEX 6 Announcement for the Start of the Registration of TLCs in Kakata District



THE LAND COMMISSION, REPUBLIC OF LIBERIA
IS CALLING ON
ALL THOSE WITH TRIBAL CERTIFICATES IN KAKATA DISTRICT



USAID
FROM THE AMERICAN PEOPLE

- ↓ To come, record, and scan their original tribal certificates, starting on Monday, ^{SEPTEMBER} 24, 2012
- ↓ The process will start at 9:00 o'clock in the morning each day
- ↓ The recording and scanning will take place at the Kakata Administrative Building
- ↓ The recording and scanning of tribal certificates will cover all of the seven Clans in Kakata District.
- ↓ Do not let the distance discourage you because this is the first step in securing your public land sale deed
- ↓ The entire recording and scanning process of your original tribal certificates will be free - you will not pay any money.
- ↓ The entire process will be fast and very short to give you time to go to your market places and do other businesses
- ↓ The tribal certificate will now be secured because a copy will be kept with the National Archives Agency through the Land Commission
- ↓ The recording and scanning of your tribal certificate will be done by:
 - The Land Commission
 - National Archives Agency
 - Ministry of Lands, Mines & Energy
 - Ministry of Internal Affairs
 - And Our International Partners



TETRA TECH SRD
LPIS



MILLENNIUM
CHALLENGE CORPORATION
UNITED STATES OF AMERICA