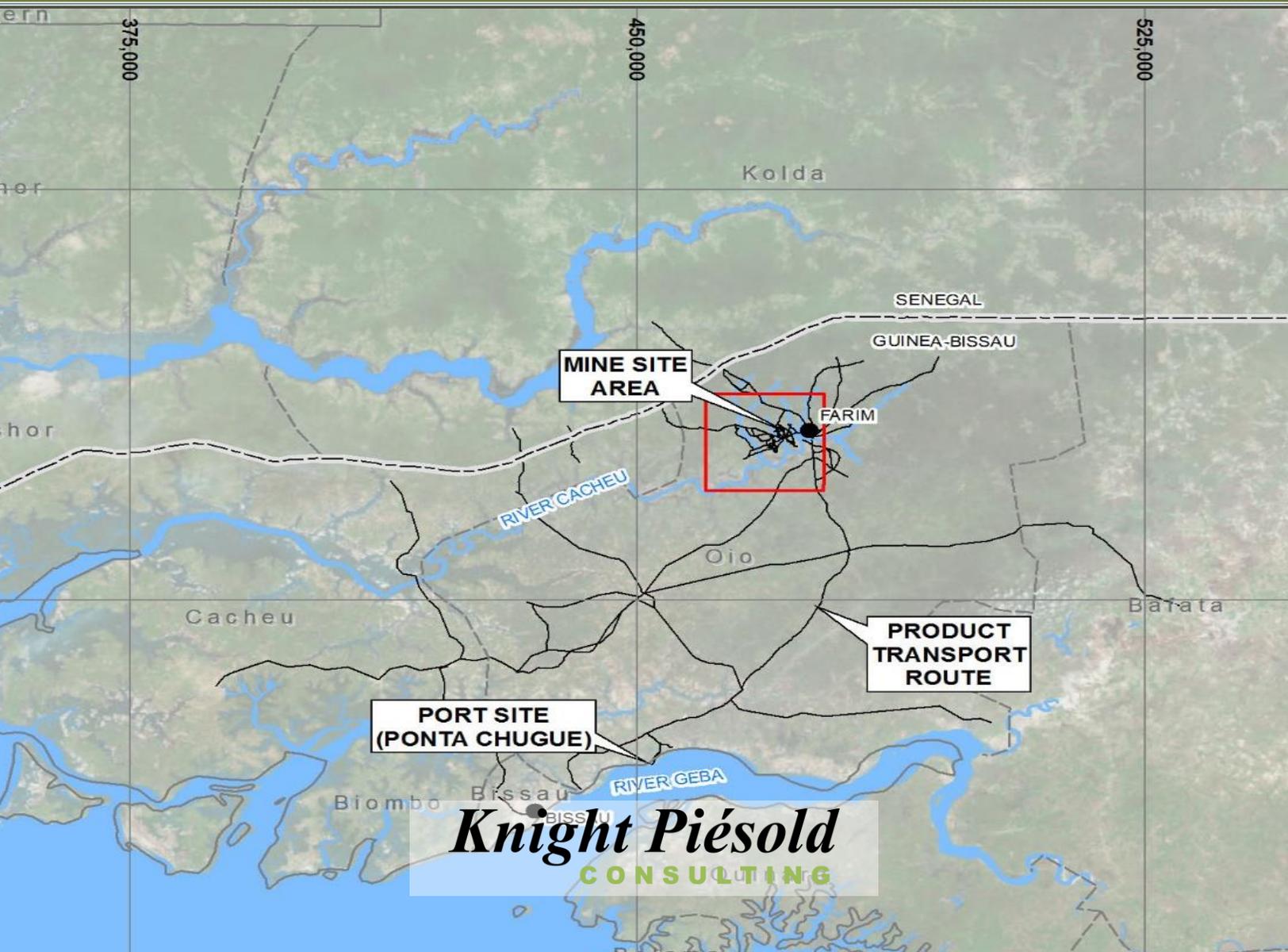




# GB MINERALS

— LTD —

## FARIM PHOSPHATE PROJECT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT NON-TECHNICAL EXECUTIVE SUMMARY





FS 64925  
EMS 550121  
OHS 550122

# **GB MINERALS LTD. FARIM PHOSPHATE PROJECT**

## **ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT**

### **NON-TECHNICAL EXECUTIVE SUMMARY NB301-520/2-17**

<b>Rev</b>	<b>Description</b>	<b>Date</b>
0	Issued in Final	September 18, 2015

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**CONSULTING**

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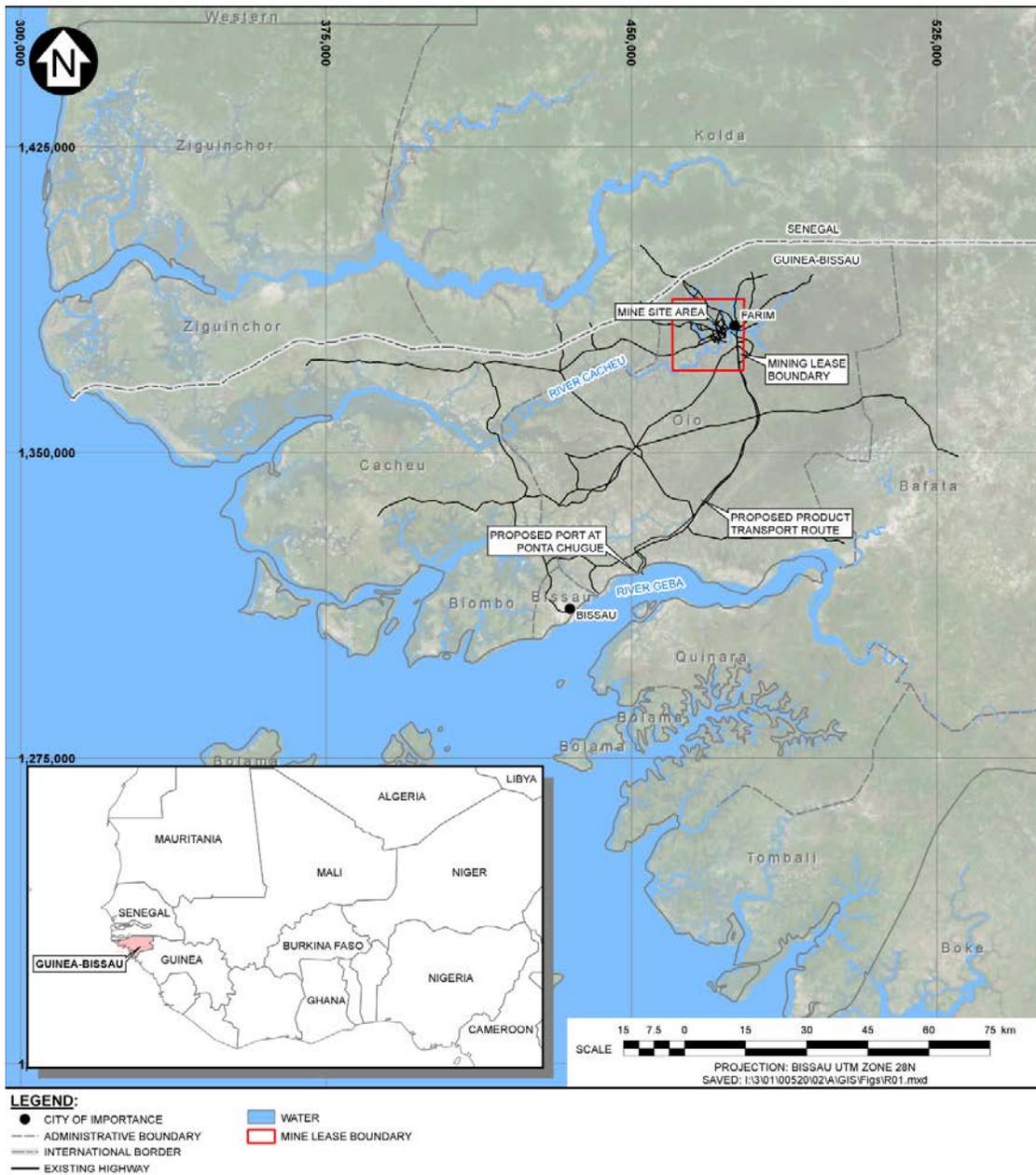
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## 1 – INTRODUCTION

### 1.1 BACKGROUND

The Farim Phosphate Project (the Project) is a proposed phosphate mine located in the central northern part of Guinea-Bissau, West Africa (Figure 1.1).



**Figure 1.1 Project Location Map**

The Project consists of the construction, operation and closure of a proposed open pit mining operation to exploit the Farim phosphate orebody, a process plant at the Mine Site to beneficiate the ore into a phosphate concentrate product, and an associated port facility to export the product to customers. The three main project components (Mine Site, Product Transport Route, and Port Site) and the Project's anticipated zone of influence are shown on Figure 1.2. The Project's zone of influence includes the area and local communities surrounding these project components, as well as the regional and national socio-economic environment at broader scales.

Project Owner Information is provided in Table 1.1.

**Table 1.1 Project Owner Identification**

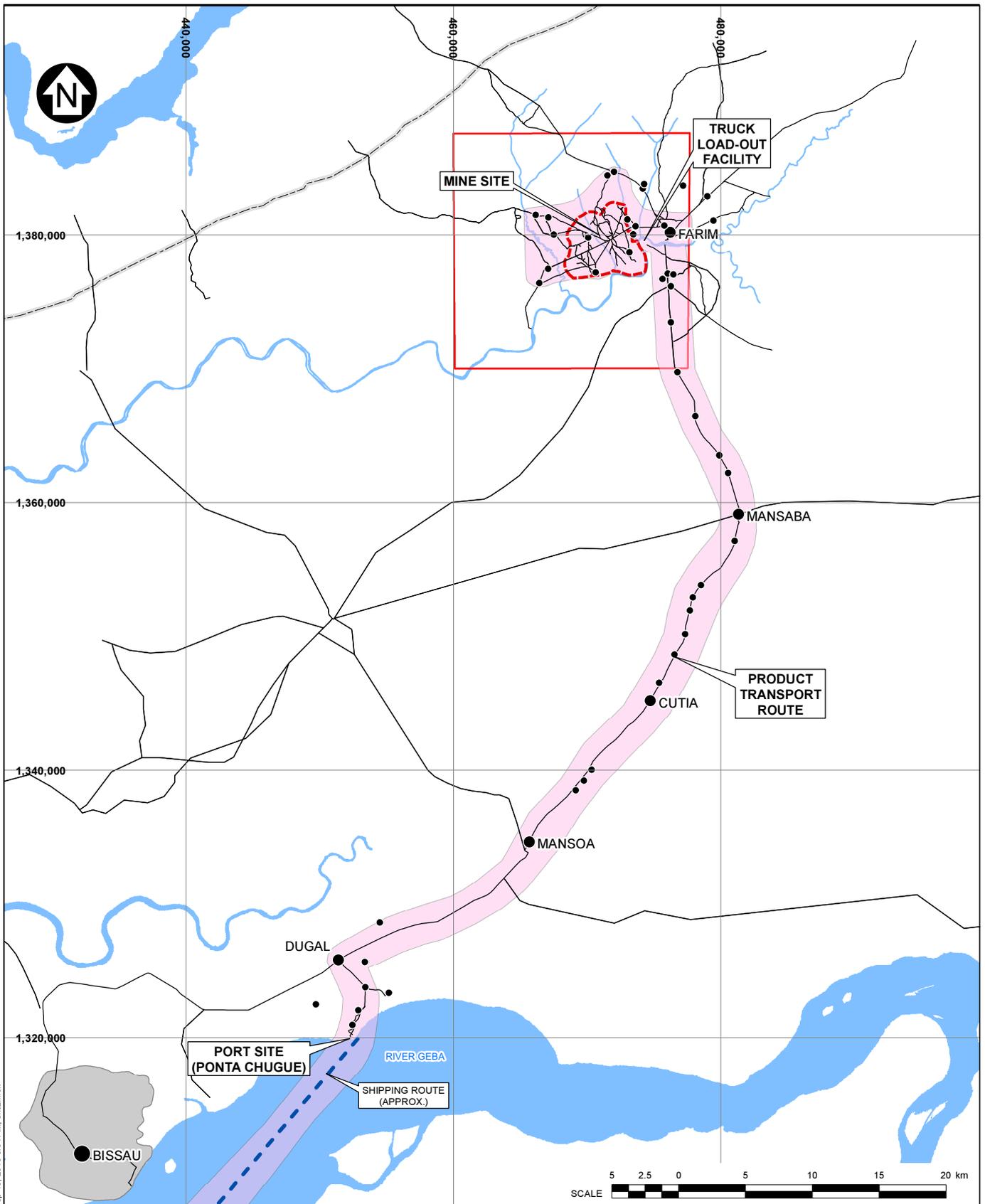
<b>Name</b>	Farim Phosphate Project
<b>Developers</b>	GB Minerals Ltd.
<b>Creation Date</b>	GB Minerals Ltd. was incorporated on July 24, 2007 as Resource Hunter Capital Corp.
<b>Activity Sector</b>	Mining
<b>Nominal Production Capacity</b>	Mine rate of 1.75 Mt/a producing 1.32 Mt/a of phosphate rock product
<b>Project Life</b>	26 years
<b>Construction Start Date</b>	2016
<b>Production Start Date</b>	4Q 2017
<b>Head Office</b>	Suite 1500, 701 West Georgia Street, Vancouver, B.C., Canada, V7Y 1C6
<b>Facility Address</b>	Farim and Ponta Chugue, Guinea-Bissau
<b>Ore Qualities and Price Rate</b>	34.0% P <sub>2</sub> O <sub>5</sub> ; spot price for phosphate rock on June 20, 2015 was USD \$115/t
<b>Name of the First Charge</b>	Luis da Silva - President, Chief Executive Officer, and Director
<b>Company Directors</b>	Chairman - Owen Ryan Directors - Luis da Silva; Kirill Zimin; Walter Davidson; Brent de Jong; Robert Edwards
<b>Environmental Director</b>	Olga Kovalik, Project Director
<b>Company Logo</b>	

GB Minerals Ltd. (GB Minerals) is the 100% owner of GB Minerals AG, the licence holder for the Farim Phosphate Project (the Project).

## 1.2 PROJECT OVERVIEW

The project design is based on a feasibility study (FS) recently completed for the Project by Lycopodium Minerals Canada Ltd. (Lycopodium, 2015a). The feasibility study concluded that the Project will generate a high quality phosphate rock product, and that it is economically suitable to be developed based on long term phosphate prices.

Construction of the Project is expected to take two years. The Project will operate for 26 years, mining at a rate of 1.75 million tonnes per annum (Mt/a) to produce 1.32 Mt/a of phosphate rock at an average grade of 34.0% P<sub>2</sub>O<sub>5</sub>. The mine will require two years to reclaim and close out. The total mine life is therefore 30 years.



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- LEGEND:**
- VILLAGE
  - TOWN
  - CITY
  - INTERNATIONAL BORDER
  - EXISTING HIGHWAY
  - - - MINE SITE FENCELINE
  - WATER
  - PROJECT ZONE OF INFLUENCE
  - MINING LEASE BOUNDARY

**NOTES:**

1. COORDINATE GRID IS IN METRES.  
 COORDINATE SYSTEM: WGS 1984 UTM ZONE 28N.



<b>GB MINERALS LTD.</b>	
<b>FARIM PHOSPHATE PROJECT</b>	
<b>PROJECT ZONE OF INFLUENCE</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. NB301-520/2 REF NO. 17 <b>FIGURE 1.2</b> REV 0

REV	DATE	DESCRIPTION	RAC DESIGNED	SWK DRAWN	RAC REVIEWED
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The general arrangement of the proposed Mine Site is shown in Figure 1.3, and will be comprised of the following components:

- Two Open Pits - Referred to as the south pit and the north pit, which will be developed using conventional open pit mining methods in two sequential phases.
- Run-of-Mine (ROM) Pad - Stockpile of phosphate ore to feed the processing plant.
- Process Plant - For processing the phosphate ore to produce beneficiated phosphate product.
- Conveyance System - A closed conveyor to move product from the product stockpile on the north side of the River Cacheu to the truck load-out facility located on the south side of the River.
- Waste Dumps - Waste overburden generated by the Project will be used to backfill the south pit and the north pit. Excess overburden will be placed within six waste dumps constructed above ground. Three of these waste dumps will be located within the footprint of the backfilled open pits, and one of the waste dumps will contain waste overburden which has the potential to generate acid and leach unacceptable levels of metals.
- Tailings Storage Facility - Tailings will be generated as a result of the process and will be pumped to the tailing storage facility.
- Water Management Facilities - Dewatering wells will be installed around the active pit areas, and water entering the pits will be directed to sumps to be pumped out of the pits into a pond. Flood protection berms, watercourse diversions and sediment and environmental control ponds will be employed to manage water across the site.
- Water Treatment Plants - One water treatment plant will provide potable water and another will treat mine effluent prior to discharge.
- Storage and maintenance facilities associated with the mine operation
- Landfill for disposal of solid, non-hazardous waste
- Fuel storage facility to store and supply fuel for power supply and vehicles
- Ablution facilities for mine staff
- Accommodation facilities for ex-patriate mine staff
- Administration and additional support facilities
- Haul roads for mining equipment to transport material from the pits to the process plant and waste dumps
- Site access roads for non-mining mobile equipment

The Product Transport Route will consist of the following components (Figure 1.2):

- A truck load-out facility located on the south side of the River Cacheu, consisting of an elevated bin to store and transfer product to trucks.
- A 2-km gravel access road to be constructed to connect the truck load-out facility to the existing paved highway.
- Use of an existing 68-km section of the existing paved road between Bissau and Dugal.
- A 6-km gravel access road from the highway turnoff at Dugal to the Port Site.
- A fleet of 31-t capacity road haulage trucks operating year-round during daylight hours to transport product from the mine to the port.

The Port Site will consist of the following components (Figure 1.4):

- Truck unloading facilities
- A closed drier shed (to dry the product from 8% to 3% moisture content)
- A second closed product storage shed
- A 200 m long wharf extending into the River Geba
- Shiploading system to convey the product into the storage holds of 35,000 DWT (dead weight tonne) capacity ships
- Administrative building

### 1.3 PROJECT NEED AND PURPOSE

The global requirement for phosphate is mainly for the production of fertilizers. In 2010, approximately 90% of the world market was for the manufacture of fertilizers and animal feed supplements. This Project will produce a high quality phosphate rock product that will be shipped to manufacturers of fertilizers.

There is no substitute for phosphorus for use in agriculture. Phosphate fertilizers stimulate root development, promote flowering and help prevent diseases and environmental stress. Fertilizers applied to correct deficiencies in soils are typically chemically manufactured materials containing compounds of phosphate that are readily soluble in water.

Development of the Project is proposed to deliver a return on investment to GB Minerals' shareholders, and to bring economic benefits to the national government of the Republic of Guinea-Bissau and to the people in the country and in the Farim region in particular. As the first modern mining development in Guinea-Bissau, the Project represents an important opportunity for the country to derive benefits from mining and demonstrate its capacity to support a world-class mining development. Development of the Project can be expected to attract additional foreign investment into the country.

### 1.4 PHYSICAL AND BIOLOGICAL SETTING

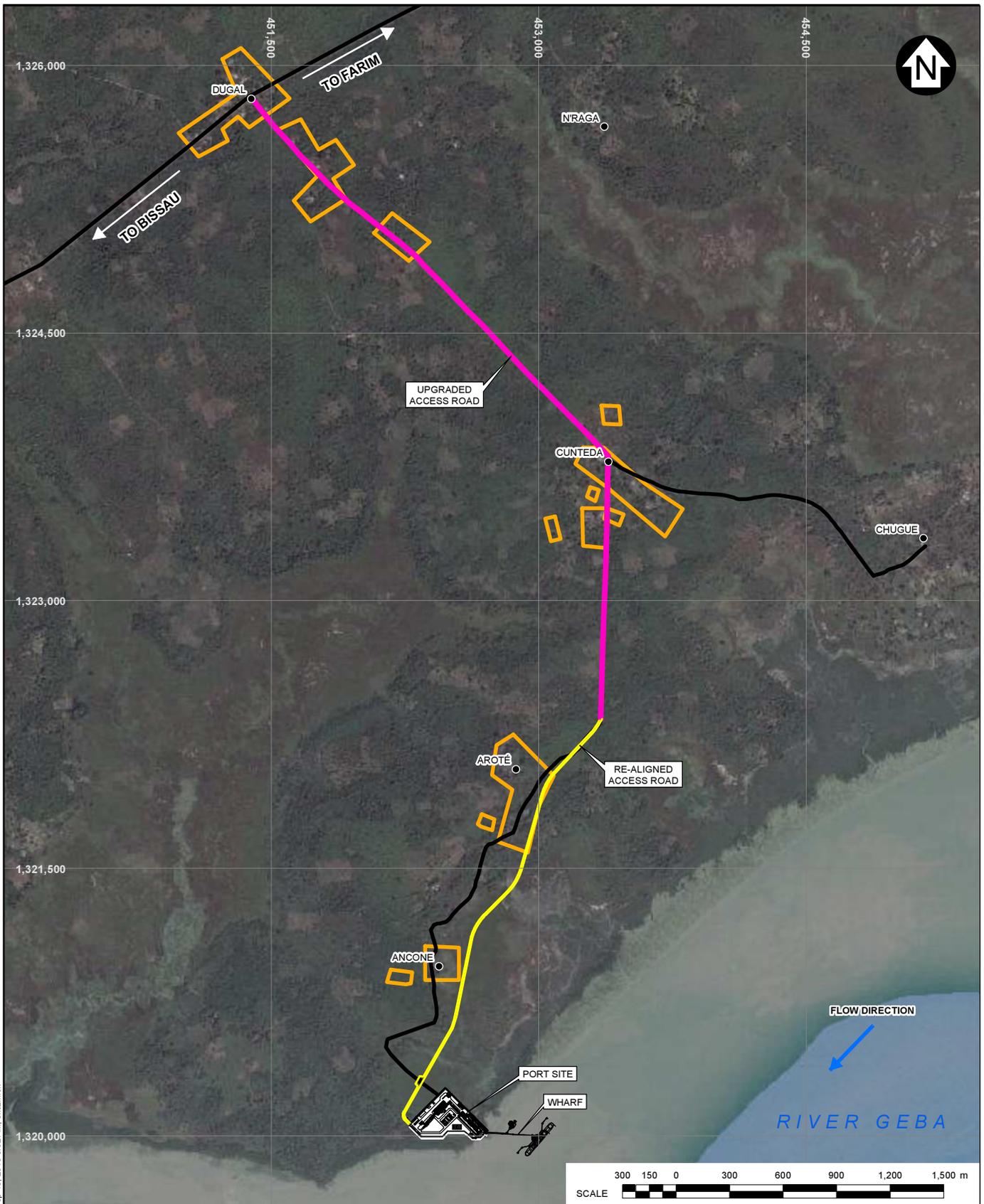
Environmental studies in support of the Project were undertaken over the period of 2011 through 2015. A description of the physical and biological setting follows.

#### **Geographic Location**

Guinea-Bissau is located at approximately 12° Latitude and 15° Longitude. Much of the country is close to sea level, and the Farim Mine Site area is similarly flat with an elevation change of approximately 40 m over a distance of 4 km between the Cacheu River and the north western edge of the Mine Site area. The elevation of the wider project study area (mine to port) varies between 5 m and 50 m.

Natural resources found in Guinea-Bissau include: fish, timber, clay, granite, limestone and unexploited deposits of petroleum, phosphates and bauxite. Approximately 10.67% of the land is arable and 235.6 square kilometres is irrigated.

Natural hazards include a hot, dry, dusty harmattan haze that may reduce visibility during the dry season and brush fires. Environmental issues include deforestation; soil erosion; overgrazing and overfishing.



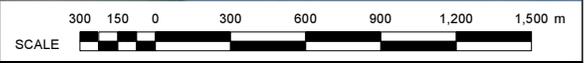
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**LEGEND:**

- VILLAGE
- EXISTING ROAD
- RE-ALIGNED ACCESS ROAD
- UPGRADED ACCESS ROAD
- POPULATED SETTLEMENT

**NOTES:**

1. PORT SITE INFRASTRUCTURE AS WELL AS BASEMAP DATA PROVIDED BY LYCOPODIUM MINERALS CANADA LTD. (MARCH 18, 2015). MODIFIED BY KNIGHT PIESOLD LTD. TO SHOW PROPOSED INFRASTRUCTURE CHANGES (APRIL 24, 2015).
2. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: WGS 1984 UTM ZONE 28N.
3. IMAGERY: ESRI DATA AND MAPS [ONLINE] (2015). REDLANDS, CA: ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE. ALL RIGHTS RESERVED.



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<b>PORT SITE AREA AND ACCESS ROAD</b>	
<b><i>Knight Piésold</i></b> CONSULTING	
PIA NO. NB301-520/2	REF NO. 17
<b>FIGURE 1.4</b>	
REV	0

REV	DATE	DESCRIPTION	RAC DESIGNED	SWK DRAWN	RAC REVIEWED
0	15SEP'15	ISSUED WITH REPORT			

## **Meteorological and Atmospheric Conditions**

The land area of Guinea-Bissau is mostly savannah with low coastal plains either colonised by freshwater wetlands (most converted to rice paddies), salt marshes or fringing mangroves that line the river banks. The climatic and seasonal variations are very distinct in Guinea-Bissau and follow the general West African climate conditions. It is hot and humid year-round with little fluctuation in average temperature. Data collected at the Bissau station indicates that temperatures range from 16.6°C to 38.6°C, with the minimum temperatures occurring in January and the maximum temperatures occurring in April.

There are two distinct seasons in Guinea-Bissau, the wet season and the dry season. During the wet season (June to October), most of the average rainfall is accounted for and the winds are predominately southwesterly. The dry season (November to May) accounts for very little rainfall and the winds are predominately northeasterly. The annual total rainfall at the Farim meteorology station in 2012 was 1,594 mm, which is representative of long-term annual precipitation values reported for Bissau. The majority of the rainfall events are short in duration and have a high intensity. Wind speeds are generally light all year round and are typically less than 18 km/h.

Air quality data collected at the Mine and Port Sites indicates that the air quality is representative of a natural environment with low concentrations of anthropogenic gases. Particulate matter is elevated (measured at the Mine Site only) due to naturally high concentrations of dust. This is further elevated during late November to middle March when the Harmattan winds blow dust from the Sahara in the direction of the study region.

The daytime and night time noise levels in the vicinity of the Project sites regularly exceed the noise limits identified in the International Finance Corporation's noise guideline values. Baseline noise surveys indicate that measured daytime noise levels are typically higher than the lowest measured night-time noise levels. Daytime noise levels are most influenced by human activities. Noise levels increase around dusk due to the calling of crickets and toads, which steadily reduce as the night passes.

## **Mine Site Hydrogeological Conditions**

The geology and hydrogeology of the Mine Site has been generalized as follows:

- An overburden layer comprising sands, clays and gravels, extends from the land surface to the absolute elevation of -30 m above sea level. This unit can be considered an unconfined aquifer and is shown to be in limited hydraulic connection with the River Cacheu due to the presence of extensive superficial clay in the lowland plain.
- A blue clay horizon is not continuous, occurring in localized areas only and ranging in thickness.
- A calcareous layer (calcium-rich rock such as limestone) lies beneath the orebody. Water levels in this unit sit at a higher elevation than those of the overburden suggesting that groundwater in this unit is under pressure with an upward flow gradient. This unit is described as a calcareous clayey friable sandstone.

Water levels respond to seasonal rainfall, dropping in the dry season and rising during the wet season. Groundwater provides baseflow to surface water bodies, including the River Cacheu and its tributaries. Groundwater elevations that suggest there is an upward flow and groundwater discharge have been observed in the south area of the Mine Site. As a result, surface water bodies are potentially sensitive to losses in baseflow due to reductions in groundwater levels. These reductions could lead to a shorter duration for ephemeral stream flows.

The quality of groundwater at the Mine Site area is reflective of the undeveloped environment. Most of the samples collected met the World Health Organization drinking water guidelines. The salinity and the chloride and sodium concentrations for all geological units are generally low, indicating rainwater recharge rather than a tidal influence from the River Cacheu. Groundwater recharge and quality immediately adjacent to the River Cacheu and Rio de Bunja (a tributary in the Mine Site area) are influenced by the tidal river during the wet season. Of the trace metal elements tested in groundwater, only the iron and manganese content were identified at concentrations above the aesthetic objectives for drinking water. The pH was also found to be outside the aesthetic objectives range in several of the samples.

#### **Aquatic Environment in the Mine Site Area**

The Mine Site is located adjacent to the River Cacheu, a major river that meanders through the study area in a southwesterly direction. There are also four streams within the Mine Site area that report to the Cacheu River: Rio de Banim, Rio de Bunja, Rio de Cavaras Marinhas, and Rio de Caur.

Adjacent to the Mine Site, the channel width of the River Cacheu is approximately 150 to 200 m and the maximum flow velocities in the river range between 1.1 to 1.5 m/s during the dry and wet seasons, respectively. The River Cacheu experiences a semi-diurnal tidal influence (two high tides and two low tides each day), thus forming part of the estuarine environment. By strict definition, any part of a river that is tidal is considered estuarine. This is further supported by the development of the mangroves and salt marsh areas, and the presence of marine/estuarine species of fish captured within the River Cacheu in the vicinity of the Mine Site. The maximum tidal variation at Cacheu near the mouth of the estuary is about 3 m, and the tidal variation at a survey location downstream of Farim at Binta was measured at about 2 m. Each of the streams transecting the Mine Site is also tide influenced.

The River Cacheu banks to the north and south are relatively flat and are susceptible to flooding during periods of high rainfall and/or high tides. The floodplain extends 1,500 m to the north and south. The river banks are composed of fine-grained sediments and are well vegetated with mangroves and other vegetation. Most of the river is in a relatively pristine state with the majority of the mangrove and beach shorelines being undisturbed. The fine-grained sediments are exposed at low tides and are subject to erosion by wave action and currents. The river is dominated by ongoing transport of fine-grained sediments; river bed sediments range from silt to clay at Farim, to sand sized particles near the estuary mouth. The monitored section of the river exhibits a quick response to rainfall events given sufficient antecedent rainfall.

The aquatic ecosystem is driven primarily by the natural wet and dry season fluctuations resulting in nutrient and sediment transport to the coastal areas, coupled to the daily tidal regime. The highest diversity of fish and invertebrates was observed in the more saline sections of the river. Seagrasses were not observed within the length of the river studied; their absence likely owing to the naturally

high turbidity and lack of suitable intertidal habitat (sandy areas). Shellfish and other invertebrates reproduce throughout the length of the river and estuary. The mangrove ecosystems along the tributaries serve as nursery areas for fish. A study of fish tissue analysis shows that the system is not contaminated from anthropogenic sources/activities.

Surface water in the Mine Site area is brackish with elevated conductivity, total dissolved solids and chloride levels within all tidally connected watercourses, including the River Cacheu and its tidally influenced tributaries (Rio de Caur, Rio de Bunja, Rio de Cavaras Marinhos, and Rio de Banim). The River Cacheu is turbid, with approximately neutral pH and high dissolved oxygen concentrations. Physical parameters vary significantly between the wet and dry seasons; during the dry season, pH ranges from 7.0 to 7.6, total suspended solids (TSS) is lower and both TDS and conductivity are higher compared to the wet season. In the wet season, the pH ranges from 6.5 to 7.0.

High levels of iron and manganese were recorded in samples taken from the Rio de Cavaras Marinhos and the Rio de Caur.

Concentrations of metals including zinc, cadmium and nickel increase from upstream of Farim to the lowest regional sample location (SW1 near Binta). This could be related to the influence of tributaries draining into the river along this reach, where relatively high concentrations of these metals have been recorded.

Elevated metals levels were recorded in baseline laboratory analysis results when compared to the Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life. Exceedances of these guidelines have been recorded for iron, cadmium, lead and zinc.

### **Aquatic Environment at the Port Site**

Like the River Cacheu, the River Geba is estuarine and heavily influenced by ocean tides. At the Port Site location, the river is almost 7 km across, with depths measured during the spring high tide ranging from 3 m to 28 m. The tide within the River Geba ranges from 3 m at the most eastern end of the Canal de Caio and 6 m near Ponte Chugue. These winds combined with the large volume of water that moves during the tidal cycle accounted for strong currents (7 to 8 m/s) and local occurrences of large standing waves (0.6 to 1.2 m) during the sampling period. The substrate in the vicinity of the Port Site consisted of fine mud with a depth of 5 to 8 m.

The freshwater wetland areas are located along the floodplains, most of which have been converted to rice paddies, with only a band of mangrove remaining along the shorelines.

### **Terrestrial Ecology**

#### *Flora*

A total of 341 plant species were recorded during various project surveys undertaken between 2011 and 2015. Floral species diversity in the area is moderate to high, but not as high as many regions of West Africa, such as the Upper Guinea Forest zone. A large proportion of the species recorded are indigenous with few exotic species occurring in the area although, in areas of higher anthropogenic disturbances, some exotic species are more prevalent.

Based on physiognomy, moisture regime, rockiness, slope and soil properties, seven main communities were recognized, namely:

- *Rhizophora - Avicennia* Mangrove community (Mine and Port Site study areas)
- Natural Forest vegetation community (Mine Site study area only)
- Secondary Forest community (Mine Site study area only)
- *Elias - Cyperus* Floodplain community (Mine and Port Site study areas)
- *Oryza* Paddy vegetation community (Mine and Port Site study areas)
- *Dialium - Sterculia* coastal woodland vegetation community (Port Site study area only)
- *Anadelphia afzeliana* seasonally wet grassland community

The *Oryza* Paddy vegetation community occurs in areas of freshwater wetlands which are not affected by tidal ebbs and flows throughout the country, these areas of freshwater wetlands have been modified to facilitate the planting of rice, so alterations to the flow of freshwater systems create large inundated areas where rice is planted. The only species found which is known to be listed by the International Union for Conservation of Nature (IUCN) Red Data list is *Raphia palma-pinus*, which is found along rivers and is listed as Data Deficient. The possible presence of two Red Data species *Floscopa axillaris* and *Digitaria patagiata* will be confirmed during follow up ecological surveys at the end of the rainy season in September or October 2015. A total of 103 flora species were recorded in this vegetation community.

Large sections of natural forests have been cleared in order to grow Cashew nuts and other crops. This vegetation community encompasses areas that have been cleared and that have been replanted with Cashew trees. The cashew plantations vary from areas which are dominated by Cashew trees (cashew monoculture), to areas of mixed cashews and secondary forest. A total of 145 flora species were recorded in this vegetation community.

Another halophytic community recorded in the study area is the salt water *lala*, a grassland. This vegetation community is found on Fluvisols in the floodplain areas adjacent to the larger rivers which are tidally influenced. The salinity of the water which floods these areas has resulted in the dominance of salt-tolerant species. The denuded areas of these areas are widely utilized by local communities for the gathering of salt during the dry season and this vegetation community appears to be an important dry season grazing area. A total of 76 flora species were recorded in this vegetation community

The natural forest community occupies large areas of the northern part of the study area, with some variation in structure and composition. This vegetation community is currently under threat due mainly to slash and burn agricultural practices for the cultivation of food crops or cashew nuts. Although only one Red Data species was recorded in this vegetation community, the likelihood of occurrence of Red Data species in this community is high. A total of 209 flora species were recorded in this vegetation community.

Mangrove forests line all the larger rivers in the region. No Red Data species were recorded in this vegetation community and, due to the specialization required for plants to survive in the tidal saline conditions, it is unlikely that any of the Red Data species known to occur in the area occur in this vegetation community. Though species diversity is low, the species occurring are highly specialized, and therefore this vegetation community is characterized as unique. This vegetation community is

integral in the functioning of the estuarine nature of the larger rivers in the area. A total of 29 highly specialized flora species were recorded in this vegetation community.

The *Dialium - Sterculia* coastal woodland vegetation community occurs in the transition zone between the terrestrial and the halophytic communities in the coastal regions. Much of the substrata of the transitional zone in the vicinity of Ponta Chugue has been severely transformed due to cropping of mainly millet and peanuts.

The most extensive wetland vegetation in the country is the locally called lala, a wet grass savannah. This vegetation community is prevalent on gleysols, which are fine textured soils, deep, grey-coloured, from alluvial origin, with the upper layers often rich in organic matter. Furthermore, this vegetation community prevails in the inner lowland plains flooded by rainwater during the wet season, located mostly in the lower zones of the mainland. Noticeable in the area of Ponta Chugue, is that this vegetation community is particularly homogenous. It is likely that this is the result of human intervention through the use of fire, or harvesting of this grass species for thatching purposes.

#### *Fauna*

Non-chordate diversity within the study area was relatively high with a total of 124 arthropod species being recorded during the study. Most species recorded were common species with some specialized species being recorded in the mangrove communities. Although the mangrove species are highly specialized for this habitat type, they are locally common and not of conservation importance. Most of the species recorded are not restricted in terms of range and habitat preferences. Common species included Red Winged Drooping and locust.

The herpetofauna of the region can be classified as having moderate diversity, of the 69 reptile species known to occur in Guinea-Bissau, only 11 species recorded. This may be due to the proximity of the Project area to the town of Farim and other settlements in the area. Common species occurring in the area include Ornate Monitor and Tree Agama.

The region can be classified as having low amphibian diversity; of the 34 amphibian species recorded in Guinea-Bissau, only five species were recorded during Project surveys, none of which are IUCN listed. None of the five recorded species appear to be utilized by the local community for food, although some species are said to have superstitious importance or medicinal uses. The rivers in the area are tidal and have a very high salinity, characteristics to which amphibians are very sensitive. For this reason most of the rivers in the study area are uninhabitable for amphibian species, and only freshwater systems host this taxon.

Avifaunal diversity in the study area was very high with a large number of upper trophic level species occurring in the area. The Hooded Vulture is currently listed as Endangered by the IUCN. Seventy-five species were recorded, including the Palmnut Vulture, Long-crested eagle, Hooded vulture and Gymnogene. In general, species diversity was moderate to high throughout the study area with the rice paddies and natural forests showing the highest levels of species diversity.

Mammal species diversity was very low in the study area, probably due to severe subsistence hunting. Hunters were regularly seen or heard during the surveys often with animals ranging from snakes to monkeys. This not only reduces the number of animals and species in the area, but also causes the remaining animals to be very shy of humans, which in turn makes accurate survey of species occurring in the area very difficult. Fifteen of the 192 mammal species known to occur in the study area were recorded during Project surveys. The species recorded in the study area include

Striped Ground Squirrel, Musk shrew, Lesser Spot-nosed Guenon, and Red colobus, all of which are common species, with the exception of Red colobus, listed as Endangered by IUCN (2010), which was recorded dead and being transported by a hunter from some distance away in the natural forests to the north.

#### *Summary of Species of Conservation Concern*

A total of 28 Red Data fauna species may occur in the area, according to the IUCN Red Data list. Some of the animals listed are believed to be locally extinct and suitable habitat for others is not available. The Red Data species that may occur in the study area consist of two reptile species, 15 avian species and 11 mammal species. The habitat suitability for Red Data species ranges from low to high with four species for which the habitat suitability can be classified as high. Only two Red Data species were recorded during Project surveys, namely the Red Colobus (recorded dead and being transported from the north, as mentioned above) and the Hooded Vulture. All indications of this study appear to show that the African slender-snouted crocodile and the West African dwarf crocodile do not occur in this area. Features of the demographics of the crocodile population in the Cacheu River system showed that the crocodile population increases exponentially with an increase in distance from the Cacheu River mouth. Young crocodiles use the area close to the Mine Site along the river as a nursery area.

Although the Hooded Vulture is currently listed on the IUCN Red Data List as critically endangered, it is a locally common species in the area with a total of more than 600 individuals being recorded during the surveys. This species has become highly human commensal throughout West Africa and is well adapted to anthropogenic disturbance. The Palm Nut Vulture's range is restricted in the study area due to its specialized nature.

#### *Exotic Species*

Guinea-Bissau has one of the lowest number of exotic species in Africa with only eight exotic invasive species occurring in the country:

- *Lantana camara*
- *Eichhornia crassipes* (aquatic plant)
- *Leucaena leucocephala* (tree)
- *Prosopis spp.* (tree, shrub)
- *Adenantha pavonina* (tree)
- *Columba livia* (bird)
- *Rattus rattus* (mammal)
- *Mus domesticus* (Mammal)

#### *Ecological Function and Conservation Importance of the Mine Site and Port Site Areas*

The ecological function of the Mine Site study area can generally be described as moderate for the majority of the study area, although this does vary from low (in the highly transformed areas due to slash and burn cropping techniques) to high in the more inaccessible areas. Areas in which prospecting and slash and burn farming has taken place, as well as areas in which settlements have been established are considered as areas where ecological function is reduced. The cashew plantations and secondary forests appear to both have moderate ecological function, particularly in areas where indigenous species have been allowed to intersperse the Cashew trees. Although areas

such as the rice paddies are transformed to some extent, the fauna species composition of these areas seem to indicate that the ecological integrity can still be considered high.

At the Ponta Chugue Port Site, the ecological integrity of the site varies between high for the Mangrove community, the Floodplain community and the less degraded coastal woodland vegetation community; moderate for the more degraded coastal woodland vegetation community and the seasonally wet grassland community, and low for the *Oryza* Paddy vegetation community. The *Oryza* Paddy vegetation community in this area are considered more degraded than those at the Mine Site due to the fact that there is a monoculture of *Oryza* spp. in these areas, whereas the *Oryza* Paddy vegetation community near the Mine Site show far greater species diversity, with a large number of indigenous species represented in these areas.

The Mine Site study area falls within the dry tropical forest biome of the Guinean Forest zone. Due to the high species diversity and intrinsic conservation value of the area it is classified as having high conservation importance overall, with subareas of low, moderate and high conservation importance due to the presence of Red Data species or other intrinsic factors. Areas that have been severely disturbed such as settlements are considered of low conservation importance. These areas are, however, quite small in relation to the overall study area (>30% of the study area). Areas that have been disturbed by farming are considered of moderate conservation importance due to the fact that rehabilitation of these areas is possible. The natural forest, floodplain and mangrove areas are considered of very high conservation importance due to the presence of Red Data species in these areas and the intrinsic importance of these areas. Finally, the rice paddies may host two of the red data plant species endemic to the region (*Floscopa axillaris* and *Digitaria patagiata*); follow up surveys are planned for September or October of 2015 to confirm.

The conservation importance at the Port Site can generally be described as moderate due to the disturbance in the area.

## 1.5 SOCIOECONOMIC AND CULTURAL SETTING

### **National Socioeconomic Setting of Guinea-Bissau**

The national socioeconomic environment of Guinea-Bissau has been influenced by a history of political instability since the country gained its independence from Portugal in 1973. In 2012, the national population of the country was 1.7 million. Only 14% of the population speak the official language (Portuguese). Guinea-Bissau is ranked 177 out of 187 countries according to the 2014 UNDP Human Development Index and has one of the lowest per capita gross domestic products in the world. Most of the population (44%) speaks Crioulo, a Portuguese-based creole language. There are many ethnic groups, with 7% of the population classified as an indigenous ethnic group (Papels). Indigenous ethnic groups such as the Papels were not identified in the vicinity of the Project.

Guinea-Bissau is divided into eight administrative regions in addition to the autonomous district of Bissau. The regions are subdivided into districts that are administered by District Administrators. In total, there are 37 districts. The region of Oio, where the project is located, is in the northern part of the country and consists of five districts: Bissora, Farim, Mansaba, Mansoa and Nhacra. The Oio region is predominantly rural, with a population estimated at approximately 215,000 inhabitants (15% of national population), and characterised by a diverse range of ethnic groups. The total population in the three districts (Farim, Mansoa and Mansaba) is

estimated to comprise 64% of the population of the Oio Region. The populations of these districts live in rural villages, with only one or two towns in each district. Farim is the second most populous district in the region, with approximately 8,681 inhabitants. Outside of Farim, the population in the villages rarely exceeds 500 inhabitants.

The local social environment can be described as rural villages that are largely dependent on small-scale agriculture for both household subsistence and income generation, and larger urban settlements where there is more social infrastructure such as schools and religious establishments. In general, the whole project area lacks adequate social infrastructure such as health care facilities, schools, sanitation, water systems, and waste management. Many households reside in compounds and land ownership is followed through the integration of traditional law such as customary land management practices and legal forms of ownership. Decision-making is primarily through consensus facilitated by the village leaders or committees.

The larger villages have trade businesses and a more cash-based local economy. The smaller communities in the project area and along the transport route engage predominantly in subsistence agriculture, with the trade of any agricultural surplus for cash income. Natural resource-based livelihoods are also predominant. Livelihood activities entail cultivation of cashew, maize, millet, sorghum, rice and fonio, which are commonly grown in the area for consumption or sale; the production of natural resources use as home building materials and medicinal products; fishing, especially in villages along the River Cacheu and near the Port Site on River Geba; livestock rearing; and the production of salt, which is undertaken predominantly by women.

### **Socioeconomic Conditions in the Local Study Area**

The conditions at the Mine Site and Port Site are similar, except that Fishing activities at the mine are focused on the River Cacheu, and fishing at the Port Site is focused on the River Geba. The Cacheu River is considered to be a more important fisheries resource than the Geba River based on discussions with the local fishermen and the Department of Fisheries. Together both river systems only contribute a small fraction of the volumes yielded from offshore fishing activities. The following summarizes the social conditions within the study area:

- **Ethnicity** - The Mine Site area includes eight ethnic groups: the Mandingas (66% of the population), the Mansonkas (17%), Fula (7.6%), and Balantes (6%). Minority groups include the Manjak, Pepel and Mancagnes. Households in the Farim area are predominantly inhabited by Mandingo (40%), followed by the Fulani (27.6%) and Balante (21.5%). The Port Site area, by contrast, is predominantly occupied by the Balante.
- **Housing** - Households are located in clusters as rural villages rather than widely distributed. Households may comprise of a single family home with a single residential structure or a compound comprised of multiple buildings that support multi-generational family members. Household sizes vary between four members to over 25 members, with an average household size consisting of 10 members. Houses are predominately made of clay, corrugated iron roofing and have between four and seven rooms. With regard to ownership, 25% of households have title to the land, 11% have an occupancy permit and more than half (55%) have traditionally determined residential authorisation.

- **Mobility** - Considerable mobility is experienced in Farim and its surrounding villages, especially among the young adult population. Mobility is often driven by a search for employment in Bissau, neighbouring countries (e.g., to Senegal, Gambia, and Cape Verde), and Europe (Portugal and France). The villages of Tambato, Canico, Tumana, Salikénié and Farim town are mostly affected by migration.
- **Religion** - Islam is the predominant religion (71% of the population) in the area and is practiced by the Mandingo and Fulani. Christians represent 25% of the population, while paganism is practiced by 4% of the population. These latter religions are mainly practiced by the Balante.
- **Social Organization** - Compounds or homesteads are often shared by more than one related family headed by a 'chief' who is the father or the grandfather. Families also share the agricultural land. Monogamy is more common (51.8% of respondents) than polygamy. In general, women and youth have the responsibility for most domestic tasks.
- **Decision-Making** - Decision-making is primarily through consensus facilitated by the village leaders or committees. The village chief (or committee) invites the heads of families and youth representatives and, in some cases, women's representatives when matters need to be discussed and decided upon. Decisions are made only after sufficient discussion and when each had the opportunity to express their opinion. Heads of villages are under the authority of the administrator of the district to which they report. The status of village head is usually held by the founding family of the village and is transferred within the family over generations.
- **Social Infrastructure/Amenities** - There is a basic hospital in Farim that has been supported by the Project to improve ward facilities. There is also a Christian church and mosque in Farim. There is a shortage of schools in the study area. Where schools are present, they are mostly temporary shelters.
- **Water Supply** - Villages and Farim town use traditional wells and hand pump-operated boreholes for domestic water. There is no reticulated sewerage system in the area and domestic (solid) waste is dumped in uncontrolled spaces.
- **Roads** - Roads within the study area are generally unpaved dirt roads. Farim attracts daily visitors from surrounding villages to access services (mosques, churches, health care, education, and recreation) and commerce such as buying and selling at the market. Most travel is by foot or bicycle with motorcycles being the most frequently used form or motorized travel.

### **Economic Activities**

The following summarizes the economic conditions within the study area:

- **Access to Land** - Land is administered following traditional law by customary authorities. Thus, the law has changed the basis of ownership through the integration of customary land management practices with legal forms of ownership. Most households in the Mine Site area (93% of households surveyed in 2012) are actively cultivating land. Of this, only 13% reported holding title to the land they cultivate, while 55% were granted access to land through traditional administrative means, and 3% cultivate fields without any formal approval.
- **Subsistence Agriculture** - Maize, millet, sorghum, rice and fonio are commonly grown in the area for consumption or sale. Maize is the most important crop, being cultivated by more than 51% of the households. However, the cultivation of cashew plantations is critical to generating cash income. The strong market links in the region support significant local investment in cashew tree planting and processing of cashew nuts. In terms of land-take,

Cashew trees are the dominant form of local land-use. The proportion of households involved in other crops (e.g., millet and beans) is between 3% and 15%. Rice, although a staple food, is cultivated by only 12% of households. There are food gardens in several villages, managed mostly by women who have their gardens either around water sources (ponds, wells or boreholes) or in their own compound. Vegetables such as okra and tomatoes are intercropped with the main field crops.

- **Food Security and Income Generation** - Food deficit was widely reported by households despite the availability of farmland. Food shortages are caused by limited access to agricultural equipment and fertilizers, poor soil quality and impacts on productivity by local salt water intrusion from the River Cacheu. Some of the produce that is cultivated in home gardens and fields is consumed by the growers and the remainder sold. Peanuts, cashews, cassava and beans are particularly important cash crops. The Project area is one of the most important regions in the country for producing peanuts, which are primarily sold in Senegal through a complex network of traders.
- **Salt Production** - Almost all women in the mining area are engaged in salt harvesting during the dry season. Using rudimentary equipment, the salt is mined from sand taken from rice fields that became salt-affected (tann) as a result of saltwater flooding the plains.
- **Livestock** - Almost 93% of surveyed households had livestock (cattle, sheep, and goats). Pig farming is generally practiced by the Balante and Manjak women, with an average of ten animals per household. Family ceremonies create the main opportunity for the sale of livestock.
- **Fisheries** - Fishing in the Farim area is practiced by 31% of households. Daily catches vary between 10 kg and 15 kg per individual and between 400 kg and 450 kg for group expeditions. There are roughly 43 fishermen grouped in an association in Farim, using a fleet consisting of 15 canoes. Within the River Geba and in the vicinity of the Port Site, preliminary results indicate that the local fishing groups are divided in fishing areas based on the location of their village and closest landing site (Porto). The proposed port is located within the Chugue community's fishing area, which is fished mainly between August and April, using 100 to 200 m long lines baited with small fish bought elsewhere. Due to the rocky nature of the river bed directly adjacent to the Chugue shoreline, the fisherman prefer to set their lines on the opposite bank near Jabada, which is 10 to 11 km from the proposed Port Site. The remaining months (May to July), all fishing activities are halted due to the strong currents and the presence of large numbers of shark that damage their long lines. These communities then revert to Cashew production/harvesting. The Chugue community also produces rice. Small nets are utilized when the paddies are flooded to catch the small fish trapped in the adjacent wetland/paddy areas.
- **Natural Resource Harvesting** - Forest products are used as food products, for home building material, and for medicinal products. Edible fruit (baobab fruit, palm fruit) is harvested in season, as are fibres, leaves (baobab leaf), sap extracts (palm wine), wood (90% of domestic energy), honey, and several medicinal plants. Products that are used and marketed include charcoal, baobab fruit, palm wine and palm fruit. Houses are built using material directly harvested from the natural surroundings (e.g., thatch, palm leaves, and wooden poles).
- **Landscape** - Four main landscape types were identified in the Mine Site area during the baseline assessment: river corridor, cultivated river valley, undulating farmland and woodland, and dense forest. None of these landscapes were determined to be particularly rare. Apart from the River Cacheu, there are no nationally or internationally recognized geographical features or

landmarks in the Mine Site study area. There are many very old trees, including giant Baobab trees within the study area, which have become the focus of the villages and the surrounding area. Some villages such as Tabandinto have been named after local tree species. Some of these mature specimens have spiritual and/or cultural significance.

### **Cultural Heritage**

A number of cultural heritage features were identified within the Mine Site area, including archaeological sites, cemeteries and spiritual sites (living/intangible cultural heritage). Cultural heritage features were identified in the vicinity of the Port Site, but beyond the proposed footprint. No evidence of critical cultural heritage as defined by International Finance Corporation Performance Standard 8 was identified at either of the project development areas. Archaeological remains were predominantly pottery sherds and other fragmentary remains of low to moderate cultural heritage significance. Field surveys confirmed the presence of three Muslim cemeteries within the mine study area. One of these cemeteries is of high sensitivity and located near the village of Saliquenhe Ba. It contains the grave of a well-known imam who lived over 100 years ago and is sometimes visited by people from within and outside the region during an annual festival. In addition, a sacred grove (or holy forest) is located south of Saliquenhe Ba and is of local to regional importance.

### 1.6 ESIA AND ESMP STRUCTURE AND CONTENTS

An Environmental and Social Impact Assessment (ESIA) has been prepared to evaluate and address the Project's environmental and social impacts and risks. Significant positive effects are expected from this Project, particularly in economic terms at both the national and local levels. It is expected that there will be potential adverse impacts on the environment and on the lives of local communities. The overall aim of the Environmental and Social Impact Assessment is to identify and assess potential environmental and social impacts that may be a consequence of the Project. As such, potential adverse impacts can be mitigated (avoided, reduced or offset), to the extent practicable, as part of the Project design. This is an iterative process during the Project design and requires the engineering, environmental and social specialists involved to have regular dialogue.

The Environmental and Social Impact Assessment consists of the following components:

**Non-Technical Summary** - Provides a concise summary of the Environmental and Social Impact Assessment in non-technical language (this document).

**Volume 1 - Introduction to the Assessment** - The context for the assessment; includes the following:

- This introductory section
- A description of the Project
- The applicable regulatory and legal framework
- A summary of the environmental and social setting and area of influence of the Project
- The Project alternatives and alternative means of completing the Project that were considered
- The outcomes of public consultation undertaken for the Project

**Volume 2 - Impact Assessment** - The detailed impact assessment of mining activities within the Mine Site area, road transport of supplies and ore, and port operations. The assessment analyzes all potential impacts from the Project, whether they are positive, negative, short term, long term, direct and indirect, reversible and irreversible. The identification and analysis of impacts includes all phases of the Project, from construction through operation to closure and into post-closure.

**Volume 3 - Environmental and Social Management Plan (ESMP)** - A significant output of an Environmental and Social Impact Assessment are the systems and plans that will guide the environmental, health, safety and social management for the Project. Presented in Volume 3 is the following:

- **Management System** - The Level 1 management system that provides the high level processes and procedures that will govern and guide the company's management, monitoring and reporting of environmental performance. The Management System identifies the corporate and external policies, guidelines and standards to be met, the roles and responsibilities of company staff in environmental management, and how the internal and external processes for reporting.
- **Discipline-specific Management Plans** - The Level 2 management plans that detail the predicted effects on various environmental and social components, the operational mitigation measures identified in the Environmental and Social Impact Assessment, and any monitoring proposed to validate that effects are as predicted. The individual management plans also provide additional detail regarding roles and responsibilities and reporting.

**Volume 4 - Technical Supporting Documents** - Information collected and analyses completed to support the Environmental and Social Impact Assessment.

This Environmental and Social Impact Assessment has been completed in accordance with draft Terms of Reference to be issued in final by Célula de Avaliação de Impacte Ambiental, the lead Guinea-Bissau agency responsible for coordinating the National environmental assessment process in Guinea-Bissau.

## 2 – LEGAL AND INSTITUTIONAL FRAMEWORK

### 2.1 APPLICABLE NATIONAL LEGISLATION

The Constitution of Guinea-Bissau establishes sovereign rights for the Republic of Guinea-Bissau for the preservation or exploitation of living and non-living natural resources. Further to the constitution, a number of laws related to environmental protection and management have been passed.

- **Mining and Minerals Law** - Law 1/2000 (the Mining and Minerals Law) regulates all issues related to the exploration and commercial production of mining substances that exist in the soil or subsoil and in the territorial waters, with the exception of oil. All mining resources in Guinea-Bissau belong to the State and property rights and the issuing of licenses/permits is the sole responsibility of the government. The Mining and Minerals Law sets out the procedures which enable individuals and entities (national or foreign) to be issued with mining leases, licenses, and rights.
- **Basic Law on the Environment** - Guinea-Bissau has developed a framework law on the environment that lays the foundation for environmental policy and environmental assessments. Law No 1/2011 of 2 March 2011 approves the Basic Legislation on the Environment. This law defines the basic concepts, norms, and principles related to the protection, preservation and conservation of the environment. It aims to improve quality of life through the management and rational use of natural resources, to achieve the sustainable use of such resources.
- **Environmental Assessment Law** - Law 10/2010 (the Environmental Assessment Law) regulates environmental and social impact assessment in Guinea-Bissau. The Environmental Assessment Law sets out the types of projects for which an Environmental and Social Impact Assessment is required. The Project is classified as a Category A project due to the potential for negative impacts. As such, a full Environmental and Social Impact Assessment was required for this project.

Law 10/2010 details the Environmental and Social Impact Assessment processes to be followed, requirements for public consultation and disclosure, the components of the studies to be undertaken and resulting reports, and the government agencies that will be involved in the assessment process.

Prior to the above legislation, Guinea-Bissau adopted the Decree-Law No. 5-A/1992 establishing the Water Code. The Water Code objectives include the following:

- Defining the legal regime of all activities relevant with water management
- Defining the institutional framework to implement national policy on water rights, guaranteeing the control and management of water resources
- Regulating water uses
- Guaranteeing the protection of the water quality in order to avoid freshwater pollution or its waste

The Water Code does not adopt end of pipe or receiving water quality objectives.

## 2.2 NATIONAL ENVIRONMENTAL ASSESSMENT PROCESS

The key national regulatory authorities involved in permitting and environmental management of extractive industries are as follows:

- **Ministry of Energy and Natural Resources** - Regulates the mineral industry in Guinea-Bissau, implements its mining policy and regulations, issues mining leases, and develops geological studies and maps.
- **Secretary of State of Environment and Tourism** - Responsible for implementing Guinea-Bissau's environmental policy.
- **Célula de Avaliação de Impacte Ambiental** - The lead authority responsible for coordinating review of the Project's Environmental and Social Impact Assessment. This department is responsible for ensuring, through collaboration with other relevant government departments, that all development projects are analysed for their potential impacts. It is also responsible to ensure that follow-up monitoring is completed and that projects are compliant with the environmental assessment process during operations.

The Secretary of State for the Environment will make a recommendation to the Ministry of Natural Resources and Energy regarding the implementation of the Project based on Célula de Avaliação de Impacte Ambiental's review of the Environmental and Social Impact Assessment. Célula de Avaliação de Impacte Ambiental will then issue an environmental licence that is either a compliance declaration that gives the project proponent one year to implement initial management measures or a compliance certificate that gives the proponent a licence to operate for one to five years. The law further establishes the government's authority to conduct environmental audits (at the expense of the proponent) to check compliance with the conditions of the environmental licence.

It is acknowledged that further national and regional regulatory agencies may be active in monitoring the Mine's performance with respect to their requirements (such as, wildlife and forestry, workplace health and safety, work permits).

## 2.3 CURRENT REGULATORY STATUS

A Mining Agreement was negotiated and signed between the Ministry of Energy and Natural Resources and GB Minerals AG on May 1, 2009. GB Minerals AG is a Switzerland-based entity 100% owned by GB Minerals Ltd. The Mining Agreement allowed for the subsequent issuance of the following mining leases to GB Minerals AG on May 28, 2009:

- Mining Lease No. 001/2009, issued on May 28, 2009, grants the company a Mining Production Licence
- Mining Lease No. 004/2009, issued on May 28, 2009, provides GB Minerals AG with a Mining Licence

GB Minerals is in good standing on both mining leases.

The Mining Agreement is considered the global agreement aggregating and coordinating the above licences and any other agreements or conditions relative to the Project. The Mining Agreement in its entirety includes:

- An Environmental Plan (submitted July 1, 2015)
- Mining Lease (granted)

- Mining License (granted)
- An Annex on Incentives (pending)
- Mining Operations Plan (submitted July 1, 2015)

The Mining Agreement provides GB Minerals with the right to construct and develop a mine to exploit the Farim phosphate deposit, and to construct and operate a port facility and any bridges, roads, transportation pipeline infrastructure required to connect the mine to the Port Site. The Government commits within the agreement to make immediately available the lands required for port infrastructure at the Ponta Chugue area.

#### 2.4 INTERNATIONAL AGREEMENTS AND TREATIES

Guinea-Bissau is a member of the African Union, Economic Community of West African States, Organisation of Islamic Cooperation, the Latin Union, Community of Portuguese Language Countries, La Francophonie and the South Atlantic Peace and Cooperation Zone.

The relevant international environmental and social development agreements to which Guinea-Bissau is a party are identified in the Environmental and Social Impact Assessment .

#### 2.5 INTERNATIONAL STANDARDS AND GUIDELINES

The Environmental and Social Impact Assessment was prepared in accordance with:

- Equator Principles III
- International Finance Corporation Performance Standards on Social and Environmental Sustainability
- Air, noise and water quality standards adopted by the IFC, established by the World Health Organization, or by other jurisdictions
- International Council of Mining and Metals best industry practice guidance documents on community development planning and mine closure

### 3 – ANALYSIS OF ALTERNATIVES

The analysis of alternatives is integral to the evaluation of the environmental, engineering, and economic feasibility of the Farim Project. The purpose of the alternatives analysis is to improve decisions on project design, construction, and operation based on alternative options to the proposed project description. The alternatives assessment process results in an economically feasible mine design that is robust from an engineering perspective.

The following Project alternatives were evaluated in the assessment:

- No development of the Project - the Zero Option
- Mining Methods
- Locations of Waste Management Facilities
- Phosphate Beneficiation
- Product Transport to Port
- Product Export
- Closure Alternatives
- Employee Accommodation

The zero option involves not developing the Project. It is expected that, with mitigation of the more significant adverse socioeconomic effects and enhancement of the beneficial socioeconomic effects, that the socioeconomic environment affected by the Projects is better off with the Project than with the zero option.

All other Project alternatives considered alternative means of carrying out the Project.

#### 4 – PUBLIC CONSULTATION

Public consultation is an important component of any project, in that it provides an opportunity for local stakeholders to engage with Project proponents. Through public consultation communities receive information about the Project and help to inform the Company on the key issues most relevant to stakeholders. Public consultation should be conducted through a proactive approach, meaning that effort should be focussed on the key concerns and managing the expectations of all stakeholders early in the life cycle of the Project. Engagement provides a valuable opportunity for the following:

- Ensure information provided by the Project is accurate
- Manage stakeholder expectations
- Provide the Company and Environmental and Social Impact Assessment team any local knowledge and comments/questions about the Project, in order to consider these in the impact assessment and when developing mitigation

The Farim Phosphate deposit has been known for some time, with exploration and bulk sampling having occurred in the mid-1980s. No public consultation records are available for the 1980s period of exploration, but GB Minerals has documented several consultation campaigns conducted over the period of 2011 through 2015. Additionally, a number of Farim residents have been employed by GB Minerals since 2011 until present.

Given the Project's exploration and stakeholder engagement history, the Project is well known to residents in the Farim area and Oio Region. The overall message from stakeholders is one of support for the Project. In fact, along with this support has been an impatience expressed by local residents, who are keen to realize benefits that are expected from the Project.

The major concerns raised during the public consultation meetings are grouped by key themes and are discussed below.

**Employment** - Many participants were interested in the potential employment opportunities resulting from the Project. Participants indicated their desire for the Project to give priority to local residents. GB Minerals intends to hire as many employees, including men and women, from the Oio Region. Priority will be given to qualified applicants from communities affected by the Project. Local residents will make up the majority of the workforce during construction, and even more so during the operation phase.

**Community Development** - The need for community development and specifically the development of social infrastructure was raised. Participants stated that the Project can benefit local communities through creation of roads, electric power supply, schools, and hospitals. The communities would like the proponent to develop a register to record potential community development opportunities. The communities proposed that it will help the Project at a later stage if they consider initiating community development program; no commitments will be made by undertaking this exercise now. Through its Community Development Plan, GB Minerals will explore the opportunities for community development that will be sustainable and will continue to flourish beyond the life of the Project.

**Health and Safety** - Comments made on potential impacts focused on problems associated with dust and contamination of water and the safety of local residents living around the mine and along the Product Transport Route. GB Minerals has developed a Community Health, Safety and

Security (CHSS) Plan to ensure the safety of all community residents. In addition to the CHSS Plan, GB Minerals will be required to meet internationally accepted thresholds relating to air and water quality.

**Displacement, Resettlement and Compensation** - The launching of the Project will imply expropriation of agricultural land and displacement of villages. Several questions were asked on how and when the populations will be displaced and where they will be resettled. Resettlement will be addressed by GB Minerals following internationally approved standards to ensure proper and fair resettlement and compensation to the affected households. A Resettlement Policy Framework has been developed for the Project. Compensation was a recurrent issue during consultation. Participants wanted to know how they may be compensated for potentially adverse impacts resulting from the Project and how economic benefits from the Project will be made available to them.

**Community Engagement** - Consultation came up as a leading concern for the stakeholders who attended the public consultation meetings. There appeared to be a general feeling that communities have been neglected in the past by both the government and the Project. In many cases the communities do not trust that the Project or the Government are willing to provide support to local communities. Based on consultation activities undertaken in 2015, the perception toward the Project has changed, with people expressing good will towards the Project.

It is important that the Project continues to provide adequate, clear, timely and consistent information about the Project and Environmental and Social Impact Assessment process, as well as information on how stakeholders can participate meaningfully to the Project. GB Minerals has developed a Stakeholder Engagement Plan to guide them in conducting meaningful engagement with relevant stakeholders throughout the life of the Project.

The Environmental and Social Impact Assessment public consultation process will provide a mechanism for disseminating accurate information and supporting the stakeholder engagement process. Both processes enable clear and consistent messages to reach stakeholders.

## 5 – IMPACT ASSESSMENT METHODOLOGY

Environmental and social impact assessment is a planning process intended to identify means of improving upon a development project's environmental and social performance. Specific objectives are to:

- Consider socioeconomic, biophysical and human health factors in the decision-making and design process.
- Identify and avoid or minimize negative impacts.
- Identify and seek to maximize beneficial (positive) impacts.
- Inform the public and other stakeholders (the Government of the Republic of Guinea-Bissau; non-governmental organizations and Equator Principle Financial Institutions (EPFIs) of the expected social and environmental outcomes and seek their input in the decision-making process.
- Give due consideration to plausible alternatives in selecting the preferred Project design and activities, balancing health, safety, environment and community aspects with Project economics, risk and good international industry practice (GIIP).

The processes involved in developing the impact assessment include:

- Conducting environmental and socioeconomic baseline studies.
- Consulting with Project stakeholders, including local communities, administrators and government agencies.
- Identifying potential issues as an outcome of studies and consultation.
- Establishing relevant subject areas and the Project's zone of influence (study areas) to focus the impact assessment.
- Establish where possible measurable benchmarks that can be used as points of reference in the assessments.
- Identifying mitigation strategies, adaptive management opportunities, and contingency plans.
- Evaluating the significance of residual impacts (the impact remaining after mitigation has been applied).
- Developing environmental management measures including monitoring programs to distinguish Project-related impacts from natural changes and to verify impact assessment predictions.

The Environmental and Social Impact Assessment has been completed in accordance with the Draft Terms of Reference (TOR), and the requirements of the Equator Principles III (The Equator Principles Association, 2013), the IFC Performance Standards, and other GIIP have also been applied.

The temporal scope of the assessment includes construction, operation and decommissioning of the Project over a 30 year period, as follows:

- **Construction** - 2 years; assumed to begin in 2016.
- **Operation** - 26 years; assumed to occur between 2018 and 2042.
- **Closure and Post-closure** - 2 years of active closure, followed by a minimum of 5 years of post-closure monitoring; assumed to occur in 2043-2044 and 2045-2049, respectively.

Though the operation phase will conclude partway through Year 26, the assessment has assumed a full 26 years of operation.

The spatial scope of the assessment includes a zone of influence around the following Project components:

- Mine Site at Farim
- Product Transport Route
- Port Site at Ponta Chugue
- Product shipping out of the River Geba

The social zone of influence of the Project includes the villages within or proximate to each of the Project components. The Project will also have a regional influence within the Region of Oio, and socioeconomic impacts at the national scale for Guinea-Bissau.

Each subject area impact assessment presented in Sections 7 through 20 generally follows a common format as follows:

- **Introduction** - The introduction introduces the scope and study areas for each assessment.
- **Baseline Summary** - A summary of baseline information presented at a level of detail appropriate to understanding the impact assessment, with reference to detailed baseline information contained in technical supporting documents (TSDs) in Volume 4.
- **Assessment Methods** - Presents any subject area specific methodology used to evaluate impacts, including any modifiers to the impact assessment methodology described in this section, any relevant thresholds or standards applied, and a brief description of any calculations or modelling used to quantify impacts.
- **Impact Assessment** - The following is provided in the impact assessment section:
- **Project Activities and Potential Impacts** - Relevant Project activities and the corresponding potential impacts predicted to occur for the particular subject area, as well as the Project phase(s) in which they will occur.
- **Mitigation Measures** - Engineering design modifications or other mitigation measures identified to reduce potentially moderate or significant impacts to acceptable levels.
- **Significance of Residual Impacts** - An assessment of the significance of impacts that are expected to remain after mitigation has been applied, based on the assessment methods described earlier in the section, and the significance criteria and evaluation process described below.
- **Prediction Confidence** - Identifies the level of confidence in the significance prediction, arising from the level of supporting baseline information, accuracy of any modelling or quantitative assessment, and/or the level of understanding of the relationship between cause and effect for the subject matter.
- **Follow Up** - Any follow up programs required to manage and/or monitor impacts to ensure proposed mitigation keeps the actual impacts within acceptable limits, as set out in the Environmental and Social Impact Assessment. Follow up programs are presented or forward-referenced in the Environmental and Social Management Plan.

Mitigation measures are identified for adverse impacts that are predicted to be moderately significant and above, in order to reduce the level of significance of the residual impact. Similarly, monitoring programs have been identified for moderate to critically significant impacts to assess the efficacy of the mitigation measures, or where the prediction confidence is low. Reference is made to the

appropriate discipline-specific management plan within the Environmental and Social Management Plan.

The hierarchy of mitigation measures used is as follows:

- **Avoid** - Not carrying out the proposed action through change of design/layout or process or even abandoning the project or aspects of a project.
- **Reduce** - By applying mitigation.
- **Compensate** - Compensation may be identified to off-set impacts. This is the last strategy in the mitigation hierarchy, and is adopted when there are no alternatives to reduce the residual impact. Examples of compensation mitigation measures include the use of biodiversity offsets and resettlement action plans.

The impact assessment ultimately narrows down to professional judgment as to whether or not the predicted impacts are significant. The concept of significance is at the core of environmental assessment and decision-making. The determination of significant impacts relates to the magnitude of an impact combined with the sensitivity of the receptor(s) expected to realize the impact:

$$\text{Significance} = \text{Magnitude (of an impact)} \times \text{Sensitivity (of receptors)}$$

where:

$$\text{Magnitude} = \text{degree of change} + \text{extent} + \text{duration} + \text{frequency} + \text{reversibility}$$

A highly sensitive receptor will be affected by the same level of impact to a greater degree than a receptor that is not sensitive. For example, a moderate magnitude impact will have a greater impact on an endangered species than on a common species. Similarly, socioeconomic impacts can be more pronounced on vulnerable communities, social groups or individuals who are more sensitive to change.

The combination of the magnitude of an impact and the sensitivity of the receptor(s) experiencing the impact determines the significance rating according to the impact significance matrix presented as Table 5.1.

**Table 5.1 Impact Significance Matrix**

Impact Significance		Sensitivity of Receptor			
		Negligible	Low	Moderate	High
Magnitude	Negligible	Negligible	Negligible	Low	Moderate
	Low	Negligible	Low	Moderate	Moderate
	Moderate	Low	Moderate	Major	Major
	High	Moderate	Moderate	Major	Critical

Variations to the above approach are described within the individual impact assessments.

## 6 – SUMMARY OF IMPACTS

### 6.1 OVERALL CONCLUSION

The Farim Phosphate Project, as described in this Environmental and Social Impact Assessment, can be expected to operate reasonably with respect to the environment.

The significance of impacts has been assessed according to the following levels:

- Negligible
- Low
- Moderate
- Major
- Critical

Socioeconomic impacts are rated as negligible, low, moderate or high.

No critical adverse impacts are anticipated as a result of the development of the Project. Adverse impacts of major significance were identified in the areas of:

- **Air Quality** - Mainly particulate matter (PM) concentrations will exceed applicable thresholds; though the majority of the predicted PM concentrations are from baseline conditions. Select exceedances of thresholds for gaseous emissions (SO<sub>2</sub> and NO<sub>2</sub>) are predicted to occur at select village receptors under certain mining scenarios and worst-case meteorological conditions.
- **Noise** - Moderate the major significant noise impacts are predicted at select village receptors along the Product Transport Route
- **Landscape and Visual Amenity** - During the operation phase, impacts of major significance to both the Mine Site landscape as well as the visual amenity as experienced by adjacent communities will occur. These impacts will be reduced to moderate significance following the implementation of mine closure measures described in the Mine Reclamation and Closure Plan.

In addition, the Project is expected to result in positive or beneficial impacts of high significance with respect to:

- Improved health of local communities
- Increases in government revenues
- Increases in business opportunities
- Employment and income, including a long-term improvement in employability beyond the life of the mine

Successful implementation of the Environmental and Social Management Plan is critical to realizing the modest level of adverse impacts and the benefits expected to result from the Project. The Environmental and Social Management Plan has been developed at a conceptual level based on the feasibility study level of engineering completed for the Project, and should be revised and refined based on detailed engineering design and further input from Government and local stakeholders and relevant NGOs.

A summary discussion of the predicted impacts of moderate to major significance is provided below.

## 6.2 DISCUSSION OF MODERATE TO MAJOR SIGNIFICANT IMPACTS

The impacts which were assessed to have a significance rating of moderate or major are summarized below:

### **Air Quality**

- **Particulate Matter** - Air quality impacts of major significance are predicted to occur at a number of village receptors in the vicinity of the Mine Site during one or more scenarios. All of the Mine Site village receptors are predicted to be impacted to some measure (of low or moderate significance). Nearly all air quality impacts are attributable to particulate matter, either or both of PM<sub>10</sub> and PM<sub>2.5</sub>. The most impacted communities affected are those communities to the west of the Mine Site including Farim and the villages between the Mine Site and Farim (i.e., Bani, Army Base and Nema).

Air quality impacts along the Product Transport Route and at the Port Site have been predicted to be of low significance with the exception of Madinga which will experience PM<sub>2.5</sub> concentrations at major significance levels (due to its close proximity to the Mine Site). Four other receptors (Colimessen Cunda, a single residence near Mansoa, a single residence near Dugal, and a single residence near Aroté) will experience moderately significant impacts for particulate matter concentrations.

- **Gaseous Emissions** - Isolated NO<sub>2</sub> impacts of major significance are predicted to occur at Bani, Nema, Farim and Sara loba during certain periods of mining. The fishing beach receptor location is predicted to be impacted by SO<sub>2</sub> at moderate significance and by NO<sub>2</sub> at major significance. The predicted impacts are based on worse case assumptions applied in the air quality dispersion modelling.

The HHERA described in Section 21 and presented as TSD-15 further evaluated the human health risks of the above air quality exceedances and determined that predicted risk levels were considered to be low and likely to be negligible. Particulate matter levels were predicted to be mainly attributable to baseline environmental conditions and not the Project.

### **Groundwater**

- **Groundwater Dewatering Affecting Other Groundwater Users** - Dewatering will occur throughout the course of the Project to ensure the open pits will not flood. Moderate adverse significant impacts have been assessed to occur with respect to decreases in groundwater availability. The affected wells are located within the Town of Farim and the villages of Nema, Sara loba, Urqui, Canico Tumana, Sandjal, and Ufude.

To mitigate these impacts GB Minerals will conduct dewatering in a staged manner, will ensure provision of water of adequate quality and quantity to the affected communities, compensate for any long-term impairment by providing potable water, and continue to monitor the effects of dewatering on these wells.

- **Metal Leaching Affecting Groundwater Quality** - Groundwater quality is important to the communities in the vicinity of the Mine Site as it is the sole source of water for domestic and agricultural use. Metal leaching may occur from ore, tailings, and waste overburden.

Therefore, runoff from waste dump WD-3b, the tailings storage facility, and the ore pad will be managed and treated prior to discharge to the environment, and these facilities will be lined to limit seepage into the groundwater.

The landfill at the Mine Site will be used to dispose of solid, non-hazardous wastes. There is the potential for landfill leachate to impact the groundwater. The landfill will be designed and operated within recognized guidelines and standards to reduce.

### **Surface Water**

- **Diversion of the Rio de Cavaras Marinhos** - Mining of the south and north pits, as well as development of SCP-1 will result in alternations to the existing flow patterns of the Rio de Cavaras Marinhos. The southernmost portion (lower reach) of the tributary will be modified due to the construction of SCP-1. Flows will be intercepted by the pond and allowed to discharge via an engineered spillway and outfall. The upper portions of the tributary will be diverted through the backfilled portion of the North Pit by Year 20 to facilitate mining of the western portions of the north pit. The Rio de Cavaras Marinhos will be diverted towards the Rio de Bunja, thus altering the Rio de Cavaras Marinhos and Rio de Bunja catchment areas.

The primary mitigation measures include sizing of the diversion to an appropriate return period (1:100 year storm) and providing suitable armouring of the diversion channel to resist erosion. At closure the lower reaches of the Rio de Cavaras Marinhos will be re-established; however the upper portions will continue to drain towards the Rio de Bunja.

- **Catchment modifications of the Rio de Bunja and Rio de Caur** - The Rio de Bunja and Rio de Caur catchments will experience further catchment modifications from development of the Mine Site. Impacts to the Rio de Caur catchment will be limited to the development of the TSF, WD-3a, and Year 25 and 26 north pit mining activities. While the mine is operating, surface flows from the TSF and WD-3a will be collected in SCP-2, thereby directing flows to discharge further downstream on the Rio de Caur. Precipitation falling within the TSF will be directed to process, thereby reducing flows into the Rio de Caur. At the end of mining, the TSF/WD-3a/WD-3b will be reclaimed as a single integrated waste landform. The final landform will be capped and slopes will be revegetated and the reductions in flow experienced during the operation phase will be restored close to pre-mining conditions.
- **Discharge of contact water (mine effluent) during the wet season** - Contact water is mine effluent that may be of adverse water quality due to lowered pH and/or elevated total and dissolved chemical constituent concentrations as a result of ARD/ML. A surplus of mine effluent will be generated in the TSF during the rainy season in excess of what can be recycled back to the process plant, and runoff from waste dumps will collect in the SCPs and ECP.

As mitigation against environmental impacts of contact water discharge GB Minerals will conduct additional geochemical evaluation of waste materials before construction and during the life of the mine to improve geochemical understanding and revise waste management plans to minimize and manage adverse water quality from waste overburden stockpiles.

### **Soils and Land Capability**

- **Reduction in Land Capability** - Impacts to soil and landscape changes have the potential to alter land capability, which is the ability of the land to support one or more high value land uses. Within most of the Project footprint, land capability impacts are temporary, however

approximately 24% of the Mine Site footprint will result in permanent changes to the soils and land capability compared to current land uses. To minimize impacts to land capability, the Project footprint has been minimized to the extent possible. Soil management measures will also be implemented, to maximize the capacity of Project-affected land for future post-closure uses.

### **Terrestrial Ecology**

- **Habitat Loss** - Sensitive vegetation communities (habitats) include mangroves, floodplains and rice paddies. These areas have been assessed to have moderate significance as a result of habitat loss. Habitat loss is expected to occur within the Mine Site and Port Site footprints as a result of land clearing activities.

Mitigation measures include clearing the minimum amount of land possible, careful clearing and replanting of vegetation, seed collection and propagation and re-planting of saplings. A nursery community project is recommended as an additional mitigation measure.

- **Spillage** - The spillage of harmful substances into mangroves has been identified as a moderately adverse significant affect. Although accidental spills may occur, GB Minerals has developed procedures for the handling of hazardous materials including fuel, as well as spill contingency procedures within the Emergency Preparedness and Response Plan. These procedures will help mitigate the risks of an accidental release affecting the natural environment.
- **Noise Disturbance** - Noise generated by the Project has the potential to disrupt terrestrial fauna. The mangrove community has been identified as a habitat that is highly sensitive to noise disturbance. Noise can act as a nascence to animals and may encourage them to temporarily leave the area. Mitigation measures identified in the Noise Management Plan will be applied to limit the noise related impacts on the terrestrial ecology of the area. These measures include, but are not limited to maintaining equipment in good working order, reducing unnecessary noise activities and using silencers/mufflers on mobile equipment.
- **Habitat Degradation** - Habitat degradation due to dust has been assessed to have a moderately adverse significant impact on mangroves (the same impact to other vegetation communities were rated low significance). Dust will be generated by the Project and will be amplified by the already dry conditions of the area, particularly during the dry season. Dust mitigation measures provided in the Air Quality Management Plan will be applied.
- **Local Wildlife Migration** - Impacts to local wildlife migrations will occur within all vegetation community types, but the impact within the mangroves community was rated as moderately significant. Both Project sites will be fenced during the life of the Project.

### **Aquatic Ecology**

- **Loss of Mangrove Nursery Habitat for Aquatic Species** - The loss of mangroves at the Mine Site will result in a loss of nursery habitat for aquatic species.
- **Ballast Water Discharges at Port** - Ballast water is used to provide stability to ships as they navigate the waters. As ships are being loaded at the wharf with product, ballast water will be discharged. Unmitigated, ballast water from other geographic locations have the potential to introduce invasive species into the local aquatic ecosystem. Invasive species introductions elsewhere have in some instances caused major changes to the aquatic ecosystems.

The International Maritime Organization requires all ships to manage ballast water in ways that minimize the potential to introduce invasive species, including ballast water exchange in the deep sea and ballast water treatment. GB Minerals will explore options to enforce adherence to the international requirements through contracts or other means as possible.

### **Noise**

- **Noise Guideline Exceedances along Road and at the Port** - Noise impacts will be most pronounced along the Product Transport Route and at the fishing beach adjacent to the Port Site. The already high noise levels measured at the Mine Site, limit the impact that Project induced noise will create. Daytime noise exceedances are predicted at four receptors along the Product Transport Route, while the fishing beach will experience both daytime and night-time noise levels exceeding threshold criteria.

A number of noise mitigation measures are proposed by GB Minerals to limit the impact of noise on sensitive receptors. These include appropriate maintenance and operation of all equipment, limiting certain activities to daytime hours, maintaining road surfaces and limiting transportation to daytime hours.

### **Cultural Heritage**

- **Impacts to Significant Tangible and Intangible Cultural Heritage Features** - The Project will require the relocation of several cultural heritage features of moderate to high sensitivity. This includes a cemetery in Saliquinhe Ba, two sacred groves near Saliquinhe Ba, and mosques in each of Saliquinhe Ba and Tambato. These sites have been included within the scope of the Resettlement Policy Framework (Volume 3), to be relocated outside the Mine Site footprint in close consultation and consent of the affected villages, which will also be resettled. A number of specific management plans will be developed in association with the Cultural Heritage Management Plan, including a Cemetery Relocation Plan, a Sacred Site Relocation Plan and a Mosque Relocation Plan. With effective development and implementation of these plans in concert with the affected communities, the residual impacts are expected to be moderately significant.

### **Landscape and Visual Amenity**

- **Landscape Impacts** - The development of the Project will change the landscape and visual amenity of the Mine Site area and the Port Site area. The landscape at the Mine Site and Port Site will be altered with the development of the north and south pit, tailings storage facility, waste dumps and Port Site infrastructure. Most adverse effects to landscape will be experienced at the south pit due to the number of highly sensitive landscape types present. Major adverse effects are predicted during the operation and closure phase at the north pit. The area of the ex-pit waste dumps will experience major adverse landscape impacts during the operation phase. The significance of impacts is predicted to reduce following the closure of the mine to moderate at the north pit, south pit and ex-pit waste dumps and to low at the tailings storage facility. The Port Site is predicted to have moderate adverse significant impacts on the landscape throughout the life of the Project.
- **Visual Amenity** - Various Mine Site components will be visible from most of the observation points studied. Major adverse significance is predicted for all observation points at the Mine Site

with the exception of one operation point which will experience low adverse significant impacts. At the Port Site, two communities Ancone and Aroté are assessed to experience major adverse visual impacts as a result of Port Site infrastructure during the operation phase. At the Port Site, impacts during the closure phase are reduced for all identified observation points to moderate and low impact significance.

### **Traffic**

Current traffic in the region largely consists of pedestrian and bicycle traffic, followed by motorcycle traffic. The regions residents are not accustomed to heavy goods vehicles and the anticipated increase in traffic as a result of the Project. The main impact of Project related traffic on local residents is to their safety, both along the Product Transport Route and on the River Geba. Impacts to resident safety can be tied back to the other identified traffic impacts including:

- **Traffic Flow** - Increase in the volume of vehicles can impact the safety of other road users who are not accustomed to high levels of motorized transport and particularly heavy goods vehicles. The presence of large ore carriers on the River Geba will drastically alter the current traffic flow, which is made up of a relatively small number of canoes operated by artisanal fishermen.
- **Infrastructure Deterioration** - Reduced quality of road conditions due to increases in traffic can impact the safety of other users.
- **Environmental Disturbance** - Accidental spills or dust generated by Project traffic impacting local residents' health.

Road traffic impacts will be most pronounced in communities along the Product Transport Route past the turn off from Dugal toward the Port Site as this area currently experiences very little traffic. Marine traffic on the River Geba will also be impacted as current traffic consists of artisanal fishermen using canoes, who are unfamiliar with large ocean going vessels. The dock infrastructure and the ore carriers maneuvering at the Port Site will impede on the existing fishermen traffic.

The impacts of traffic will be most pronounced during the construction phase when traffic volumes are expected to be highest and when local residents are just beginning to be introduced to these other forms of traffic. During operations the impact of traffic is expected to remain at moderately adverse significance. The volume of traffic will be slightly below that of construction traffic. Residents would have had the opportunity to become accustomed to the new traffic make-up of the area and would have also been educated on traffic safety. Following closure the impact of traffic is expected to be reduced to low for traffic safety, environmental disturbance and infrastructure deterioration. Traffic flow impacts are assessed to remain moderate during active closure.

To mitigate traffic related impacts, GB Minerals will impose speed limits, limit driving to daytime hours, require drivers to undergo driver training, provide education awareness campaigns to residents and post signage. GB Minerals will regularly inform River Geba users of the shipping and port operations schedule.

### **Socioeconomics**

- **Physical and Economic Displacement** - There are two aspects of land acquisition, which apply to this Project:
  - Physical relocation of households, where homes and livelihoods will need to be replaced
  - Infringement on livelihoods, where compensation will be required

Five villages in the Mine Site area will be relocated as a result of the Project. These communities include Tambato Mandinka, Canico, Saliquehnie, Ponta Capsec and Ponta Zeca/Saliquenhe Porto. No relocation of villages will need to be conducted along the Product Transport Route or at the Port Site.

Households that are impacted by land acquisition but do not have direct loss of a place of residence are referred to as economically displaced households. For these households the impact is a result of loss of assets or the loss of access to assets. The number of households that would fall into this category has not yet been estimated. However, given the majority of land use in the area is undertaken by neighbouring villages, it can be assumed that most of the households affected at the Mine Site will be part of the communities that will be resettled.

At the time of the completion of the Environmental and Social Impact Assessment, the full extent of resettlement and compensation was estimated using socioeconomic baseline data collected and land use mapping to identify potential land uses and crops that will need to be compensated. The Resettlement Policy Framework was undertaken as an initial precursor to a detailed Resettlement Action Plan, which will be developed in consultation with impacted communities and government authorities. A detailed asset inventory survey will be undertaken as part of Resettlement Action Plan development.

- **Community Infrastructure and Resources** - The infrastructure in the area is limited and many villages in the region do not have access to schools or health clinics. The potential influx of workers may strain the local infrastructure in the area. This may result in longer wait times for health services or reductions in the quality of care provided, reduced education quality and conflict between local residents and individuals economically benefiting from the Project who may 'purchase' services.

Although the influx of migrants may cause strain on local infrastructure, investment in the area by GB Minerals and the Government of Guinea-Bissau will result in improvements to locally available infrastructure and services. Through GB Minerals' Community Development Plan legacy projects that may include infrastructure and service improvements are planned. Taxes and revenues generated by the Government of Guinea-Bissau can be reinvested into the areas service and infrastructure. These initiatives would improve current and future resources and services in the area.

- **Community Health** - An increase in communicable diseases and sexually transmitted infections may occur in the region as a result of the Project. This is largely due to in-migration of people that may have been exposed to communicable diseases and sexually transmitted infections that have the potential to spread it to the local population, close living conditions, as well as poor hygiene practices. Mine and transport industries are known to attract high-risk groups for the transmission of sexually transmitted infections.

In another aspect, the development of the Project can lead to overall improved health of local communities. The improvement to health can result from education and awareness campaigns on the spread of disease, how to manage disease from spreading and how to protect oneself from contracting disease and through investment into regional health services, thereby improving the quality of care available to the local population.

- **Local Economic Development and Employment** - The Project will lead to local economic development in the region and to employment. Increase in revenue for the Government of Guinea-Bissau will result, allowing the government to reinvest in the country and help to improve its economic status. Business opportunities will arise as a result of the Project, as support services for the Project will be required and as disposal incomes increase more individuals will be able to purchase goods or services within the region. Direct and indirect employment will result from the Project. The Project will support an average of 660 workers during the operation phase. Indirect employment numbers, although not estimated are generally greater than direct employment numbers. The Project will also result in improved long-term employability of individuals as training and job experience will make them desirable to other companies for employment following the closure of the Mine.

Adverse economic effects may transpire as a result of the Project. One such impact is increased inflation, which may limit the purchasing power and impact households that are not economically benefiting from the Project. An economic depression may occur following the construction phase (which generally requires greater dependence on support services and the purchasing of goods) and following the closure of the Project. To reduce the impacts of a potential economic depression, it will be important for GB Minerals to engage in community development projects that are sustainable and able to survive beyond the life of the Mine. Loss of employment following mine closure is the final adverse economic impact. However, given the improved employability of workers, the opportunities for other jobs will be improved.

## 7 – ENVIRONMENTAL MANAGEMENT

### 7.1 OVERVIEW

Volume 3 of the Environmental and Social Impact Assessment is the Environmental and Social Management Plan. The purposes and objectives of the Environmental and Social Management Plan are to:

- Summarize commitments made in the Environmental and Social Impact Assessment
- Provide the regulatory and institutional framework (company policies) under which the Environmental and Social Management Plan can be further developed and implemented
- Identify the systems GB Minerals will employ to manage its environmental and social risks, including the Project Management structure for social and environmental responsibility, and the responsibilities that will be assigned to GB Minerals staff or its contractors
- Identify and describe monitoring requirements and permissible levels (targets) for monitoring
- Identify general training requirements
- Provide an implementation schedule and budget for implementing mitigation measures and the monitoring program
- Define reporting and change management procedures

The Environmental and Social Management Plan consists of the following hierarchy:

- **Level 1 - Management System** - The main body of this volume.
- **Level 2 - Discipline-specific Management Plans** - Identified in the Management System, for which conceptual level plans have been included in the appendices of this volume.
- **Level 3 - Standard Operating Procedures** - Detailed instructions or operational standards for executing the discipline-specific management plans. Most Level 3 standard operating procedures will be developed as the Project moves into the detailed engineering design and construction phases.

The **Level 1 Management System** is structured as follows:

- **Section 1 - Introduction** - Presents the background to the study, an overview of the Project, the Environmental and Social Management Plan approach and report structure.
- **Section 2 - Legal and Institutional Framework** - Presents a summary of the national legislation and international standards, guidelines and best management practices, as well as GB Minerals' corporate policies and commitments.
- **Section 3 - Organizational Capacity** - Outlines the organizational structure proposed to implement the Environmental and Social Management Plan. It includes proposed training and capacity building programs to be adopted.
- **Section 4 - Impact Mitigation and Monitoring** - Summarizes the residual environmental and social impacts following mitigation identified in the Environmental and Social Impact Assessment, and provides a summary of the mitigation measures planned to offset the Project's adverse consequences and enhance positive environmental and social impacts in tabular format. It includes the associated monitoring to ensure compliance, together with responsibilities and an estimate of associated costs.

- **Section 5 - Monitoring Evaluation and Reporting** - This section outlines the specific monitoring program to confirm and demonstrate the efficacy of the Environmental and Social Management Plan. It also includes measures to be adopted in the event of non-compliance with the Environmental and Social Management Plan and/or an emergency.
- **Section 6 - Implementation Schedule and Cost Estimate** - Outlines how the Environmental and Social Management Plan will be aligned with the overall project schedule along with a cost estimate to implement the Environmental and Social Management Plan.

The following **Level 2 discipline-specific management plans** have been included:

- Air Quality Management Plan
- Noise Management Plan
- Erosion and Sediment Control Plan, which includes a preliminary Soil Salvage Management Plan
- Water Management Plan
- Biodiversity Management Plan
- Waste Management Plan
- Occupational Health and Safety Plan
- Emergency Preparedness and Response Plan
- Preliminary Mine Reclamation and Closure Plan
- Stakeholder Engagement Plan
- Community Health, Safety and Security Plan
- Community Development Plan
- Cultural Heritage Management Plan
- Resettlement Policy Framework

**Candidate Level 3 Standard Operating Procedures** to be considered for development in the future include:

- Land Clearance Procedures
- Topsoil Stripping and Stockpiling Procedures
- Air Quality Monitoring Procedures
- Groundwater Monitoring Procedures
- Groundwater Dewatering Procedures
- Surface Water Monitoring Procedures
- Chance Finds Procedure
- Site Inspection Procedure
- Vehicle Inspection Procedures
- Emergency Response Procedures

The Environmental and Social Management Plan is an integral part of the Environmental and Social Impact Assessment, but will act as a stand-alone document which specifies the organizational structure including resources, capacity, training needs, roles and responsibilities, the impact and mitigation summary, the monitoring program and the procedure for the management of changes having a potential environmental impact. The Environmental and Social Management Plan will be

updated as needed throughout the Project life in response to changes in project circumstances, legislation and guidance, unforeseen events, and the results of monitoring.

Contractors vying for contracts with GB Minerals will be required to include environmental and social management measures that are aligned with this Environmental and Social Management Plan. If required, GB Minerals will develop draft contract documents aligned with the Environmental and Social Management Plan and the above mentioned objectives so that contractors can include environmental and social management in their tender documents.

## 7.2 IMPLEMENTATION SCHEDULE

The Environmental and Social Management Plan informs the overall planning process of the Project. The Environmental and Social Management Plan guides the planning and design, construction and operational phases of the development to eliminate or mitigate the various possible risks to the environment and its surrounding inhabitants during the planning and pre-construction phase. In addition, this practice will subsequently minimize damage to the study area during the Project.

This Environmental and Social Management Plan will be used during the pre-construction, construction, operational and decommissioning phases of the proposed project, and will be updated periodically as the Project develops.

The implementation schedule is described at a conceptual level in Table 7.1.

**Table 7.1 Environmental and Social Management Plan Implementation Schedule**

Step	Schedule Detail
1	Draft Environmental and Social Management Plan submitted to Guinea-Bissau Government (completed)
2	Environmental and Social Management Plan revised, included with Environmental and Social Impact Assessment, impacts and mitigation table included (completed)
3	Guinea-Bissau Government/lender due diligence generates Environmental Social Action Plan; Environmental and Social Management Plan revised to address input and updated based on detailed design prior to construction

## 7.3 COST ESTIMATES

Table 7.2 presents the estimated life of project environmental and social management costs for the Project, inclusive of mine closure.

This estimate excludes GB Minerals staff salaries and facilities required by management plans (e.g., environmental laboratory setup). This cost estimate was prepared using professional judgment, and is based on the Project design presented in the Environmental and Social Impact Assessment and feasibility study. The cost estimate should be updated following completion of detailed design and prior to construction.

**Table 7.2 Environmental and Social Management Plan Implementation Cost Estimate**

<b>Environmental and Social Management Plan Actions</b>	<b>Construction (2 years)</b>	<b>Operations (26 years)</b>	<b>Closure (7 years)<sup>3</sup></b>	<b>Total (\$USD)</b>
Biodiversity Management <sup>1</sup>	529,000		-	529,000
Community Resettlement and Cultural Heritage <sup>2</sup>	3,800,000		-	3,800,000
Environmental Monitoring Laboratory Testing & Monitoring (water, soil, air, noise)	38,000	1,950,000	-	1,988,000
Technical Consultants	400,000	10,400,000	-	10,800,000
Community Relations	400,000	5,200,000	-	5,600,000
Training	100,000	1,300,000	-	1,400,000
Final Mine Closure	-	-	11,180,000	11,180,000
			<b>Total</b>	<b>35,297,000</b>

**NOTES:**

1. BASED ON A PERIOD OF TEN YEARS AND DOES NOT INCLUDE THE COSTS FOR GB MINERALS TO EMPLOY A BIODIVERSITY CONSERVATION OFFICER.
2. BASED ON COSTS ASSOCIATED WITH IMPLEMENTING SCENARIO 2 OUTLINED IN APPENDIX 3P.
3. FINAL MINE CLOSURE COST ESTIMATE INCLUDES ENVIRONMENTAL MONITORING, TECHNICAL CONSULTANTS, AND COMMUNITY RELATIONS DURING THE ACTIVE CLOSURE PHASE (2 YEARS) AND POST-CLOSURE MONITORING PHASE (5 YEARS).