

Simandou Project

Social and Environmental Impact Assessment (SEIA)

Marine Offloading Facility



Company:	Rio Tinto
Product Group:	Iron Ore
Business Unit:	Simfer SA
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Abbreviations

Abbreviation	Definition
AIDS	Acquired immune deficiency syndrome
ANFO	Ammonium nitrate-fuel oil (blasting agent)
ARI	Average Recurrence Interval
ART	Antiretroviral therapies
ASS	Acid Sulphate Soils
BCD	Below Chart Datum
BGEEE	Bureau guineen d'evaluation des etudes environnementales (Guinean Environmental Impact Assessment Bureau)
CD	Chart Datum
CFC	Chlorofluorocarbon
CSD	Cutter Suction Dredger
dB	Decibel
DOC	Dissolved Organic Carbon
EMP	Environmental Management Plan
EPCM	Engineer, Procure, Construct and Manage
ERM	Environmental Resources Management
EU	European Union
GDP	Gross Domestic Product
GPS	Global Positioning System
HGV	Heavy Goods Vehicle
HIV	Human immunodeficiency virus
HSEC	Health, Safety, Environment and Communities
Hz	Hertz
IAHP	International Association of Ports and Harbours
IBA	Important Bird Areas
IFC	International Finance Corporation
IMO	International Maritime Organisation
KBA	Key Biodiversity Areas
kHz	Kilohertz
LSC	Logistical Supply Centre
MD	Managing Director
MOF	Marine Offloading Facility
MSL	Mean Sea Level
MSDS	Material Safety Data Sheet
NECC	North Equatorial Counter Current
NGO	Non Governmental Organisation

Abbreviation	Definition
NO ₂	Nitrogen dioxide
NTU	Nephelometric turbidity units
O ₃	Ozone
PIANC	World Association for Waterborne Transport Infrastructure
PM _{2.5}	Particulate matter with with a diameter of 2.5 micrometres or less
PM ₁₀	Particulate matter with with a diameter of 10 micrometres or less
psu	Practical salinity units
RTC	Road Traffic Collisions
rms	Root mean square
Ro-Ro	Roll-on roll-off
RTIOEP	Rio Tinto Iron Ore Expansion Projects
SEIA	Social and Environmental Impact Assessment
SEIS	Social and Environmental Impact Study
SEL	Sound exposure level
SEMP	Social and Environmental Management Plan
SEP	Stakeholder Engagement Plan
SPMT	Self Propelled Modular Transporters
STI	Sexually Transmitted Infections
SO ₂	Sulphur dioxide
TB	Tuberculosis
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
ToR	Terms of Reference
TSHD	Trailing Suction Hopper Dredger
TSS	Total Suspended Solids
UNESCO	United Nations Educational, Scientific and Cultural Organization
VCT	Voluntary Counselling and Testing
WHO	World Health Organisation
WMP	Waste Management Plan
WWTP	Waste Water Treatment Plant

Glossary

Term	Definition
Acid-sulphate soils	Acid sulphate soil (ASS) are soils and sediments containing iron sulphides. When exposed to air due to drainage, these soils produce sulphuric acid and often also release iron, aluminium and heavy metals.
Aeolian	Of or relating to the wind; produced or carried by the wind.
Affected Community	Local communities that are affected by a project either positively or negatively.
Airshed	The air around us.
Alluvial	Sediment deposited by flowing water, as in a river bed, flood plain or delta.
Alternatives Analysis	Analysis to examine feasible alternatives such as alternative project locations, designs or operational processes, or alternative ways of dealing with social and environmental impacts.
Anthropogenic	Relating to humans.
Aquifer	An underground layer of porous rock or sediment that contains water.
Articulated heavy haul truck	All-wheel drive, off-road dump truck.
Associated Infrastructure	Infrastructure whose viability and existence depend exclusively on the Project and whose goods or services are essential for the successful operation of the Project.
Baseline Data	Data gathered during the Social and Environmental Assessment used to describe existing conditions in the area of the project, such as physical, biological, socio-economic, and labour conditions, including any changes before the project commences.
Bas Fonds	Wetlands of high productivity in lower valleys, mainly used for vegetables, cassava, sweet potatoes.
Benthic	The ecological zone at the lowest level of the water column including the surface layer of sediment.
Biodiversity	Integrating concept that includes the ecosystems within which the people of the world live, as well as the multitude of species that are used by humankind for food, fibre, medicines, clothing and shelter. Biodiversity is the variety of life in all its forms, including genetic, species and ecosystem diversity.
Biodiversity Action Plan	Process which assess how the proposed activities affect biodiversity and renewable natural resources, determine how biodiversity and renewable natural resources can be managed as part of the client's activities and how adverse impacts can mitigated and identifies responsibilities (internally and externally) and resources for management and mitigation.
Bioregion	Relating to the geographical area characterised by distinctive flora and fauna.
Bogoni	Rice fields in direct contact with the sea and sea channels that are only used for rice cultivation.
Bonded Labour	Practice that by which forced labour is extracted by creating debt or other obligations not based on a valid and mutually beneficial economic purpose that must be worked off on terms that effectively prevent the worker's exit from the work.
Bony fish	Fish that have a skeleton made of bone.
Bowsers	A vehicle tanker containing fuel or water.
Bunding	Containment around a storage area to contain the contents in case of rupture or spillage.
Cavitation	A source of underwater noise caused by a vessel's propeller.

Term	Definition
Cetaceans	(Phylum Chordata, Class Mammalia). Species include dolphins and whales.
Chance Find Procedure	A project-specific procedure that will operate if previously unknown cultural heritage resources, particularly, archaeological resources, are encountered during project construction or operation. The procedure includes record keeping and expert verification procedures, chain of custody instructions for movable finds, and clear criteria for potential temporary work stoppages that could be required for rapid disposition of issues related to the finds.
Child Labour	Work by children that is economically or likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral or social development. Obligations on child labour are extended to the client's supply chain.
Consultation	Consultation involves two-way communication between the Project and the affected communities. The consultation process should be undertaken in a manner that is inclusive and culturally appropriate and that provides the affected communities with opportunities to express their views on a project risks, impacts and mitigations measures, and allows the client to consider and respond to them. The consultation process will ensure free, prior and informed consultation.
Continental shelf	An undersea extension of a continent.
Culvert	A man made structure used to channel water.
Cumulative impact	Impacts that arise from multiple Projects within a region.
Dara	Fields on plains not in direct contact with the sea that are used mainly for rice.
Demersal	The part of the water column that is near to the seabed and the benthos. Demersal fish are those that spend the majority of their lifecycle on or near to the seabed.
Desiccation-tolerant	The ability of a plant or animal to withstand drying out.
Dynamic equilibrium	In geomorphology, the term 'dynamic equilibrium' refers to
Echinoderms	(Phylum Echinodermata) are invertebrate marine organisms usually characterised by a five-fold symmetry. Examples include: sea urchins and starfish.
Ecosystem	The interrelationships between all living organisms in a given area, and their relationships to non-living materials.
Ecosystem Services	The benefits that people obtain from ecosystems, including: provisioning services (such as food, fibre, fresh water, fuel wood, biochemicals, genetic resources); regulating services (such as climate regulation, disease regulation, water regulation, water purification, degradation of pollutants, carbon sequestration and storage, nutrient cycling); and cultural services (spiritual and religious aspects, recreation and ecotourism, aesthetics, inspiration, educational values, sense of place, cultural heritage).
Edge effect	Increase in number of common species that normally are present in the marginal habitat at the expense of species typical of the interior habitat.
Elasmobranchs	(Phylum Chordata, Class Chondrichthyes) Cartilaginous fishes, including sharks, rays and skates.
Emergency Response Plan	Plan to address contingencies associated with process upset and accidental circumstances. They include clearly assigned responsibilities for the assessment of the degree of risk to life and property with procedures on whom to communicate different types of emergencies with and how.

Term	Definition
Endemic species	A species that is only found in a particular region and nowhere else in the world. Since these species are not widespread and may be confined to only one or two protected areas, they are of great conservation concern.
Equinoctial tides	Twice yearly highest spring tides.
Estuaries	A partly enclosed body of water that has one or more rivers flowing into it and is connected to the open sea.
Floatel	Accommodation barge
Food chain	A feeding hierarchy where a flow of energy is moved from one organism to another. For example: trees and shrubs (producer) → giraffe (herbivore) → lion (carnivore).
Geogrid	Material used to reinforce soils and similar materials.
Geo textiles	A strong synthetic fabric used in civil engineering to retain an embankment.
Grievance	A grievance is a complaint or concern raised by an individual or organisation who judges that they have been adversely affected by the Project during any stage of its development. Grievances may take the form of specific complaints for actual damages or injury, general concerns about Project activities, incidents and impacts, or perceived impacts.
Grievance Procedure	Procedure developed by the Project in accordance with IFC requirements: to receive and facilitate resolution of concerns and grievances about the client's environmental and social performance;. procedure for workers (and their organizations, where they exist) to raise reasonable workplace concerns; and procedure to receive and address specific concerns about compensation and resettlement that are raised by displaced persons or members of host communities.
Ground-truthing	Field trip to gather data that either complements or disputes airborne remote sensing data.
Habitat	The locality or environment in which an animal lives.
Harmattan	A dry and dusty West African wind.
Hazardous Waste	Substances classified as hazardous wastes possess at least one of four characteristics- ignitability, corrosivity, reactivity or toxicity – or appear on special lists.
Heritage	Valued objects and qualities such as cultural traditions, unspoiled countryside, and historic building that have been passed down previous generations.
HSEC-MS	See Social and Environmental Management System.
Hydrodynamic	Relating to moving liquids.
Hydrophilic	Substances that are attracted to, and dissolve well within, water.
Hypersaline	Very high salt concentrations in water.
Infectious Disease	Illnesses that are attributable to specific infectious agents or their toxic products that arise through transmission of these agents or their products from an infected person, animal or inanimate reservoir to a susceptible host. Examples include water-borne, water-related, food-borne, respiratory diseases and sexually transmitted diseases.
Information Disclosure (also Public Disclosure)	The process of providing information to the affected communities and other stakeholders that is timely, accessible, understandable, and in the appropriate language(s). For projects with potential adverse impacts, information on the purpose, nature and scale of the project, the duration of proposed project activities, and any potential risks to and potential impacts on such communities should be included.
Intangible Cultural Heritage	Cultural knowledge, innovations and practices of communities embodying traditional lifestyles.

Term	Definition
International Good Practice	The exercise of professional skill, diligence prudence and foresight that would reasonably be expected from skilled and experienced professional engaged in the same type of undertaking under the same or similar circumstances globally.
Invasive species	Non-native species that upset the balance of the ecosystem as they may be bigger, faster growing or more aggressive than the native species.
Isobath	A contour line on a map connecting points of equal depth in a body of water.
IUCN Red List	This list has been developed by the International Union for Conservation of Nature (IUCN) and details the global conservation status of a wide range of biological species. List of species that are designated by the World Conservation Union (IUCN) to be critically endangered or endangered. The Red List website is http://www.redlist.org .
Landscape	A geographical mosaic composed of interacting ecosystems resulting from the influence of geological, topographical, soil, climatic, biotic and human interactions in a given area.
Laterite	Red soils that are rich in iron oxide.
Lay down area	Temporary storage area for supplies and materials.
Mitigation measures	Designs, and methods for construction, operation and closure of a project that are introduced into the plans for a project, to prevent adverse impacts, where impacts cannot be prevented altogether, to reduce them as low as is technically and financially feasible, and to remedy or compensate for adverse effects, and measures to provide and enhance the positive benefits of a project.
Modified habitats	Land and water areas where there has been apparent alteration of the natural habitat, often with the introduction of alien species of plants and animals, such as agricultural areas.
MOF	Marine Offloading Facility used as service port and transit point of equipment and materials used during the construction and operation phase of the Simandou Project.
Mono-specific	A genus that contains only one known species.
Morphodynamic	Relating to the movement of sediments.
Natural habitats	Land and water areas where the biological communities are formed largely by native plant and animal species, and where human activity has not essentially modified the area's primary ecological functions.
Non-native species	An introduced, alien, exotic or non-indigenous species, or simply an introduction, is a species living outside its native distributional range, which has arrived there by human activity, either deliberate or accidental. Some introduced species are damaging to the ecosystem they are introduced into (eg weeds), others negatively affect agriculture and other human uses of natural resources, or impact on the health of animals and humans.
Occupational Health and Safety	Refers to the range of endeavours aimed at protecting workers from injury or illness associated with exposure to hazards encountered in the workplace or while working.
Particulate Matter	Fine particles of solid matter.
Patrilineal	Relating to tracing ancestral descent through the paternal line
Peak sound level	A measurement of an impulsive underwater source.
Peak-to-peak sound level	A measurement of an impulsive underwater source.
Pelagic	The part of the water column in the open sea that is not closely associated with seabed.
Pollution	Refers to both hazardous and non-hazardous pollutants in the solid, liquid or gaseous forms, and is intended to include other forms such as nuisance odours, noise, vibration, radiation, electromagnetic energy and the creation of potential visual impacts including light.

Term	Definition
Polychaetes	(Phylum Annelida, Class Polychaeta) are truly segmented worms, mostly marine, and are characterized by extensions of each segment with numerous bristles projecting from them.
Primary forest	Forest which has never been subject to human disturbance, or has been so little affected by hunting, gathering and tree-cutting that its natural structure, functions and dynamics have not undergone any changes that exceed the elastic capacity of the ecosystem.
Protected areas	An area of land and/or sea especially dedicated to the protection of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.
Ramsar site	Wetlands designated by the contracting parties for inclusion in the List of Wetlands of International Importance because they meet the Criteria established under the Ramsar Convention.
Receptor	Any ecological or other feature that is sensitive to, or has the potential to be affected by an activity.
Resettlement and Compensation Policy Framework	Establishes the principles and procedure that will be followed in planning resettlement and awarding compensation to people who are physically or economically displaced by a project, including the process by which people can raise a grievance if they consider that have been adversely affected or unfairly treated.
Residual Impacts	Residual impacts are impacts that remain after mitigation measures, including those incorporated into the project's design, have been applied.
Root mean square sound level	A measurement of a continuous underwater sound.
Sand ripple	Underwater dunes (ripples) formed on a bed of sand or gravel under the action of water flow and waves.
Sea squirt	A marine species with a cylindrical or globular body enclosed in a tough outer covering.
Secondary habitats	Habitats that have been disturbed and / or is being restored, for example degraded forest recovering from selective logging or areas reclaimed after being cleared by slash-and-burn agriculture.
Simfer S. A.	A Guinean registered company and currently jointly owned by the Rio Tinto Group (95%), and the International Finance Corporation (IFC – 5%). The Government of Guinea has an option to acquire up to a 35% equity interest in Simfer S.A.
Skeletal soils	Soils that are well drained and of medium or fine texture.
Social and Environmental Impact Assessment (SEIA)	The process of predicting and evaluating the social and environmental impacts and risks of a proposed project and identifying mitigation measures that will enable the project to meet the requirements of stakeholders, applicable laws and regulations, and any additional requirements for social or environmental performance identified by the Project, and so that impacts are as low as technically and financially feasible.
Social and Environmental Management Plan (SEMP)	A plan setting out all the proposed mitigation measures that the proponent of a project will take to prevent, reduce, remedy and compensate for adverse effects, and to maximise the benefits of the project. Also the plan for monitoring and auditing that will be undertaken to confirm compliance with the SEMP.
Social and Environmental Management System (SEMS)	Part of the client's overall management system for the project, the Social and Environmental Management System includes the organizational structure, responsibilities, policies, procedures and practices, and resources and is essential for successfully implementing the project-specific management plan developed through the social and environmental assessment of the project. A good management system

Term	Definition
	enables continuous improvement of the project's social and environmental performance, and can lead to improved economic, financial, social and environmental project outcomes (also referred to in Rio Tinto as the Health, Safety, Environmental and Communities Management System – HSEC-MS)
Sound exposure level	The total noise energy delivered over a measured duration averaged over 1 sec.
Stakeholder Engagement	Part of the Social and Environmental Assessment, stakeholder engagement is an ongoing process involving disclosure of information, consultation with affected communities, and the establishment of a grievance mechanism.
Subaquatic vegetation	Plants that grow and live underwater
Turbidity	The measure of the degree to which water losses transparency due to the presence of suspended particles.
Weed	A plant whose presence is considered unwanted. Weeds may be unwanted for a number of reasons; they might be unsightly, or crowd out or restrict light to more desirable plants or use limited nutrients from the soil. They can harbour and spread plant pathogens that infect and degrade the quality of crop or horticultural plants. Some weeds are a nuisance because they have thorns or prickles, some have chemicals that cause skin irritation or are hazardous if eaten, or have parts that come off and attach to fur or clothes.
Working conditions	Conditions in the workplace and treatment of workers. Conditions in the workplace include the physical environmental, health and safety precautions and access to sanitary facilities. Treatment of workers includes disciplinary practices, reasons and process for termination of workers and respect for the workers personal dignity.

Simfer SA

Simandou Project

Marine Offloading Facility

Social and Environmental Impact Assessment (SEIA)

Non-Technical Summary

1 Introduction

This document is a non-technical summary of a Social and Environmental Impact Assessment prepared for a group of early construction activities associated with the Simandou Project. The Simandou Project is a world-scale iron ore mining project in Guinea, West Africa, being planned by Simfer S.A. (Simfer), a member of the Rio Tinto Group. Simfer holds a mining concession for the southern part of the Simandou range in south-eastern Guinea, in partnership with the International Finance Corporation and the Government of Guinea. The Simandou Project also includes a trans-Guinean railway and a deepwater port for export of iron ore from the country. Main construction activities for the Simandou Project are scheduled to commence in 2012. The early construction activities include: development and initial operation of the Marine Offloading Facility, associated temporary worker accommodation, a quarry and a combination of new roads and upgrades to existing roads. Collectively, these activities are referred to as the Project.

The purpose of the SEIA report is threefold:

- to provide information on the proposed developments;
- to explain how the proposed developments have been planned and designed to minimise the potential for adverse environmental and social effects; and
- to explain how the proposed developments have been planned and designed to maximise benefits.

This non technical summary highlights the main components of the Project and key baseline sensitivities that may be affected by the Project. It summarises key impacts and explains measures which have been designed to avoid, reduce, remedy or compensate for adverse impacts. A range of smaller scale impacts will also prevail and are covered in detail in the SEIA report, including measures to avoid and reduce the impact. The SEIA studies have been undertaken by an international team coordinated by Simfer including a number of international and Guinean specialists.

2 The Project

The 'Project' consists of a Marine Offloading Facility (MOF), a quarry, new roads and upgrades to existing roads (see *Figure 1*). The MOF will include facilities for worker accommodation, warehouses, an extensive laydown area, fuel supply and storage. The MOF will be located close to the river mouth of the Morebaya River in the Maferinya sub-district, just north of Ile Kabak. The MOF will facilitate the import of construction materials and equipment for use in construction of the main mine, rail and port development. The quarry at the site of an existing 19 ha rock outcrop will provide necessary rock and crushed stone for construction activities associated with the main port development.



- Principal Road / Route Principale
- - - Upgrading of Existing Road /
Modernisation des Routes Existantes
- - - New Road Corridor (Tentative Alignment) /
Nouveau Routier (Alignement Provisoire)



CLIENT: Simfer SA		SIZE: A4	TITLE: Figure 1 Project Setting / Definition du projet	
ERM 0 5 Kilometres				
SOURCE: NASA Landsat Program, 2003 PROJECTION: WGS 1984 UTM Zone 28N		DATE: 14/11/2011		CHECKED: MK
		DRAWN: GN		APPROVED: KR
		PROJECT: 0131299		SCALE: As scale bar
		DRAWING: po_PMOF_Non_Tech.mxd		REV: 0

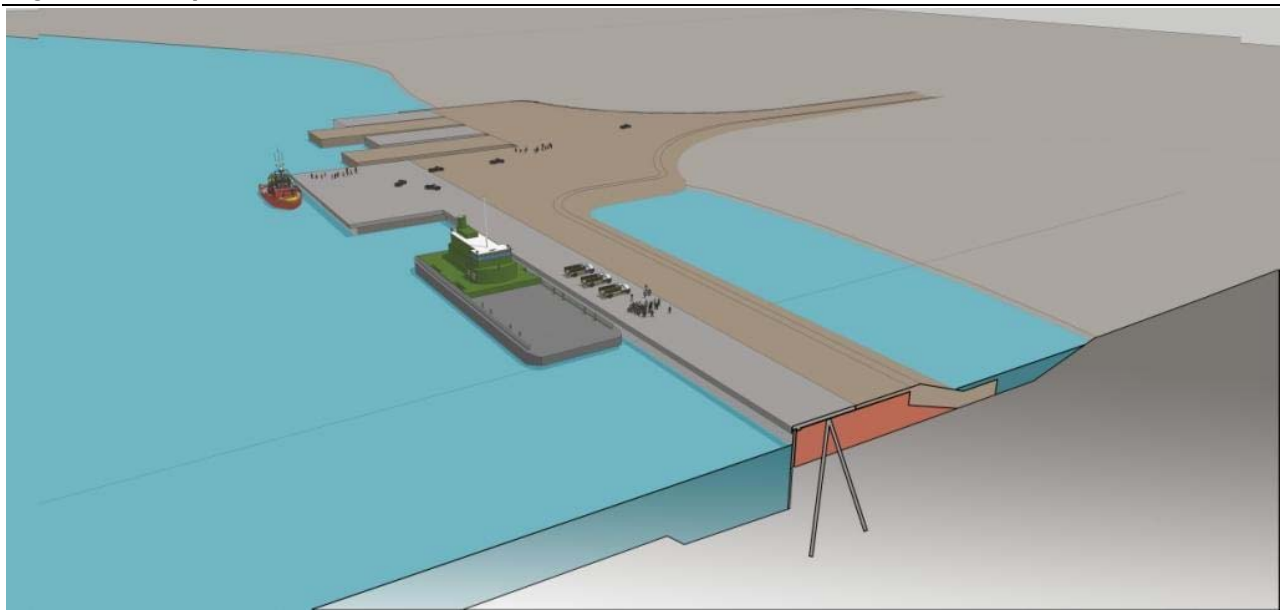
The MOF covers an area of approximately 1.9 km² of which 1.35 km² is laydown area. An approach channel to the MOF will be dredged generating some 14 million m³ of dredge spoil. The channel will have a width of 100 m over a length of approximately 24 km. Dredge disposal will be at a suitable location offshore. A work force of up to 350 people will be required for construction of the MOF. At the height of the operation phase the MOF will employ up to a 100 people with as many as 500 vehicle loads per day leaving the MOF site

Construction of the MOF is estimated to take 16 months. It is scheduled to be partly operational by June 2012 and fully functional by May 2013. To acquire operational capability from the MOF as quickly as possible, construction activities will be phased:

- Phase 1 involves land clearance to establish a laydown area; construction of a roll-on roll-off barge landing ramp; an access road; construction of a temporary worker camp (this may consist of an onshore camp or an accommodation barge moored in the Morebaya River); and bringing in shallow draught landing craft and barges for initial offloading of equipment for building the remainder of the MOF.
- Phase 2 includes an upgrade of the existing public road from Maferinya to the MOF site; the construction of up to 40 km of new roads from the MOF to a proposed port stockyard location and to a proposed causeway at Ile Matakang; initial dredging of an approach channel and disposal of the dredged material; establishment and operation of a quarry and borrow pits; construction of a quay; creation of hardstanding areas; installation of facilities for drainage, waste management, water supply power supply and storage; and construction of offices.
- Phase 3 involves deepening of the approach channel by dredging and disposal of the dredged material.

On completion of the main port, the MOF will likely remain in service but any future operations will be discussed as part of the SEIA for the main Simandou Project. The present SEIA covers the period of construction and initial 3 years of operation of the MOF.

Figure 2 Representation of the MOF



3 Baseline Environment

3.1 Physical Baseline

The Project area lies in the coastal region just north of Ile Kabak approximately 35 km south of the capital, Conakry. The coastal region has a tropical monsoon climate with extensive rain fall during the rainy season and very dry conditions during the dry season. The area is characterised by two rock outcrops that dominate the landscape, the larger of which is targeted for the quarry, mangroves lining the Morebaya River and a

number of creeks, areas of tended rice field (*'bogoni'*) and uncultivated grasslands and areas of both planted and natural trees. Soils are clayey near the river and along the mangrove creeks. Reddish soils abound further inland and within the corridor of the planned roads. Groundwater and surface water is likely to be of poor quality for use as potable water due to its brackish nature, but is otherwise good quality.

Estuarine and marine salinity is controlled by the mixing of fresh water from the riverine system and marine saltwater. All along the coast in Guinea, salinity decreases during the rainy season with greater input of fresh water. Turbidity is highest in upstream areas and decreases out into the sea. Turbidity is also considerably higher during the dry season compared to the rainy season. As is the case for many other Guinean lowland rivers, the high silt load has led to the development of sandbanks in the mouth of the river that are tidally immersed.

3.2 Biological Baseline Environment

There are no national or international designated protected areas located near the Project area.

Terrestrial habitats in the Project area include savannah, secondary lowland forest, crop/fallow land, rocky outcrops and wetlands. In low land areas much dense forest and mangroves have been cleared and used for rice culture. Remaining forests are mainly planted forest characterised by fruit trees and oil palms. Rocky outcrops feature a distinctive habitat for specific plants. Aquatic habitats include mangroves, salt marsh, and the rocky shore, sandbanks and beaches. Mangroves are considered particularly important as they provide habitat for migratory birds and the West African manatee, spawning and nursery areas for a variety of fish and shrimp species, stabilise bottom sediments and protect shorelines from erosion. Oysters are harvested from rocky shores and mangroves for food.

Besides a wide number of common species several species of conservation or commercial interest may be present within the Project area. Key species or types of species of conservation interest are outlined below.

- Information from local villagers suggests that the West African manatee and Atlantic humpbacked dolphin are regularly spotted in the nearshore waters and therefore likely occasionally present in the Morebaya River mouth including larger mangrove creeks.
- Several species of birds of conservation interest occur in the region, although many of these species are not unique to the Project site and have large distribution ranges. Migratory birds from Europe use intertidal areas, salt marshes and mangroves in winter. There is also a wide variety of year-round resident birds that occur in mangrove and forested areas.
- A number of sea turtle and crocodile species are known to occur along the Guinean coast. Although these may be present they have not been observed in the estuary. Beaches near the river mouth are likely to be too disturbed for significant turtle nesting activity.
- The blackchin guitarfish and milk shark were recorded in surveys undertaken in support of the SEIA. Several other shark and ray species can be expected to be present in coastal and offshore waters, including the Morebaya River estuary.

No land-based mammals of conservation interest are present, but a number of common bat species, rodents and the patas monkey can be expected to be present in the wider Project area.

Species of commercial interest include fish and plant species. Commercial and local fisheries target horse mackerel, sardines, shad, croakers and grunts. Guitarfish are also believed to be targeted by fisheries in West Africa. Plants of economic importance include mangroves for firewood, oil palm and mango trees.

3.3 Human Baseline Environment

The Project area in general is extensively used for agriculture with a large area converted into rice paddies. The MOF footprint is currently partly uncultivated or fallow land and partly covered with rice paddies of the *Bogoni* type. It is not known to what extent the *Bogoni* are presently cultivated. It is possible they are

seasonally abandoned or the land is in a fallow stage of the production. Agriculture is the main livelihood source for Ile Kabak. Rice is the major crop, although market garden crops (eg red pepper, aubergine, water melon, okra) are also grown and sold. Other significant income sources are fishing, salt production, oyster gathering and palm oil production. Many households generate their income from several activities.

There are multiple traditional fishing areas around Ile Kabak, although none are designated fishing zones. In the MOF area where the MOF is proposed, there are no fishing villages that will be directly impacted by the footprint of the project, although there are a small number of fishing huts along the shoreline of the Morebaya River that appear to be temporary (ie not in permanent use) and not obviously part of a village.

There is a village (Tomboulea) within the MOF footprint of approximately 7-10 structures, six households living on and near the rock outcrop on the river bank. A number of settlements lie along an existing track which could provide access to the site and along the existing road to Maferinya that will be upgraded. Most households are native to the area, but few households include immigrants from Sierra Leone. Villagers from Madinagbe, a few kilometers north of Singuie also use the land.

Drinking water supply is a major problem in all villages on Ile Kabak, as groundwater is brackish for much of the year and people have to travel farther inland to find suitable drinking water. In the MOF footprint there are two seasonal water wells and along the roads that will be widened there are several further seasonal and permanent water wells.

There are a number of known heritage sites of historical or cultural importance on Ile Kabak and Ile Matakang. However, no formally recognised cultural heritage sites have yet been identified in the MOF footprint or within the corridor of the planned road, except for two marks on a rock outcrop that are considered to have value to the local population. It is possible that additional undiscovered sites will be present.

4 Summary of Impacts and Mitigation Measures

A systematic approach has been followed to identify and evaluate the impacts on the physical, biological and human environment. The following sections highlight the key potential impacts and the measures that will be taken to mitigate the impacts identified. The Project activities can be divided into three main categories that can cause impacts to the physical, biological or human environment during the construction phase. These are marine works, onshore construction, quarry operations and road building and non-routine events. The majority of impacts arises from site selection and land clearance, the consequences of which will still be felt during the operation phase. A small number of additional impacts occur during the operation phase. Significant impacts during the initial three years of operation are limited to traffic accidents, maintenance dredging and impacts from in-migration, which have been included in the summary below where relevant.

Key impacts from **marine works** are:

- Dredging and dredge disposal results in high levels of sediment in the water column and smothering of the seabed. This will affect the distribution of fish, marine mammals and turtles and sensitive habitats. Measures to avoid and reduce these impacts include reducing the dredged area to as small as possible and development of a comprehensive dredge management plan. The same measures will be in force during maintenance dredging. After these measures the impact is considered to be of *minor significance*.
- Collisions between Project vessels and marine mammals and turtles can cause fatal injuries. The potential impact to animals will be managed by imposing speed restrictions, watching for animals and limiting operations if animals are within 50 m of a vessel. Following these measures the impacts to turtles and marine mammals are considered to be of *minor significance*.
- Loss of and disruption to fishery based livelihoods may occur from loss of and displacement of traditional fishing grounds and collision between fishing vessels and/or fishing gear with Project vessels. In order to manage these potential impacts community liaison officers will be used to inform fishing communities about activities, to explain the navigation risks, safe distances / exclusion / transit zones and deal with their concerns. Patrol vessels will be used to avoid interactions between Project vessels and local boats.

A range of measures will be applied to avoid and reduce impacts to fish and fishery based livelihoods from other aspects of the project. After these measures have been taken into consideration the impact of disruption to fishery-based livelihoods is considered to be of *minor to moderate* significance.

Key impacts from **onshore construction work at the MOF, quarry operations and road building** are:

- The Project will result in loss of, and disruption to, land-based livelihoods, most notably agriculture and agriculture related activities through land take and obstruction of access. This includes a small area of *bogoni* rice fields under the footprint of the MOF. This impact will be managed by designing the Project so that, as far as possible, highly productive agricultural land or settlements is avoided and that access can be maintained. However, in the event that this cannot be avoided a plan for land acquisition, resettlement and compensation of affected people will be developed in line with the Project Resettlement and Compensation Policy Framework. Following these measures the impact is considered to be of *moderate significance*.
- Sites of cultural heritage importance may be lost or disturbed during onshore construction works, road building and quarrying. In addition there will be a permanent change of the landscape, which may hold cultural significance. The smaller rock outcrop on the river bank will be spared in recognition of two features of cultural interest on this rock. If a site or feature of cultural importance cannot be avoided, the Project will consult the local community to determine the mitigation and or compensation that is required. Access to areas of cultural or special significance to local communities will be maintained. Given these measures and that little is currently known about cultural heritage in the Project area a conservative assessment of the impact has been applied. The impact to cultural heritage is considered to be of *moderate to major significance* and the impact to the landscape is considered to be of *major significance*.
- The Project will attract people to the area in search of employment. This inflow of migrants will put additional pressure on local infrastructure and government bodies to deliver services and will result in increased demand for land and natural resources, such as water, firewood and fish. In addition in-migration affects the capacity of the government bodies to deliver services to the area. To manage this impact an in-migration strategy and plan will be developed. This will be developed and implemented in partnership with local authorities and traditional leaders. Following development of the in-migration strategy and plan the impact to government bodies and local administration is considered to be *minor to moderate significance*. The impact on infrastructure and demand for land and natural resources is considered to be of *moderate to major significance*.
- The increased population associated with the presence of workers and in-migration has the potential to increase the spread of diseases. In addition, stagnation of water in areas where tidal flows and natural drainage are disturbed by the Project, can increase breeding grounds and habitats for malaria carrying mosquitoes and in turn increase malaria locally. These impacts will be avoided and reduced by restricting interaction between workers and the local population and development and implementation of an in-migration strategy and plan, as described above. Careful design and not obstructing waterways will avoid the creation of new mosquito breeding grounds. Following these measures these impacts are considered to be of *moderate significance*.
- Construction works (particularly from road construction) can cause loss or deterioration of a large expanse of mangrove habitat. Obstruction of waterways causes the habitat to be divided and prevents regular tidal flooding, which impacts animals and plants that depend on this habitat. In addition, further mangrove habitat may be lost through conversion to rice fields as a result of loss of agricultural land or in-migration attributed to the Project. Quarrying of the larger rock outcrop will reduce the amount of already limited rocky habitat. The MOF and road will be designed to maintain a free flow of water and minimise the loss of mangrove habitat and the smaller rock outcrop in the Project area will be preserved. This will not prevent the loss of some mangrove and the main rock outcrop. The resulting impact on mangrove and rocky habitat is considered to be of *moderate significance*.
- Construction and operation activities increase traffic. Road accidents are likely to cause injury or death. This impact will be managed by reducing the traffic through community areas to a minimum level and the development of a traffic awareness programme, however, the impact will remain of *major significance*.

- Quarry and piling operations will emit noise. Noise reduction measures, such as quiet equipment, screening and undertaking noisy activities during the day, will be taken to reduce the noise levels. A temporary safety zone will be enforced around the quarry that will prevent unacceptable exposure of workers and local people. People who are affected will be entitled to compensation in line with the Project Resettlement and Compensation Policy Framework. Piling also results in intermittent underwater noise. The piling operations are of limited duration. Best practicable means will be implemented to reduce noise and vibration impacts. Measures in this regard may include soft starts, effective equipment maintenance and the use of enclosures. The resulting impact of noise is of *minor significance*.
- Local people will benefit from additional employment opportunities. The Project's fair and transparent employment policy will be applied to those obtaining employment with the Project. A fair, transparent, culturally appropriate and accessible Grievance Procedure will be available to all workers. This is considered a *positive* impact on local communities.
- Other impacts from onshore construction, road building and quarrying are of less significance provided measures to avoid and reduce impacts are taken into consideration.

Key impacts from **non-routine events** are:

- There is the potential for large spillages due to road accidents and spillages at onshore facilities. Such events pollute soils and local water bodies, which in turn can affect terrestrial and aquatic ecosystems. This potential impact can be managed by introducing measures to reduce the risk of traffic accidents, including adequate road lighting, sign posts and speed limits and regular vehicle maintenance. The Project will also develop Oil and Chemical Spill Contingency Plans, which will be maintained, reviewed frequently and tested (*eg* drills). Spill kits will also be onsite. In view of these measures, the risk of and potential impacts from a spill the impact is considered to be of *minor to moderate significance*.
- Large spills to the marine environment can also occur due to vessel collisions or groundings. Any release of pollutants will impact on water quality and in turn affect marine ecosystems. Measures designed to avoid and reduce this potential impact will include navigation controls to avoid collisions and groundings, such as lighting and marine navigation aids at the MOF and approach channel and an exclusion zone around construction and dredging vessels. Following these measures to reduce the risk of and avoid potential impacts from a spill the impact is considered to be of *moderate significance*.
- Excessive flooding caused by an extreme rain event, tides or storm surge and made worse by the presence of the MOF and roads will affect habitats and results in drowning / displacement of species. Storm water drainage, irrigation and run-off systems will be designed to minimise risks of flooding caused by an extreme rain event. An Emergency Flood Response Plan with contingency measures will also be developed in case water levels exceed the design levels. The resulting impact is considered of *minor significance*.

5 Next Steps

The SEIA for which this is the Non-Technical Summary is being submitted to the Government of Guinea for consideration and approval. It is also being made available for review and comment by interested external stakeholders through dissemination to national regional and local governmental authorities and non-governmental organisations, and publication on the web (at www.riotintosimandou.com/index_seia.asp).

Local communities will also be consulted during field visits which are scheduled over the forthcoming weeks. The field teams will speak to representatives of the local administration, local leaders and members of the community, as well as to people whose land and resources may be directly affected by the development. All views expressed through these consultations will be taken into account in finalising the proposals for the project.

Simfer SA

Simandou Project

Marine Offloading Facility

Social and Environmental Impact Assessment (SEIA)

Main Report

1 Introduction to the Project and the SEIA Report

1.1 Purpose of the SEIA Report

This document is the report of a Social and Environmental Impact Assessment (SEIA) prepared for part of a programme of advance works needed for the Simandou Mining Project. It covers the development of a Marine Offloading Facility (MOF) together with and associated quarry and access roads needed for construction of the main project and is one of a series of advance works SEIA reports being submitted for the Simandou Project.

The Simandou Project is a world-scale mining project comprising:

- An open pit iron ore mine in the Simandou Range in south-eastern Guinea, approximately 600 km from the Guinean coast and 400 km from the Liberian coast, with an estimated resource capacity of 95 million tonnes per annum (mtpa);
- A Trans-Guinean railway of about 670 km to transport the ore from the mining concession to the Guinean coast;
- A new deepwater port located south of Conakry in the Forécariah prefecture; and
- Various associated developments providing utilities and infrastructure to the project including construction facilities and materials, power generation, water, access and accommodation.

The Simandou Project is being developed by the Guinean-registered company Simfer S.A. (Simfer). Simfer is a member of the Rio Tinto Group, and holds a mining concession for iron ore over the southern part of the Simandou mountain range. The current shareholders of Simfer are Rio Tinto (95%) and the International Finance Corporation (IFC) – 5%). The mine will be operated by Simfer and the construction of the rail and port infrastructure will be carried out by a Special Purpose Vehicle (SPV), intended to be held 51% by the Government of Guinea and 49% by the shareholders of Simfer and its affiliates. The mine, rail and port developments, and their associated infrastructure is hereafter referred to as the Simandou Project. An SEIA for the full Simandou Project is in preparation and will be submitted to Government in 2012.

In preparation for the planned start of construction for the Simandou Project in 2012, Simfer wishes to develop the MOF, MOF quarry and associated roads to support the Project (referred to as the MOF Project). As this needs to be in place prior to start of construction of the main project, an early application is being made for permission to develop these elements. This document has been prepared to support that application in accordance with the requirements of the Guinea Environment Code and EIA Decree (see *Section 1.2* below).

The MOF will be used to offload construction materials and equipment, the quarry will provide necessary rock and crushed stone for construction and the roads will provide access to the main project sites. In addition, there will be facilities for worker accommodation, warehouses and laydown area, fuel supply and storage and other necessary facilities. The plans for the Project envisage the development of the MOF Project over a period of approximately 16 months, starting in early in 2012. Further details are provided in *Chapter 2*.

The purpose of this SEIA report is to provide information on the proposed works and to explain how they have been planned and designed to minimise the potential for adverse environmental and social effects and to maximise the benefits of the works.

The SEIA studies have been undertaken by an international team coordinated by Environmental Resources Management (ERM) and including a number of international and Guinean specialists. The key members of the SEIA team are introduced in *Annex A*.

1.2 SEIA and other Regulatory Requirements

This SEIA has been prepared to accompany an application to the Government of Guinea for permission to develop the MOF, MOF quarry and roads for the Project. The assessment has been carried out in accordance with the Guinean Environment Code ⁽¹⁾, Presidential Decree 199/PRG/SGG/89 on Environmental Impact Studies (the EIA Decree) ⁽²⁾, and Order 990/ NRNE/SGG/90 on the content and methodology for impact studies ⁽³⁾. The assessment is also designed to comply with the requirements of IFC ⁽⁴⁾ and Rio Tinto Group policies with respect to impact assessment and mitigation.

1.2.1 Guinean EIA Legislation

The Environment Code sets out the fundamental legal principles to be complied with when developing projects in order to ensure the protection of environmental resources and the human environment. Article 82 of Title V of the Code specifies that if a project is likely to have a significant impact on the environment, then the developer is obliged to conduct an Environmental Impact Study. This study must be submitted to the Minister for the Environment prior to the construction of a Project in order to allow evaluation of the direct and indirect impacts of the Project on the environment of Guinea and the quality of life of the people of Guinea.

The EIA Decree defines the types of projects that require an Environmental Impact Study. Class 2 includes works for the construction and management of ports. Accordingly, the proposed MOF is considered to fall under the scope of the Decree.

In addition to the requirements relating to Impact Assessment, Simfer must also comply with all Guinean legislation relating to protection and management of the environment and social, socioeconomic and labour law, with international conventions which Guinea has ratified, and with IFC standards and guidance regarding environmental and social performance. *Annex B* provides a summary of relevant policy and legislation in Guinea and the regulatory and administrative structure in Guinea.

1.3 Approach to the Assessment

1.3.1 Key stages

The assessment for the MOF Project has been undertaken in accordance with the guidelines and procedures noted above. It has followed a systematic process of predicting and evaluating the impacts the Project is expected to have on the physical, biological and human environment, and identifying measures that the developer is able take to avoid, reduce, remedy, offset or compensate for adverse impacts, and to provide benefits.

The overall approach followed is shown schematically in *Figure 1.1* and the key steps are described in the subsequent sections.

(1) Code for the Protection and Development of the Environment, Ordinances 045/PRG/87 and 022/PRG/89

(2) Presidential decree 199/PRG/SGG/89 codifying Environmental impact Studies

(3) Arrêté 990/NRNE/SGG/90 establishing the content and methodology for Environmental Impact Studies.

(4) IFC requirements are set out in the IFC Policy on Environmental and Social Sustainability and its supporting Performance Standards and EHS Guidelines – see <http://www.ifc.org/policyreview>

Figure 1.1 ESIA Approach

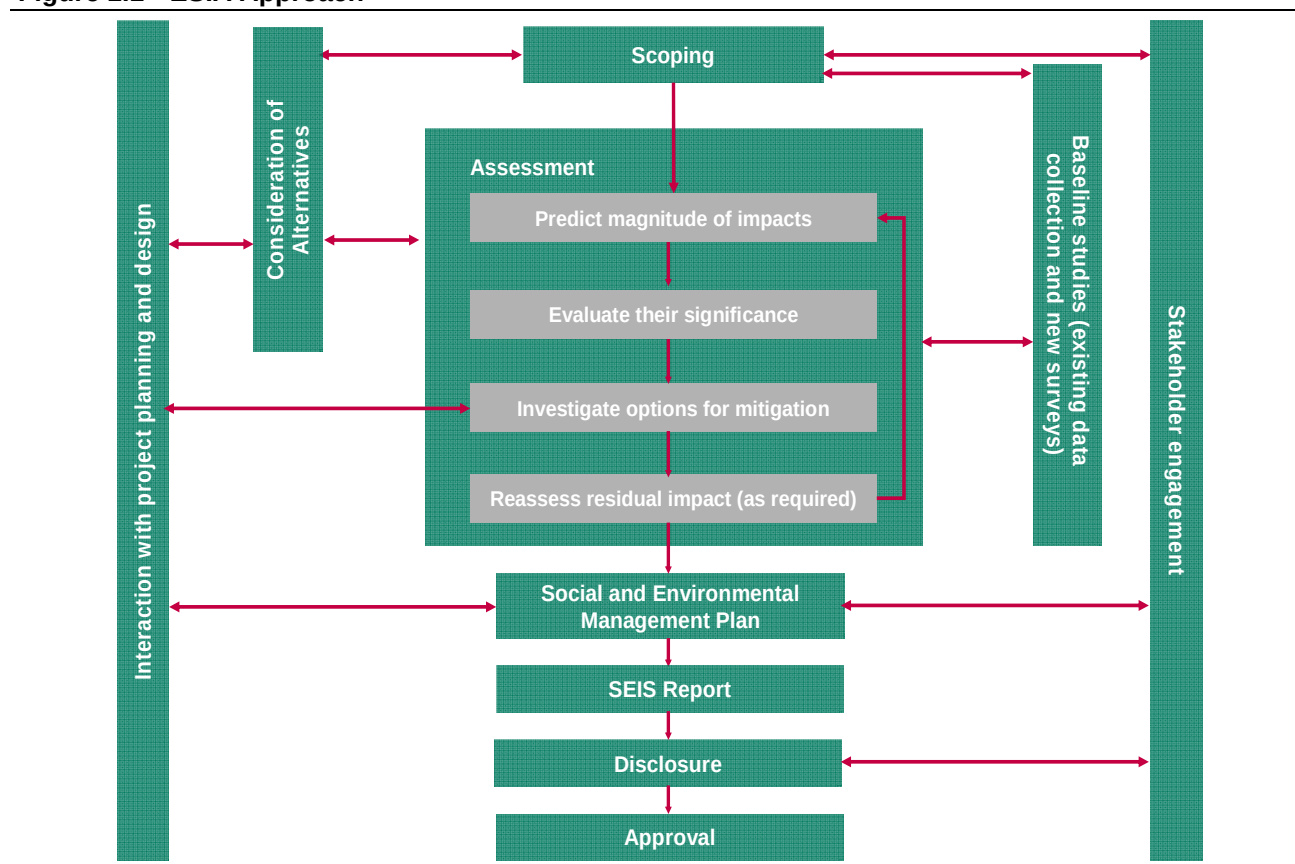


Table 1.1 Summary of the SEIA Process

Stage	Summary of Approach
Scoping and Stakeholder Engagement	The assessment has been scoped to ensure it is focused on the significant environmental and social impacts which may arise from the Project. This involved a systematic consideration of the potential for interaction of project activities with features in the environment to identify where significant impacts were likely to occur. The results of scoping were agreed with Government in the SEIA Terms of Reference and formed the basis for planning the assessment study. The Terms of Reference are introduced in <i>Chapter 3</i> and a full copy is provided in <i>Annex C</i> . The SEIA also took into account the results of consultations on the draft terms of reference which were published in September 2011 and discussed at a series of stakeholder conferences across Guinea during September and October.
Baseline development	For the key issues identified in scoping, available information on the current environmental and social conditions was gathered with particular emphasis on sensitive aspects potentially affected by the Project. Reconnaissance visits were undertaken to potential sites in July and August 2011. The potential for future development in the absence of the Project has been considered and the No Project scenario provides the baseline against which the impacts of the Project are predicted and evaluated.
Alternatives	Where alternatives exist for the siting or design of particular components of the Project these have been considered in collaboration with the engineering design team. The SEIA has appraised the environmental and social impacts of these alternatives and the selected result is presented in this SEIA report. The rationale behind siting of the project and selection of the proposed design and construction techniques is presented from a technical, environmental and social perspective.

Stage	Summary of Approach
Impact assessment	This stage was focused on predicting how environmental and social conditions may change from the baseline as a result of the Project. The types of impacts that could occur were identified in terms of their potential nature, magnitude, spatial extent, duration and likelihood and evaluated by reference to established standards and norms. The focus was on identifying significant impacts (<i>ie</i> the most important and the impacts with the potential to cause greatest harm) including both positive and negative effects.
Mitigation measures	Where the potential for significant impacts was identified, measures to avoid, reduce, remedy or compensate for adverse impacts and to maximise benefits were identified in consultation with the wider Project team. These include requirements relating to the siting and design of the Project and methods to be adopted during construction, operation and rehabilitation of sites.
Social and Environmental Management Plan (SEMP)	All mitigation measures are presented in a Social and Environmental Management Plan (SEMP) presented in <i>Annex D</i> . The SEMP identifies all the measures that will be implemented during design, construction, and closure of the Project and identifies the responsibilities, timing, and monitoring and auditing to be carried out to ensure all mitigation commitments are met. The SEMP is accompanied by a Policy framework for Land Acquisition, Compensation and Resettlement detailing how acquisition of land for the facilities will be managed in accordance with international good practice.
Reporting, Disclosure and Approval	The final stage in the SEIA process is the publication and dissemination of this SEIA Report. The report is being submitted to Government for consideration and will be disclosed for comment to affected communities and other stakeholders through a further programme of events and consultations. All comments will be considered in finalising the proposals and the SEMP. Simfer will also plan a programme of continuing engagement with stakeholders during development of the individual sites including implementation of a Grievance Procedure to handle complaints from affected people.

1.3.2 Managing Uncertainty

The MOF Project SEIA has been based on the project information presented in Chapter 2 of this report. In some instances certain details are not yet fully defined. As a result the SEIA team has based the assessment on the best information available at the current time and has made assumptions where there are gaps or uncertainties about how the Project will be designed, built, operated and closed to enable an assessment to be undertaken at this stage. These assumptions have been made in consultation with Simfer, and have been selected to provide predictions of the reasonable worst case in terms of environmental and social impact. Where assumptions have been made, these are identified and the nature of any resulting uncertainty is identified.

Whenever details of the project design are not finalised, the impact assessment has considered a number of possible scenarios representing the range of options that might be implemented (the envelope or 'maximum parameters' approach). The SEIA has then reported the likely worst case in terms of the possible scenarios that might be implemented for the Project. The final detailed design of the Project should not vary beyond these limits so that the Project as built should not have an impact that is worse than that described in this report.

These scenarios are specified in terms of maximum and/or minimum operational and design parameters that lead to a worst case impact for each of the individual social and environmental aspects. For example, for roads these could be in terms of:

- maximum length of the alignment;
- maximum width of the right of way;
- maximum number and size of in-river structures for waterway crossings; and

- maximum heavy goods vehicle flow on the road.

In each case, careful consideration is given to the inter-relationships between different topics (eg noise, footprint, location) of the proposed development in order to address the environmental and social impacts of the Project as a whole. The maximum adverse impact in terms of any one type of impact would automatically result in the maximum potential impact when different impacts are considered collectively. This approach feeds through into the range of mitigation measures that are deemed necessary.

The general approach has, therefore, been to take a conservative and cautious view of the likely impacts of the Project. Where it is known that Project details may change from those described here, commitments to mitigation are expressed in terms of standards of environmental performance that will be achieved rather than as specific technical measures. Several areas of additional work that will be undertaken during detailed design and before work starts are identified, together with commitments to submit further information to regulators and investors on development of mitigation to ensure performance standards are met. The SEMP identifies these additional studies, and defines monitoring plans and contingency measures that will be implemented if actual impacts turn out to be worse than predicted.

1.3.3 Potential for Cumulative Impact with Other Relevant Developments

Good practice in SEIA requires that consideration be given to the potential for the project to have cumulative impacts with other developments taking place in the same area. Review of current plans indicates that there are no other major projects foreseen during the period of construction and initial 3 years of operation within a short distance of the proposed MOF location.

Another mining company, Forécariah JV (with participation of Bellzone Mining PLC and the Guinean Development Corporation), is developing an iron ore concession in the Forécariah Prefecture near Yomboeli and connected to a port near Benti. Based on information available at the present time it is understood that this development will not involve development in the same area as the MOF and cumulative impacts are unlikely to occur. The cumulative impacts of the Forécariah JV project and the main Simandou Project will be considered in the Simandou Project SEIA.. Current understanding is that this development is unlikely to interfere with the MOF and its associated road network

There is however some overlap with other advance works being planned for the Simandou Project, including road improvements and development of temporary camps and logistics supply centres. These developments are the subject of separate SEIA submissions being made for the Simandou project and the potential for cumulative impacts with the MOF will be considered in developing the detailed plans for these works. The impacts of the advance works and the main project will all be addressed in the Simandou Project SEIA.

1.4 Structure of the Report

The remainder of this report is organised as follows.

Chapter 2 provides a description of the proposed Project, including a description of activities to be undertaken during construction and operation. This section also explains how alternatives were being considered.

Chapter 3 presents a summary of the scoping process that was carried out to develop the Terms of Reference, including the stakeholder engagement activities undertaken to date and the plans with respect to ongoing and future stakeholder engagement.

Chapters 4 to 6 present the potential impacts of the Project on the Physical, Biological and Human Environment, and the mitigation measures that will be employed to minimise the risk of potential adverse impacts. Each chapter provides:

- an introduction to the topic, to the sources and types of impact addressed in the chapter (ie the scope) and the methods used;

- an outline of the types of baseline conditions likely to be encountered across the Project;
- topic-specific criteria used in the assessment of impact significance;
- a description of the impacts and the mitigation measures that will be adopted to avoid, reduce, remedy or compensate for adverse impacts and to provide benefits.

Table 1.2 identifies where the information required by Order 990 on the Content and Methodology for Impact Studies can be found in the report.

Table 1.2 Meeting the Requirements of Order 990 on Content of Environmental Impact Studies

Information required by Order 990	Location in Report
1. Description of the Project including its objectives, location, cost, date of investment and schedule for implementation	See Chapter 2
2. Analysis of the baseline state of the environment, in particular elements susceptible to being affected by the development (sites, natural riches, landscape, socio-economic way of life and culture of the people)	For physical environment including geology, pedology, hydrogeology, hydrology/oceanography, noise and air quality – See Chapter 4, Section 4.3 For natural environment, fauna and flora – See Chapter 5, Section 5.3 For human environment including socio-economic conditions and cultural heritage – see Chapter 6, Section 6.3
3. Analysis of the effects of the Project on the environment	For impacts on the physical environment – see <i>Chapter 4, Section 4.4 et seq</i> For impacts on the natural environment see <i>Chapter 5, Section 5.4 et seq</i> For impacts on the human environment, see <i>Chapter 6, Section 6.4 et seq</i>
4. The reasons for choice of the site	See <i>Chapter 2, Section 2.2</i>
5. Measures envisaged to prevent, reduce and if possible compensate for damaging effects and an indication of their cost and effect	For impacts on the physical environment – see <i>Chapter 4, Section 4.4 et seq</i> For impacts on the natural environment see <i>Chapter 5, Section 5.4 et seq</i> For impacts on the human environment, see <i>Chapter 6, Section 6.4 et seq</i> All costs of mitigation are included in the planned budget for the Project. The effect of mitigation measures is described.

1.5 Next Steps

In accordance with good impact assessment practice and requirements of the EIA Decree, this SEIA Report will be disclosed to potentially affected parties to help them understand the risks, impacts and opportunities associated with the Project and provide them with an opportunity to comment, and for their comments to be considered by the Government in making its decision on approval of the Project, and by Simfer in finalising the proposals and implementing the Project.. This will be done:

- through stakeholder consultations in the affected area during November 2011;
- by publication of the SEIA report on the Project website http://www.riotintosimandou.com/index_seia.asp;
- through written consultation with government agencies, and national and international non-governmental organisations.

Copies of the report are available on the website, can be obtained on request by applying to Simfer at simandou.eise@riotinto.com, and can be viewed at Rio Tinto and Simfer offices at:

- SIMFER SA, Immeuble Kankan, Cité chemin de fer, BP 848, Conakry, République de Guinée ;
- Rio Tinto, 17 Place de Reflets, La Défense, Courbevoie, 92097 Paris ; and
- Rio Tinto, 2 Eastbourne Terrace, Paddington, London.

A feedback process has been established for stakeholders to provide comments via the web, email, by post or in person, and all submissions will be taken into account in finalising the proposals and the SEMP.

2 Project Description

2.1 Introduction

This chapter provides a description of the proposals for design, construction and operation of the Marine Offloading Facility (MOF), associated roadworks, and quarry, hereinafter referred to as the 'Project'. Where reference is made to the overall mine, rail and port Project, this is referred to as the 'Simandou Project'. The Simandou Port is referred to as the 'main port' to distinguish it from the MOF.

The main function of the MOF is the import of construction materials and equipment for the Simandou Project, brought in by barge. The quarry will provide rock and crushed stone for construction and the roadworks will provide access from the MOF to the main project sites. In addition, there will be worker accommodation, warehouses, an extensive laydown area, fuel supply and storage and other necessary facilities.

The MOF is required because very large quantities of materials and equipment need to be imported into Guinea for construction of the Simandou Project and there is no existing port facility that provides the necessary capacity. Some materials could be imported via the port in Conakry but this would cause major disruption to existing port operations and carriage of goods through the city would have a major impact on the city's road network and population. The port of Kamsar further north is also not suited to the import of the required volume of materials and equipment for the main project.

The following sections describe:

- Section 2.2: the location and design of the MOF including the reasons for selecting the proposed site;
- Section 2.3: the Project schedule;
- Section 2.4: construction of the MOF; and
- Section 2.5: operation of the MOF.

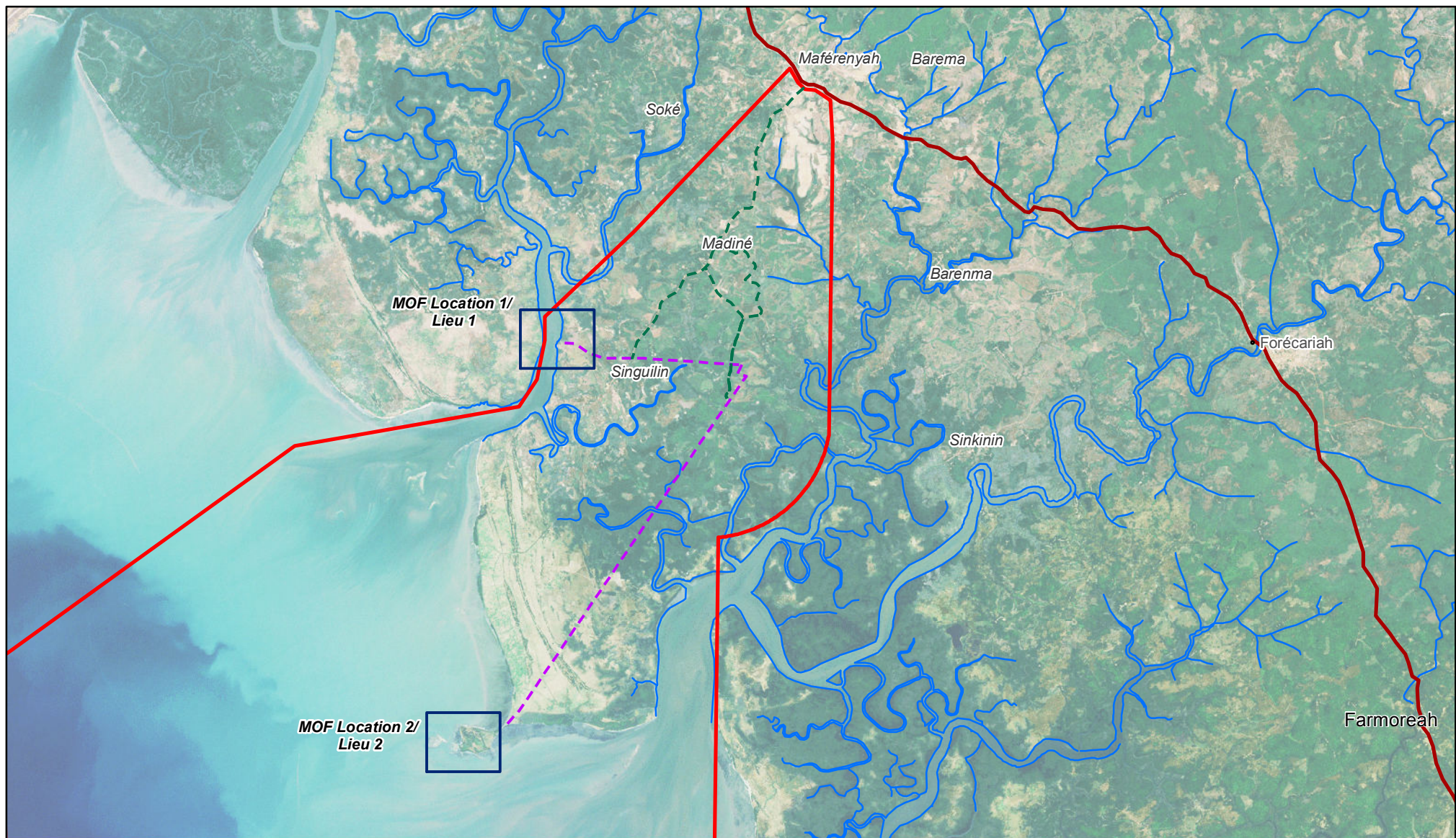
At present there are no specific plans for the MOF after construction of the Simandou Project is complete. Options include its continued operation to service the main project, handover to the government for future operation as a local harbour, or closure and decommissioning of the site. Given this uncertainty, this SEIA does not address plans for the long term. An assessment of the impacts of long term continued operation or closure will be included in the Simandou Project SEIA which will be completed and published in 2012.

2.2 Project Location and Design

The MOF will be located on the east bank of the Morebaya River, 3 km north of Touguyiré, in the Maférinya Sub-Prefecture of Forécariah Prefecture and Kindia Region.

2.2.1 Alternatives Considered

Two options have been considered for the location of the MOF: the first on the Morebaya River and the second location at the south-western corner of Île Matakang at the southern end of Île Kabak (see *Figure 2.1*).



- Upgrading of Existing Roads/
Modernisation des Routes Existantes
- New Access Roads (Tentative Alignment) /
Nouvelle Route d'Accès (Alignement Provisoire)
- Principal Road / Route Principale
- Preliminary Outline of Project Area /
Esquisse Préliminaire de la Zone du Projet



CLIENT: Simfer SA		SIZE: A4	TITLE: Figure 2.1 MOF Siting Options / Options d'Emplacement du MOF	
ERM Kilometres				
SOURCE: NASA Landsat Program, 2003 PROJECTION: WGS 1984 UTM Zone 28N		DATE: 10/11/2011	CHECKED: MK	PROJECT: 0131299
		DRAWN: GN	APPROVED: KR	SCALE: As scale bar
		DRAWING: po_PMOF_Siting_Options.mxd		REV: 0

File: 0131299_Simandou_GIS_IG_CK_Maps\ERM\PortMOF_SEIA\Map_PMOF_Siting_Options.mxd

The following criteria were considered in the selection of the currently proposed site:

- proximity to navigable water and amount of dredging required;
- availability of land and land elevation;
- soil bearing capacity;
- site drainage;
- availability of rock;
- overland access routes;
- proximity and connectivity to other Simandou Project components;
- constructability and technical feasibility; and
- environmental and social constraints.

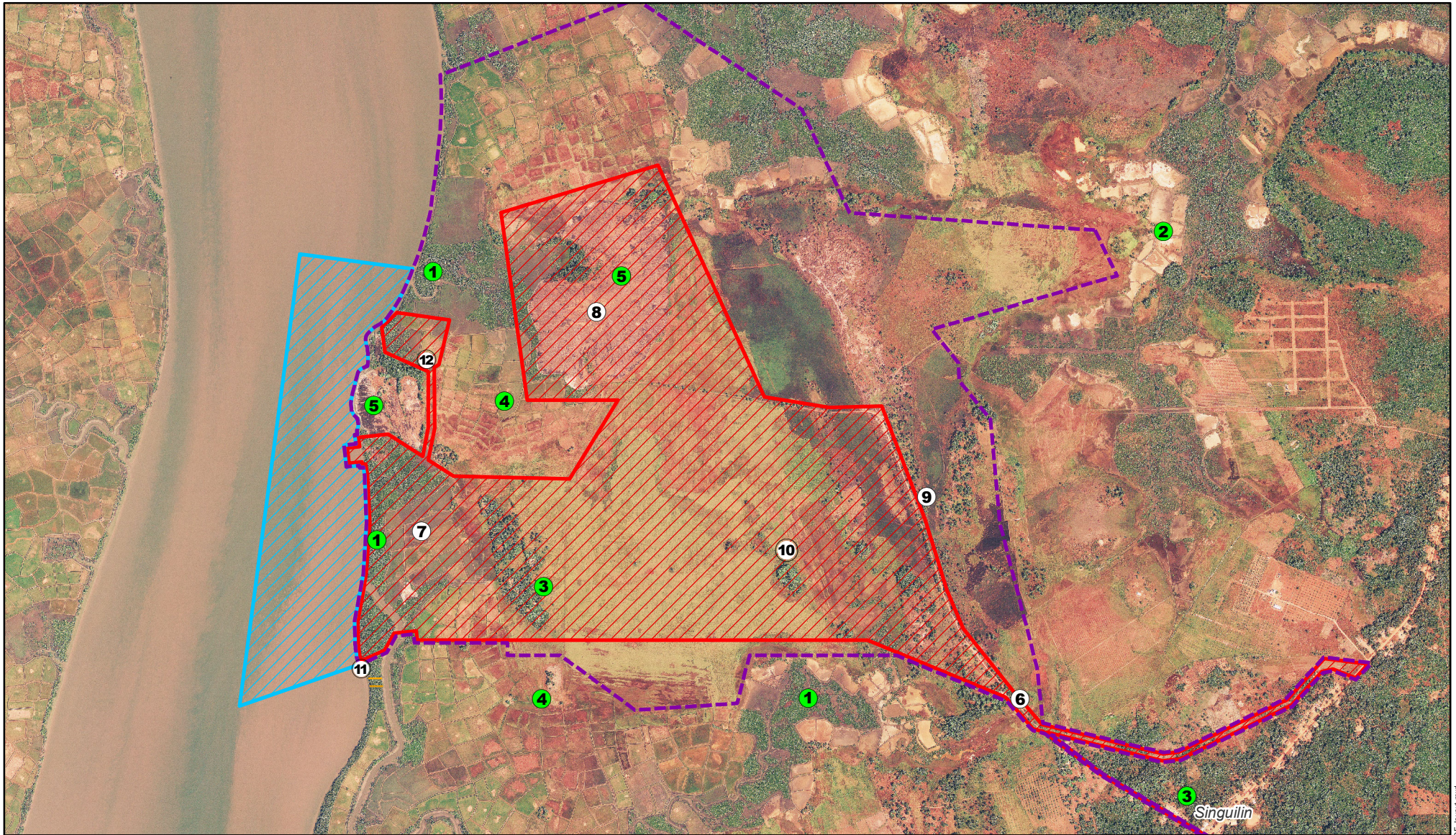
The preferred site on the Morebaya River was selected for the following reasons.

- it requires less initial dredging and therefore leads to less impact on the marine environment from dredging works and dredged spoil disposal;
- there is a sufficient area of reasonably flat, suitable land for the port area with an adjacent large area of low quality grassland habitat suitable for use as a laydown area;
- there is a granite outcrop immediately to the north which will provide a good supply of material for construction;
- it requires less loss of valuable mangrove habitat, and this can be further reduced by the realignment of an existing mangrove lined creek as part of design;
- fewer inhabitants are affected at this location; and
- it is more easily accessed from the existing road network requiring only a short link to the existing road to Maférinya which can be upgraded to provide access to the N4 national road.

Both locations will require construction of a haul road, either from the Morebaya site down to Île Matakang, or from Île Matakang up to the planned stockyard at the end of the Simandou Railway. The preferred route for this haul road is still being investigated and possible scenarios for this route have therefore been considered so as to provide a reasonable worst case assessment as discussed in *Section 1.3.2 (Dealing with Uncertainty)*.

2.2.2 The MOF Facilities

An indicative layout of the development is shown in *Figure 2.2* and a general arrangement of the proposed quay area is shown in *Figure 2.3*.



- Site Perimeter / Périmètre du Site**
- Temporary Construction Buffer / Zone Tampon Temporaire de Construction**
- Extent of Marine Structures / Etendue des Structures Maritimes**
- Existing Features / Fonctionnalités Existantes**
- 1 Mangroves
 - 2 Salt Pans / Basins de Sel
 - 3 Village / Village
 - 4 Rice Fields / Rizières
 - 5 Rock / Rouche

- Proposed Project Components / Composantes du Projet Proposé**
- 6 Access Road / Route d'accès
 - 7 Port Area / Zone du Port
 - 8 Quarry / Carrière
 - 9 Fence / Cloture
 - 10 Lay Down Area / Zone de dépose
 - 11 New Channel Outlet / Nouvelle Sortie du Chenal
 - 12 Access to Proposed Floating Accommodation / Accès aux Logements Flottants Proposés

Ciente:	Simfer SA	Tamaño:	A4	Título:		Figure 2.2 Indicative MOF Layout / Plan Indicatif du MOF	
SOURCE: GeoEye 0.5m (Feb 2011) PROJECTION: WGS 1984 UTM Zone 28N		0 500 Metres		Fecha: 10/11/2011	Revisado por: MK	Proyecto: 0131299	
				Dibujado por: GN	Aprobado por: KR	Escala: As scale bar	
				Dibujo N°: po_PMOF_layout.mxd			Rev: 0

The following facilities are foreseen:

- barge landing ramp to allow access for landing craft for early deployment of equipment and vehicles;
- a berth and quay for up to two heavy lift vessels with Lo-Lo (load-on, load-off) capabilities of up to 13,000 Dry Weight Tonnes capacity and an estimated 300 tonnes per lift;
- tug/pilot boat harbour;
- up to two Ro-Ro (roll-on, roll-off) barge berths with ramp for delivery of vehicles;
- shoreline protection works (seawalls, revetments and/or other forms of structures to prevent erosion);
- aids to navigation (buoys to mark navigation channels, turning basin and marine structures);
- fuel barge and berth;
- fuel unloading, transfer and distribution;
- buildings for port offices, customs, warehousing, emergency response facilities;
- facilities for vehicle cleaning, wheel washing and inspection, sewage treatment, potable water supply, electricity generation, lighting, waste management and disposal;
- worker accommodation (one barge with accommodation for up to 350 people and/or a temporary worker camp at a designated site either at or near the MOF location);
- laydown area of approximately 1.35 km²;
- a helipad; and
- fencing around the perimeter.

The Project will also include dredging and dredge disposal works that is required to enable access to the MOF from the nearest deepwater.

In addition to the facilities associated with the actual MOF, the Project also includes the following roadworks.

- Construction of an access road to the MOF from the nearest existing road at Maliguéya.
- Upgrading of the public road from Singuie to Maférinya, and of two existing unnamed access roads that lead off this road to the location of the proposed Simandou Project stockyard. The purpose of this road upgrading work is to enable year-round passage of 30-40 tonne heavy goods vehicles (HGV) to and from the MOF until such time as new roads have been provided for the main project.
- Construction of a new road across Île Kabak that directly connects the access road leading from the MOF to the location of the proposed stockyard and to Île Matakang. This road will relieve the existing public road system and will accommodate larger vehicles including articulated heavy haul vehicles.

Finally, the Project includes the development of a quarry at the site of an existing 19 ha granite rock outcrop located just north of the MOF (see *Figure 2.1*). This quarry will supply aggregate materials for the construction of the MOF and the main project.

Key characteristics of the MOF elements are presented in *Table 2.1*.

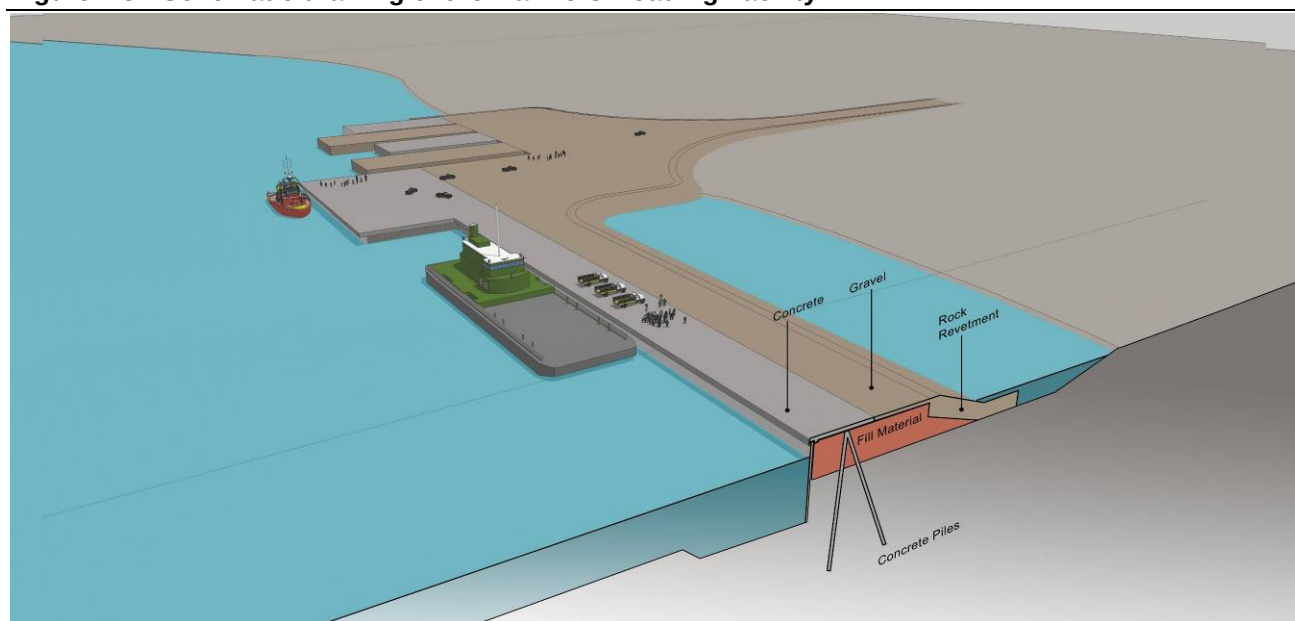
Table 2.1 Key MOF Characteristics

Non-Spatial Elements	Description	
Project Life	Construction Phase: approximately 16 months Operational Phase: approx 3 years Post operation: to be decided	
Power Supply	Generator station equipped with 2 diesel-powered 800 kW generator sets with a fuel storage tank onsite. Resupply by fuel barge.	
Fuel Tank and Pipeline	A pipeline of 1000 m between fuel barge mooring and fuel storage tank. Bunded double-skinned fuel storage tank of 1000 m ³ . Vehicle fuelling facility.	
Water Supply	Initial supply by road from existing sources inland, followed by on-site abstraction and treatment in package water treatment plant for potable use Construction and process water will be supplied from surface water run-off collected in sedimentation ponds and from wells and surface freshwaters	
Sewage treatment	Modular treatment plant with discharge to Morebaya River.	
Waste management	Temporary storage only with waste sent to dedicated waste management facility at the nearest Simandou Project logistics supply centre	
Hours of Operation	24 hours per day, 7 days per week	
MOF Capacity	An order of magnitude estimate of the volume of material to be brought in over the 16 months construction period is: • 17 500 tonnes of fuel • 15 700 tonnes of equipment (vehicles, modules) • 2 900 lifts In the 3 years of operation the estimated volume is: • 590 000 tonnes of fuel • 750 000 tonnes of construction materials (vehicles, modules, equipment, materials) • 24 000 lifts	
Spatial Elements	Description	Footprint / Dimensions
Berth/Quay Areas	Main quay comprises concrete deck supported by piles on infilled river bank with sheetpiling along river and rock revetments at landward side.	
	Ro-Ro Ramp concrete deck supported by piles on infilled river bank with sheetpiling along river and rock revetments at landward side.	
	Heavy Lift Berth (using ship cranes)	
Dredged Areas	Morebaya River channel	24 km long, 100 m wide, 8.5 m Below Chart Datum (BCD)
	Swing Basin	-8.5 m BCD (maintained to -7.5m BCD)

Non-Spatial Elements	Description	
	Berth Pocket	40 m wide, -9.5 m BCD (maintained to -9.0m BCD)
Quay Area	Area of quays, customs and bonded storage area. Gravel on compacted fill material.	0.45 km ²
Laydown Area	Hardstand. Gravel, concrete slabs or paving on compacted fill material.	1.35 km ²
Temporary worker camp for construction of MOF	- Construction of a temporary camp within or near the area of the MOF; and/or - A large worker accommodation barge, referred to as a 'floatel', to be moored in the Morebaya river or coastal area with accommodation for up to 350 workers.	
Road upgrading	Upgrading of existing roads / tracks from Maférinya down to Singuie and along the access road to the MOF	30 km length, 7 m wide road with 1.5 m shoulders.
New roads	An approximate corridor for a new road to the main port is shown in <i>Figure 2.1</i> . The road will comprise layers of compacted fill covered by a weather proof surface.	25 km of 14 m wide, 4 lane road. The exact length will depend on the terrain and need to avoid critical habitats and communities. For the purpose of this SEIA, a worst case scenario length of 40 km is assumed under a 'maximum parameters' approach (see <i>Chapter 1, Section 1.3.2</i>).

An illustration of what the completed MOF quay area could look like following commissioning is shown in *Figure 2.3* below.

Figure 2.3 Schematic drawing of the Marine Offloading Facility



2.3 Schedule and Phasing

The MOF will be constructed in 3 phases over a period of 16 months. Phase 1 is mainly access roadwork, bulk earthworks and construction of a barge landing ramp for landing fleet of earth moving vehicles that will begin work on building the rest of the onshore components of the MOF and associated roads. Phase 2 is the construction of the onshore facilities and quay. In Phase 3, there will be additional dredging to bring the approach channel to sufficient depth.

The key components of each phase are described below.

2.3.1 Phase 1

Phase 1 will involve:

- land clearance to establish a laydown area, comprising clearing, levelling and fencing of a main site of approximately 1.35 km²;
- adjacent construction of roll-on roll off barge landing ramp for landing craft;
- access road upgrading;
- installation of a temporary worker camp for some 350 construction workers (either an onshore camp or a 'floatel' moored in the Morebaya River); and
- bringing in shallow draught landing craft and barges for initial offloading of equipment for building the MOF.

2.3.2 Phase 2

Phase 2 will involve:

- construction of the new roads from the MOF to the Simandou stockyard location and to Île Matakang;
- upgrading of the existing roads to the site including the road from Singuie to Maférinya;
- dredging of an approach channel to a depth of 3.5 metres Below Chart Datum (BCD) and disposal of the dredged material;
- establishment and operation of the quarry and any required borrow pits;
- construction of the quay, hardstanding areas for offloading operations and installation of cranes and other equipment;
- installation of facilities for site drainage, sewage treatment and disposal, potable water supply, power generation by diesel-powered generators, lighting, fuel unloading, storage and distribution, waste management and storage; and
- construction of offices and other buildings.

2.3.3 Phase 3

Phase 3 will comprise the deeper dredging of an approach channel to a depth of 8.5 metres Below Chart Datum (BCD) and disposal of the dredged material, to allow larger vessels to visit. Dredged material will be

disposed of at a site 15 km southwest of the entrance to the Morebaya River in water depths in excess of 20m.

2.4 Construction

A brief description of the following key elements of the construction of the MOF is provided below.

- site preparation (clearing and grubbing, levelling, re-profiling and grading);
- dewatering;
- piling and construction of suspended quay, berths and Ro-Ro ramp;
- construction of revetments and rock armouring;
- infilling and reclamation;
- site drainage and dewatering;
- protection dolphins, link-span and fendering system;
- quarrying
- dredging; and
- construction of roads and other on-site facilities.

Construction equipment will include earthmoving equipment for site preparation, shallow draught barges for transport of equipment and materials, mobile jack-up rigs for piling operations, graders, trucks and other road construction equipment. All buildings, tanks and treatment units will be brought in as pre-fabricated modules.

Barges associated with Phase 1 will include landing craft of 600 to 5 400 Dry Weight Tonnes (DWT).

Vessels associated with Phases 2 and 3 will include fuel barges (typically 3 650 DWT), general purpose barges of between 2 000 – 5 400 DWT, heavy lift cargo vessels of up to 13 000 DWT and tugs/other small craft for ferrying personnel to/from offshore sites for marine construction works.

2.4.1 Site Preparation

Site preparation will include clearing of onsite vegetation, and removing and stockpiling of topsoil. Ground excavation and improvements may be required involving the removal of weak material and placement and compaction of structural fill to the required levels (see *Section 2.4.3*).

The site will be graded with a slight rise towards the landward side with secondary falls within the profile to facilitate drainage. Once level the area will be capped using graded aggregate and surfaced with block paving, concrete slabs or gravel depending on the usage of each area. Road and site drainage will be installed.

2.4.2 Dewatering

Dewatering may be required during construction and will be carried out using pumps connected to flexible pipes to channel water away from the site. Appropriate discharge or reuse options for this water will be identified if required, depending on the volume and quality of water. These options could include use for dust suppression or other non-potable construction water uses. If the water cannot be reused a permit will be obtained and it will be discharged in accordance with applicable standards into the Morebaya River or a tributary.

2.4.3 Piling and Quay Construction

Piling will be carried out for the quay and in areas where ground-bearing capacity is insufficient. The soils at the site are expected to be primarily silt, clay and silty clays overlying granite bedrock at approximately 30 metres below the mud line. The extent of ground improvement work will depend on the presence and depth of underlying bedrock and could involve a combination of vibro-compaction (and vibro-replacement). If bedrock is not present, then ground improvement works will be either grouted rock columns or concrete displacement columns.

Piled sections of the suspended quay and berth areas are expected to take approximately 2 months to complete and will be undertaken using vibration piling followed by percussive piling at the end.

Once piling works are complete, construction of a suspended quay deck will commence. The quay will be constructed sequentially, extending out from the shore. The bulk of the works will be carried out from land.

2.4.4 Revetment Rock Armouring

Revetments will be provided to dissipate wave energy and reduce wave overtopping. This will shelter the MOF (keeping vessel movements at berth to within $\pm 200\text{mm}$), and prevent erosion of and subsidence of marine structures and reclaimed land.

They will also accommodate surface water drainage of quay decks, access roads and other pavements.

The revetments will be composed of a central core comprising rock fill material, and outer rock armouring consisting of an underlayer and primary armour layer, with stone size and weight greatest in the outer layer. Rock armour and core material will be stockpiled on site. Approximately 0.3 million m^3 of rock material will be required to construct the revetments and hardstand and this is likely to be won from the planned quarry north of the MOF site.

2.4.5 Infilling

The quay area will be reclaimed by infilling the area between the revetment walls and sheet piling. Once the area is infilled and graded to the correct level, a layer of capping material consisting of graded fill material will be used to form a stable and suitable base upon which to layer the quay deck surface. Geo textiles and geogrid may be used to strengthen embankment fills.

2.4.6 Surface Water Drainage

Drainage will deflect natural stream flows away from the site and cater for surface run off within the site boundaries. The drainage network within the site will be established at the commencement of construction activities so that dirty water can be captured and directed to temporary silt traps and sedimentation ponds. The captured water may be reused during construction for dust suppression and for compaction moisture control when conditions are dry and to supplement the operational raw water supply. Reuse will be dependent on the salinity of the captured water.

The size of sedimentation ponds will be based on 24 hour retention for a 1 in 2 year average recurrence interval (ARI) rain event. The ponds will be rectangular in shape to facilitate the settling out of suspended solids. Water quality will be regularly monitored to ensure that the captured water is safe for release. If extreme rain events exceed the pond capacity the overflow is expected to be sufficiently diluted to have no impact on receiving water when overflows occur.

Open earth site drains will be generally trapezoidal shaped with a minimum bed width of 1.2 m to allow cleaning out with bobcats or similar machines. The design will accommodate rainfall events based on an ARI of 1 in 20 years for sustained flow that maintains a freeboard and a limiting scour velocity of 0.8 m per second.

Culverts will comprise mainly plastic-coated corrugated steel pipes and reinforced concrete box culverts. The culverts will be located to reduce the blocking effect of the embankment formation and orientated to minimise disruption to existing drainage paths.

2.4.7 Protection Dolphins, Link-span and Fendering System

Quays will be fitted with dolphins and a fendering system that ensures safe and efficient berthing and mooring of vessels. A link-span will be installed at the ramp to allow the operation of moving vehicles on and off a RO-RO vessel. The equipment will be brought in as modules and assembled and mounted on site.

2.4.8 Capital Dredging

Construction of the MOF will include the capital dredging of an approach channel in the Morebaya River to a depth of 8.5 metres Below Chart Datum (BCD). The channel will have a width of 100 m over a length of approximately 24 km (see *Figure 2.4*).

Figure 2.4 MOF Morebaya River Dredge Channel

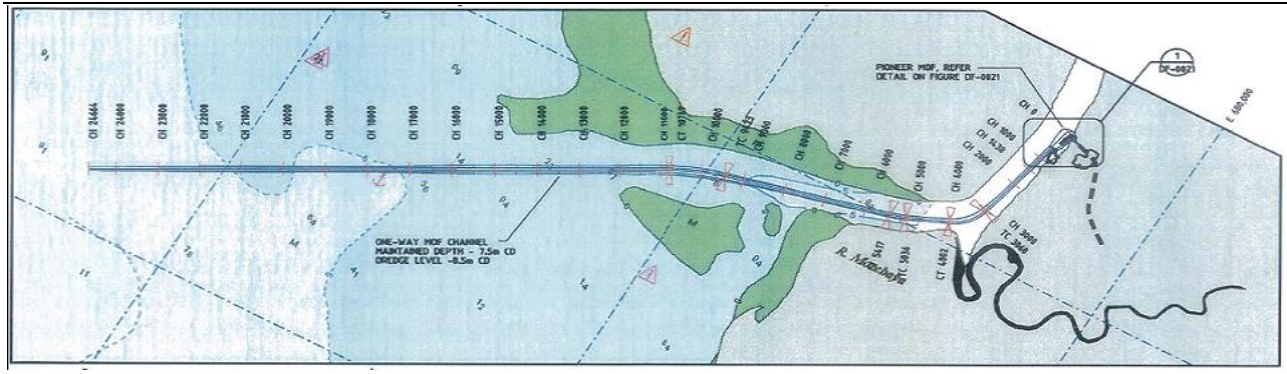


Figure 2.5 Typical Dredgers



2.4.9 Quarrying and Borrow Pits

Rock material will be required for the construction of onshore facilities such as roads, laydown areas, buildings, and for marine works such as revetments. Construction of the main port facility and stockyard will also require rock. Investigations are ongoing to identify the optimal sources for this material but it will be sourced from within the site perimeter or from established suppliers where possible, or by developing new quarries or borrow pits to supply the works. The nearest source of rock is likely to be the granite rock outcrops north of the MOF site.

If this is found to be suitable the quarry method is expected to use the traditional open pit practice of drilling and blasting rock benches, loading of material with either a wheel loader or excavator with hydraulic grab, and hauling to the destination with large haul trucks.

Drilling will be done with heavy duty down the hole and top hammer drill rigs to a preset pattern. The blasting parameters will be designed to suit the rock conditions and gradation requirements. The holes will be charged with slurry explosives as base charge and ANFO (a type of blasting agent) as column charge.

Material exceeding one tonne will be extracted for armour rock using hydraulic excavator equipped with hydraulic grab. For production of small armour (100 kg to 1000 kg), larger size rock will be broken into smaller sizes using heavy duty excavator mounted hydraulic hammers.

Smaller material from the quarry face will be loaded by wheel loaders and transported by dump trucks to a stone crusher plant. It will pass through a system of surge hoppers, secondary and tertiary impact crushers, sizing screens and conveyors to produce crushed aggregates of various gradings. Products will be either loaded directly into trucks or stockpiled for future use.

Other material for site preparation, fill material and roads will be sourced from within the site perimeter, from established suppliers where available or from small short term borrow pits located nearby. Details on the plans for borrow pits including environmental mitigation measures, are presented in the advance works SEIA for Simandou Project Camps and Logistics Supply Centres. These will be followed for any borrow pits required for the MOF Project.

2.4.10 Road Construction

The MOF Project will include will construction of new roads and upgrading of existing roads to handle the large volumes of traffic.

For new roads, a 30 m Right of Way (RoW) will be cleared of vegetation, structures and other obstacles. Once the ground has been cleared, topsoil will be stripped and, where practical, put aside for later reinstatement. The RoW will then be graded to create an adequate surface for road construction.

Roads will be designed to protect existing drainage courses. Culverts will be placed for existing waterways and across seasonally flooded depressions so as to prevent impoundment.

Where ground conditions are unsuitable, superfluous material will be excavated and removed a layer of fill spread and then compacted to specifications. This process may be repeated several times until a suitable elevation and ground bearing capacity is achieved.

The completed road will be finished with bitumen or other weatherproof surface.

Upgrade of the existing roads may involve widening, re-alignment of sections, infill and new surfacing. The Maferinya to Singuie will be improved to provide a 7 m carriageway with 1.5 m shoulders and finished with bitumen or other weather proof surface.

Examples of earthmoving works during road construction are shown in *Figure 2.6*.

Figure 2.6 Examples of Road Construction



2.4.11 Construction Waste Management

During construction, wastes will be segregated at the point of generation and stored in separate containers (eg, metals, wood, miscellaneous packaging) located at various waste collection areas on the site. Waste will be stored in these areas until it can either be re-used or recycled on-site or transferred to a central waste management facility at the nearest Simandou Logistics Supply Centre. The waste storage area will be a restricted access area used only to receive, segregate and store waste prior to disposal.

At the central waste management facility wastes will be recycled or treated prior to safe disposal. Inert wastes generated during construction such as soil, rock and cured concrete will be re-used wherever possible. Wood, paper, plastic packaging and cardboard will be sent for recycling if facilities are available or safely incinerated. Treatment and disposal of hazardous wastes will be accomplished primarily by incineration or placement in a properly engineered, lined and managed landfill.

2.4.12 Construction Workforce

The MOF construction workforce is expected to number approximately 350 people. Initially workers will be housed in a pioneering worker camp near the MOF. Longer term accommodation will then be set up either within the site perimeter or on a worker accommodation barge or 'floatel' moored in the Morebaya River. The worker camp will consist of modular units brought in by truck and barge that can be quickly assembled and disassembled.

If available a 'floatel' could accommodate up to 500 people. Facilities would include individual rooms, recreation area, restaurants, potable water supply and distribution, sewage treatment, communications and a heli deck. The 'floatel' location would be moored nearby on the bank of the Morebaya River north of the

MOF site. An access ramp and car park would be provided at the 'floatel' mooring with a short access road to the MOF.

Expatriate workers and non-local nationals will be housed at the workers camp and transported by bus to and from the work site with the majority of this movement being in the morning and evening. Local personnel will be picked up from their villages by bus and transported to the work site in the morning and returned home in the evening.

2.5 MOF Operation

The MOF will operate for approximately 3 years for the import and transfer of materials, vehicles and equipment for use in construction of the Simandou mine, rail and port development.

It will operate on a roll-on roll-off (Ro-Ro) basis for movable equipment and load-on load-off (Lo-Lo) for handling of bulk goods and containers. Facilities will include customs clearance, storage and servicing of equipment and handling of construction materials.

2.5.1 Movement of Good, Equipment and Materials

The operation of the MOF will involve considerable traffic movements from the MOF area to construction sites and laydown areas for the main project. Traffic movements to and from the MOF are estimated to be of the order of 500 vehicles per day. As these movements will extend across the Simandou Project their impact is not assessed here but will be considered in the main project SEIA.

Tug boats and service vessels will also operate from the MOF in support of planned maritime construction activities, including heavy lift ships and Ro-Ro vessels of between 6 500 – 13 750 DWT, and general cargo vessels of up to 8 000 DWT.

2.5.2 Electricity Supply and Distribution

Estimated power demand is expected to be 1000 kW per day, and will be supplied from two 800 kW diesel generators on site. Buried electrical cables will distribute power around the site. Vessels at berth will use their own power supply.

2.5.3 Fuel Supply and Distribution

Diesel fuel for generators and construction equipment will be initially be brought in by road tankers (11,000 to 34,000 litre capacity). An estimated 17,500 tonnes of fuel will be brought in by 600 large tanker movements over the first 16 months. During this time a pipeline will be constructed to carry fuel from a dedicated double-hulled fuel barge to an onshore fuel storage tank. The fuel barge will be moored in the Morebaya River and resupplied by visiting tankers. The onshore tank will be double-skinned, with a capacity of 1,000m³ and secondary containment to prevent spills reaching the external environment.

Some 590,000 tonnes of diesel is expected to be supplied through the MOF over three years of operation.

2.5.4 Water Supply and Distribution

Owing to the lack of reliable freshwater sources nearby, potable water will initially also be supplied by road from existing wells or rivers east of the N4 highway. During phase 2 a system of modular water treatment plants (WTPs) will be set up that will enable production of potable water from ground and or surface water in the area. Necessary permits will be obtained for any new abstractions.

Process water for use in construction processes (eg concrete production) and dust control will be sourced from sedimentation ponds and existing surface water bodies, such as rivers and seasonal wetlands. No saline or brackish water from nearby creeks or groundwater resources will be used.

Firefighting water will be held in tanks to provide a sustained flow rate of 250 000 litres per hour, for up to four hours.

2.5.5 Sewage Treatment

During the initial stages of construction, sewage will be treated using portable chemical treatment units. Modular sewage treatment plants will then be installed to treat sewage from the worker camp and site offices designed to achieve the applicable standards for treated effluent. Treated effluent will be discharged to the Morebaya River via an outfall in compliance with these criteria. Sewage sludge will be sent by truck to the central waste management facility for incineration.

2.5.6 Waste Management

All waste produced during MOF operation will continue to be managed as described in *Section 2.4.11*.

2.5.7 Maintenance Dredging

Maintenance dredging will be required once the MOF is operational, in order to maintain declared channel and berth depths for the safe passage of visiting vessels. The frequency and volume of maintenance dredging is not known at this stage and will depend upon the rate at which the dredged channel and berths naturally fill in with sediment. The methodology and disposal sites for maintenance dredging are likely to be the same as described above for the capital dredging operation.

2.5.8 Workforce

The workforce required for operation of the MOF will be approximately 100 people. The arrangements for personnel will be similar to those for construction (see *Section 2.4.12*).

2.6 Post Operation

Future plans for the MOF after construction of the Simandou Project are not yet decided. It may remain in service, with its operations becoming part of the main project or it could be handed over to another operator or closed and decommissioned. Continued operation of the MOF, or the arrangements for handover or for closing and decommissioning will be assessed in the main Simandou Project SEIA.

3 Scoping and Stakeholder Engagement

3.1 Introduction

As set out in *Section 1.3*, an initial scoping exercise was carried to identify the potential significant impacts associated with development of the MOF Project and plan the Social and Environmental Impact Assessment (SEIA). The results of this were reported as part of the SEIA Terms of Reference submitted to Government in August 2011⁽¹⁾. The section of the Terms of Reference referring to the MOF is presented in *Annex C*. This identifies the main topics that form the basis for the impacts addressed in the later chapters of this SEIA Report.

To assist the Government in reviewing the Terms of Reference, a formal presentation was made to the Guinean Bureau for Evaluation of Environmental Studies (BGEEE) and representatives from the BGEEE were accompanied on a field visit to show them the types of locations planned for the Project and to discuss the scope of the SEIA.

Following this, the views of other stakeholders regarding the proposed Project and the scope of the SEIA were sought through a programme of consultations undertaken for the wider Simandou Project. The aim was to ensure that the views and concerns of stakeholders were considered as part of the impact assessment process, that the SEIA process focused on likely impacts of most importance to stakeholders, and that mitigation plans took into account the views and expectations of stakeholders. In this context, a stakeholder is defined as a person who has an interest in the Project, either as an individual or as a representative of a group.

3.2 Stakeholder Consultations

Stakeholder consultation involved dissemination of information about the Project to government authorities and a series of stakeholder events in September and October. A national conference was held in Conakry on September 19th and was attended by an invited audience from national, regional, prefectural and local government, non-governmental organisations, academic and research institutions, community representatives and the media. Following the national conference, a series of stakeholder events were held in the ten prefectures affected by the Simandou Project.

Only the event in Forécariah is relevant for the MOF SEIA. At least two weeks prior to this event, local leaders including Prefects and Governors were formally invited to attend and were asked to communicate the events to relevant stakeholders, including Sub-Prefects and traditional leaders, within their respective communities. The event was open to members of the public, and was publicised by local leaders and through announcements on local rural radio stations.

The locations, dates, approximate numbers of attendees and comments received at both the national conference, and at the Forécariah event, are summarised in *Table 3.1*. Summary attendance lists for both events are provided in *Annex C*. As shown in the annex, the meetings were attended by representatives from national, regional, prefectural levels and local government, community leaders, members of the public and representatives from the local media.

Table 3.1 Stakeholder Consultation Events

Location	Prefecture	Date	Approx no. of participants	No. of comment forms
Conakry	Conakry	19 September 2011	170	95
Forécariah Centre	Forécariah	22 September 2011	170	171
TOTAL			340	266

(1) The full Terms of Reference covered the main Simandou Project but specific sections were included relating to the planned early works including the MOF

At both events, participants were provided with brochures describing the proposed developments and information regarding where the Terms of Reference could be obtained (on the web or in hard copy). Participants were also provided with a feedback form to facilitate submission of their comments. The brochures, terms of reference and comment forms were also available on the Simandou SEIA website and copies were provided to national ministries and agencies, non-governmental organisations, governorate and prefectural authorities. Comment forms could be handed in on the day, submitted on-line or returned by email or by hand to Simfer and to Simandou Project offices and infoshops in Beyla and Kérouané. Feedback on the advance works Terms of Reference was requested within 30 days.

As shown in *Table 3.1*, a total of approximately 340 individuals attended the consultation events held and more than 250 comment forms have been received thus far. It should be noted that the consultations covered the Simandou Project, as well as the MOF, and the comment period remains open for the Simandou Project. Members of the SEIA team also visited the MOF area and nearby settlements in July and informal consultations took place at this time. The majority of comments received to date, relevant to the MOF, relate to the following key issues:

- The Project's employment opportunities, particularly for the young;
- Rio Tinto's support to local organisations and associations and for income generating activities;
- The resettlement compensation process (how will the compensation rates be set? will there be differences between families?);
- The selection of host sites in case of resettlement (will the local population be involved in the choice? how will bad experiences from the past be avoided?); and
- The protection of the environment in the Project area and at sea for fishermen (what measures will be taken for the protection and restoration of plant cover? will the fishermen still be able to go fishing?).

A further opportunity for comments regarding the MOF will be provided following publication of this draft report.

3.3 Future Stakeholder Engagement

A continuing programme of stakeholder engagement is planned during the next stages of the MOF Project. This SEIA Report will be disseminated to national, regional and local government authorities and national and international non-governmental organisations, and their comments will be considered in finalising the SEIA and Social and Environmental Management Plan. The disclosure period will run for approximately 30 days following submission of the draft SEIA Report to the Government of Guinea. During this disclosure period the draft report will be:

- available on the Rio Tinto website http://www.riotintosimandou.com/index_seia.asp
- available on request by applying to Simfer at simandou.eise@riotinto.com
- available for review at Rio Tinto and Simfer offices:
 - Simfer SA, Immeuble Kankan, Cité Chemin de Fer, BP 848, Conakry, République de Guinée
 - Rio Tinto Simfer SA Info Centres at Beyla and Kérouané;
 - Rio Tinto, 17 Place de Reflets, La Défense, Courbevoie, 92097 Paris ; and
 - Rio Tinto, 2 Eastbourne Terrace, Paddington, London.

The feedback process that has been established for the Terms of Reference will continue during the disclosure period. Stakeholders can provide comments via the website, by email to the address shown above and by post or in person at any of the Rio Tinto offices listed previously.

Any comments received during this disclosure period will be reviewed and considered by the SEIA team when drafting the final Project proposals, mitigation proposals and SEIA Report. In cases where a response is necessary, one will be provided within 30 days of receipt of the comment.

In parallel, the MOF site and road corridor will be visited by social and environmental specialists, together with the engineering team, and the local administration and local community will be consulted on planning for each facility. Local consultation regarding the findings of the SEIA will be carried out during this visit. Local land owners and users will also be consulted on arrangements for acquisition or temporary leasing of the land and to agree compensation for displacement of existing land uses (refer to *Annex F*).

Comments received from stakeholders will be recorded in the Stakeholder Register for the Simandou Project. This register will be made available when the SEIA for the Simandou Project is being published in 2012.

3.4 Grievance Procedure

Throughout this process a Grievance Procedure will operate to ensure that any grievances are received, considered and resolved in accordance with international good practice. In this context, a grievance is defined as a complaint or concern raised by an individual or organisation who judges that they have been adversely affected by the Project during any stage of its development. Grievances may take the form of specific complaints for actual damages or injury, general concerns about Project activities, incidents and impacts, or perceived impacts.

The Grievance Procedure will follow the approach currently operating in the area of the mine. This is a simple and transparent process designed to be culturally appropriate and readily accessible to all parties within affected communities at to operate at no cost and without retribution. The procedure will not impede access by stakeholders to other judicial or administrative remedies. Individuals and groups can lodge grievances by various means including, in person, by mail or email to any of Simfer's satellite offices in Beyla, Kérouané, Moribadou, Macenta, Mamou and Forécariah, to members of Simfer's Communities Team who regularly visit local affected communities, and via the website (http://www.riotintosimandou.com/index_seia.asp) and the Simandou email address: (simandou.eise@riotinto.com).

A written record of all grievances is maintained and effective resolution of grievances in a timely manner is facilitated by appropriate means including dialogue and site visits.

The grievance procedure has already been communicated to communities in the area of the mine. It was also communicated during all of the stakeholder engagement events completed to date and will continue to be communicated as part of ongoing stakeholder engagement.

4 Impacts on the Physical Environment

4.1 Introduction and Scope

This Chapter provides an overview of the physical baseline and an assessment of the impacts to the physical environment from the Material Offloading Facility (MOF). This includes both the marine and the terrestrial environments.

The terrestrial physical environment incorporates the freshwater fluvial environment, comprising drainage channels and any underlying hydrological features, and terrestrial environment. The marine environment includes the offshore, coastal and tidal sections of the main fluvial water bodies within the study area, principally the Morebaya River and hinterland.

4.2 Methods and Sources of Information

The overall impact assessment methodology is presented in *Annex C*. Receptor specific values and sensitivities are described in each relevant section of the assessment below.

The principal source documents used include:

- “*Etat de reference du milieu aquatique. Site des installations portuaires*”, SNC Lavalin, completed December 2008.
- Final Report Value Enhancement Study – Environmental Component Simandou Project, Rio Tinto/ SNC Lavalin Environment, June 2010.
- Draft Report Value Enhancement Study Rail Road and Port Site, Rio Tinto Simandou/ GEPFE, June 2010.
- Simandou – Port and Rail Project in Kabak Preliminary Report Fishing Villages. Rio Tinto Simfer/ GEPFE/ SNC Lavalin, 2011.

The baseline for the physical environmental components addressed by this chapter is additionally informed by a site fly over, walk over, boat trips, review of drilling logs from ongoing geotechnical field investigations and a desktop review of previous studies by Simfer.

Site visits by the Project team have enabled walk-over observations to be made to supplement aerial imagery, desktop data sources and previous surveys of comparable or nearby areas. This has allowed the development of the site physical and biological baseline. In addition social field studies have covered much of Ile Kabak nearby and some of the villages close to the MOF site.

Where supplementary information is used it is referenced in footnotes.

The information sources referred to above are considered to be the best available data existing at present to inform this assessment. The details of survey methods used are described in these documents. Some of the information held in these documents refers to an area immediately south of the present study area. However, given that the two areas are both within Maritime Guinea the habitats are likely to be very similar and so the available data is considered to be of sufficient detail to inform the assessment of environmental impacts associated with this Project. Additional surveys are being undertaken to verify this assumption. The surveys will supplement the understanding of the site and will aid monitoring. If the findings of these on-going surveys significantly contradict those referred to in the baseline, Simfer is committed to re-evaluating the impacts and providing corrective actions, as appropriate.

Baseline information is only presented when it is relevant to activities associated with the proposed MOF development, and its potential environmental and social impacts. The project team has scoped in or out potential impacts to receptors based on the information available, and justification is given for the inclusion or exclusion of specific environmental and social impacts.

4.3 Baseline Environment

This section provides a general introduction to the study area and describes the environmental baseline conditions. The following topics are discussed:

- Geographic setting
- Geology
- Soils
- Non-marine surface waters
- Terrestrial noise and vibration
- Climate
- Air quality
- Microclimate
- Oceanography
- Marine and estuarine sediments

4.3.1 Geographic Setting

The republic of Guinea covers an area of approximately 245 000 km², and is divided into four distinct regions based on their specific human, geographic and climatic characteristics. The project is situated in the region known as Maritime Guinea, an area which encompasses the entire Guinean coastline, which stretches for approximately 320 km between the countries of Guinea Bissau in the north, and Sierra Leone in the south.

The project area itself lies in the coastal region between the shoreline and the Fouta-Djalou mountains in the le Kabak region approximately 35 km south of the capital, Conakry. The topography transitions from mountainous areas in the east via a series of plains to the mangrove areas that border the shoreline, transacted by the Morebaya river system. The coastal formations are primarily formed by tidelands composed by fluvial and marine sediments. It is noted that there is a defined wet season in the area and that at this time there may be periodic/ seasonal flooding of much of the area. This is not only an important component of the cycle of use of the '*bogoni*' rice fields and habitation but also clearly alters the nature of the local hydrological regime at these times. The baseline description herein assumes the base hydrologic regime, not that under an inundated flood plain *Figure 4.1* provides an overview of the study area.

Additional and ongoing research is also being undertaken to supplement the available data regarding the habitats of the region. Existing data is largely generic in nature for the entire Maritime Guinea area, although some more specific information does exist for some locations further south.

The site setting is currently that of a subsistence rural agriculture and areas of uncultivated land, trees and rock outcrop with scattered low density village habitation nearby (see *Figure 2.2*).



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SOURCE: GeoEye 0.5m (Feb 2011) PROJECTION: WGS 1984 UTM Zone 28N		

TITLE: Figure 4.1 Remote Sensing Image of MOF Study Area / Image de télédétection de la zone d'étude du MOF		
DATE: 10/11/2011	CHECKED: MK	PROJECT: 0131299
DRAWN: GN	APPROVED: KR	SCALE: As scale bar
DRAWING: po_geosetting_MOF.mxd		REV: 0

4.3.2 Geology

There is no published detailed information on the geology in the coastal area of Guinea. Coastal areas originate from Tertiary and Quaternary geological periods, the latter including Holocene deposits. Existing data from a borehole, located in the Morebaya River adjacent to the proposed MOF quay ⁽¹⁾, indicate that the geological strata underlying the Project area consist of an initial layer of unconsolidated sands and clays, approximately 20-30m in thickness, underlain by granite bedrock. Further geotechnical surveys are on-going. Sediments are believed to be of mixed marine and fluvial origin. To the north of the proposed MOF exist two outcrops of granite.

4.3.3 Soils

The soils in Maritime Guinea are classified into three groups:

- Potential acid-sulphate soils can be either continental or maritime. The maritime soils are characterised by variable salinity (both seasonally and spatially) and acidity due to frequent submersion and drainage of the soils.
- Lateritic soils have low mineral and organic content. Areas of lateritic soils were previously covered by forests which have since declined.
- Skeletal soils are shallow soils comprising weathered rock fragments and are found on slopes in mountainous regions with high erosion rates. In Maritime Guinea these soils can be found close to the Fouta-Djolon mountains.

No soil classification has been undertaken at the MOF at this time, however soils are likely to include potential acid sulphate ⁽²⁾ and lateritic soils.

Soils across the site are expected to be varied and representative of the transition from a saline/ brackish channel system to areas of tended rice field (*'bogoni'*) and uncultivated grasslands and areas of trees. Many areas of soil within the flood plain are annually/ intermittently inundated with silt laden flood waters which will contribute to the physical and chemical properties of soil. Soils are believed to be natural and there are no significant known sources of anthropogenic contaminants upstream on the Morebaya River or locally. Based on desktop studies and walkover surveys, there is no evidence of soil treatment via chemical fertiliser/ improver agents.

4.3.4 Groundwater

Limited baseline information is available on the nature and properties of groundwater aquifers underlying the MOF site and surrounding area. The site overlies ground which is known to be water bearing due to the presence of shallow groundwater which is exploited for water supply. There is evidence from a number of sources including stakeholder consultation activities that some local borehole/ well water supplies are brackish or seasonally brackish and that water in some of these sources is restricted in availability. This indicates that boreholes and local shallow water supplies are likely to be in unconfined aquifers which are in hydraulic continuity with the brackish river water and/or are affected by seasonal inundation by brackish flood waters. These shallow groundwater bodies are also supplemented by freshwater recharge from precipitation infiltrating through soils.

The port baseline study produced by SNCL in 2010 indicates that the underlying solid geological formations in the coastal area of Guinea may also be water bearing. However as the MOF project should not affect these deeper/ confined groundwaters they are not considered further in this baseline description or assessment.

(1) Golders, Draft Geotechnical Borehole Log, BH004M. 2011

(2) Acid Sulphate Soil Risk Mapping.SNC Lavalin. 2011. Technical note prepared for Rio Tinto.

4.3.5 Non-marine Surface Waters

Within the context of tidal river systems in the area the principal surface water body of interest to the MOF development is the Morebaya River which is classified as 'marine' in this assessment.

At present the entire development site would be classified as 'greenfield' with associated rainfall runoff characteristics. Soils are close to the water table and saturated in some locations. The site is relatively flat with a low hydraulic gradient toward the Morebaya River. Exceptions to this are the granite rock outcrops which are likely to be of very low permeability. Precipitation is likely to run off the surface into surrounding soils or is lost via evaporation. A small amount of precipitation may infiltrate through cracks or imperfections in the granite itself.

For the purposes of this assessment non marine surface waters are those water bodies which lie upon the flood plain and are not tidal. These water bodies may be seasonal in nature, only being present during the wet season. At the MOF site, the surface water represents a network of artificial drainage channels which are managed to create, flood and drain the '*bogoni*' rice fields.

These channels and associated flooded areas support small populations of fish which are farmed by women tending fields and are used for drainage/ irrigation. They are not exploited for drinking water supply and are limited in flow and discharge volume. These channels are important from a number of perspectives in relation to the MOF development:

- The hydraulic regime and network of the channels supports irrigation of bordering agricultural land, including '*bogoni*' rice fields.
- Fish populations are cultivated within the channels.
- The flowing water prevents stagnation and the development of poor water quality/ breeding grounds for mosquitoes and insects and associated disease issues.
- In case of a pollution event, the channels can transport contaminants to linked fields and downstream water bodies such as the Morebaya River.

Existing surface waters are not exploited as drinking water as they are brackish in nature. The surface waters should otherwise be of good chemical quality given the lack of contamination sources and low level of development in the area. However, in agricultural areas surface waters may have concentrations of pesticides or fertilisers in common with other rice growing regions of the world.

4.3.6 Terrestrial Noise and Vibration

Baseline data were collected as part of the VES studies at Kimpipi and Sourinene both of which are located further south toward Benti. New noise baseline data will be collected for Ile Kabak as part of on-going surveys.

In lieu of baseline data, in terms of noise it is useful to qualitatively describe the site and setting in terms of the acoustic environment. The MOF area is currently undeveloped natural land under subsistence agricultural land use and at present the predominant noise sources are natural. Some anthropogenic noise sources do exist and include vehicles such as cars, trucks and motorbikes, boat engines, and domestic noise sources such as small generators and electric radios.

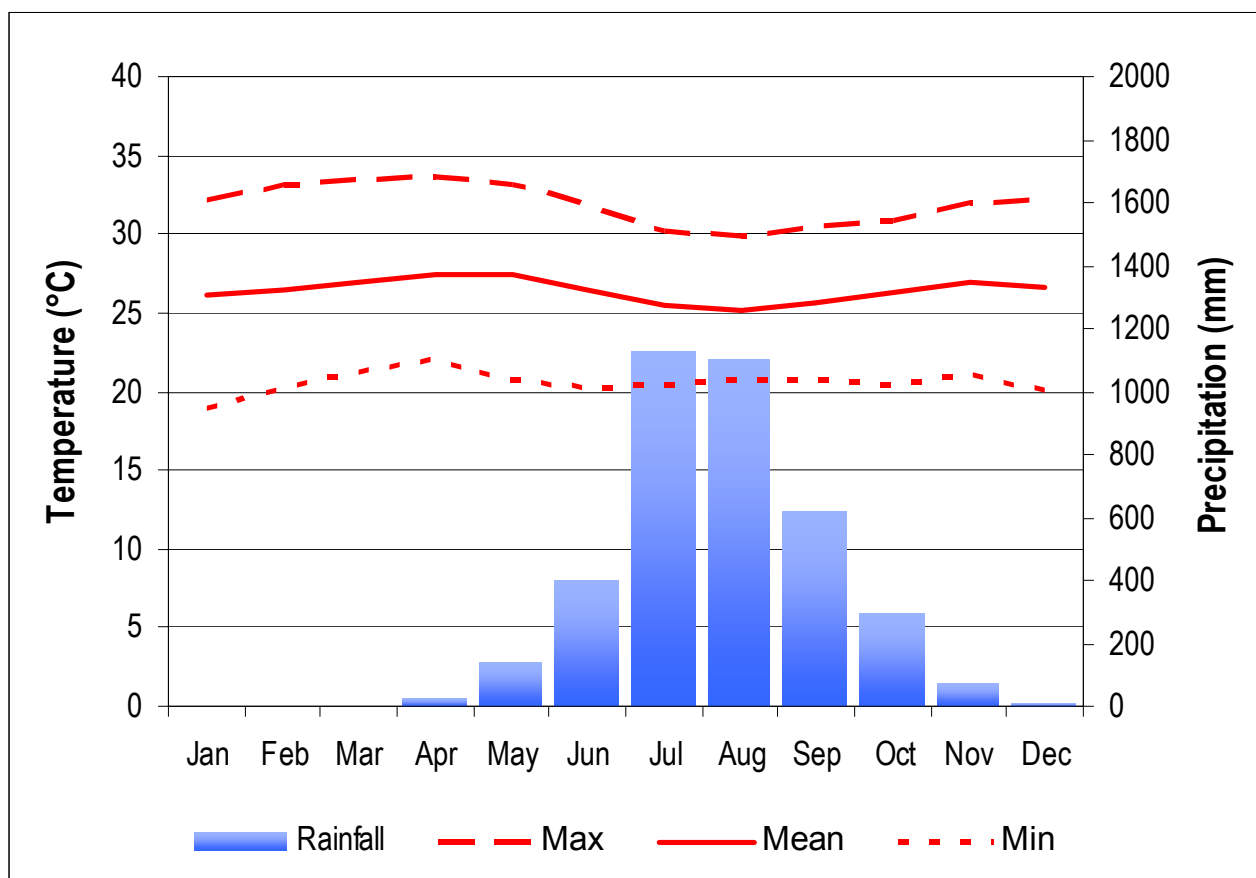
The MOF site has a very low population density and for the majority of the site there no developed roads. The eastern boundary of the site lies close to a number of small settlements and a road where background noise levels may be a little higher. Generally however the baseline noise environment is considered to be at or close to natural levels over the majority of the site. Levels of traffic are so low that in the context of the proposed development and associated traffic flows as to constitute a low anthropogenically generated noise environment.

4.3.7 Climate

The MOF project is not expected to have any impact on climate and therefore the baseline conditions are not evaluated in detail and no sensitivity / value is determined. A brief summary of typical seasonal weather is provided below as for example the rainy season may exacerbate environmental impacts on other receptors. The climate in Guinea is described as a tropical monsoon climate, with a consistent annual average temperature, ranging from 24°C in August to 28°C in March. The temperature difference between day and night shifts from 4-6°C in the north to 2-3°C in the south.

The wet season runs from May to November, with the majority of rain falling in summer months. Monthly temperature and rainfall statistics for the city of Conakry, approximately 30 km from the study area, are included in *Figure 4.2*.

Figure 4.2 Precipitation Statistics for Conakry, Guinea (1961-1990)



Data source: www.weather.gov.hk ⁽¹⁾

4.3.8 Air Quality

No baseline air quality data has been collected for the MOF site. Previous baseline data studies at Ile Kabak carried out from August 2007 to early 2008 included continuous monitoring for monthly dust settlement and average gaseous contaminant levels (SO₂, NO₂, O₃). The findings of this study determined that the airshed exhibits low levels of conventional contaminants SO₂, NO₂, and typical of a rural setting unaffected by industrial activities. Ozone levels were in line with those expected in a coastal setting. Maximum particulate concentrations (PM₁₀ and PM_{2.5}) were found to be very high in the dry season exceeding World Health Organisation (WHO) criteria but good in the wet season.

(1) http://www.weather.gov.hk/wxinfo/climat/world/eng/africa/w_afr/conakry_e.htm

The area is currently undeveloped natural land under subsistence agricultural use and the existing predominant sources of potential pollutants to air are from natural sources. Natural seasonal variations in dust / particulate matter do occur and levels can become high in the dry season. These elevated levels are commonly associated with the Harmattan wind which blows dry dusty air from the Sahara to the coastline, or due to particulates from bush fires ⁽¹⁾. Some minor anthropogenic air pollutant sources do exist and include emissions from vehicles such as cars, trucks and motorbikes, boat engines as well as dust from vehicle movements and fires. At present there are no major or concentrated population centres or industrial sites and associated sources of emissions to air close to the MOF site.

The MOF site and road corridor have a very low population density and for the majority of the study area has no formal developed roads. The eastern boundary of the site lies close to a number of small settlements and a road where dust/ particulate levels may be a little higher. Generally however the baseline air quality environment is considered to be at or close to natural levels over the majority of the site.

4.3.9 Microclimate

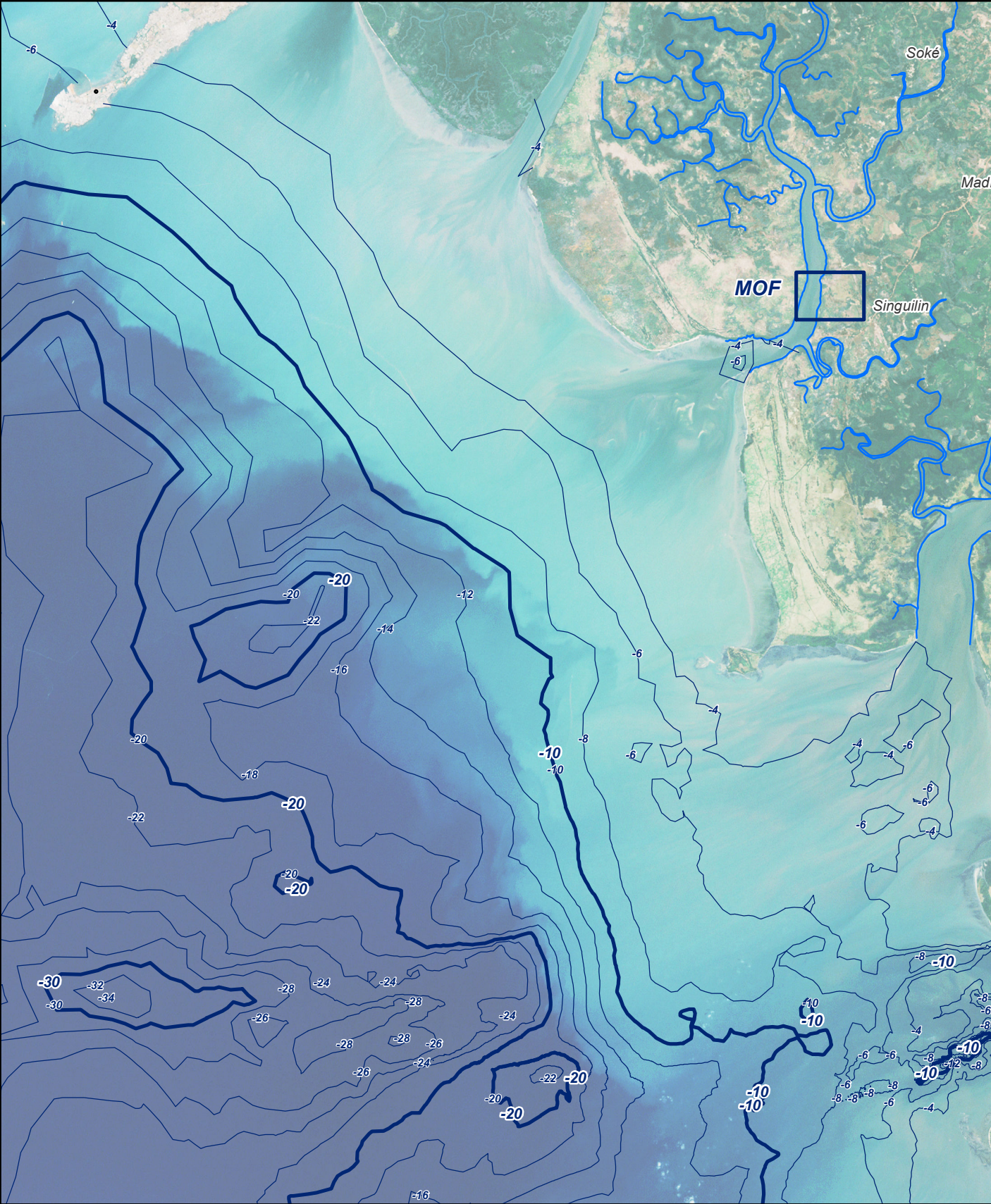
In agreement with the findings of the scoping exercise undertaken for the development of the overall project Terms of Reference the MOF project does not contain any components which would be expected to affect microclimate to any significant level. As such microclimate is not considered further in the MOF assessment.

4.3.10 Oceanography

Bathymetry

The continental shelf off Guinea is the largest on the African continent, measuring up to 120-130 km wide in some places, with a shallow gradient of typically less than 0.1%. The shelf is shallow with water depths typically below the 20 m depth contour. Prominent features include a submarine canyon where the 20 m depth contour extends further shoreward. Regional bathymetry is presented in *Figure 4.3*.

(1) SNC Lavalin, Baseline Study, Port, 2010



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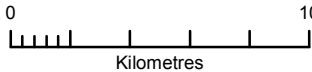
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Currents

The Guinea Current stretches along Africa's Atlantic coast from Guinea-Bissau to Angola ⁽¹⁾. It flows east at approximately 3°N along the western coast of Africa and can reach velocities of near 1 m/s in the reaches the Gulf of Guinea near 5°W ⁽²⁾. It is made up of water from the North Equatorial Counter Current (NECC) and the Canary Current. The seasonal instability of these two currents can affect the seasonal variability of the Guinea Current. The Guinea Current, like other eastern ocean boundary currents, is characterised by areas of upwelling and increased biological productivity.

The currents along the Guinean coastline are influenced by winds and seasonal conditions. In general, during the dry season (November-April) the Canary Current and upwelling events bring cold saline water in a south-southwest trend. Currents in the littoral zone are controlled by tides, with tides propagating up to 35 km upstream of rivers due to low riverine output.

In contrast, during the rainy season (May-October) warm, saline tropical surface currents are driven in a northerly direction by monsoon winds. Input of freshwater becomes much more important in influencing currents in the littoral zone, as precipitation can be up to 4,000 mm (4 m) over some months.

Tides

The tidal range in Guinea is typically higher than 3.3 m. In the north of the country, where the continental shelf is wider and shallower the tidal range can reach 6 m. In coastal areas the tidal current typically flows in a north-northeast direction during the flood tide and south-southwest during the ebb. Tidal current velocity can reach 1.2 m/s during the spring tide and 0.7 m/s during the neap tide. The tidal levels experienced at the MOF are shown in *Table 4.1*.

Table 4.1 Tidal Ranges at the Service Wharf

Tidal Stage	Tidal Level (m CD)
Highest Astronomical Tide (HAT)	4.14
Lowest Astronomical Tide (LAT)	0.00
Mean High Water Springs (MHWS)	3.70
Mean High Water Neaps (MHWN)	2.90
Mean Low Water Springs (MLWS)	0.60
Mean Low Water Neaps (MLWN)	1.20

Source: Baird report (2008) ⁽³⁾.

Waves

The dominant winds are the Harmattan ⁽⁴⁾ and monsoon winds. These winds generate weak surface waves and variable local winds. The frequency and wave height decrease towards the south.

(1) US Aid (2007) Guinea Biodiversity and Tropical Forests 118/119 Assessment. Prepared by the Biodiversity Analysis and Technical Support Team

(2) Joanna Gyory, Barbie Bischof, Arthur J. Mariano, Edward H. Ryan. "The Guinea Current." Ocean Surface Currents. (2005). <http://oceancurrents.rsmas.miami.edu/atlantic/guinea.html>.

(3) Baird report, Simandou project pre-feasibility study capital maintenance dredging and disposal, 2008.

(4) A hot, dry trade wind that blows from the northeast or east in the western Sahara and is strongest in late fall and winter (late November to mid-March).

4.3.11 Marine and Estuarine Sediments

There is a high sediment input from the various rivers and estuarine areas to the continental shelf of southwest Guinea. Sediment becomes finer with an increasing amount of shell fragments / organic remains further from shore. Very coarse sand is present in rivers and river mouths and very fine sand and fine sand can be found 15 km from shore, which is frequently suspended. A band of coarser, medium grained sand exists in a north-northwest – south-southeast trend approximately 25-30 km offshore.

The active sedimentation in the area is highly dependent on alluvial input during the rainy season, and tidal currents scouring sediment from estuaries during the dry season. The higher energy environment closer to shore leads to the formation of dune systems. Sand ripples can be found further from shore. In addition, the high sediment input along the continental shelf results in siltation of underwater canyons and depressions further offshore.

4.3.12 Water Quality

Estuarine and Coastal

Estuarine water temperature is strongly influenced by seasonality. During the dry season temperatures remain fairly constant, with temperatures around 30°C recorded in mangrove channels. During the rainy season temperature becomes more variable, with variations of up to 3.3°C observed.

Salinity is controlled by the mixing of fresh water from the riverine system and marine saltwater. During the dry season salinity ⁽¹⁾ increases from 18-30 psu upstream to 30-35 psu downstream. In general, salinity decreases during the rainy season with greater input of fresh water. A more gradual horizontal salinity gradient develops, increasing from 0-5 psu upstream to 18-30 psu in the estuary mouths.

The upstream parts of rivers represent a higher energy environment when compared to downstream. As such turbidity is highest in these upstream areas and decreases out into the sea. Turbidity is also considerably higher during the dry season compared to the rainy season where the greater volume of water carried by rivers 'dilutes' the suspended sediments. Surface turbidity in the Forécariah River measured more than 300 NTU ⁽²⁾ during the dry season compared to less than 10 NTU in the rainy season; turbidity in the Morebaya River can be expected to be of similar magnitude. Turbidity in mangrove channels is more variable, with no particular trends observed.

Concentrations of Total Organic Carbon (TOC) and Dissolved Organic Carbon (DOC) are slightly higher during the dry season, whereas dissolved oxygen is lower likely owing to the increased productivity. Concentrations of nitrate and nitrite are below the limits of detection in both the dry and rainy seasons, while phosphorous and silicon are higher in the dry season. Concentrations of silicon are higher upstream as a result of alluvial runoff.

Marine

Marine water temperature is lower than that of estuarine waters, typically 27°C, with temperatures more variable during the rainy season. During the dry season salinity is greater than 35 psu, however, during the rainy season salinity is strongly influenced by increased river runoff becoming less saline, ranging from 18 to 30 psu up to 30 km offshore.

Marine turbidity is much lower offshore than in estuaries and coastal waters. As rivers join the sea the water slows and more sediment is able to settle out of suspension. Similarly with estuarine turbidity, marine turbidity is lower during the rainy season due to the greater volume of river water.

(1) Salinity is presented in psu (practical salinity units) which is a measure of the mass of salt in a kg of water. Ocean water has a salinity of 35 psu.

(2) Nephelometric turbidity units.

Concentrations of TOC and DOC in the marine environment show little variation between the dry and rainy seasons and are typically below the limit of detection. Similarly concentrations of nutrients including nitrate, nitrite and silicon are below the limits of detection.

4.4 Prediction, Evaluation and Mitigation of Impacts

This section covers both impacts from construction and operational activities. Impacts from operation and construction have been assessed together due to the long-term period over which the changes are likely to manifest themselves. This is particularly true for changes in geomorphological patterns or obstruction of hydraulic connectivity. Where impacts are specific to the activities in the operation phase this has been highlighted.

After construction and operation of the MOF as defined for this Project it is anticipated that the MOF will continue to operate for the lifetime of the wider Simandou project and this period and associated potential impacts will be addressed by the SEIA of the main Project.

In terms of construction phase impacts, impacts may arise from one of the following broad categories:

- marine works, dredging and dredge disposal;
- routine discharges from temporary sewage treatment plants (STP);
- land use change;
- onshore construction works;
- road construction;
- drainage and construction run-off;
- resource use and waste; and
- non-routine events.

In terms of impacts from operation, these may fall under the following broad categories:

- physical presence of the MOF;
- physical presence of road and road use;
- discharges and emissions (incl. STP, from permanent drainage);
- maintenance dredging;
- resource use and waste; and
- non-routine events.

Also, activities that result in an impact on one and the same receptor in a given location have been assessed together.

4.4.1 Criteria for Assessment

In the preceding baseline sections the value / sensitivity of the receptors was evaluated. In the impact assessment undertaken in this section this value/ sensitivity is evaluated alongside the magnitude of change for any given impact to determine the significance of the impact. The magnitude of change depends on the nature, scale, probability and duration of the particular change that is envisaged. Significance is therefore determined by considering the sensitivity / value of the receptor and the magnitude of change expected as a result of the development. The assessment has determined there is no specific sensitivity of geology to change, therefore no significant impact has been identified.

Where it is possible and appropriate sensitivity / value is evaluated according to criteria, in some cases only a qualitative evaluation is appropriate and where this is the case this is stated. The criteria are used in this study and outlined in *Table 4.2*. *Table 4.2* presents the outcome of the assessment of sensitivity / value for physical environmental receptors and the justification behind the rating. In some cases physical environmental components may have not true sensitivity to change, but changes in them are of importance to secondary receptors, where this is the case this is identified. Where secondary receptors, such as biodiversity which depend upon a physical environmental characteristic are of significance these are also

mentioned for consideration and context but are evaluated in more detail in the appropriate section of the SEIA.

Table 4.2 Criteria for Sensitivity / Value of Physical Environment Receptors

	Sensitivity / Value
Geology	Geology has no inherent sensitivity to change but changes in local geology may be importance within the context of the physical landscape, in relation to water resources, biodiversity and cultural heritage.
Soils	Soils may be sensitive to changes in the physical structure, chemical nature and fertility. This is of importance in relation to their role within the wider ecosystem supporting vegetation growth and role in the hydrological regime and also in supporting human populations in terms of agricultural production and the general level of exposure to harmful substances within the environment. The classification of the sensitivity / value of soils is based on a qualitative assessment of a range of issues and in consideration of the above factors. In the physical impact assessment soils are classified as being of low, medium or high value / sensitivity in line with the following criteria. High • Highly vulnerable to physical disturbance, structure may be easily broken down and take a long period to recover. • Soil is rare or provides high value substrate for natural or agricultural productivity and or supports specialist flora/ fauna / forms of agriculture. • Soil plays an important role in local hydrological regime. • Soil is of good 'natural' quality and is not affected by anthropogenic sources of contaminant. Medium • Vulnerable to physical disturbance, structure may be broken down and but recovery possibly within one or two growing seasons. • Soil is provides a substrate for natural or agricultural productivity and or supports standard forms of flora/ fauna / forms of agriculture. • Soil plays a role in local hydrological regime but is not a critical component. • Soil is of 'natural' quality with no more than low levels of anthropogenic sourced contaminants present. Low • Soil is robust and not vulnerable to physical disturbance. • Soil is provides a poor substrate for natural or agricultural productivity. • Soil plays little or no role in local hydrological regime. • Soil is artificial, contaminated or otherwise non-natural and easily replaced.
Seabed characteristics and coastline	The seabed and beach environment may be sensitive to changes in the physical structure and chemical nature. This is of importance in relation to their role within the wider ecosystem supporting the marine and estuarine ecosystem and providing coastal defence to coastal communities.

	Sensitivity / Value
	In the physical impact assessment coastal and estuarine sediment and coastline characteristics are classified as being of low, medium or high value / sensitivity in line with the following criteria. High - Highly vulnerable to physical disturbance, structure may be easily broken down and take a long period to recover. - Sediment type is rare or provides high value substrate for natural productivity and or supports specialist flora/ fauna. - Sediment is of good 'natural' quality and is not affected by anthropogenic sources of contaminant. Medium - Vulnerable to physical disturbance, structure may be broken down and but recovery possibly within 3 years. - Sediment is provides a substrate for natural productivity and or supports standard forms of flora/ fauna. - Sediment is of 'natural' quality with no more than low levels of anthropogenic sourced contaminants present. Low - Seabed and coastline are robust and not vulnerable to physical disturbance. - Sediment provides a poor substrate for natural. - Sediment is artificial, contaminated or otherwise non-natural and easily replaced.
Water resources – groundwater, non-marine surface water and marine waters	Water resources may be sensitive to changes in the flow regime, resource availability and quality. This is of importance in relation to their role within the wider ecosystem supporting aquatic flora and fauna, within the wider functioning of the hydrological regime and also in supporting human populations in terms of water supply for potable and other uses and in supporting water dependent food sources such as fisheries and the general level of exposure to harmful substances within the environment. In lieu detailed baseline data to provide context or in some cases quality thresholds / criteria, the classification of the sensitivity / value of water resources is based on a qualitative assessment of a range of issues and in consideration of the above factors. In the physical impact assessment water resources are classified as being of low, medium or high value / sensitivity in line with the following criteria. High - Highly vulnerable to pollution or change in terms of resource availability. - Water resource supports important/ vulnerable secondary receptors which depend upon it whether flora, fauna, soils or human beings. - Water resource is relied upon locally with no alternative source. - Water resource is fundamental part of wider hydrological regime and ecosystem.

	Sensitivity / Value
	- Water resource is pristine quality, uncontaminated, highly protected or classified as vulnerable / protected under national/ international law and standards/ objectives. Medium - Vulnerable to pollution or change in terms of resource availability. - Water resource supports some secondary receptors which rely upon it whether flora, fauna, soils or human beings. - Water resource is relied upon locally although alternative sources may exist. - Water resource is a component of the wider hydrological regime and ecosystem. - Water resource is good/ 'natural' quality, with no more than low levels of anthropogenic sourced contaminants present, it may be classified as vulnerable / protected under law/ standards/ objectives at a local/ regional level of importance. Low - Resource is not vulnerable to pollution or change in terms of resource availability. - Water resource not important in supporting secondary receptors and not exploited for water supply. - Water resource is plentiful and unimportant in context of wider hydrological regime and ecosystem. - Water resource is poor quality, artificial, or contaminated and easily replaced and not protected under any water quality standards/ objectives.
Terrestrial Noise and Vibration	Noise impact assessment is typically a quantitative procedure which evaluates impacts in relation to source of noise based on sensitivity criteria which are developed based on the receptor in question and other factors such as the context of the baseline environment, the time of day/ week at which a receptors is exposed and the period over which receptors are exposed. A range of sensitivity and assessment criteria have been developed for the wider Simandou project in line with IFC and other criteria to enable the quantitative assessment of potential noise impacts. These include target criteria for construction works, exposure criteria in association with road traffic, general noise criteria and specific criteria in relation to blasting. For the purposes of the MOF SEIA a qualitative assessment has been undertaken, mainly because at this time there is not sufficient clarity of the likely construction phase impacts which will be the most significant for the MOF. There is also not currently sufficient data to allow a quantitative assessment of blasting operations at the Quarry. As a result a qualitative assessment which describes the likely potential impacts on receptors and potential mitigation measures has been undertaken and therefore no specific sensitivity criteria are presented. A quantitative assessment of noise impacts designed to target the required mitigation measures will be undertaken when sufficient baseline data is available.
Air Quality, GHG and Climate	Air quality sensitivity criteria for the Simandou project are being developed in line with the IFC criteria. The sensitivity descriptors used for air quality are typically quantitative and based on the potential sources of potential contaminant eg particulates, oxides of Nitrogen or oxides of Sulphur. These are used to assess potential exceedances of thresholds designed to protect human health and ecosystems or determine contributions of greenhouse gas emissions. As a result where relevant these quantitative thresholds are presented where relevant to allow assessment of impact significance.

4.5 Impacts to Geology

Potential impacts to geology will occur through quarrying.

The quarry site of approximately 19 ha will be permanently altered due to the removal of rock. This will potentially have secondary impacts on number of receptor groups including habitats and biodiversity, landscape character and potentially cultural heritage. In addition, the quarrying activities will restrict access to a wider area of land, which although not directly impacted, may degrade through lack of 'tending' and maintenance of drainage systems.

Quarrying transforming a currently undeveloped area into an active quarry and a large proportion of exploitable rock resource will be extracted which will result in a permanent change in the local geology. As a result the **magnitude** of impacts to geology from the MOF and associated quarrying is considered **large**. The geological formation has **no inherent primary value or sensitivity** in terms of geology but does in terms of its value to other secondary receptors such as its value as a resource, a habitat, or a landscape feature.

As a result, there is no further evaluation of the significance of impacts to geology of the project. Quarrying and impact on geology in terms of its importance to secondary receptors and indirect impacts are addressed where appropriate in other relevant sections of this study.

No mitigation and no residual impact are presented in relation to geology as no significant impact has been identified.

4.6 Impacts to Soils - Overview

Sensitivity / Value of Soils

Changes in the quality, structure and properties of the soils of the site, including pH, may have secondary impacts on other environmental or social receptors or future use. Soils are widespread but are important to agriculture, in supporting biodiversity and in the hydrological regime and as a result soils are considered to be of a **medium sensitivity / value**.

Potential Impacts

Potential impacts to soils will occur through a range of activities, the most significant of these include:

- clearance, grubbing and stripping required for construction of the MOF and roads;
- physical presence of structures and infrastructure including roads and hardstanding;
- indirectly through changes in the drainage and hydrological regime (see *Section 4.13*);
- spillages and pollution events; and
- reduction in agricultural tillage/ use of areas.

Some of the impacts to soils will be temporary and associated with the construction phase of the Project. The exception to this is the initial loss of soils or access to soils under the project footprint. This will occur in the early stages of construction, but the effect will persist for the life time of the project. The main groups of impact to soils have been identified as:

- Erosion, soil loss and damage from ground clearance, site run-off and wind
- Contamination arising from minor spillages from stores, mobile plant and vehicles.

These impacts are assessed below.

4.7 Impacts to Soils from Ground Clearance, Site Run-off and Wind Erosion

4.7.1 Assessment of Impacts

Bare earth will be exposed during construction through vegetation clearance, grubbing and stripping top soil and stockpiling of soils. This will result in soils being more susceptible to erosion via rainfall and runoff or wind. This could result in the loss of valuable topsoil, and secondary impacts on water quality and air quality and nuisance caused by dust. Impacts will also vary seasonally, eg heavy rainfall during the rainy season may result in issues relating to runoff potentially effecting receiving water bodies, whilst dry conditions in other seasons could present issues in terms of dust control with effects on nearby settlements. Where significant, secondary impacts are evaluated in more detail in the relevant sections of this assessment. There will be losses of soil associated with site clearance for both the MOF and new road construction or for extensive road widening activities. Where work is simply upgrading of a road within the same footprint there should be no change and therefore no impact on soils is anticipated.

The estimated area of the MOF site clearance will be approximately 1.4 km² while a yet undefined but likely an area of comparable extent will be cleared for the new roads and borrow pits. The drainage system of the MOF site, roads and drainage infrastructure in surrounding land will be designed to prevent erosion of the banks of water courses and surrounding soils. Top soils will be stockpiled for future use/ decommissioning and will not be 'lost'.

It is also important to recognise that only part of the project area will be affected by long term soil losses under the MOF footprint. The area within fence line installed for the purposes of exclusion from the quarrying area includes a large area which should not be lost and in time could potentially be returned to full use. There will be no significant loss of soils in the quarry area due to its rocky nature.

As a result, and taking into account consideration of the factors discussed above the **magnitude** of soil loss related to roads is considered to be **small** and that related to the main MOF site **medium**. For the MOF project overall the magnitude would be therefore considered to be **medium**. The soils at the site have been evaluated as of **medium value/ sensitivity**.

Consequently the potential significance of soil erosion loss and damage is evaluated being of *moderate significance*.

4.7.2 Mitigation Measures

There is no mitigation for loss of land under the footprint other than the minimisation of the footprint. The intention to stockpile and, in the future, re-use top soils will prevent overall loss of this resource from the site foot print and surrounding area.

The principal mitigation measures in relation to erosion and loss of soils relate to appropriate control of site and vegetation clearance activities and groundwork, control of gradients, site drainage and runoff, and dampening down in dry periods to minimise aeolian losses of soil as dust and particulates. The specific measures to be implemented at the MOF are described in detail under the headings 'soils, run-off and flooding' and 'pollution of soils and water' in the SEMP which is appended as *Annex D* to this SEIA. The relevant sections of the SEMP outline the requirements of the works to comply with IFC and Simfer requirements.

4.7.3 Residual Impact

The residual impact relating to soil erosion, losses and damage through land take, site construction and operation is assessed as being of *minor significance*. Although some change will occur it will be over a fixed area for a fixed period and its environmental impact will be largely mitigated.

4.8 Impacts to Soils from Contamination

4.8.1 Assessment of Impacts

Throughout both construction and operation there is the potential for contamination of soils due to the introduction of numerous potential new sources of contaminants. As the site transforms through soil clearance and ground preparation to an engineered hard standing the area of exposed and therefore at risk soils will reduce. Use of vehicles, plant, materials and stores for materials, wastes and fuel present the potential for spillages of fuels, and other potentially polluting substances. It is assumed that all bulk fuel and other hazardous materials storage will be designed to contain spills through appropriate impermeable bases, bunding capacities and maintenance as required and as such non routine pollution from these major sources would be expected. However, large spills are possible and may occur due to accidents such as a road traffic accident involving a fuel truck containing typically 30 000 l of fuel, which could potentially release its whole cargo. *Annex E* discusses the likelihood and consequences of non-routine events. A truck accident is probable and the consequence is medium. A large spill involving a fuel truck will affect an area of land and its soils; run off could potentially affect groundwater, freshwater and marine waters, and will affect a range of terrestrial and aquatic fauna and flora and humans that rely on the soils for food production.

Use of stores, fuel bowzers, mobile plant and vehicles has the potential for localised / minor spillages of fuels and other hazardous materials onto exposed soils. These spills would typically be relatively small volumes, and should be prevented and quickly identified and stopped through good site management. As a result the **magnitude** of such a localised spill would be considered to be **small**. Large spills, however, are assessed as having a **medium magnitude** of impact given its potential for a large footprint and widespread secondary impacts. The soils at the site have been evaluated as of **medium value/ sensitivity**.

As a result the potential significance of contamination of soils by minor spillages is evaluated as *minor significance* and large spills are evaluated as *moderate significance*.

4.8.2 Mitigation Measures

The principal mitigation measures in relation to minor spills relate to appropriate control of site practices, upkeep of plant and equipment, provision of training and cleanup equipment, in line with standard requirements for construction works and operations such as that of the MOF.

Specific measures to be implemented at the MOF and associated roads are described in detail under the heading 'pollution of soils and water' and 'soils, run-off and flooding' in the SEMP which is appended as *Annex D* to this SEIA. The relevant sections of the SEMP outline the requirements of the works to comply a range of IFC and Simfer requirements including IFC Performance Standard 3 – V2 Resource Efficiency and Pollution Prevention and the accompanying guidance.

4.8.3 Residual Impact

Following the implementation of the mitigation measures above the residual impact to soils from minor spillages from mobile plant and vehicles is assessed as being *not significant* as although some change will occur it will be over a small area for a small period and its environmental impact will be largely mitigated. Mitigation measures to prevent road accidents will consist on driver training and appropriate road signs. However, these measures are unlikely to eliminate the risk of one or two accidents occurring per year. Therefore, the residual impacts from large spills are reduced and evaluated as of *minor significance*, also taking into consideration the reduced probability of a large spill are still considered to be of *moderate significance*.

4.9 Impacts to Groundwater - Overview

Sensitivity / Value of Groundwater

Groundwater may be sensitive to changes in quality or, in terms of the resource the volume of water available for abstraction. Existing groundwater is likely to be of poor quality for use as potable water due to

its brackish nature, but there is little alternative. Groundwater should otherwise be of good quality given the lack of contamination sources and low level of development in the area.

On the basis that both local human populations and biodiversity rely upon local groundwater and could be affected by changes in quality or availability, groundwater is considered to have a medium sensitivity / value.

Potential Impacts

Potential impacts to groundwater will occur through a range of activities, the most significant of these include:

- quarrying, excavation and dewatering;
- clearance, grubbing and stripping required for construction of the MOF and roads;
- physical presence of structures and infrastructure including roads and hardstanding;
- indirectly through changes in the drainage and hydrological regime (see *Section 4.13*);
- spillages and pollution events; and
- reduction in agricultural tillage/ use of areas.
- abstraction for dewatering.

Impacts to groundwater will be associated with both the construction and operational phases of the project. Excavation and dewatering will typically be short term and will occur in association with construction phase activities. Impacts on groundwaters from changes in site drainage systems long term but once suitable mitigation measures have been implemented during construction these will apply for the life of the operation. Dewatering around the quarry will potentially be required for the lifetime of the operation of the quarry. The main sources of impact to ground water have been identified as:

- changes in land use, site drainage and permeability.
- potential pollution of groundwaters.
- groundwater abstraction for dewatering.

4.10 Impacts to Groundwater from Changes in Land Use, Site Drainage and Permeability

4.10.1 Assessment of Impacts

The shallow groundwater resources around the site will play an important role in the local hydrological regime, indirectly supporting biodiversity and will affect the nature and salinity of soils at the site. In addition despite being of low quality for drinking and brackish they are an important source of water supply for small numbers of the local population which live on or close to the MOF site.

The change in land use and introduction of positive drainage, such as creation of hardstanding MOF and surfaced roads will result in locally reduced infiltration of precipitation and recharge into the shallow unconfined groundwater bodies understood to underlie the area. Assuming suitable drainage design and the relatively small surface area of road surfaces impacts from roads should be less significant than those at the MOF or not significant.

Changes in the site permeability and runoff characteristics will have localised impacts (directly under the footprint and nearby) on shallow unconfined groundwater bodies. These impacts will be long term, occurring for the lifetime of the operation of the site and will be direct. As discussed above, there will additionally be a range of secondary impacts upon receptors which rely upon local groundwater. The brackish shallow groundwater bodies at the site are not high quality and would be sensitive to changes in precipitation fed recharge which will balance salinity from the nearby river systems. As a result of the above the **magnitude** of impacts to groundwater from changes in land use at and around the MOF site hardstanding is considered **medium**. The **magnitude** of impacts to groundwater from change in land use at and around the roads will be of a much smaller scale as only a limited stretch of land is sealed and are likely to be *not significant*.

The shallow groundwater resource at is considered to be of **medium sensitivity / value** as it is common locally and of low quality, but is used for drinking water supply and is of importance for secondary receptors dependent upon it.

The overall impact to groundwaters from changes in land use, drainage and permeability at the MOF site is of *moderate significance*. There should be *no significant effect* to groundwaters from changes in land use, drainage and permeability associated with roads.

4.10.2 Mitigation Measures

- The principal mitigation measures in relation to the impacts of changes in landuse, permeability and drainage on the shallow groundwaters underlying the site relate to appropriate drainage design to minimise losses of freshwater recharge from precipitation. Where the development of the water supply affects secondary receptors such as local residents relying upon shallow groundwater for drinking water supplies the project will provide an alternative sustainable water supply.
- The specific measures to be implemented at as part of the MOF project are described in detail in the 'soils, run-off and flooding' and 'geology and hydrogeology' sections in the SEMP which is appended as *Annex D* to the SEIA. The relevant sections of the SEMP outline the requirements of the works to comply with IFC and Simfer requirements.

4.10.3 Residual Impact

Following the mitigation measures discussed above the residual impact to groundwater from land use change is assessed as being *minor significance* as although some change will occur its environmental and hydrogeological impact will be spatially limited and largely mitigated through good drainage design.

4.11 Impacts to Groundwater from Potential Pollution

4.11.1 Assessment of Impacts

Throughout both construction and operation there is the potential for contamination of groundwaters due to the introduction of numerous potential new sources of contaminants. As the site transforms through soil clearance and ground preparation to an engineered hard standing the area of exposed permeable ground and therefore groundwater at risk will reduce. Use of vehicles, plant, materials and stores for materials, wastes and fuel present the potential for spillages of fuels, and other potentially polluting substances. As with the evaluation of risk to soils, it is assumed that all bulk fuel and other hazardous materials stores will be designed to contain spills through appropriate impermeable bases, bunding capacities and maintenance as required and as such no routine pollution from these major sources would be expected. However, as with soils, large spills are probable and may occur due to accidents such as a road traffic accident involving a fuel truck containing typically 30 000 l of fuel, which could potentially release its whole cargo. A large spill involving a fuel truck has the potential to affect groundwater, as well as freshwater and marine waters, and will affect a range of terrestrial and aquatic fauna and flora and humans that rely on the groundwater.

Use of stores, fuel bowsers, mobile plant and vehicles has the potential for localised / minor spillages of fuels and other hazardous materials onto exposed permeable ground overlying groundwaters. These spills would typically be relatively small volumes, and should be quickly identified and stopped through good site management. As a result the **magnitude** of such a localised spill would be considered to be **small**. Large spills, however, are assessed as having a **medium magnitude** of impact given its potential to affect groundwater and secondary impacts.

The shallow groundwater resource at is considered to be of **medium sensitivity / value** as it is common locally and of low quality in terms of salinity but is unlikely to be otherwise polluted. Groundwater is used for drinking water supply and is of importance for secondary receptors dependent upon it.

As a result the potential significance of contamination of shallow groundwaters by minor spillages is evaluated as *minor significance* and large spills, which are evaluated as of *medium significance*.

4.11.2 Mitigation Measures

The principal mitigation measures in relation to minor spills relate to appropriate control of site practices, upkeep of plant and equipment, provision of training and cleanup equipment, these are standard to most construction works and operations such as that of the MOF. Specific measures to be implemented at the MOF and associated roads are described in detail under the headings 'geology and hydrogeology', 'pollution of soils and water' and 'soils, run-off and flooding' in the SEMP which is appended as *Annex D* to this SEIA. The relevant sections of the SEMP outline the requirements of the works to comply with a range of IFC and Simfer requirements including IFC Performance Standard 3 – V2 Resource Efficiency and Pollution Prevention and the accompanying guidance.

4.11.3 Residual Impact

Following the implementation of the mitigation measures above the residual impact to shallow groundwaters from minor spillages from mobile plant and vehicles is assessed as being *not significant* as although some change may occur it will be over a small area for a short period and its environmental impact will be largely mitigated or remediated. Residual impacts from large spills are reduced and evaluated as of *minor significance*, also taking into consideration the reduced but still considered to be of *moderate significance*, as mitigation measures such as training of drivers are unlikely to eliminate the risk of road accidents.

4.12 Impacts to Groundwater from Abstraction

4.12.1 Assessment of Impacts

As discussed above, groundwater availability and the level of the water table is important to a range of receptors.

There will be no groundwater abstraction at the MOF site or for related works either for potable water supply or for process water and other demands such as dampening down. There may however be dewatering works in association with both construction excavation and quarrying. There is no need for dewatering during the operation phase.

Changes in the level of the water table and groundwater salinity as a result of dewatering will have localised impacts (within the zone of influence of abstraction/ cone of depression) on shallow unconfined groundwater bodies.

Impacts associated with ground works/ excavations for construction will be short term and highly localised though the geographical zone of influence would depend upon ground permeability and pump rate. As a result of the above the **magnitude** of impacts to groundwater from temporary dewatering of excavations during construction at the MOF is considered **small**.

Impacts associated with development of a well field for quarry dewatering or to act as a 'cut off' around the quarry site could be spatially more significant due to the size of the quarry site and potentially also penetrate deeper into the ground though the geographical zone of influence would depend upon ground permeability and pump rate. The exact impacts to groundwater from quarry dewatering needs to be established through a further evaluation of dewatering requirements at the site which are not currently understood but would be larger than for construction excavations and would occur for a longer time period and would therefore be likely to be considered to be of **medium magnitude**.

The shallow groundwater resource at the site is considered to be of **medium sensitivity / value** as it is common locally and of low quality in terms of salinity but is unlikely to be otherwise polluted. Groundwater is used for drinking water supply and is of importance for secondary receptors dependent upon it. The overall impact to groundwaters from short term construction excavation related dewatering at the MOF site is of *minor significance*. The overall impact to groundwaters from quarry related dewatering require further evaluation but a preliminary evaluation is of a *moderate significance* as they will occur.

4.12.2 Mitigation Measures

The principal mitigation measures associated with impacts of dewatering on local groundwater supplies will be based on a more detailed understanding of the site hydrogeological properties. Measures should be implemented to prevent excessive draw down and minimise saline intrusion resulting from changes to flow as a result of pumping.

The specific measures to be implemented at the MOF are described in detail under the heading 'geology and hydrogeology' in the SEMP which is appended as *Annex D* to this SEIA.

4.12.3 Residual Impact

Following the mitigation measures discussed above the residual impact to groundwater from dewatering will be temporary and spatially constrained, minimising effects on key sensitive receptors such as vegetation of public water supplies.

Through careful design of the dewatering regime and monitoring for draw down and saline intrusion it should be possible to reduce impacts to being of *minor significance* as although some change will occur its environmental and hydrogeological impact will be spatially limited and largely mitigated through good design.

4.13 Impacts to Non-marine Surface Waters - Overview

Sensitivity / Value of Non-marine Surface Waters

Non-marine surface waters may be sensitive to changes in quality and flow.

The salinity level of surface waters is also of importance and these waters would be sensitive to a reduction in freshwater supply from rainfall and runoff.

Surface waters are an important constituent to the regional environment, and their quality and availability is important both to local communities and biodiversity. Subsequently surface waters are considered to have a **medium** sensitivity / value.

Potential Impacts

Potential impacts to non-marine surface waters will occur through:

- quarrying, excavation and dewatering;
- clearance, grubbing and stripping required for construction of the MOF and roads;
- physical presence of structures and infrastructure including roads and hardstanding;
- changes in the drainage and hydrological regime;
- spillages and pollution events; and
- reduction in agricultural tillage/ use of areas.

Impacts to non-marine surface waters will be associated with both the construction and operational phases of the project. Impacts on non-marine surface waters from changes in site drainage systems long term but once suitable mitigation measures have been implemented during construction these will apply for the life of the operation. Potential pollution events, especially from small scale spillages may occur during both the construction and operational phases of the project. The main groups of impact to non-marine surface waters have been identified as:

- Changes in land use, site drainage and permeability.
- Impacts on non-marine surface waters by sediment load in site runoff.
- Potential pollution of non-marine surface waters from potential pollution

4.14 Impacts to Non-marine Surface Water from Changes in Land Use, Site Drainage and Permeability

4.14.1 Assessment of Impacts

At the MOF site the change in land use, and specifically the creation of hardstanding (1.4 km²) with positive drainage will result in changes to the rainfall runoff characteristics of the site and will affect the existing hydrological regime and the complex network of ditches which move water around the 'bogoni' fields. A small area of 'bogoni' (16 Ha) will be lost under the footprint of the Project. In addition a larger area of 'bogoni' lies within the safety zone of the quarry. Lack of access by local villagers to maintain the drainage system may compromise the hydraulic regime in this area.

As such it may be necessary to balance flows to prevent periodic surge flooding of the surface water channels during storm events. It is assumed that this embodied mitigation is included within the design. Simply oversizing the local channels to accept storm flows is unlikely to be acceptable to local communities as it could create severance of access / movement across the area and may not balance flow and groundwater recharge which is important in the dilution of the higher salinity areas in the 'bogoni' – a lack of this freshwater dilution may make cultivation less feasible and must be avoided.

In the wider area the creation of the roads associated with the MOF will require some crossings of channels. Such crossings may restrict flow velocity and the overall volume of discharge and may have secondary impacts on the sedimentation regime and water quality due to reduced flushing or by cutting off small channels altogether. Most of these channels are brackish and in full continuity with the estuarine system and impacts to them are assessed in the marine sections of this study.

The **magnitude** of impacts to the surface water drainage ditch systems feeding the 'bogoni' from change in land use is considered **medium**. Changes in the site permeability and runoff characteristics will have localised impacts (directly under the footprint and nearby) on the drainage network. These impacts will be longterm, occurring for the operation of the site and will be direct. As discussed above, there will additionally be a range of indirect impacts on receptors which rely on local surface waters. These water bodies are not rare, are man made and not likely to be of high quality but are currently not polluted by anthropogenic contaminant sources. As a result they would be sensitive to changes in quality, flow and local runoff characteristics. The **value / sensitivity** of the non-marine surface waters at the site is considered to be of **medium** as though they are common locally, manmade and not of high quality, they may locally have higher importance for secondary receptors dependent upon them.

The overall impact to the surface water drainage system from changes in land use is of *moderate significance*.

4.14.2 Mitigation Measures

As the surface water system is complex and heavily managed it is recommended that detailed consultation is undertaken with the local land users to determine the most appropriate form of mitigation. Prior to this process and based on the current understanding of the system mitigation measures will be implemented to reduce and avoid impacts to surface water. These are described in more detail under the headings 'geology and hydrogeology', 'pollution of soils and water' and 'soils, run-off and flooding' in the SEMP which is appended as *Annex D* to this SEIA.

4.14.3 Residual Impact

Following the mitigation measures above the residual impact to the surface water drainage system from land use change is assessed as being *minor significance* as although some change will occur its environmental and hydrological impact will be largely mitigated through appropriate design.

4.15 Impacts to Non-marine Surface Waters from Site Run-off

4.15.1 Assessment of Impacts

Bare earth will be exposed during construction through vegetation clearance, grubbing and stripping top soil and stockpiling of soils. This will result in soils being more susceptible to erosion via rainfall and runoff or wind. This could result in the transport of sediments in run off to nearby surface waters which could have a range of negative impacts on water quality and channel hydraulics. Impacts will also vary seasonally, typically being worse during the rainy season where much more site runoff would be expected than in the dry season.

There will be the potential for sediment laden runoff to be associated with site clearance for both the MOF and new road construction or for extensive road widening activities.

The drainage system of the MOF site, roads and drainage infrastructure in surrounding land will be designed to prevent erosion of water courses and surrounding soils in the long term and therefore the principal period of risk in relation to sediment laden site runoff is the construction period.

As a result consideration of the factors discussed above the **magnitude** of sediment laden runoff affecting non-marine surface waters during construction is **medium**. The receiving water bodies at the site have been evaluated as of **medium value/ sensitivity**.

As a result the potential significance of pollution by sediment loads in runoff is evaluated being of *moderate significance*.

4.15.2 Mitigation Measures

The principal mitigation measures in relation to erosion and loss of soils and their impact on surface waters relate to appropriate control of site and vegetation clearance activities and groundwork, control of gradients, site drainage and runoff. The specific measures to be implemented at the MOF are described in detail under the headings 'geology and hydrogeology', 'pollution of soils and water' and 'soils, run-off and flooding' in the SEMP which is appended as *Annex D* to this SEIA. The relevant sections in the SEMP outline the requirements of the works to comply with a range of IFC and Simfer requirements.

4.15.3 Residual Impact

The residual impact relating to sediment load impacts on non-marine surface waters is assessed as being of *minor significance*. Although some change may occur it will be over a fixed area for a fixed period and its environmental impact should be largely mitigated with good construction works site management.

4.16 Impacts to Non-marine Surface Water from Potential Pollution

4.16.1 Assessment of Impacts

Throughout both construction and operation there is the potential for contamination of non-marine surface waters due to the introduction of numerous potential new sources of contaminants. Use of vehicles, plant, materials and stores for materials, wastes and fuel present the potential for spillages of fuels, and other potentially polluting substances. As with the evaluation of risk to soils and groundwaters, it is assumed that all bulk fuel and other hazardous materials stores will be designed to contain spills through appropriate impermeable bases, bunding capacities and maintenance as required and as such no routine pollution from these major sources would be expected. The introduction of positive drainage potentially means that spillages which in a green field setting would have been locally confined and affected soils and potentially groundwaters may runoff via the drainage system and be directed toward non-marine (or marine) surface waters. However, as with soils and groundwater, large spills are probable and may occur due to accidents such as a road traffic accident involving a fuel truck containing typically 30 000 l of fuel, which could potentially release its whole cargo. A large spill involving a fuel truck has the potential to affect surface

water, and will affect a range of terrestrial and aquatic fauna and flora and humans that rely on these water bodies.

Use of stores, fuel bowzers, mobile plant and vehicles has the potential for localised / minor spillages of fuels and other hazardous materials which may be transported via drainage systems or exposed ground and lead to contamination of receiving surface waters. These spills would typically be relatively small volumes, and should be quickly identified and stopped through good site management, however once positive drainage is installed they can move quickly to vulnerable surface waters and even small spills can affect relatively large areas. As a result the **magnitude** of such a minor spill would be considered to be **small to medium**. Large spills, however, are assessed as having a **medium magnitude** of impact given its potential for pollution to non-marine surface waters and secondary impacts.

Non-marine surface waters are considered to be of **medium sensitivity / value** as it is common locally and of low quality in terms of salinity but is unlikely to be otherwise polluted. Groundwater is used for drinking water supply and is of importance for secondary receptors dependent upon it.

As a result the potential significance of contamination of non-marine surface waters by minor spillages is evaluated as *minor to moderate significance*, especially considering the secondary receptors such as agricultural land use and biodiversity. Large spills are evaluated as of *moderate significance*.

4.16.2 Mitigation Measures

The principal mitigation measures in relation to spills relate to appropriate control of site practices, upkeep of plant and equipment, provision of training and cleanup equipment, these are standard to most construction works and operations such as that of the MOF. The specific measures to be implemented at the MOF are described in detail under the headings 'geology and hydrogeology', 'pollution of soils and water' and 'soils, run-off and flooding' in the SEMP which is appended as *Annex D* to this SEIA. The relevant sections of the SEMP outline the requirements of the works to comply with a range of IFC and Simfer requirements including IFC Performance Standard 3 – V2 Resource Efficiency and Pollution Prevention and the accompanying guidance.

4.16.3 Residual Impact

Following the implementation of the mitigation measures above the residual impact to non-marine surface waters from minor spillages from mobile plant and vehicles is assessed as being *minor significance* as although some change may occur it should be controlled, limited in extent and duration and its environmental impact will be largely mitigated or remediated. Residual impacts from large spills are reduced and evaluated as of *minor to moderate significance*, also taking into consideration the reduced probability of a large spill after mitigation measures have been adopted.

4.17 Impacts to the Marine Physical Environment – Overview

Sensitivity / Value of Marine and Estuarine Sediments

The current quality of marine and estuarine sediments is considered to be of 'natural quality' and supports standard forms of flora/ fauna. Although the seabed and coastline are vulnerable to disturbance they are naturally in a constant state of flux and in time a new equilibrium will be reached. In addition beaches nearby are not considered to be sites of significant turtle nesting and therefore do not support high value species. As a result the sensitivity / value of the seabed and coastline is considered to be of **medium** sensitivity / value.

The current quality of marine, estuarine and coastal water quality is considered to be of 'natural quality'. As a result would be considered to be of **medium** sensitivity / value.

Potential Impacts

Potential impacts to the marine physical environment will occur through:

- dredging and dredge disposal (including maintenance dredging);

- marine works;
- run off and drainage to the marine environment;
- physical presence of the MOF; and
- spillages and pollution events.

Impacts to the marine physical environment will be associated with both the construction and operational phases of the project. Impacts from changes in site drainage systems will be long term but once suitable mitigation measures have been implemented during construction these will apply for the life of the operation. Potential pollution events, especially from small scale or larger spillages may occur during both the construction and operational phases of the project. The main groups of impact to non-marine surface waters have been identified as:

- Impacts to seabed characteristics and coastline.
- Impacts to water quality.

4.18 Impacts to Marine Physical Environment – Seabed Characteristics and Coastline

4.18.1 Assessment of Impacts

Impacts to the seabed characteristics and coastline may be caused by:

- the presence of the MOF along the river bank; and
- dredged areas and dredge disposal site affecting the local hydrodynamic and sedimentary regime.

Secondary impacts to biodiversity, fauna and flora are discussed in Chapter 5.

The presence of the MOF at the river bank will alter the shape of the coastline and affect the local hydrodynamics and sedimentary regime. Structures that protrude into the Morebaya River may cause erosion and / or accretion of sediment locally to the structure along the coast, however, for the MOF only the ramp will substantially protrude into the river, with other small changes at the coastline due to the presence of the MOF. Changes in bathymetry caused by dredging and dredge disposal will potentially affect the seabed, sand banks and beaches by altering the hydrodynamic regime and sediment supply to the coast. The newly created approach channel is expected to cause drawdown of sand from adjacent sand banks and shores in the Morebaya River estuary as the channel seeks to fill in while it tends towards a new geomorphological equilibrium. This will continue over time as the approach channel is maintained at depth through additional maintenance dredging. It is also possible that sediment supply to the beaches and near the MOF may be affected, which may cause either sediment to be deposited or eroded, or a combination of both. The net effect of these changes is a gradual modification of sand banks, seabed and beaches over time until a new dynamic equilibrium is reached.

Sedimentation from both the sediment plume and sediment disposal can change the sediment particle size distribution across a wide area, which can have secondary impacts on biological receptors (as discussed in *Chapter 5*). The footprint of the dredge spoil disposal site is difficult to establish. The exact location of the disposal sites have not been determined but are likely to lie at depths in excess of 15 m or in natural depressions closer to shore but away from sensitive receptors such as turtle nesting beaches. Dredge disposal is intermittent and the location within the designated disposal area where the dredge hoppers release their load will vary over the construction period. Once released, the sediment drops to the sea floor and smothers the seabed. The descending plume will spread in a lateral direction. An estimated volume of 13.8 Mm³ will be deposited on the seabed. In view of the largely loose nature of the sediment and assuming a 1 m thick deposit, it can be argued that the spoils will eventually become distributed evenly across an area of the seabed measuring approximately 13.8 km².

Impacts to the wider seabed and coastline are likely to occur only locally to the MOF, dredged areas and dredge disposal site and any changes are expected to be relatively small scale, especially in comparison with natural changes and sedimentation from fluvial inputs. Therefore the **magnitude** of impact to the seabed and coastline is assessed as **medium**. The **value / sensitivity** of the seabed and coastline is considered to be **medium**.

As a result the potential significance of impacts to the seabed and coastline is evaluated as *moderate significance*.

4.18.2 Mitigation Measures

The principal mitigation measures associated with the impacts to the seabed characteristics and coastline will be design of the MOF, minimisation of dredged areas, where possible, and locating the dredge disposal areas away from sensitive habitats and receptors. In addition remediation will be carried out where significant impacts occur. The specific measures to be implemented at the MOF are described in detail under the heading 'marine environment' in the SEMP which is appended as *Annex D* to this SEIA.

4.18.3 Residual Impact

Following the implementation of the mitigation measures above the residual impact to the seabed and coastline is assessed as being *minor significance* as although some change may occur it should be limited in extent and its environmental impact will be mitigated to the extent practicable or remediated, where appropriate.

4.19 Impacts to Marine Physical Environment – Marine Water Quality

4.19.1 Assessment of Impacts

Impacts to marine water quality (including brackish streams that lead into marine waters) may be caused by:

- the dredge and dredge disposal sediment plume (including maintenance dredging);
- discharges (including sewage, oils, lubricants and other chemicals);
- discharges from temporary or permanent sewage treatment facilities onshore;
- other site run off and drainage; and
- spillages and pollution events.

Throughout both construction and operation there is the potential for contamination of marine waters (including brackish streams and drainage channels that lead to marine waters) due to the introduction of numerous potential new sources of contaminants. Some site run-off and drainage will enter the marine environment as well as discharges of sewage, oils, lubricants and other chemicals from vessels and onshore facilities. Acid sulphate soils (ASS) that have been disturbed and stored on land have the potential to drain into marine waters and can cause a reduction in pH and increase in heavy metals. In addition the acidic conditions generated by ASS can corrode concrete and steel ⁽¹⁾. Use of vessels and machinery presents the potential for spillages of fuels, and other potentially polluting substances. As with the evaluation of risk to soils, groundwaters and non-marine surface waters, it is assumed that all bulk fuel and other hazardous materials stores will be designed to contain spills through appropriate impermeable bases, bunding capacities and maintenance as required and as such no routine pollution from these major sources would be expected. The introduction of positive drainage potentially means that spillages in a green field setting would have been locally confined and affected soils and potentially groundwaters may runoff via the drainage system and be directed toward marine or non-marine waters. Large spills, however, are also possible and may occur due to accidents such as collision of a fuel tanker with another vessel or grounding, extreme weather events, poor maintenance and operational / navigational errors. In the event of an accidental release from a fuel tanker its complete cargo may be discharged, which would be approximately 25 000-45 000 DWT of fuel for a medium range tanker. A large spill involving a fuel tanker will affect a large area of marine waters and coastline with secondary impacts to a large range of aquatic fauna, flora and humans that rely on the coastline and marine waters for fishing.

The sediment plume can reduce water quality through increased turbidity, remobilised contaminants and nutrients and reduced oxygen concentrations. It is likely that there will be a relatively high initial increase in suspended sediment concentration up to a few tens of metres away from the dredger. The plume becomes rapidly less dense with increasing distance. It is expected that a slight increase in suspended matter will be

(1) <http://www.dpi.nsw.gov.au/agriculture/resources/soils/ass/general/introduction>. Accessed 19/07/2011.

noticeable at a considerable distance downstream of the dredge or dredge disposal site, however, the Morebaya River estuary naturally experiences naturally very high suspended sediment concentrations caused by the river outflow, wave action, tidal currents and the fine sediment characteristics. Considering dredge spoil disposal will occur at regular intervals throughout the dredging period, dissolved oxygen levels in the water column are likely to recover between dumping events. Any temporary reduction in dissolved oxygen concentration is unlikely to cause major water quality deterioration, even for very short periods. The tidal currents and waves will also re-oxygenate water. In a study by Lee et al (1978) ⁽¹⁾ it was demonstrated that dissolved oxygen concentrations decreases only slightly (in the study case by approximately 1.5 mg/l) for only a very short time period (recovery of over 90% in less than 5 minutes and recovery of 100% in 10 minutes) when large amounts of sediment containing large amounts of oxygen-demanding materials are dumped in an open water disposal site. Concentrations of nutrients and contaminants, such as metals and hydrocarbons, may be increased within the plume due to the release of the contaminant from the sediment but this is also short-lived.

Impacts to marine water quality are assessed as being of **medium magnitude** given the regional and relatively short term nature of increased turbidity from the sediment plume and drainage, but also taking into consideration the low levels of contaminants that are expected to be released, the rapid dispersal and dilution of discharges/drainage due to the high level of water exchange and natural variable turbidity. Localised / minor spillages of fuels and other hazardous materials may be transported via drainage systems or exposed ground and lead to contamination of receiving marine waters. These spills would typically be relatively small volumes, and should be quickly identified and stopped through good site management. However, once positive drainage is installed they can move quickly to vulnerable surface waters and even small spills can affect relatively large areas. As a result the **magnitude** of such a minor spill would be considered to be **small to medium**. Large spills, however, are assessed as having a **large magnitude** of impact given its potential to affect a large area of marine waters and coastline and for very widespread secondary impacts.

Marine waters are considered to be of **medium sensitivity / value** as they are vulnerable to pollution, important to some local fauna and expected to contain no more than low levels of anthropogenic sourced contaminants.

As a result the potential significance impacts to marine waters is evaluated as *moderate significance*, especially considering the secondary receptors such as biodiversity, except for large spills which are evaluated as *major significance*.

4.19.2 Mitigation Measures

The principal mitigation measures in relation to impacts to water quality relate to appropriate control of site practices, upkeep of plant and equipment, provision of training and cleanup equipment, which are standard to most construction works and operations such as that of the MOF. Specific measures to be implemented are described in detail under the headings 'pollution of soils and water' and 'marine environment' in the SEMP which is appended as *Annex D* to this SEIA.

4.19.3 Residual Impact

Following the implementation of the mitigation measures above the residual impact to the marine water quality is assessed as *minor significance* as although some change may occur it should be largely mitigated with good construction works and operational site management. Residual impacts from large spills, however, are reduced but remain evaluated as *major significance*, although the probability of a large spill will have been reduced following implementation of mitigation measures.

(1) Lee, G.F. (1978). Evaluation of the Elutriate Test as a Method of Predicting Contaminant Release during Open Water Disposal of Dredged Sediment and Environmental Impact of Open Water Dredged Materials Disposal, Vol. II: Data Report," Technical Report D-78-45, US Army Engineer Waterways Experiment Station, Vicksburg, MS

4.20 Impacts relating to Airborne Noise and Vibration - Overview

Low noise levels can be described as being important because of their value to receptors which perceive noise. Therefore noise levels are sensitive to change and particularly to new types and sources of noise as well as higher noise levels.

As described in Section 4.3.6, the site currently has very low levels of anthropogenic noise. The construction and operation of the MOF will introduce many new anthropogenic noise sources, potentially at high levels and in all likelihood at 'antisocial' times given 24hr operations. In addition the MOF will result in a significant increase in the levels of vehicle traffic on local roads which will also increase noise levels and disturbance. In terms of noise level there is sensitivity in terms of reduced environmental quality though the introduction of new anthropogenic noise sources and higher overall noise levels and disturbance. In addition there are specific issues in relation to noise levels, well-being and health and safety which also need to be considered in relation to changes in the current low noise environment.

Noise impacts are considered with reference to most sensitive receptors and their perception of noise and disturbance. For the MOF and associated works including quarrying and roads the most sensitive receptors are considered to be the local human population and in particular residents. In addition noise and disturbance could affect biodiversity including both terrestrial and avian fauna.

The following broad groups of activities have been grouped for evaluation of potential impacts:

- construction and operation activities at the MOF;
- construction activities on roads;
- operational road traffic; and
- quarrying activities.

4.21 Noise and Vibration Impacts from Construction and Operational Activities at the MOF

4.21.1 Assessment of Impacts

Construction of the MOF will involve a range of processes and activities common to typical onshore and coastal construction operations. Key noise sources will include:

- the use of generators for electricity supply;
- the use of heavy plant, machinery and vehicles;
- the presence and use of large vessels and cranes/ other lifting gear for offloading vessels and stevedoring and stockpiling of supplies; and
- pile and sheet pile driving.

Of these activities pile driving is likely to be the most significant noise source, though handling of large containers etc can also generate high noise levels, which may be intermittent and unpredictable. Many of these activities may occur during both construction and operation, and will be undertaken within the MOF compound and thus at some distance from any residential populations. However, workers will be exposed. Piling, which is only likely to occur during construction, will be undertaken mainly at the quay structures on the river front and should be a considerable distance from any residents on the east bank of the Morebaya. However, the presence of residential settlements on the west bank will need to be determined as noise may readily propagate across the river.

The impacts of noise generation from MOF on local residential receptors could be considered to be significant. Residents are located at distances of tens to hundreds of meters from the site and the sources of the greatest noise generating activities during construction and operation. Never the less, noise levels will rise across the MOF site and potentially affect neighbouring communities on both sides of the river. Activities and associated noise will be 24 hours a day, 7 days a week (24/7) and will persist for the life of the

project although it is noted that some of the most significant noise sources such as piling will occur for a limited period during construction only.

The local population and 'noise environment' will be sensitive to changes in noise levels. At present the area is largely undeveloped with low levels of anthropogenic noise generated and there are residential populations living in close proximity to the site.

As a result the potentially unacceptable noise related impacts may occur and will need to be mitigated to reduce the significance of impacts to acceptable levels.

4.21.2 Mitigation Measures

The principal mitigation measures will be control of noise source levels and noise propagation through plant and equipment specifications and working methods and control of the perception of noise disturbance by local populations through management/ restrictions on the timing of noise generating activities.

It is recommended that quantitative analysis should be undertaken when sufficient detail is available in order to determine the magnitude and significance of impacts and based on this specify and check the required mitigation in line with the proposals outlined in the SEMP which is appended as *Annex D* to this SEIA.

Mitigation criteria and requirements including recommended offsets are described in the 'noise and vibration' section in the SEMP which is appended to this SEIA. These measures are intended to minimise noise impacts on sensitivity receptors, training of operators, adjust working hours where relevant, and plan activities to reduce cumulative noise production. The relevant section of the SEMP outlines the requirements of the works to comply with a range of IFC and Simfer requirements including IFC EHS Guideline 1.7 Noise.

4.21.3 Residual impacts

Residual impacts will include a generally increased baseline level of noise from anthropogenic sources within the area of influence of the project. Mitigation measures including source control and offsets should ensure that no unacceptable environmental impacts arise in relation to noise related impacts of the project as a result of receptor noise level exposure exceeding the established threshold criteria.

4.22 Noise and Vibration Impacts from Construction Activities on Roads

4.22.1 Assessment of Impacts

Construction of the roads associated with the MOF will involve a range of processes and activities common to typical highway construction works. Key noise sources will include:

- the use of generators for electricity supply; and
- the use of heavy plant, machinery and vehicles.

Though potentially less noisy than activities such as pile driving at the MOF site, road construction will be undertaken much closer to potential residential receptors in properties and settlements alongside the roads. Noise will be typical to construction work including emissions from engines and the noises generated by breaking surfaces, excavation and grading activities.

The impacts of noise generation from MOF road construction on local residential receptors could be significant. Residents are located close to the source of the noise generating activity which may be 24/7 but should only persist at any one location for a short period as road construction progresses down the alignment.

The local population and 'noise environment' will be sensitive to changes in noise levels. At present the area is largely undeveloped with low levels of anthropogenic noise generated and there are residential populations living in close proximity to the site.

Noise experienced at receptors close to the road is likely to be significant and exceed permissible limits, it will be short term for the duration of the construction phase, which is likely to only last a few weeks in each

area. As a result the potentially unacceptable noise related impacts may occur and will need to be mitigated to reduce the significance of impacts to acceptable levels.

4.22.2 Mitigation Measures

The principal mitigation measures will be control of noise source levels and noise propagation through plant and equipment specifications and working methods and control of the perception of noise disturbance by local populations through management/ restrictions on the timing of noise generating activities.

It is recommended that a qualitative or quantitative analysis should be undertaken when sufficient detail is available in order to determine the magnitude and significance of impacts and based on this specify and check the required mitigation in line with the proposals outlined in the SEMP.

In some circumstances local residents may need to be resettled further from the noise source/ road due to offset requirements. Any such activities will be covered in line with the IFC requirements as described in the resettlement and compensation framework appended as *Annex F* to this SEIA.

Preliminary mitigation criteria and requirements including recommended offsets are described in the 'noise and vibration' section in the SEMP which is appended to this SEIA. These measures are intended to minimise noise impacts on sensitivity receptors, training of operators, adjust working hours where relevant, and plan activities to reduce cumulative noise production. The relevant sections of the SEMP outline the requirements of the works to comply with a range of IFC and Simfer requirements including IFC EHS 1.7 Noise.

4.22.3 Residual Impacts

Residual impacts will include a generally increased baseline level of noise from anthropogenic sources within the area of influence of the project.

The mitigation measures employed including source control, temporary compensation or relocation and offsets should ensure that no unacceptable environmental impacts arise in relation to noise related impacts of the project as a result of receptor noise level exposure exceeding the established threshold criteria.

4.23 Noise and Vibration Impacts from Operational Road Traffic

4.23.1 Assessment of Impacts

The MOF is designed as the primary material (equipment and supplies) handling facility for the project. Throughout its operation large volumes of heavy wagon traffic will ferry supplies and equipment to the various areas of the project where it is required be this the port, railway or mine of the main Project. All this traffic will flow out of the MOF site and along the road system covered by this assessment before joining the wider road network.

Noise sources will include engine noise, bumping and banging of loads, breaking etc and are likely to occur in relatively close proximity to residential properties. Traffic in and out of the MOF is likely to be 24/7 and will occur for the lifetime of the operation.

The impacts of noise generation from MOF road construction on local residential receptors will be significant. Residents are located close to the source of the noise generating activity which may be 24/7 and which will occur for the lifetime of the project.

The local population and 'noise environment' will be sensitive to changes in noise levels. At present the area is largely undeveloped with low levels of anthropogenic noise generated and there are residential populations living in close proximity to the site.

As a result the potentially unacceptable noise related impacts may occur and will need to be mitigated to reduce the significance of impacts to acceptable levels.

4.23.2 Mitigation Measures

The principal mitigation measures will be control of noise source levels and noise propagation through plant and equipment specifications and working methods and control of the perception of noise disturbance by local populations through management/ restrictions on the timing of noise generating activities.

It is recommended that a qualitative or quantitative analysis should be undertaken when sufficient detail is available in order to determine the magnitude and significance of impacts and based on this specify and check the required mitigation in line with the proposals outlined in the SEMP.

Mitigation criteria and requirements including recommended offsets are described in the 'noise and vibration' section in the SEMP which is appended to this SEIA. These measures are intended to minimise noise impacts on sensitivity receptors, training of operators, adjust working hours where relevant, and plan activities to reduce cumulative noise production. The relevant sections of the SEMP outline the requirements of the works to comply with a range of IFC and Simfer requirements including IFC EHS 1.7 Noise.

4.23.3 Residual Impacts

Residual impacts will include a generally increased baseline level of noise from anthropogenic sources within the area of influence of the project.

Prior to mitigation noise experienced at receptors close to the road is likely to be significant and exceed permissible limits, which will occur for the life time of the project.

The mitigation measures employed including source control, relocation and offsets should ensure that no unacceptable environmental impacts arise in relation to noise related impacts of the project as a result of receptor noise level exposure exceeding the established threshold criteria.

4.24 Noise and Vibration Impacts from Quarrying Activities at the MOF

4.24.1 Assessment of Impacts

The principal noise source associated with quarrying will be blasting. In addition to blasting other activities which may be significant noise sources include drilling, crushing, plant movements and rock handling, stockpiling and transportation.

Quarrying maybe undertaken for the lifetime of the project but blasting is likely to be an intermittent event with the other noise generating activities described occurring more frequently. There are strict restrictions on quarrying and blasting activities including Simfer's own standards. As a result a 500m exclusion zone has been placed around the quarry site, this will mitigate against the most significant and potentially harmful levels of noise but disturbing levels of noise may still be experienced outside the 500 m exclusion zone.

The impacts of noise generation from quarrying on local residential receptors could be significant. Residents are located at outside the site and exclusion zone but noise levels will rise across the MOF site in comparison to current levels and potentially affect neighbouring communities on both sides of the river. Activities and associated noise will be 24/7 and will persist for the life of the project although it is noted that the most significant noise source – blasting is likely to be intermittent but potentially pre-warned. The local population and 'noise environment' will be sensitive to changes in noise levels. At present the area is largely undeveloped with low levels of anthropogenic noise generated and there are residential populations living in close proximity to the site.

As a result the potentially unacceptable noise related impacts may occur and will need to be mitigated to reduce the significance of impacts to acceptable levels.

4.24.2 Mitigation Measures

The principal mitigation measure will be the 500m exclusion zone. In addition there will be control of noise source levels and noise propagation through plant and equipment specifications and working methods and

control of the perception of noise disturbance by local populations through management/ restrictions on the timing of noise generating activities.

It is recommended that qualitative or quantitative analysis should be undertaken when sufficient detail is available in order to determine the magnitude and significance of impacts and based on this specify and check the required mitigation in line with the proposals outlined in the SEMP.

Preliminary mitigation criteria and requirements including recommended offsets are described in the 'noise and vibration' section of the SEMP which is appended to this SEIA. The relevant section of the SEMP outline the requirements of the works to comply with a range of IFC and Simfer requirements including IFC EHS 1.7 Noise.

4.24.3 Residual Impacts

The mitigation measures employed including source control, relocation and offsets should ensure that no unacceptable environmental impacts arise in relation to noise related impacts of the project as a result of receptor noise level exposure exceeding the established threshold criteria.

4.25 Impacts on Air Quality, GHG and Climate

4.25.1 Sensitivity / Value of air quality

The current air quality, with the exception of dust levels, is considered to be good and as a result would be considered to be of **high** sensitivity / value. Dust or particulates can be a significant source of nuisance and have the potential to reduce environmental quality. With regards to particulate levels, it is acknowledged that natural baseline levels of particulates are high during the dry season, but additional contribution from the project would not be seen as detrimental to air quality. Given the naturally elevated conditions in the dry season, in terms of particulates, the sensitivity / value would be considered to be **medium** during the dry season and **high** in the wet season.

4.25.2 Assessment of Impacts

There should not be any significant impacts relating to air quality resulting in health issues, GHG and climate from the MOF projects and associated activities as there are no major sources identified. There are likely to be some nuisance related impacts from dust arising from with construction and operational activities of the MOF, roads and with quarrying activities.

The upgrade and/or construction of roads has the potential to cause nuisance through dust/ particulates generated by construction activities and blasting/ quarrying. Potential impacts from construction activities will therefore be temporary (typically a few weeks at each location), although during this time dust generation has the potential to be a significant nuisance. Dust from blasting/ quarrying could persist for the life time of the project.

Dust, or particulate matter (PM) is generated during all phases of construction. The main sources of PM emissions include crushing, grinding, drilling, blasting, and transport. Dust tends to settle within a few tens to hundreds of metres of its source, depending on particulate size and wind. Due to the proximity of existing communities to many of the road sections to be upgraded, it is likely that significant numbers of sensitive receptors will lie within this zone. The impact is principally related to dust during the dry season which has a very localised effect. The **magnitude** is considered **small**. Without mitigation, this would result in an impact of *minor significance*.

4.25.3 Mitigation Measures

The principal form of control will be dampening down of surfaces and stockpiles and dust generating activities such as crushing. Exposed surfaces will be sealed/ surfaces or re-vegetated as soon as is feasible to prevent losses. Additional controls may include speed limits of vehicle movements and use of covered wagons for transport of particulate rich bulk haulage. Specific measures to be implemented are described in detail under the heading 'air quality' in the SEMP which is appended as *Annex D* to this SEIA.

4.25.4 Residual Impact

Following the mitigation measures impacts should be reduced but some dust/ particulate nuisance to nearby residents and populations is probable, though the level of this in the context of the elevated dry season dust levels will be *not significant*.

4.26 Waste and Resource Use Efficiency

4.26.1 Assessment of Impacts

Waste will be generated and resources will be used during both the construction and operational activities of the MOF, roads and with quarrying activities. Inefficient use of energy and other resources could lead to unnecessary consumption, generation of waste and other emissions. Waste generated at the MOF site will be sent to one of the logistic centres that covered in the separate SEIA on temporary camps and logistic supply centres.

Construction and operation of the MOF, the quarry and associated road infrastructure will require supply of water for activities such as road making, maintenance activities, potable use and processes such as concrete batching. Where water is abstracted from wells and rivers, it has the potential to adversely affect supply for existing communities and ecosystems.

Ineffective management of waste and waste management facilities could lead to excessive use of material resources and pollution of soils and water in the vicinity of disposal sites. The Project is committed to minimising waste and to make efficient use of natural resources.

4.26.2 Mitigation Measures

A number of measures will be undertaken to reduce the waste production, ensure adequate disposal, and increase resource use efficiency. This includes a comprehensive waste management plan that outlines the strategy and concrete actions for waste disposal including hazardous waste. Specific measures to be implemented are described in detail under the heading 'resources and waste' in the SEMP which is appended as *Annex D* to this SEIA. The measures follow best practice requirement including the IFC EHS Guidelines for Waste Management Facilities (2007).

4.26.3 Residual Impact

Following best practice as described in the SEMP, the residual impact of waste and resource use will be minimised to as low as reasonably practical.

4.27 Cumulative Impacts

Cumulative impacts are impacts that may arise when other activities and known or committed developments take place in the area of the Project at the same time. Within short distance of the proposed MOF location, there are no other major projects foreseen during the period of construction and initial three years of operation. However, there is some overlap with a separate early works component of the Simandou Project, the temporary camps and logistic supply centres, which are planned further inland. During the operation period of the MOF, construction will also commence at other sites that are part of the overall Simandou Project. There will be extensive movements of vehicles, people and materials between the MOF and these other sites. The impacts of the temporary camps and logistic supply centres are assessed in a separate ESIA and are in an area purposely distinct to that covered by this ESIA in order to avoid cumulative impacts. As such no cumulative impacts with the temporary camps and logistic supply centres SEIA are predicted. Construction of roads and traffic between the MOF and the construction sites of the overall Simandou Project within the wider Kabak area are considered within this chapter.

Another mining company, Forécariah JV (with participation of Bellzone Mining PLC and Guinean Development Corporation), is developing an iron ore concession in the Forecariah district. Current understanding is that this development is unlikely to interfere with the MOF and its associated road network, therefore cumulative impacts are not predicted.

5 Impacts on the Biological Environment

5.1 Introduction and Scope

This Chapter provides a high level overview of the biological baseline conditions in terms of protected areas, habitats and species, with particular reference to species of conservation interest. It also contains an assessment of the impacts to the biological environment from the Marine Offloading Facility (MOF). See *Chapter 2* for an overview of the project description, location and the potentially project affected area, which includes the adjoining section of coastline.

5.2 Methods and Sources of Information

An overview of the impact assessment methodology is presented in *Chapter 1*. Full details of the methodology are provided in *Annex C*.

The baseline for the biological environment addressed in this chapter is based upon site reconnaissance and boat trips in June to August 2007, interpretation of high resolution remote sensing imagery and a desktop review of previous biological studies. A key baseline reference document was the report “*État de référence du milieu aquatique. Site des installations portuaires*”, completed December 2008 by SNC Lavalin for Simfer. In addition, information on mangrove habitat was informed by “*SNCL (2011) Simandou Project – Port Components – Baseline environmental report for the mangrove forest of Ile Kabak (Guinea)*” and further information on fish species present was taken from “*SNCL (2011) Simandou Project – Port Component – Baseline Environmental Report for Fish Studies off Île Kabak (Guinea)*” and “*SNCL (2011) Simandou Project–Environmental Baseline Survey 2011 Coastal fish survey–Preliminary results*”.

Supplementary information, where used, has been referenced in footnotes.

The quality of the environmental baseline information presented in this SEIA is considered of adequate quality to inform the assessment of impacts. Desktop research, site visits and reports from previous work by Simfer in Guinea are considered sufficient to understand the biological baseline environment. Further and ongoing research is being undertaken to verify this assumption. If the findings of this research significantly contradict the findings of the baseline reports that inform this assessment, Simfer is committed to re-evaluating the impacts and providing corrective actions, as appropriate.

5.3 Baseline

This Section provides baseline information on the Ile Kabak area, the Morebaya River and the surrounding coastal area. The focus is on presenting pertinent information that is necessary to understand how the project may affect the environment. A lot of the information available in the SNC Lavalin report referred to above is specific to the region south of the Project area (also within Maritime Guinea). That region is very similar to the study area and the available data are relevant to the Project area. From a biological perspective it is argued that the habitats and species present in these two areas are similar.

5.3.1 Protected Areas

Guinea has six types of protected areas: national park (parc national), strict nature reserve (réserve naturelle intégrale), managed nature reserve (réserve naturelle gérée), special reserve (réserve spéciale) or faunal sanctuary (sanctuaire de faune), trophy hunting zone (zone d'intérêt cynégétique) and hunting zone (zone de chasse) ⁽¹⁾.

There are no national or international designated areas in the immediate vicinity of the project area. The nearest protected areas are Saraboli, Kaloum and Mont Dixinn, which are all classified forests. The closest of these, Kaloum classified forest, is located approximately 36 km to the north.

(1) USAID (2007) Guinea Biodiversity and Tropical Forests 118/119 Assessment. Prepared by the Biodiversity Analysis and Technical Support Team.

In addition, Ile Blanche, located 40 km northwest of the proposed MOF, is classified as a Ramsar site due to it being used on a regular basis, by at least 1% of the biogeographic population of royal tern (sterne royale (Fr.), *Sterna maxima*). This waterbird species ⁽¹⁾ tends to congregate in large numbers in one location during at least one phase of its life cycle. Ile Blanche is the last substantial refuge in Guinea for the Olive Ridley sea turtle (tortue olivâtre (Fr.), *Lepidochelys olivacea*) ⁽²⁾ and possibly other sea turtle species, which nest on the sandy beaches of Ile Blanche.

Although not protected by law, the Guinean Forests of West Africa are recognised as a biodiversity hotspot by Conservation International. This hotspot encompasses an extensive band of varying types of lowland forests stretching from Guinea eastward to Cameroon ⁽³⁾. Representative forest types are present in the coastal zone bordering with Sierra Leone to the south and in areas of Upper Guinea, although not in the vicinity of the Project area.

Impacts to the protected areas have been assessed as not significant in the scoping phase and therefore will not be assessed further. This is predominantly due to the distance to the project area but also due to the temporary and low level of development.

5.3.2 Habitats

Guinea has an extensive network of terrestrial and aquatic environments, including vast estuaries, a large archipelago rising from a continental shelf and seasonally flooded coastal plains. The Maritime Guinea region presents a varied topography, climate and soil composition, which provides a wide range of habitats. Its coastal ecosystem includes 305 km² of intertidal flats, 2,036 km² of mangroves, 755 km² of fresh- or brackish-water coastal marshes and 605 km² of inundated rice fields ^(4,5). The area south of Conakry has been modified by human activities and is now arable land. In low land areas, dense forest has been cleared and used for rice cultures.

Figure 5.1 shows the land cover and habitat classification for the project area.

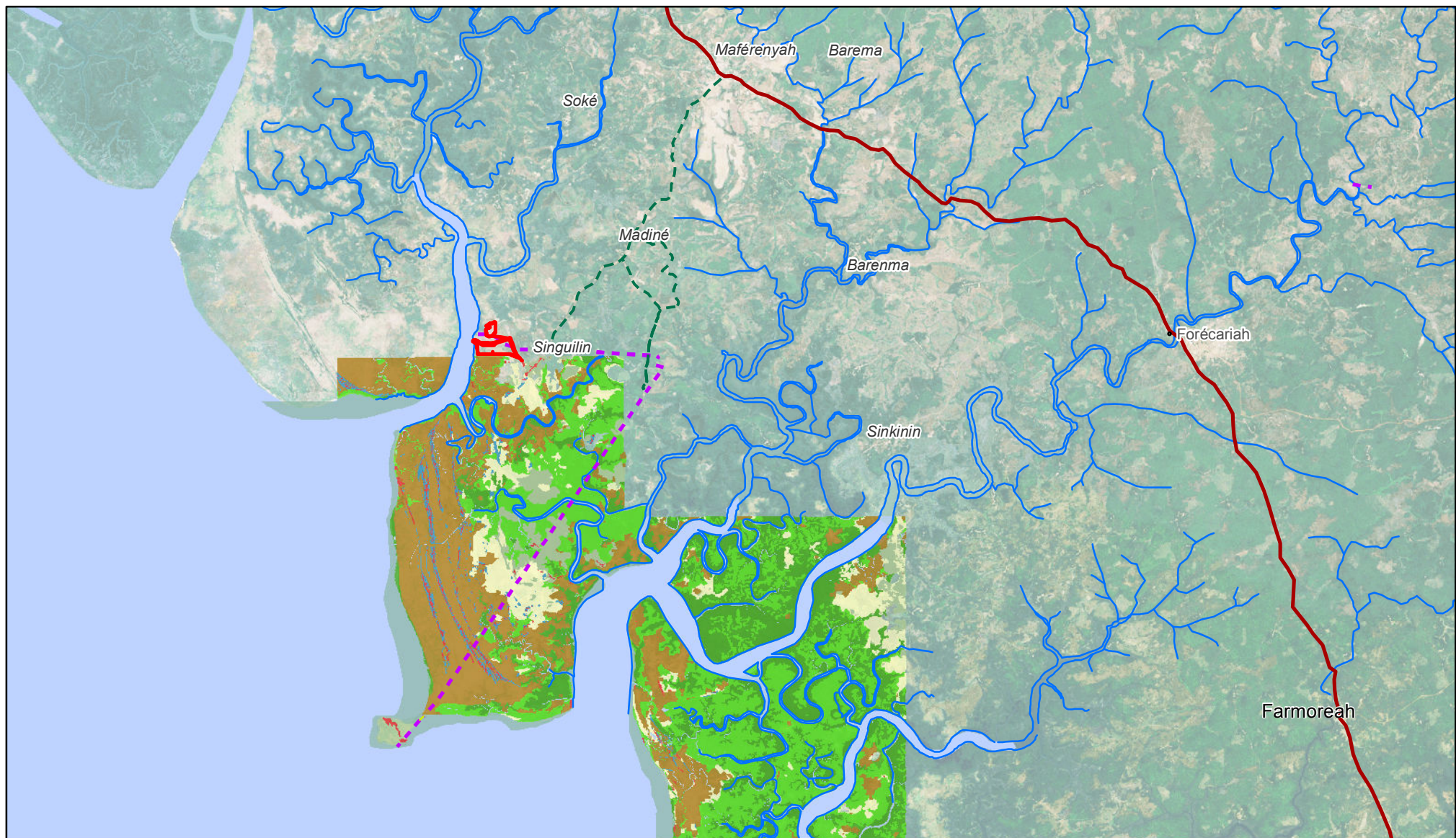
(1) Peter Robertson. Important Bird Areas in Africa and associated islands – Guinea.

(2) The Annotated Ramsar List: Guinea 16/10/2007. <http://www.ramsar.org> [accessed 15 August 2011]

(3) Conservation International. Biodiversity Hotspots: Guinean Forest of West Africa. Available from: http://www.biodiversityhotspots.org/xp/hotspots/west_africa/Pages/default.aspx

(4) US Aid (2007) Guinea Biodiversity and Tropical Forests 118/119 Assessment. Prepared by the Biodiversity Analysis and Technical Support Team.

(5) Corcoran, E., Ravilious, C. and Skuja, M. (2007) Mangroves of Western and Central Africa, Cambridge, UK, UNEP- Regional Seas Programme/UNEP-WCMC

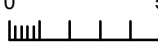


- Upgrading of Existing Roads /
Modernisation des routes existantes
- MOF Red Line Boundary /
Limite du MOF en Ligne Rouge
- New Access Road (Tentative) /
Nouvelle Route d'Accès (Provisoires)
- Principal Road / Route Principale

**Land Cover Classification /
Classement d'utilisation des Terres**

- Wooded village / Boisé villageois
- Foreshore / Estran
- Secondary lowland forest /
Forêt de basse terre secondaire
- Low Mangrove / Mangrove basse

- High Mangrove / Mangrove haute
- Water Body / Plan d'eau
- Rice Fields / Rizière
- Bare Soil covered with Low Plants
/ Sol nu ou recouvert de plantes basses
- Village

CLIENT: Simfer SA		SIZE: A4	TITLE: Figure 5.1 Land Cover Classification / Classement d'utilisation des terres		
ERM 					
SOURCE: NASA Landsat Program, 2003 PROJECTION: WGS 1984 UTM Zone 28N			DATE: 14/11/2011	CHECKED: MK	PROJECT: 0131299
			DRAWN: GN	APPROVED: KR	SCALE: As scale bar
			DRAWING: po_Land_cover_Habitat.mxd		REV: 0

File: 0131299_Simfer_SA_GIS_CK_Maps\ERM\PortMOC_SEA\A4\po_Land_cover_Habitat.mxd

Mangroves

Mangroves are species of salt tolerant trees that are found along most of the length of the Guinean coastline. Guinea's mangrove population comprises a quarter of West Africa's total mangrove wetland. Until 50 years ago, the entire coastline, except for a short section near Conakry, was lined with the densely rooted trees ⁽¹⁾. In recent years many of the coastal forests have been cleared for agriculture.

Tidal waters penetrate deeply into the interior of mangroves, carrying salty water and allowing mangroves to thrive up to 10 km inland.

The non-uniformity of mangrove dominated shorelines creates an important habitat for migratory birds and endangered species, such as the West African manatee ⁽²⁾. Mangroves also provide spawning and nursery areas for a variety of species, stabilise bottom sediments and protect shorelines from erosion ⁽³⁾. Mangroves have a high conservation value as the species composition is very specific due to the adaption of plants to marine alluvium and salt water.

Research into the different classes of mangroves present in the study area using satellite imagery has been conducted for the Project ⁽⁴⁾. Four mangrove classes were mapped: the black mangrove dominates, followed by dwarf red mangrove, medium red mangrove and tall red mangrove. In the Ile Kabak region mangrove forests are located primarily along the edges of the various estuaries and tidal creeks and zonation patterns of the four classes are similar to those previously reported for this region of the world.

Guinean mangroves form three distinct forest types, dependent on site conditions:

- riverine mangrove areas are found mostly along channels;
- fringe mangroves cover only small areas close to the coast; and
- basin mangroves are found in more elevated areas than riverine mangrove areas.

Both the tall and medium red mangroves would be considered riverine mangroves ⁽⁵⁾. Such mangroves are found along the edges of tidal creeks and along main estuaries where ideal conditions of low water salinities and daily tidal flushing occur. The dwarf red mangrove and the black mangrove would be considered either fringe or basin mangroves and are typically found at higher elevations and in areas of high salinities. For the Kabak region, the dwarf red mangrove forms a transition zone between the medium red mangrove and the much higher elevated and further inland black mangrove. The black mangrove is ideally suited to drier conditions and higher salinities and thus forms the transition zone between the dwarf red mangrove and salt pans or terrestrial vegetation.

An illustration of mangrove assemblages is shown in *Figure 5.2* and an example of mangrove habitats is shown in *Figure 5.3*.

(1) US Aid (2007) Guinea Biodiversity and Tropical Forests 118/119 Assessment. Prepared by the Biodiversity Analysis and Technical Support Team.

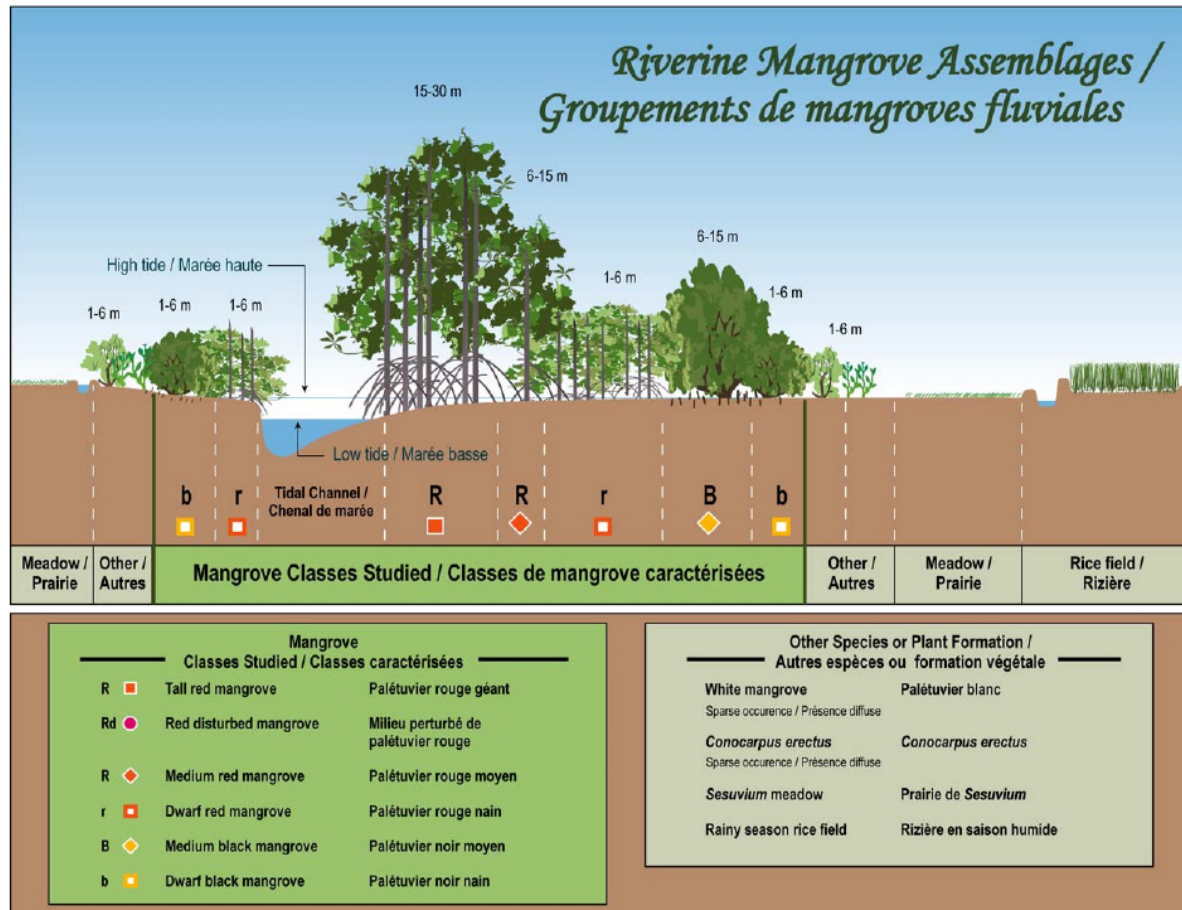
(2) US Aid (2007) Guinea Biodiversity and Tropical Forests 118/119 Assessment. Prepared by the Biodiversity Analysis and Technical Support Team.

(3) Mangrove.org (n.d.) Ecological Importance of Mangrove Habitat. Available from: <http://mangrove.org/video/Mangroves.pdf>

(4) SNCL (2011) Simandou Project – Port Components — Baseline environmental report for the mangrove forest of Ile Kabak (Guinea). Environnement Illimité inc.

(5) SNCL (2011) Simandou Project – Port Components — Baseline environmental report for the mangrove forest of Ile Kabak (Guinea). Environnement Illimité inc.

Figure 5.2 Riverine Mangrove Assemblages



Source: SNCL, 2008.

Figure 5.3 Mangrove Habitat



Source: ERM, 2011

Salt Marsh

A salt marsh is a coastal habitat found along the upper-intertidal zone. The habitat comprises salt tolerant vegetation, including grasses, reeds and shrubs, a wide range of invertebrates living in and on the sediment and other species including fish and water birds. *Sesuvium portulacastrum* is a characteristic and widespread salt marsh plant in Guinea that covers extensive areas along the coast adjacent to or in abandoned rice fields.

Salt marshes are ecologically important as they provide a link between the terrestrial and marine ecosystems. They also form important spawning and nursery areas for a variety of common estuarine fish species.

Rocky Shore

Rocky shores found throughout the West Guinea coastal area consist of beach rock; and blocks comprising a mix of carbonate sand and shells. Examples of rocky shore habitat are shown in *Figure 5.4*. The rock provides a substrate for the mangrove oyster *Crassostrea gasar*, which is harvested for food.

Figure 5.4 Rocky Shore Habitat at Ile Matakang



Source: ERM, 2011

Sandbank and Beach

Sandbanks occur along the Guinean coast in areas of high energy sedimentation. Sandbanks and beach habitat provide potential nesting sites for marine turtle species and feeding sites for migrating birds. However, given the intensity of fishing, the beaches along the coastal section of the proposed MOF are considered too disturbed for significant turtle nesting. *Figure 5.5* presents sandbanks in river mouths.

Figure 5.5 Sandbank Habitat



Source: SNCL, 2008

Savannah

Savannah habitats can either be predominantly made up of grasses, shrubs or trees. Grass savannah is characterised by herbaceous species and are frequently found in the transitional zones adjacent to forest areas. Shrub savannah is typically dominated by well-spaced species and similarly is found on transitional zones between grass savannah, fallow land and forest. Tree savannah consists of vegetation ranging from 7 to 30 m in height.

The closest area of substantial savannah is almost 6 km to the east of the Project site. Savannah habitat is much more prevalent to the northeast of the Project area, although some poor grassland savannah is found within the site perimeter.

Secondary Lowland Forest

Lowland forest grows on flat lands at elevations generally less than 1,000 m. A secondary lowland forest is one that has been disturbed and / or is being restored, for example degraded forest recovering from selective logging or areas reclaimed after being cleared by slash-and-burn agriculture ⁽¹⁾. There are sections of secondary lowland forest within the project area lying between the Morebaya and Forécariah Rivers. The dominant species in lowland forest around Ile Kabak is the oil palm (*Elaeis guineensis*) which is occasionally found as mono-specific stands.

Crop Land / Fallow Land

Cropland is land cultivated with crops that occupy the land for long periods. Rice is an important crop in Guinea particularly in western areas where 32% of the 640,000 tonnes of rice is produced annually ⁽²⁾. The percentage of land used as cropland in Guinea has increased over the last 40 years, from approximately 1.85% in 1984 to over 2.7% in 2008 ⁽³⁾. 'Bogoni' type rice fields are particularly prevalent in the project area and large areas are present along both banks of the Morebaya River.

(1) Mongabay.com. Available from: <http://rainforests.mongabay.com/0103.htm>

(2) Reliefweb. Available from: <http://reliefweb.int/node/166429>

(3) TradingEconomics.com. Available from: <http://www.tradingeconomics.com/guinea/permanent-cropland-percent-of-land-area-wb-data.html>

Rocky Outcrop

The rocky outcrops present in the area are comprised of granite. The rocks promote highly seasonal ecosystems ⁽¹⁾. During the dry season, the appearance is rather dry and barren. By contrast, the rainy season reveals a multitude of plant communities. Prominent are desiccation-tolerant vascular plants (eg *Afrotrilepis pilosa*). These rocky outcrops are considered important habitats for carnivorous plants (mainly *Utricularia* spp.). Along the sides it is common to find hydrophilic plant communities that depend on the specific local hydrological conditions that the rock provides.

Gallery Forest

Gallery forest is absent from the MOF Project site, but may be found further inland. Gallery forests are located on river floodplains and are influenced by elevated water tables or periodic flooding. The gallery forests are fairly homogenous in floristic composition. Typical species include representatives of the Leguminosae, Euphorbiaceae and Rubiaceae ⁽²⁾. Evergreen trees such as *Cynometra megalophylla* and *Dialium guineense* are likely to be present.

Wetlands

The wetland habitat comprises of a wide variety of aquatic plants characteristic of fresh and brackish calm water environments. *Carex*, *Juncus* or *Phragmites* (sedge, rush and reed) associations are the dominant vegetation. No extensive wetland are present around Ile Kabak but small patches of wetland vegetation are likely to be found in rainfed ponds and floodplains in the Project area that do not become dry or hypersaline during the dry season.

5.3.3 Fauna

This section highlights the types of species that may be present within the Project area and draws attention to species of higher conservation interest that could potentially be affected by the Project. The tables in this Section contain only species of higher conservation interest, which vary by animal type and number of species.

Terrestrial Mammals

There are no terrestrial mammal species of moderate to high conservation interest regularly observed in the Project area.

Several species of low sensitivity / value primate, bats and rodents are known to occur. The Aba roundleaf bat (*Hipposideros abae*) and Buettikofer's fruit bat (*Epomops buettikoferi*) typically live in moist lowland areas or caves in small colonies of less than 100 individuals. Primates, such as the patas monkey (*Erythrocebus patas*), which are found in the Project area, are highly mobile and live in family groups averaging 15 individuals in dry woodland and savannah areas. Several species of rodent, including the striped ground squirrel (*Xerus erythropus*) and the greater cane rat (*Thryonomys swinderianus*), have a more widespread distribution.

Marine Mammals

There are 22 species of marine mammal that are regularly observed in the coastal region of southwest Guinea. Of these, 11 species are listed on the IUCN Red List. However, none are believed to be endemic or have limited distribution. The species of conservation concern classified as vulnerable and above on the IUCN Red List are listed in *Table 5.1*.

(1) Speth, P., M. Christoph and B. Dieckrüger, Impact of Global Change on the Hydrological Cycle in West and Northwest Africa. Springer publisher, ISBN 978-3-642-12956-8.

(2) Speth, P., M. Christoph and B. Dieckrüger, Impact of Global Change on the Hydrological Cycle in West and Northwest Africa. Springer publisher, ISBN 978-3-642-12956-8.

Table 5.1 Marine Mammals of Conservation Concern

English name	French name	Latin name	Conservation status (IUCN)
<i>Delphinidae</i>			
Atlantic humpbacked dolphin	Dauphin à bosse de l'Atlantique	<i>Sousa teuszii</i>	Vu
<i>Balaenopteridae</i>			
Sei whale	Rorqual boréal	<i>Balaenoptera borealis</i>	En
Blue whale	Baleine bleue	<i>Balaenoptera musculus</i>	En
Fin whale	Rorqual commun	<i>Balaenoptera physalus</i>	En
<i>Physeteridae</i>			
Sperm whale	Grand cachalot	<i>Physeter catodon</i>	Vu
<i>Trichechidae</i>			
West African manatee	Lamantins ouest africain	<i>Trichechus senegalensis</i>	Vu

IUCN conservation status = DD: Data deficient; LC: Least concern; Nt: Near threatened; Vu: Vulnerable; En: endangered; Cr: Critically endangered; Ew: Extinct in the wild; Ex: Extinct.

Of the species presented in *Table 5.1* only the West African manatee and Atlantic humpbacked dolphin are likely to occur regularly in the Morebaya River and the nearshore area. The other species are cetaceans that have very large ranges and a pelagic distribution.

Information from local villagers suggests that manatees are frequently observed in mangrove habitats to the south of the Project area ⁽¹⁾. Given the similarity in habitat it is likely that they will occur in the mangrove channels in the Project area. During the dry season manatees move further upstream.

Birds

There are 726 species of bird regularly observed in Guinea either as migrant or nesting populations. Species listed in *Table 5.2* represent species of conservation concern that may be found within the Project area. Several of these species have limited distribution due to habitat preferences. Other species of conservation concern may be present however these are not unique to the Project site and have large distribution ranges.

Table 5.2 Birds of Conservation Concern

English name	French name	Latin name	IUCN status
<i>Psittacidae</i>			
Grey parrot	Perroquet jaco	<i>Psittacus erithacus</i>	Nt
<i>Bucerotidae</i>			
Yellow-casqued hornbill	Calao à casque jaune	<i>Ceratogymna elata</i>	Nt
<i>Pycnonotidae</i>			
Baumann's olive-greenbul	Bulbul de Baumann	<i>Phyllastrephus baumanni</i>	DD
<i>Sturnidae</i>			
Iris glossy-starling	Choucador iris	<i>Lamprotornis iris</i>	DD

(1) SNCL, 2008

English name	French name	Latin name	IUCN status
Phoenicopteridae			
Lesser flamingo	Flamant nain	<i>Phoenicopus minor</i>	Nt
Procellariidae			
Fea's petrel	Pétrel gongon	<i>Pterodroma feae</i>	Nt
Balearic shearwater	Puffin des Baléares	<i>Puffinus mauretanicus</i>	Cr
Scolopacidae			
Eurasian curlew	Courlis cendré	<i>Numenius arquata</i>	Nt
Black-tailed godwit	Barge à queue noire	<i>Limosa limosa</i>	Nt

IUCN conservation status = DD: Data deficient; LC: Least concern; Nt: Near threatened; Vu: Vulnerable; En: endangered; Cr: Critically endangered; Ew: Extinct in the wild; Ex: Extinct.

Source: Avibase website ⁽¹⁾ and Demey (2008) ⁽²⁾

Migratory birds are likely to use intertidal areas, salt marshes and mangroves whereas endemic and nesting species tend to be resident in mangrove and forested areas. The species listed above can be found in a variety of habitat types. For example hornbills live in terrestrial grassland areas whereas flamingos are regularly observed in salt marshes, salt pans and rice paddies. Hornbills are large predominantly fruit-eating birds that fill an important ecological function in tropical forests as seed dispersers.

Amphibians and Reptiles

No amphibians of conservation interest are known to be present. Several types of amphibian, such as frogs, will occur in the Project area and are likely to reside in habitats such as rice paddies and drainage ditches. Reptiles of conservation concern present in the Forécariah River and along the coast belong to either the sea turtle (Cheloniidae) or crocodile (Crocodylidae) families. Given the similar habitat types, these reptiles are likely to be present in the Project area. Sea turtles will only occasionally swim as far upstream as the Project site and are therefore more restricted to the coastal habitats only. Reptiles of conservation concern are listed in Table 5.3.

Table 5.3 Reptiles of Conservation Concern

English name	French name	Latin name	IUCN status
Cheloniidae			
Loggerhead sea turtle	Caouanne	<i>Caretta caretta</i>	En
Green sea turtle	Tortue verte	<i>Chelonia mydas</i>	En
Hawksbill sea turtle	Tortue imbriquée	<i>Eretmochelys imbricata</i>	Cr
Kemp's ridley sea turtle	Tortue de Kemp	<i>Lepidochelys kempii</i>	Cr
Olive ridley sea turtle	Tortue olivâtre	<i>Lepidochelys olivacea</i>	Vu
Dermochelyidae			
Leatherback sea turtle	Tortue luth	<i>Dermochelys coriacea</i>	Cr
African Dwarf crocodile	Crocodile nain	<i>Osteolaemus tetraspis</i>	Vu

IUCN conservation status = DD: Data deficient; LC: Least concern; Nt: Near threatened; Vu: Vulnerable; En: endangered; Cr: Critically endangered; Ew: Extinct in the wild; Ex: Extinct.

(1) <http://avibase.bsc-eoc.org/checklist.jsp?region=gn&list=clements>

(2) Demey (2008) Projet Simandou – Guinée Inventaires ornithologiques dans le corridor du chemin de fer et la zone du por. RAPPORT DE MISSION.

Beaches extending south from the Morebaya River have been identified as potential sea turtle nesting areas. However, as mentioned previously the beach is too disturbed for significant nesting activity. Crocodiles are regularly observed in the estuarine locations to the south of the Project area. Given the similarity in habitats it is possible that crocodiles will also occur in the Project area. Other types of reptile, such as snakes and monitor lizards, are likely to be present, however, none are species of high or medium conservation interest.

Invertebrates

There are a large number of species of marine, freshwater and terrestrial invertebrates that may occur in the Project area. Of these species, three are of conservation concern and are listed in *Table 5.4*.

Table 5.4 Invertebrates

English name	French name	Latin name	IUCN status
<i>Gecarcinucidae</i>			
Purple marsh crab	Crabe pourpre d'eau douce	<i>Afrithelphusa monodosus</i>	Cr
Tree hole crab	Crabe d'eau douce arboricole	<i>Globonautes macropus</i>	Cr
<i>Neritidae (Genus of marine and freshwater snails)</i>			
Species of nerite snail	Espèces d'escargots 'nérites'	<i>Neritina rubricata</i>	Nt

IUCN conservation status = DD: Data deficient; LC: Least concern; Nt: Near threatened; Vu: Vulnerable; En: endangered; Cr: Critically endangered; Ew: Extinct in the wild; Ex: Extinct.

Note: Endemic species are shaded green.

Purple marsh crabs are known to live in wetland habitats in northwest Guinea and have been classified from less than 20 specimens ⁽¹⁾. The tree hole crab is endemic to the Upper Guinea rainforests. Given the very limited distribution of these species it is unlikely that they will occur in the Project area ⁽²⁾.

Neritina rubricata is a species of freshwater snail found in mangroves, mudflats and lagoons in West Africa. Given its habitat preferences it may be present, although is not limited to the Project area.

Other species of invertebrates including polychaetes, molluscs, echinoderms and crustaceans are common in habitats found in the Project area.

Fish

There are 125 species of bony fish and 62 species of rays and shark that occur in the brackish and coastal environment in Guinea. Many of the species are predominantly open water pelagic species that have some conservation interest. Given that these are unlikely to be significantly affected by the Project they have not been included in *Table 5.5* below. There are also many species endemic to Guinea, although few (if any) are restricted to the Project area. *Table 5.5* presents species of conservation concern that may be present in the Project affected area ie the nearshore area or in the Morebaya River / estuary.

(1) Cumberlidge, N. 2008. *Afrithelphusa monodosa*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.1. <www.iucnredlist.org>. Downloaded on 06 October 2011.

(2) Cumberlidge, N. 2008. *Globonautes macropus*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.1. <www.iucnredlist.org>. Downloaded on 06 October 2011.

Table 5.5 Fish of Conservation Concern

English name	French name	Latin name	IUCN status
Ariidae			
Giant sea catfish	Mâchoiron géant	<i>Arius gigas</i>	Nt
Alopiidae			
Common thresher shark	Requin renard	<i>Alopias vulpinus</i>	Vu
Carcharhinidae			
Bull shark	Requin bouledogue	<i>Carcharhinus leucas</i>	Nt
Blacktip shark	Requin bordé	<i>Carcharhinus limbatus</i>	Nt
Tiger shark	Requin tigre commun	<i>Galeocerdo cuvier</i>	Nt
Lemon shark	Requin citron	<i>Negaprion brevirostris</i>	Nt
Blue shark	Requin bleu (ou Peau bleue)	<i>Prionace glauca</i>	Nt
Dasyatidae			
Daisy stingray	Pastenague Marguerite	<i>Dasyatis margarita</i>	En
Porcupine ray	Pastenague sans dard	<i>Urogymnus asperrimus</i>	Vu
Gymnuridae			
Spiny butterfly ray	Raie-papillon épineuse	<i>Gymnura altavela</i>	Vu
Leptochariidae			
Barbeled houndshark	Emissole barbue	<i>Leptocharias smithii</i>	Nt
Myliobatidae			
Spotted eagle ray	Aigle de mer tacheté	<i>Aetobatus narinari</i>	Nt
Pristidae			
Wide sawfish	Poisson-scie tident	<i>Pristis pectinata</i>	Cr
Large-tooth sawfish	Requin-scie	<i>Pristis perotteti</i>	Cr
Common sawfish	Poisson-scie commun	<i>Pristis pristis</i>	Cr
Rajidae			
Thornback skate	Raie bouclée	<i>Raja clavata</i>	Nt
Bottlenose skate	Raie blanche	<i>Rostroraja alba</i>	En
Rhinobatidae			
Blackchin guitarfish	Guitare de mer fousseuse	<i>Rhinobatos cemiculus</i>	En
Common guitarfish	Guitare de mer commune	<i>Rhinobatos rhinobatos</i>	En
Rhynchobatidae			
Lubbert's guitarfish	Poisson-paille africain	<i>Rhynchobatus luebberti</i>	En
Sphyrnidae			
Scalloped hammerhead	Requin-marteau halicorne	<i>Sphyrna lewini</i>	En

English name	French name	Latin name	IUCN status
Squat-headed hammerhead shark	Grand requin-marteau	<i>Sphyrna mokarran</i>	En
Smooth hammerhead	Requin-marteau commun	<i>Sphyrna zygaena</i>	Vu
Squatidae			
Sawback angelshark	Ange de mer épineux	<i>Squatina aculeata</i>	Cr
Smoothback angelshark	Ange de mer ocellé	<i>Squatina oculata</i>	Cr
Triakidae			
Common smoothhound	Emissole commune	<i>Mustelus mustelus</i>	Vu

IUCN conservation status = DD: Data deficient; LC: Least concern; Nt: Near threatened; Vu: Vulnerable; En: endangered; Cr: Critically endangered; Ew: Extinct in the wild; Ex: Extinct.

Note: Endemic species are shaded green ⁽¹⁾.

Several of the shark species are found in both coastal and offshore waters. Certain species (in particular the bull shark) are coastal and freshwater species that inhabit shallow waters in bays, estuaries, rivers and lakes. Other species, for example guitarfish, may occur along the coast and in rivers where waters remain sufficiently saline.

Recent sampling programs conducted for the Project have confirmed the presence of several species of higher conservation interest ⁽²⁾ ⁽³⁾. These include: the daisy stingray (raie (Fr); *Dasyatis margarita*); Lusitanian cownose ray (Mourine lusitanienne (Fr); *Rhinoptera marginata*), which is listed endangered on the IUCN redlist; blackchin guitarfish (Raie-guitare fousseuse (Fr) *Rhinobatos cemiculus*).

There are several species of fish that are important to local and commercial fisheries that are found in the Project area. While not all are of conservation interest these species are nonetheless important to communities. Information on fishing is provided in *Chapter 6*. Target species for the commercial pelagic fishery include:

- horse mackerel (chinchard, *Trachurus trachurus*);
- Sardinella sp. (Sardinella aurita, Sardinella maderensis, Sardinella rouxi);
- Bonga shad (ethmalose d'afrique, *Ethmalosa fimbriata*) and shad (Alose rasoir, *Ilisha africana*);
- mackerel (maquereau espagnol, *Scomber japonicus*).

Target species for the demersal fishery include:

- croakers (bars), including *Pseudotolithus brachygnethus*, *Pseudotolithus senegalensis*, *Pseudotolithus typus*, and the bobo croaker (bobo, *Pseudotolithus elongates*);
- soles, including *Cynoglossus caneriensis*, *Cynoglossus monodi*, *Cynoglossus senegalensis*);
- catfish (machoirons, *Arius heudeloti*, *Arius Istiscutatus* and *Arius parkeri*);
- lesser African thread fin (petits capitaines, *Galeoides decadactylus*);

(1) Bah *et al.*, (1997) Monographie nationale sur la diversité biologique. Ministère des travaux publics et de l'environnement. Direction nationale de l'environnement. Conakry. 146p.

(2) SNCL (2011) Simandou Project – Port Component — Baseline Environmental Report for Fish Studies off Île Kabak (Guinea). Environnement Illimité inc.

(3) SNCL (2011) Simandou Project–Environmental Baseline Survey 2011 Coastal fish survey–Preliminary results. Environnement Illimité inc.

- grunts (grondeurs), including *Pomadasys incisus* and *Pomadasys jubelini*;
- cephalopods, including cuttlefish (*Sepia* sp.);
- sea bream, red Pandora (fausse daurade, *Pagellus bellottii*); and
- shrimp, including *Penaeus notialis*, *Penaeus kersthurus*, *Perapenaeopsis atlantica*.

The main targeted species for the artisanal fishery include bonga shad and sardines.

Guitarfish (species in *Table 5.5*) are also believed to be targeted by fisheries in West Africa as the fins of blackchin (*Rhinobatos cemiculus*) in particular are highly prized (fetching up to 100 Euro/kg). Despite over exploitation there are no international and national conservation measures in place to protect the species ⁽¹⁾.

5.3.4 Flora

The Guinean Forests hotspot is home to an estimated 9,000 vascular plant species of which approximately 20 percent (1,800 species) are thought to be endemic ⁽²⁾. The flora of this hotspot is closely related to the flora of central Africa and most genera are widespread throughout both regions, although West Africa has high levels of local endemism at the species level.

Plant species of conservation concern likely to occur in the project area are shown in *Table 5.6*.

Table 5.6 Flora of Conservation Concern

English name	French name	Latin name	IUCN status
<i>Fabaceae</i>			
Afzelia	Savanna Doussié	<i>Afzelia africana</i>	Vu
<i>Combretaceae</i>			
Black afara	Framiré	<i>Terminalia ivorensis</i>	Vu
<i>Rubiaceae</i>			
West African boxwood	Acajou jaune d'Afrique	<i>Nauclea diderrichii</i>	Vu

IUCN conservation status = DD: Data deficient; LC: Least concern; Nt: Near threatened; Vu: Vulnerable; En: endangered; Cr: Critically endangered; Ew: Extinct in the wild; Ex: Extinct.

All three species listed in *Table 5.6* are tree species and are likely to occur in areas of lowland forest. Savannah grasses typically have a widespread distribution and are not of conservation concern. Grass species common in Maritime Guinea and therefore likely present in the Project area include *Andropogon gayanus*, *Aspila Africana*, *Briillantaisia lamium*, *Heliotropium baclei*, *Ceratotheca sesamoï*, *Chaetolepsis gentianoides*, *Chasmopodium caudatum*, *Hyparehenia rufa*, *Imperata cylindrical*, *Pennisetum polystachion*, *Pennisetum purpureum*, *Pryceups* sp., *Eleocharis setifolia*, *Solenostemon rotundifolius*, *Spermaceae verticillata*, *Utricularia spiralis* var. *pobeguini*.

The mangroves in the Project area are dominated by seven species: *Acrostichum aureum*, *Avicennia germinans*, *Conocarpus erectus*, *Laguncularia racemosa*, *Rhizophora harrisonii*, *Rhizophora mangle* and *Rhizophora racemosa*. These species are widespread in West Africa and are able to form three distinct forest types as described in the habitats section.

(1) Notarbartolo di Sciara, G. et al. (2007) *Rhinobatos cemiculus*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.1. <www.iucnredlist.org>. Downloaded on 06 October 2011.

(2) Conservation International. Biodiversity Hotspots: Guinean Forest of West Africa. Available from: http://www.biodiversityhotspots.org/xp/hotspots/west_africa/Pages/default.aspx

There are also a number of economically important plant species. The oil palm (*Elaeis guineensis*) is widely planted throughout the tropics for oil production, while valuable timber species include the African ebony (*Diospyros gracilis*), two genera of African mahogany (Entandrophragma and Khaya) and iroko (*Milicia excelsa*), which are widely exploited.

5.4 Prediction, Evaluation and Mitigation of Impacts

The following sections each assess an impact to either habitats or a group of species from land use change or a construction or operational activity. Impacts on different receptors are listed below by activity. In addition an assessment of cumulative impacts can be found in *Section 5.33*.

- impacts from land use change (*Sections 5.5 to 5.10*);
- impacts from marine works including dredging and dredge disposal (*Sections 5.11 to 5.15*);
- impacts from onshore construction works at the MOF (*Sections 5.16 to 5.18*);
- impacts from road construction and upgrading (*Sections 5.19 and 5.20*);
- impacts from non-routine events during construction (*Section 5.21*);
- impacts from the physical presence of the MOF and roads during operation (*Sections 5.22 to 5.27*);
- impacts from maintenance dredging and dredge disposal during operation (*Sections 5.28 to 5.31*); and
- impacts from non routine events during operation (*Section 5.32*).

For the purpose of this assessment 'Land Use Change' encompasses changes to all habitat types, whether terrestrial, estuarine or marine. Emphasis is on the change in land use that is the direct result of the site selection, the layout and the temporary and permanent footprint of the Project. These correspond to direct impacts. Further potential impacts in terms of habitat degradation may occur due to alteration of the hydrological cycle (onshore) and changes to coastal processes in the nearshore marine environment. Such impacts are considered indirect impacts that result from land use change. Additional impacts will arise from marine and land based construction activities. In contrast to the impacts to habitats discussed under *Land Use Change*, these impacts are of a temporary nature and last for the duration of construction.

In addition to impacts predicted from routine activities, those impacts that would occur as a result of an accident or unplanned event within the Project are taken into account. In these cases the probability of the event occurring is also considered. An inventory of possible non-routine events that are relevant to the Project is presented in *Annex E*.

For each type of Project activity, the assessment first discusses the nature of the individual impacts on a particular habitat or group of species in isolation, and then proceeds with an assessment of the significance of the collective impact on a particular habitat, species or group of species at risk from the Project activities.

The MOF Project SEIA has been based on the project information presented in *Chapter 2* of this report. In some instances certain details are not yet fully defined. Whenever details of the project design are insufficiently known in the course of the SEIA, the impact assessment has taken a conservative approach and assessed the likely worst case in terms of the possible scenarios that might be implemented for the Project. The final detailed design of the Project should not vary beyond these limits so that the Project should not have an impact that is worse than that described in this report. For further details on the approach to the assessment see *Chapter 1*.

Specific criteria used in the assessment of impacts on biodiversity and the biological environment are presented below.

5.4.1 Assessment of Significance

The significance of potential impacts is a product of the sensitivity / value of the receptor and the predicted magnitude of the impact on that receptor together with an element of expert judgement. The term 'magnitude' encompasses:

- the nature of the change (what is affected and how);

- its size, scale or intensity;
- its geographical extent and distribution; its duration, frequency, reversibility; and where relevant
- the probability of occurrence as a result of accidental or unplanned events.

Sensitivity / value is evaluated according to criteria. These criteria are outlined in *Table 5.7*. *Table 5.8* presents the outcome of the assessment of sensitivity / value for the habitats in the Project area and the justification behind the rating. Sensitivity / value of species is highlighted in the assessment below and in many cases species of conservation interest that are either high or medium sensitivity / value are assessed together.

Table 5.7 Criteria for Sensitivity / Value of Habitats and Species

Value and/or Sensitivity	Description of Criteria
Low	Sites: areas not included in the criteria for high value and/or sensitivity are considered in expert opinion to be of low value and/or sensitivity. Habitats: not globally regionally or nationally protected or listed and which are common or abundant and which are not critical to other ecosystem functions. Habitats which are very common and widespread in West African region or habitats generally modified or degraded by anthropogenic activities, or land with no real conservation significance in expert opinion. Species: not protected or listed, common or abundant and is not critical to other ecosystem functions and is not included in the criteria for moderate or high sensitivity and/or value. Ecosystem Services: services provided by the ecosystem are of low importance at the local, regional and global level.
Medium	Sites: areas not included in the criteria for high value and/or sensitivity are considered in expert opinion to be of moderate value and/or sensitivity. Habitats: locally rare, small or scattered; vegetation communities or sub-communities; habitats which include a set of species not very common in Guinea; include species which have specific adaptations to that habitat; habitats rich in biodiversity; and habitats common in the region but important for ecosystem services. Also includes any low value and/or sensitivity habitats used by moderate or high value and/or sensitivity species as important breeding, feeding areas or migration routes, including those alongside watercourses. Species: Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD) species (IUCN 2009), some species from The National Monograph on the Biological Diversity of Guinea (Ministère des Travaux Publics et de l'Environnement 1997) dependent on a case by case basis using expert opinion and is not included in the criteria for high value and/or sensitivity species Ecosystem Services: services provided by the ecosystem are recognised to have moderate to high value at the local, regional or global level but the service has viable and accessible substitutes.

Value and/or Sensitivity	Description of Criteria
High	Sites: legally designated areas and other designated areas that have been recognised for their importance for biodiversity. Officially protected areas, proposed protected areas, important but unprotected sites are identified following globally recognised systems and through regional/national processes. Habitats: supporting a set of unique species in comparison to other examples of the habitat; habitats already threatened within the region; habitats with a limited global extent or a significant proportion of the total extent of that habitat type will be affected. Also includes habitats used by high value and/or sensitivity species as important feeding areas or migration routes, including those alongside watercourses. Includes Tier 1 and Tier 2 habitats as defined by IFC, PS6. Species: Critically Endangered (CR) or Endangered (EN) species (IUCN 2009), some species from The National Monograph on the Biological Diversity of Guinea (Ministère des Travaux Publics et de l'Environnement 1997) dependent on a case by case basis using expert opinion. Species and taxa having a particularly restricted distribution (ie endemic to a site or found globally at fewer than 10 sites or terrestrial/freshwater species having a distribution range less than 50,000 km² or marine species having a distribution range less than 50,000 km² or restricted-range bird species (those with a global breeding range less than 50,000 km²) (Stattersfield et al., 1998)). As value and/or sensitivity is based on irreplaceability and vulnerability, following a precautionary principle, a moderate value / sensitivity species but restricted to an area would be classed with high value and/or sensitivity. Ecosystem Services: services provided by the ecosystem are of major importance at a local, regional or global level and there are few or no viable and accessible alternatives or substitutes for the service.

Table 5.8 Sensitivity / Value of Habitat Types

Habitat	Sensitivity / Value	Justification
Open woodland and shrub land savannah	Low	Tree canopy covers 15-40%. Very common and widespread in Guinea and within the Project area. Generally modified by anthropogenic activities.
Secondary lowland forest	Low	Very common and widespread in Guinea and within the Project area. Degraded/regenerating lowland forest. Generally modified by anthropogenic activities.
Planted forest	Low	Widespread near human settlements. Planted fruit orchards, shade trees, coconut groves and oil palm plantations provide products and services to people and animals.
Grassland savannah	Low	Very common and widespread in Guinea and within the Project area. Generally modified by anthropogenic activities (agriculture).
Rocky outcrop	Medium	Geographically restricted in the vicinity of the project area. Supports hydrophilic vegetation. Not common in coastal lowland.

Habitat	Sensitivity / Value	Justification
Gallery forest ⁽¹⁾	High	Includes any forest that grows along a river or stream characterised by hydrophilic plants. Often used for wildlife movement. Rich in biodiversity.
Wetlands	Medium	Seasonally flooded and/or permanent brackish or freshwater wetlands support a high diversity and provide important to birds and small mammals. The habitat is widespread.
Mangrove forest	High	Littoral habitat. Floristic composition is very specific due to the adaptation of plants to marine alluvium and salt water. Also important as habitat for rare and endangered species and as nursery habitats for many fish species. Important to birds.
Salt marsh	Medium	Littoral habitat. Floristic composition is very specific due to the adaptation of plants to marine alluvium and salt water. Habitat and nursery for many fish species. Important to birds. Generally modified by anthropogenic activities (rice culture).
Sandbank and beach	Low	The majority of habitats will be of low value / importance as they are geographically widespread and are only used as feeding and resting grounds for marine and coastal birds. Note: beaches that are frequently used for nesting by sea turtles are accorded a high sensitivity / value.
Cropland and fallow land	Low	Region of intensive cultivation. Geographically widespread and of no real conservation significance.

5.5 Impacts to Habitats from Land Use Change

5.5.1 Assessment of Impacts

Direct impacts to habitats will occur through:

- removal of substrate from dredging the access channel, turning circle and MOF location;
- dredge spoil disposal to the seabed;
- clearance of terrestrial and littoral habitat and earthworks required for construction of the MOF; and
- clearance of terrestrial and littoral habitat and earthworks required for road construction.

Indirect impacts to habitats will occur through:

- changes in hydrodynamic conditions causing impacts to coastal and littoral habitats; and
- habitat loss and transformation from modification and obstruction of waterways; and
- secondary impacts resulting from habitat fragmentation.

The total footprint from dredging the approach channel, berthing areas and turning circle is approximately 474 ha. For Project details see *Chapter 2 Project Description*. This constitutes seabed habitat, subtidal and intertidal sand banks.

The footprint of the dredge spoil disposal site is more difficult to establish. The selection of disposal sites has not been finalised but are likely to lie at depths in excess of 15 m or in natural depressions closer to shore. Dredge disposal is intermittent and the location within the designated disposal area where the dredge hoppers release their load will vary over the construction period. Once released, the sediment drops to the sea floor and smothers the seabed. The descending plume will spread in a lateral direction. An estimated

(1) Gallery forest is not a distinct forest type in terms of species composition, but is a term that applies purely to the appearance of the forest (M. Cheek, pers. comm., 2008).

volume of 13.8 Mm³ will be deposited on the seabed. In view of the largely unconsolidated nature of the sediment and assuming a 1 m thick deposit, the spoils will eventually become distributed evenly across an area of the seabed measuring approximately 13.8 km².

With both dredging and dredge disposal, the initial loss of seabed habitat and sand banks underneath the footprint is complete as the seabed is removed in one location and the resulting dredge spoils blanket the existing seabed in another location. The newly exposed sediment in both locations provides new substratum to the various species assemblages that were formerly present. Over time, this new habitat will become colonised by a suite of benthic species. Direct impacts on marine and estuarine habitats from removal of substrate and dredge spoils are therefore considered temporary as over time sediments will be reworked and it is likely the original habitat types will be naturally restored, especially in the dynamic estuarine and coastal environment.

Construction of the MOF and roads requires clearance of terrestrial and littoral habitat, which reduces the available habitat extent by directly removing terrestrial and littoral habitat and can have a permanent or temporary impact on habitats and biodiversity. Permanent habitat loss will occur for permanent structures, while temporary habitat loss may occur where there is only limited clearing for temporary access ⁽¹⁾.

The total footprint of the MOF is approximately 1.4 km², which can be divided into the following categories and loss of habitat types:

- 8 ha of mangrove and 105 ha grass savannah land, cropland / fallow land (rice fields) and planted forest at the MOF site and laydown area;
- 19 ha of rocky habitat at the quarry site; and
- A small but as yet undefined area of miscellaneous habitat (forest patches, cropland / fallow land and grass savannah land) along the access road and road to Maferinya that will be upgraded.

Along the new roads that need to be built and/or upgraded, the potential habitat loss comprises:

- Assuming a worst case length of 40 km of new road, in the order of 175-225 ha of grassland, cropland / fallow land and mangrove habitat along the alignment of the new roads and at the necessary borrow pits.

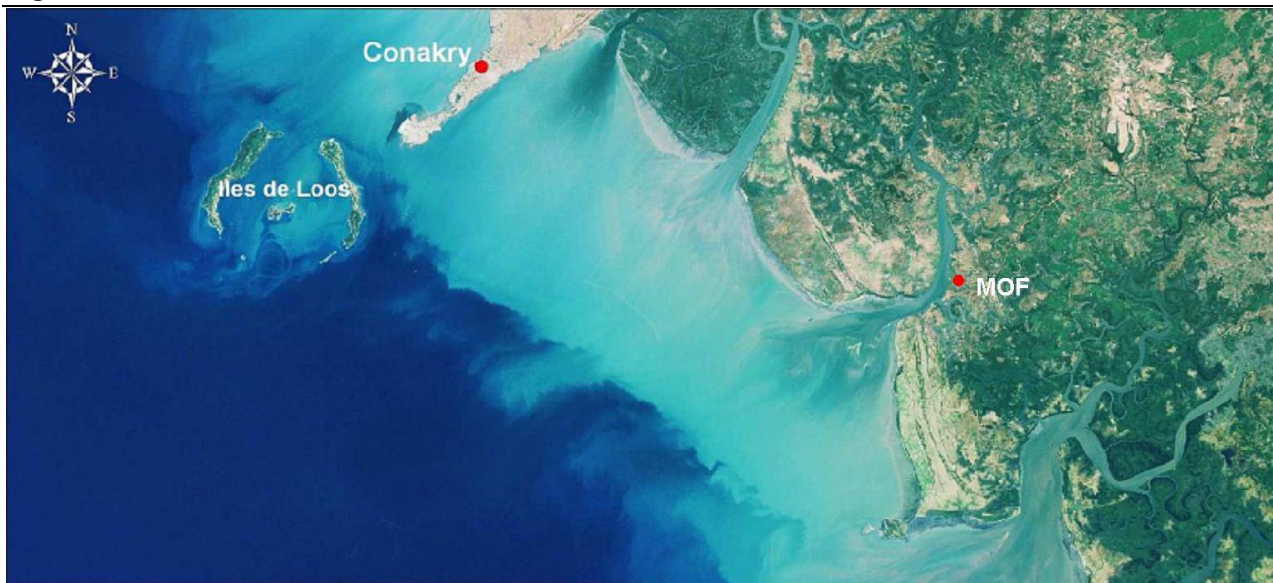
The magnitude and extent of indirect loss and change of habitat is difficult to establish.

Marine and estuarine habitats such as seabed, sandbanks and beaches will be indirectly impacted from changes in hydrodynamic conditions. Removal of substrate and subsequent disposal of the spoils has the potential not only to change the depth of habitat but also to alter the hydrodynamic regime across the depression and spoil area, which may make the habitat unsuitable for species currently using the area.

Sedimentation from both the sediment plume and sediment disposal can change the sediment particle size distribution and smother benthic species in a much wider area, which can also make the habitat unsuitable for species currently using the area and / or change prey availability thus altering the habitat quality. Part of the silt and mud fraction of the sediment will suspend in the water column and disperse with the strong tidal currents across much of the coastal shelf, adding to the already extensive silt plumes that characterise the coastal waters off Guinea (see *Figure 5.6*).

(1) International Council on Mining and Metals (ICMM) (2006) Good Practice Guidance for Mining and Biodiversity.

Figure 5.6 Turbid Waters off the Guinea Coast



Source: Baird, 2008 ⁽¹⁾.

Indirect impacts may also occur due to the change in bathymetry and coastline shape altering the hydrodynamic regime and sediment supply to the coast. For instance, the newly created approach channel causes drawdown of sand from adjacent sandbanks and shores in the Morebaya River estuary as the channel seeks to fill in while it tends towards a new geomorphological equilibrium. This will continue over time as the approach channel is maintained at depth through additional maintenance dredging. It is also possible that sediment supply to the beaches and near the MOF may be affected, which may cause either sediment to be deposited or eroded, or a combination of both. With the present understanding of the morphodynamic behaviour in this location, it is not possible to establish the exact extent of these indirect changes in habitat availability. What is known, however, is that these changes will manifest themselves on timescales that allow the communities in these marine and estuarine habitats to adapt. Gains in the availability of one valued habitat will be offset by losses in another not less valued habitat. The net effect of these changes is a gradual modification of sandbanks, seabed and beaches over time until a new dynamic equilibrium is reached.

Indirect habitat loss is likely to occur due to reduction of hydraulic connectivity of upstream waterways (mangrove creeks, streams, rice field and salt pan irrigation channels, wetlands and seasonal ponds) causing further loss of habitat and fragmentation. This is possible just south of the MOF where infill of an existing mangrove creek blocks the outflow.

Of further concern is the effect that the new roads will have on the flow of water to mangroves situated some distance inland, as found in the project area, which can ultimately cause large areas of mangrove to die back long after the initial construction period. A large expanse of mangroves and salt marsh is located around the main creeks on Ile Kabak. The mangroves reach far inland. The inland margin is only flooded by equinoctial spring tides. The area is characterised by a sparse vegetation of small stunted mangroves trees and grasses and large areas devoid of any vegetation. Here the salt water in the topsoil is strongly concentrated through evaporation, whereas during the rainy season the soils may be completely leached of salt. Regular flooding by the tides prevents the build up of excessive salt in these areas. The regular flooding also prevents excessive siltation by maintaining drainage and lateral flow within the mangroves and scouring of channels.

Under a worst case scenario, the new roads will permanently block the waterways. Roads act as a causeway that cut off the regular exchange of water completely. This assumes that no bridges or culverts

(1) W.F. Baird & Coastal Engineers Ltd. (2008). Simandou Project Pre-Feasibility Study. Capital and Maintenance Dredging and Disposal. Report for SNC Lavalin and Rio Tinto.

are present. In depressions behind the causeway, water flow will be restricted due to impounding which subsequently can kill many mangroves. Areas on higher elevations will become even more saline during the dry season rendering the soils unproductive. The mangroves upstream of the road obstruction that are no longer subjected to tidal inundation will eventually perish. Over time mangrove and salt marsh habitat will disappear and a mosaic of hypersaline land devoid of vegetation, rainfed brackish and freshwater ponds and wetlands colonised by annual opportunistic plant species (mostly grasses and reeds) will emerge. Disturbed or barren areas are also likely to be colonised by invasive species before native plants can become established. It is not possible to predict the exact outcome of this transformation. It can be expected that the succession of habitats will take many years. The initial loss of mangrove and salt marsh habitat in the absence of continued tidal exchange will occur much more rapidly. It follows that valuable mangrove habitat and salt marsh habitat will succumb to much less valuable habitats characterised by opportunistic species and poor diversity.

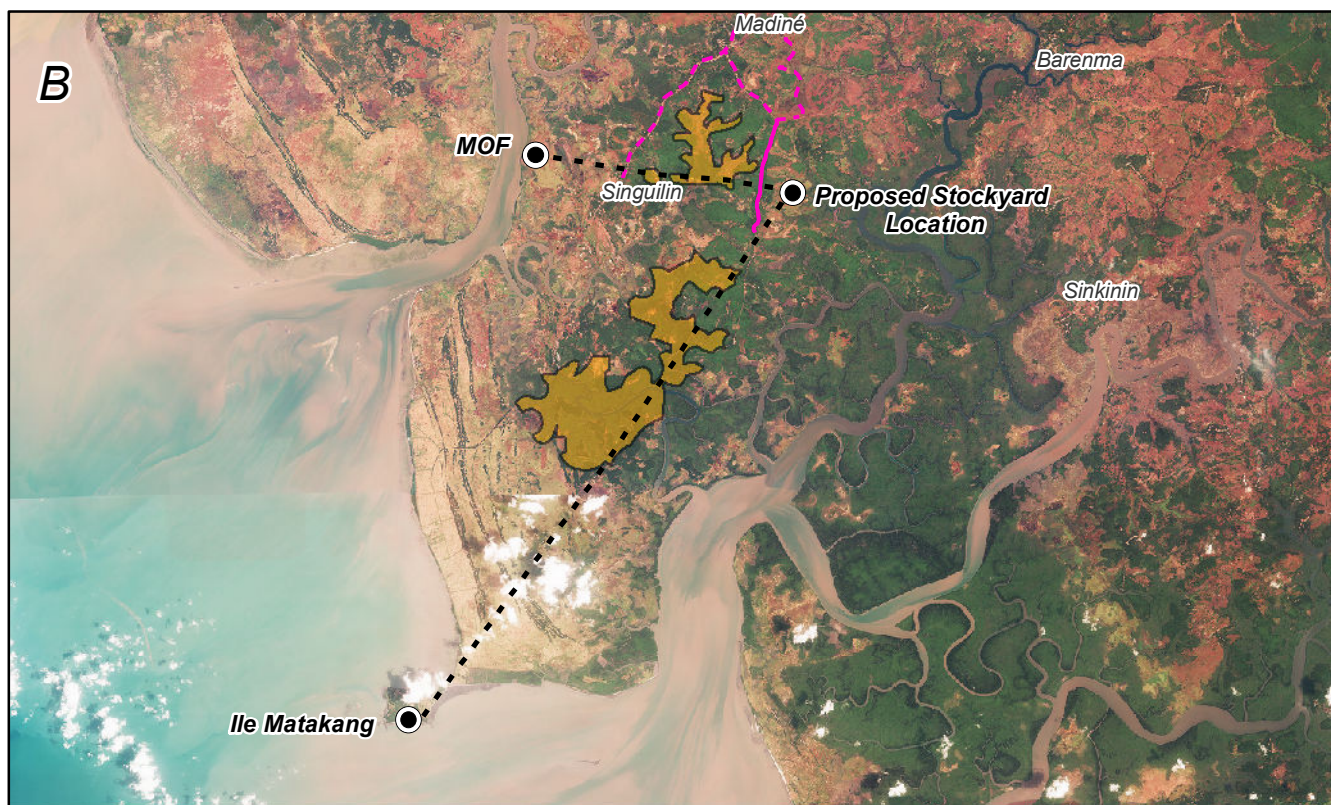
Moreover, many of the ponds that develop behind the causeway will provide breeding habitat to insects. Malaria mosquitoes are able to exploit impounded stagnant pools retained within stands of mangroves and saltmarsh environments, caused by siltation or other blockage of the normal tidal channels and thus not subject to the normal daily flushing.

The extent of loss of mangrove and salt marsh habitat will clearly depend on the location of any waterway crossings and the extent of the obstruction in water flow (*ie* complete blockage or reduced tidal exchange). *Figure 5.7* shows the extent of mangrove habitat at risk from complete blockage of tidal exchange from two hypothetical road alignments between the MOF and the proposed stockyard location and Ile Matakang). It follows that the further the obstruction is located from the tidal outflow channel, the smaller the extent of mangrove habitat lost. If some degree of tidal exchange can be maintained or restored the magnitude of the impact will be of a lesser extent. Assuming a worst case scenario for the road alignment that permanently blocks the main mangrove creeks closest to the tidal outflow channel (similar to scenario B in *Figure 5.7*) an estimated 22 km² of mangrove habitat and its associated flora and fauna is potentially lost over time. This corresponds to 1.1% of the 2039 km² ⁽¹⁾ of the remaining mangrove habitat in Guinea (2006 estimate).

In addition, the Project could cause indirect loss of mangrove habitat if existing areas are cleared for crops as a result of loss of agricultural land or in-migration attributed to the Project. The conversion of mangroves to rice fields is one of the greatest threats to this type of habitat ⁽²⁾.

(1) Corcoran, E., Ravilious, C. and Skuja, M. (2007) Mangroves of Western and Central Africa, Cambridge, UK, UNEP–Regional Seas Programme/UNEP–WCMC.

2 FAO (2007) cited in Kovacs, Flores de Santiago, Bastien and Lafrance (2010) An Assessment of Mangroves in Guinea, West Africa, Using a Field and Remote Sensing Based Approach, Wetlands 30: 773 - 782



- Area of Mangrove at Risk / Zone des Mangroves à Risques (A)
- Area of Mangrove at Risk / Zone des Mangroves à Risques (B)
- New Road Alignment / Alignement de la Nouvelle Route
- Alternative Road Alignment / Alignement de la Route Alternative
- Upgrading of Existing Roads / Modernisation des Routes Existantes

CLIENT:

Simfer SA

SIZE:

A4

TITLE:

Figure 5.7
Effect of Road Construction on Mangrove / Effet de la Construction de la Route sur les Mangroves.

DATE: 14/11/2011

CHECKED: MK

PROJECT: 0131299

DRAWN: GN

APPROVED: KR

SCALE: As scale bar

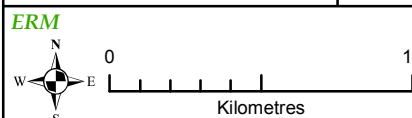
DRAWING:

po_causeway_construction_effect.mxd

REV:

0

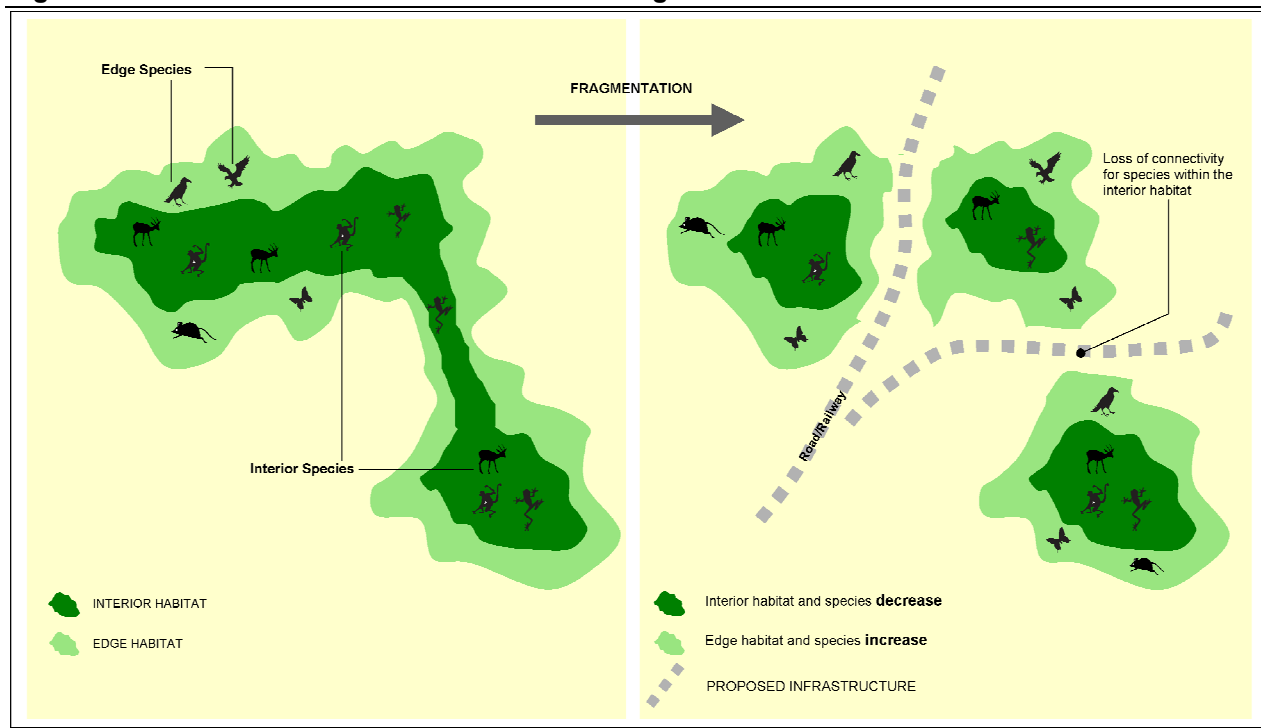
SOURCE: GeoEye 0.5m (Feb 2011)
PROJECTION: WGS 1984 UTM Zone 28N



Habitat fragmentation is caused by division of an area of habitat into smaller sections, such as by construction of roads. Habitat fragmentation can have a significant impact on biodiversity through net loss of habitat, increased edge effects and geographic isolation of species. It also restricts the distribution of individual species if natural wildlife corridors are disturbed. Creation of physical obstacles such as fences, ditches and the presence of the road itself act as obstacles to the movement of fauna.

Habitat fragmentation is explained in *Figure 5.8*. Impacts to species are discussed further below.

Figure 5.8 Illustration of the Effects of Habitat Fragmentation



Edge effects occur where the separated smaller areas of habitat caused by fragmentation are less resilient to change and the longer edges of the habitat type provide greater potential for pest plants and animals to occupy the site ⁽¹⁾. This is an effect likely to happen where current patches of savannah lowland and / or seasonally inundated wetlands are intersected by roads, rendering the two parts prone to gradual deterioration around the new edges introduced by the roads. The route alignment for the new road has not yet been established. Using the maximum parameters approach (see *Chapter 1*), one can argue that in a worst case scenario along a maximum length of the road of approximately 40 km, a strip of 30 m of roadside habitat along both sides of the embankment will deteriorate in quality. This corresponds to an additional area of 240 ha of the original habitat type lost. In addition, there is the risk that the remaining interior habitat will reduce in size down to a level that it can no longer support viable populations of a local species of conservation interest. The type of habitats affected is dependent on the route alignment but likely comprises a mixture of cropland / fallow land, grassland savannah, mangroves, salt marsh, secondary lowland forest and planted forest.

The **magnitude** of direct and indirect impacts to marine and estuarine habitats is considered **medium** as a change in habitat distribution will occur, however, only a small proportion of the available habitat will be affected permanently and it is unlikely to threaten the long-term integrity of the habitats and the populations that depend on them. Seabed, beach, and sandbank habitats are considered to be of **low sensitivity / value** as they are not protected and are common in the vicinity of the MOF. Beaches near the MOF are not

(1) International Council on Mining and Metals (ICMM) (2006) Good Practice Guidance for Mining and Biodiversity.

known to support large numbers of nesting turtles. The overall impact to marine and estuarine habitats is of *minor significance*.

The **magnitude** of direct and indirect impacts to terrestrial and littoral habitats from changes in land use is considered **large** as a significant proportion of the available habitat will be lost or fragmented. Some of the habitats within the footprint and in the vicinity of the MOF have been altered by human activities and represent degraded secondary habitats, however, much of the mangrove habitat and other habitats along the new roads route are in their natural condition. Grassland savannah, secondary lowland forest, planted forest and cropland / fallow land are considered to be of **low sensitivity / value** in terms of habitats and are common in the locality. The rock outcrop is considered to be of **medium sensitivity / value** as the rock outcrop, and hydrophilic vegetation growth associated with small streams flowing down the outcrop, are less common in the local area, even though there is an adjacent smaller outcrop that will be retained. The next nearest similar feature is located approximately 20 km away. Mangrove habitats are considered to be of **high sensitivity / value** as they are important for fisheries and as habitats for rare and endangered species, such as the African manatee, and as nursery habitats for many fish species ⁽¹⁾. The overall impact to terrestrial and littoral habitats from land use change is of *moderate significance*, except for impacts to rocky habitats which are considered to be of *major significance* and to mangrove habitat which is of *critical significance*. The latter arises primarily from the indirect impacts caused by blockage of important waterways that allow tidal exchange to mangroves.

5.5.2 Mitigation Measures

The Project will adhere to the IFC Performance Standard 6 where applicable (see *Annex B* for details on Performance Standard 6). In addition to minimising the extent of the Project footprint, a number of mitigation measures will be implemented to reduce and avoid impacts to habitats. Mitigation measures will include measures to minimise loss of habitat and impacts to sensitive habitats. For full details please refer to 'Biodiversity and Nature Conservation' and 'Marine Environment' within the SEMP.

5.5.3 Residual Impact

Following the mitigation measures, residual impacts to marine and estuarine habitats are assessed as being reduced but remain as *minor significance*. The residual impact to terrestrial and littoral habitats from land use change is assessed as being of *minor significance*, except for impacts to rocky outcrop and mangrove habitats, which are considered to be of *major significance* and may trigger compensation or offsetting under IFC Performance Standard 6.

5.6 Impacts to Mammals and Birds from Land Use Change

5.6.1 Assessment of Impacts

Impacts to mammals and birds may occur due to:

- direct loss of individuals; and
- displacement from habitat loss and fragmentation.

Habitat loss and disturbance through site clearance and earth moving can cause the direct loss of individual birds or mammals in the direct footprint of the MOF and roads. However, individuals are more likely displaced due to disturbance / loss of habitat outside the footprint of the construction zone and habitat affected area. In addition, displacement caused by habitat fragmentation can occur as isolated habitat patches may not provide adequate habitat quality or quantity for some species and can affect foraging grounds for birds if irrigation systems and streams are adversely affected.

Birds are likely to use estuarine waters, intertidal sandbanks, beaches, salt marshes and mangroves for foraging and disturbance to these areas may alter the distribution of birds in these areas. In addition birds

(1) UNEP (2007) Mangroves of Western and Central Africa. UNEP-Regional Seas Programme/UNEP-WCMC.

may be affected in terrestrial foraging areas. Most bird species that occur in irrigated rice fields are common, while rare and endangered species are concentrated in West African floodplains that have not been converted to cultivated rice fields ⁽¹⁾. Therefore the likelihood of bird species of interest is reduced due to the lack of uncultivated habitat within and in the vicinity of the MOF. Birds of conservation interest may occur within the footprint of the new roads and mangroves due to their undisturbed condition. This includes the Eurasian curlew (courlis cendré (Fr.), *Numenius arquata*) that was recorded in the area of the MOF. The **magnitude** of impact to mammals and birds is considered **medium** as a few individuals may be lost and a change in distribution will occur given the amount of habitat loss and fragmentation. However, displacement and a loss of a few individuals are unlikely to threaten the long-term integrity of the bird or mammal populations. Mammals and most bird species are considered to be of **low sensitivity / value**, however, some bird species are considered to be of **medium sensitivity / value** given their restricted distribution and conservation status. The overall impact to mammals and birds is of *minor significance*, except for impacts to birds of conservation interest, which are considered to be of *moderate significance*.

5.6.2 Mitigation Measures

Mitigation measures to reduce and avoid impacts to mammals and birds will be the same as for habitats. See mitigation measures above.

In addition, techniques to avoid trapping of faunal species during construction will be implemented (see 'Biodiversity and Nature Conservation' section within the SEMP).

5.6.3 Residual Impact

Following the mitigation measures the residual impact to mammals and birds is assessed as being *not significant*, except for impacts to birds of conservation interest, which are considered to be of *minor significance*.

5.7 Impacts to Reptiles and Amphibians from Land Use Change

5.7.1 Assessment of Impacts

Impacts to reptiles and amphibians may occur due to:

- direct loss of individuals; and
- displacement from habitat loss and fragmentation.

As with birds and mammals above, site clearance and earth moving can cause the direct loss of individuals in the direct footprint of the MOF and roads, although direct displacement and displacement from habitat fragmentation is more likely. In particular loss of irrigation ditches and associated habitats may result in direct mortality or displacement of reptiles and amphibians.

The **magnitude** of impact to reptiles and amphibians is considered **small** as a change in distribution will occur given the amount of habitat loss and fragmentation, however, it is considered unlikely that significant populations of amphibians or reptiles are present within the area of land to be cleared due to the nature of habitats present. Larger reptiles such as crocodiles and monitor lizard will be occasional visitors and have wider territorial ranges. Therefore, the long-term integrity of the populations should not be affected. The reptiles and amphibians that are present are considered to be of **low sensitivity / value**. The overall impact to reptiles and amphibians is of *minor significance*.

(1) Wymenga, E. & Zwarts, L., 2010 Use of Rice Fields by Birds in West Africa. Waterbirds 33 97-104

5.7.2 Mitigation Measures

Mitigation measures to reduce and avoid impacts to amphibians and reptiles will be the same as for habitats and birds and mammals, where applicable. In addition techniques to avoid trapping animals during land clearance will be implemented (refer to 'Biodiversity and Nature Conservation' section of the SEMP).

5.7.3 Residual Impact

Following the mitigation measures the residual impact to amphibians and reptiles is assessed as being *not significant*.

5.8 Impacts to Benthic Communities from Land Use Change

5.8.1 Assessment of Impacts

Impacts to benthic fauna and flora from land use change may occur due to:

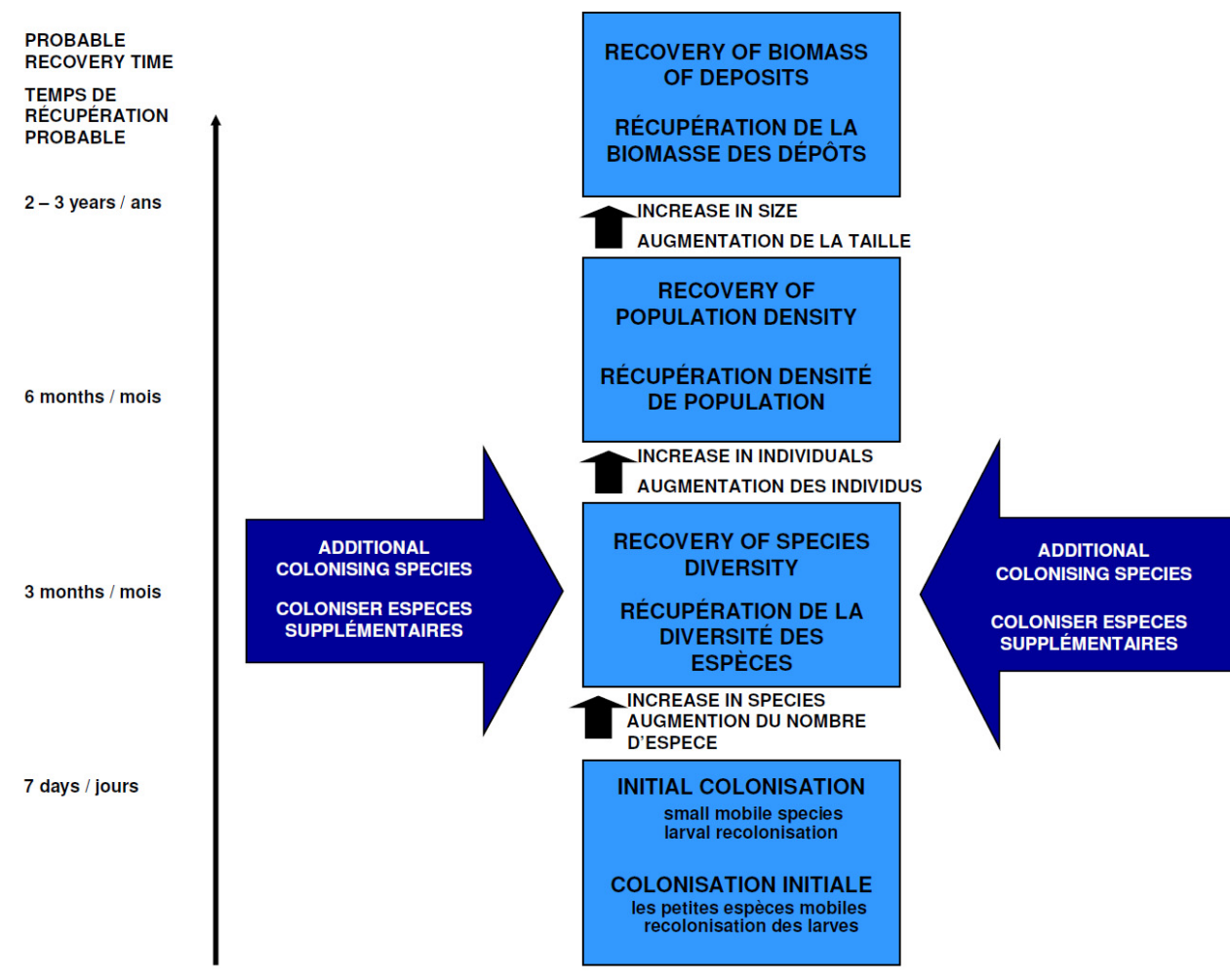
- loss of individuals;
- change in habitat availability;
- smothering by sediment plumes; and
- creation of new hard substrate (the MOF).

Loss of individuals can be caused by the direct removal by the dredger and by disposal. Recovery of species following disturbance such as dredging depends on the nature of the new sediment as well as sources and types of re-colonising animals or vegetation, although communities in soft sediments generally recover relatively quickly. The sediment plume can change the sediment particle size distribution, which contributes towards the change in habitat type. Depth changes and changes in hydrodynamics and sedimentary regime also contribute towards change in habitat, which can lead to the habitat no longer being suitable for the species (ie a loss of suitable habitat) and a change in species composition.

Further individuals will be impacted by the sediment plume settling onto the seabed, however, many benthic organisms are able to survive a thin covering by sediments or will be able to move away, burrow up or extend siphons into the water column. There is no record of seagrass and other subaquatic vegetation present in or near the Morebaya River and approach channel. The benthic fauna is adapted to high sedimentation. Recovery of species following disturbance such as dredging depends on the nature of the new sediment as well as sources and types of re-colonising animals or vegetation. Research ⁽¹⁾ has shown that re-establishment of the benthic community in soft sediments may take up to 3 years. Opportunistic species such as polychaetes will initially dominate. The recovery of benthic fauna is illustrated in *Figure 5.9*. Dredging activities are noted to lead to a 30-70% reduction in species diversity and corresponding 40-95% reduction in the abundance of individuals. A reduction in the benthic productivity of the affected area is likely in the first two to three years.

(1) Newell, R.C., Seiderer, L.J. and Hitchcock, D.R. 1998. The impact of dredging works in coastal waters: A review of the sensitivity to disturbance and subsequent recovery of biological resources on the sea bed. *Oceanography and Marine Biology: an Annual Review* 1998, 36,127-178.

Figure 5.9 Typical Recovery Times of Benthic Macrofauna Populations after Dredging



The quay at the MOF provides new habitat that will become colonised by a suite of benthic species typical of hard substrates. The species are likely limited to species that are currently found on the stilt roots of the mangroves that will be removed. Only a small surface area is added with a limited degree of habitat complexity ⁽¹⁾.

No higher value benthic species are recorded as being present in the Project area, therefore all benthic species are assessed together. The **magnitude** of effect on the benthos is **small** as only a limited area of seabed will be affected, recovery is possible and no reduction in biodiversity is predicted. The **value / importance** of the benthic fauna and flora is assessed as **low** as no benthic species present are rare or protected and the recolonisation of soft sediment and colonisation of new hard substrates is likely to occur in time (except in areas where maintenance dredging will occur – see Section 5.29). The overall significance of impacts to benthic fauna and flora is of *minor significance*.

5.8.2 Mitigation Measures

Mitigation measures to reduce and avoid impacts to benthic fauna and flora will be the same as for habitats. See 'Biodiversity and Nature Conservation' section within the SEMP.

(1)Schmude K. L., Jennings M. J., Otis K. J., Piette R. R.. (1998), Effects of habitat complexity on macroinvertebrate colonization of artificial substrates in north temperate lakes, J. N. Am. Benthol. Soc. 17, 73-80.

5.8.3 Residual Impact

Following the mitigation measures the residual impact to benthic fauna and flora is assessed as being of *minor significance*.

5.9 Impacts to Fish from Land Use Change

5.9.1 Assessment of Impacts

Impacts to fish may occur due to:

- change in habitat availability; and
- displacement from habitat loss.

Displacement may occur through changes in suitable habitat type (ie depth and sediment particle size distribution) and changes in their benthic food availability.

In the areas affected by dredging, benthic food availability will be affected. The temporary loss of benthic productivity, up to 3 years, may affect fish stocks of commercial interest. This includes demersal species of croakers (bars (Fr.), Sciaenidae) and grunts (grondeurs (Fr.), Haemulidae) that are commonly caught in the nearshore area. Marine ecologists generally agree that less than 10% of this productivity is channelled to fish higher up in the food chain. Most of the fish inhabiting the potential dredge and dredge disposal area are wide-foraging or migratory, spending only part of their life cycle in the dredge and dredge disposal footprint. In addition, the habitat characteristics of the seabed are very homogenous in geographic extent, extending over kilometres of seafloor. The potential area where dredging and dredge disposal occurs and benthic productivity is affected is relatively small. The characteristics of how the dredging and dredge disposal activity progresses over time and the patchiness and extent of the area affected suggest that any localised loss of benthic productivity is of limited duration and well within the natural variability of benthic production of the wider coastal area. Therefore, the overall **magnitude** of changes in habitat and benthic food availability on fish stocks would probably be **small** and short to medium duration.

Of further concern are species of guitarfish, skates and sawfishes and other protected species listed in *Table 5.5* that are known to inhabit estuaries and coastal waters in Guinea. All these fish species may be affected where habitat is anticipated to be lost or disturbed by the sediment plume and the footprint of the MOF. The species use subtidal areas for feeding and nursery grounds and disturbance to these areas may alter their distribution. Impacts to these species are assessed as being site of **very small magnitude** given that that there are other areas of similar habitat available nearby, only a small proportion of the available habitat will be lost or disturbed and only a few individuals may be lost. The **sensitivity / value** of guitarfish and other species of conservation interest is assessed as being **medium** to **high** depending on their protection status. The overall impact to these species from changes or loss in habitat is assessed as being of *minor* to *moderate significance*. Other fish species, including those that are of interest to local fisheries and that may use both mangrove and subtidal habitat for feeding and nursery grounds are considered of **low sensitivity / value**. The overall impacts to other fish species from changes or loss in habitat is assessed as being of *minor significance*.

5.9.2 Mitigation Measures

Mitigation measures to reduce and avoid impacts to fish will be similar to those identified for habitats. For further details refer to the SEMP 'Biodiversity and Nature Conservation' section. Additional mitigation measures have been identified in order to reduce and avoid impacts to fish including avoiding dredging in sensitive areas and seasons. For details refer to 'Marine Environment' within the SEMP.

5.9.3 Residual Impact

Following the mitigation measures the residual impact to guitar fish and other species of conservation interest is assessed as being of *minor significance* and the residual impact to other fish species fish considered *not significant*.

5.10 Impacts to Vegetation from Land Use Change

5.10.1 Assessment of Impacts

The possible impacts of the Project on vegetation are similar in nature as those discussed under *Section 5.5 Impacts to Habitats from Land Use Change* above. It is not expected that the Project affects plant species of conservation interest as these species correspond to tree species associated with lowland forest. This habitat type is not found in the immediate vicinity of the MOF and the road corridor. Impacts to specific vegetation are not further discussed.

5.11 Impacts to Fish from Marine Construction Works

5.11.1 Assessment of Impacts

Impacts to fish from marine works may occur due to:

- sediment plumes;
- accidental mortality by entrainment;
- routine discharges; and
- underwater noise.

Dredging activity can affect fish and shellfish both directly through uptake by the dredging process and also indirectly through changes to movement and settlement of the sediment plume. The coastal waters near the Project area are characterised by high sediment loads, particularly during the wet season. Fish species are tolerant of these high sediment concentrations. Dredging is an intermittent activity. A hopper is typically loaded up to capacity and subsequently the vessel moves out to the disposal location. Fish will be able to avoid excessive sediment plumes by moving away. Small bottom-dwelling fish species may be disturbed, but the effect will be short-lived as the plume dissipates and sediment settles down. The tides and waves ensure mixing of the water column thus preventing the development of low oxygen conditions that can be lethal to fish.

Individual fish may get killed by entrainment of the fish by the dredger. Individual fish species may rest on the seabed. Many fish will actively avoid the draghead of the dredger, but some bottom-dwelling fish species including species of conservation interest species may not be able to move away in time. This would represent a direct loss.

Routine vessel discharges during construction have the potential to affect water quality, which in turn could impact fish. In accordance with MARPOL 73/78 regulations, vessels will not be allowed to discharge harmful substances in the nearshore area (< 3 nm). Floating craft such as a worker accommodation barge (floatel) are also required to comply with the requirements similar to those set out for vessels under MARPOL 73/78. Waste water effluent is produced during construction and may enter the Morebaya River and adjacent waterways. The effluent will be treated and as discussed in *Chapter 4* there will not be a residual impact. No secondary impacts to fish are expected.

All construction related noise impacts are discussed cumulatively in this section, including those arising from dredging, piling and from vessel engines and thrusters. *Table 5.9* presents typical underwater noise levels from activities that will occur during construction.

Table 5.9 Typical Noise Levels

Sound source	Source level (dB re 1µPa m) at 1 m	Bandwidth (Hz)	Major amplitude (Hz)	Duration (ms)
Small boats and ships	160 – 180 rms (root mean square)	20 - >10,000	>1000	Continuous
Large vessels	180-190 rms	6 - >30,000	>200	Continuous
Dredging	168 – 186 rms	30 - >20,000	100-500	Continuous
Pile driving	228 Peak 243 – 257 Peak-Peak	20 - >20,000	100-500	Impulse, 50

Source: OSPAR, 2009 ⁽¹⁾

Ship-related engine and thruster noise will be continuous throughout the construction period. In particular the noise from the use of thrusters is expected to be relatively high. Corresponding noise levels are expected to be within the range of small boats and ships and large vessels, as presented in *Table 5.9*. The noise produced by the dredgers depends on their operational status, sea bed removal method and type of sediment, transit and dumping ⁽²⁾. In general the noisiest activity is associated with the seabed removal. Dredging emits continuous broadband sound during operations, mostly in the lower frequencies. Dredging noise is expected to occur for up to 10 months.

Piling will be required for the construction of the quay and ramp. Piling represents a significant noise source associated with the construction phase of the Project, however, piling is unavoidable as it is required for structural support. *Table 5.9* presents typical piling noise levels, although actual noise levels vary with pile size, piling method and geology. Piling is expected to be intermittent and continue for up to 3 months within the construction period. Piling will be infrequent and of short duration within this timeframe compared with the other sources.

The activities above all produce a certain amount of underwater noise, which can impact fish distributions and hearing. Several fish species of conservation interest, such as guitarfish and important local fisheries species are expected to be occasionally present in the Morebaya River and coastal waters in the vicinity of the MOF and marine works. Different fish species are known to respond differently to underwater noise, with impacts ranging from behavioural response (eg fleeing or avoiding the area) to death. Hearing specialists and hearing generalists are recognised. The hearing sensitivities of the guitarfish and other species of conservation interest listed in *Table 5.5* that occasionally may be present in the Morebaya River are unknown. However, other elasmobranchs, such as rays and sharks that also have no swim bladder, tend to have relatively low auditory sensitivity. These species are therefore considered to have low auditory sensitivity for the purpose of this assessment.

In this assessment the potentially lethal effects on fish have been considered rather than behavioural responses. Current guidance on the impacts of underwater noise on fish comes from the Fisheries Hydro Acoustic Working Group (FHWG) ⁽³⁾. The FHWG has established interim criteria for the potentially lethal effects on fish. The interim criteria are expressed in terms of peak sound level and cumulative sound exposure level (SEL). The criteria for peak sound level are 206 dB re 1 µPa (peak) and for SEL 187 dB re 1µPa² s for fish weighing more than 2 g and 183 dB re 1µPa² s for fish weighing less than 2 g. The SEL criteria are intended to take into account the likely noise exposure over time, which would require more detailed knowledge of likely timings of activities than is available at this stage of the project.

(1) Götz, T., Hastie, G., Hatch, L.T., Raustein, O., Southall, B.L., Tasker, M. and Thomsen, F. (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. OSPAR Commission Biodiversity Series.

(2) Wyatt (2008). Joint Industry Programme on Sound and Marine Life Review of Existing Data on Underwater Sounds Produced by the Oil and Gas Industry Issue 1

(3) California Department of Transportation (2009) Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Prepared by: ICF Jones & Stokes and Illingworth and Rodkin, Inc.

If compared against the interim criterion of 206 dB re 1 μ Pa (peak) only pile driving exceeds the noise threshold. Peak levels for other events would be of the order of 3 dB higher than rms levels and this assumption has been used when comparing the noise levels in *Table 5.9* with the criteria. Therefore, it is considered unlikely that severe damage will occur to fish due to dredging, vessel engine and thruster noise as noise from these sources is expected to be below the levels that could cause damage. However, physical damage may occur due to piling noise if fish are in very close proximity to the piling location. Marine pile driving has been shown to produce high sound pressures underwater, which have fatally injured fish ⁽¹⁾. Given the small number of piles required, fatal noise levels are temporary and site-specific in nature, it is very unlikely that individuals of guitarfish and other estuarine species of conservation interest will be present close to the piling operations. The species concerned are not confined solely to the Morebaya River but can be expected to move around in the coastal and estuarine waters along the Guinean shore. Assuming a worst case scenario of the loss of a few individuals, it is unlikely that the population of these species would be adversely affected.

Behavioural responses to noise below the lethal level from any of the aforementioned construction activities may also be seen affecting fish at some distance from the piling location *ie* noise from dredging and vessel engines as well as piling noise. Depending on their hearing ability and the distance to the noise source, fish may show either strong or mild behavioural reactions to noise. Of the fish species present in the Morebaya River, fish with more sensitive hearing mechanisms may react several kilometres from the source ⁽²⁾. The majority of fishes, including species of conservation interest such as the guitarfish, do not have specialisations to enhance hearing and are therefore assumed to be less sensitive. Hearing generalists will have smaller behavioural response zones. Fish are likely to return to the area upon cessation of piling. Strong and mild behavioural responses from guitarfish and other species of conservation interest are considered site-specific and localised in nature.

Species of local fisheries interest as described in *Section 5.3.3* above are abundant. The loss or disturbance of individuals or larvae of these species will not have an impact on the viability of the population of these species.

Therefore the combined impact of underwater noise from pile driving, changes in water quality and entrainment on fish populations is assessed as being a **very small magnitude** effect. The **sensitivity / value** of guitarfish species and other species of conservation interest listed in *Table 5.5* in the Morebaya River is assessed as **medium** to **high** given their conservation status. Other species are of **low sensitivity / value**.

Consequently, the overall impact of underwater noise, entrainment in dredging equipment, dredge plumes and routine discharges to fish species of conservation interest is assessed as being of *minor to moderate* significance. The overall impacts to other fish species is assessed as being *not significant*.

5.11.2 Mitigation Measures

A detailed list of mitigations can be found in the SEMP sections relating to 'Marine Environment', 'Noise and Vibration' and 'Pollution of Soils and Water'.

5.11.3 Residual Impact

Residual impacts from routine discharges, entrainment, and underwater noise associated with marine works and the presence of vessels have been assessed. The residual impact from these activities together to guitarfish and other fish species of conservation interest is reduced to *minor significance* following the adoption of mitigation measures. Impacts on other species were assessed as *not significant* following the adoption of mitigation measures.

(1) Reyff, J.A. 2009. Reducing underwater sounds with air bubble curtains. TR News 262:31-33.

(2) Popper AN, Hastings MC (2009) The effects of anthropogenic sources of sound on fishes. Journal of Fish Biology 75:455-489.

5.12 Impacts to Marine Mammals from Marine Construction Works

5.12.1 Assessment of Impacts

Impacts to marine mammals, including the manatee, may occur due to:

- changes in water quality due to increased turbidity from the sediment plume and routine discharges;
- collision risk and entrainment; and
- underwater noise from dredging, dredge disposal and piling.

Impacts to water quality due to contaminants from the sediment plume and routine discharges were assessed in *Chapter 4*. Residual impacts to water quality were considered not significant. Secondary impacts to marine mammals from water quality changes are therefore unlikely. Naturally high levels of turbidity occur because of high sediment loads in river run-off, wave breaking, wind and tidal mixing. Marine mammals such as the Atlantic humpback dolphin and manatees are tolerant of the high levels of turbidity experienced in coastal waters. Whale species are not common in the inshore environment where the dredging operations and marine works take place but largely restricted to deeper waters offshore. It is unlikely that marine mammals will be affected by the sediment plumes brought about by dredging operations or routine discharges.

There is a small risk of collisions between marine mammals and construction vessels, including dredgers. The potential is small because most marine mammal species are known to display an active avoidance response. The greatest risk of collision would be in relation to vessels cruising at considerable speed. In view of their ability to avoid vessels and widespread distribution, dredging and dredge disposal are highly unlikely to have an impact on marine mammals.

There is, however, a potential risk for Project vessels to collide with West African manatees (*Trichechus senegalensis*) during both construction and operation of the MOF, which may cause injury or death to individuals. Manatees are elusive mammals that only rarely are observed in the coastal and estuarine waters near the proposed MOF. The species feed on aquatic vegetation and overhanging vegetation along river banks and in mangrove areas. Guinea has extensive suitable habitat and the species is known to occur in the area ⁽¹⁾ ⁽²⁾.

Manatees may be particularly vulnerable to collisions with vessels due to their nearshore and likely estuarine distribution. This assessment is based on research on the West Indian Manatee, which is thought to be similar in appearance and behaviour to the lesser-known West African manatee ⁽³⁾. Wounding and killing in collisions with boats has long been a major issue for West Indian manatees in Florida, where there are frequent vessel movements ⁽⁴⁾. About half of adult West Indian manatee mortality is attributable to human-related causes, primarily watercraft collisions, which is significant as the manatee population growth rate is highly sensitive to changes in adult survival rate. Sub-lethal effects from collisions with manatees are also an issue as injuries may reduce the breeding success of wounded females and may permanently remove some animals from the breeding population ⁽⁵⁾. Inadequate hearing sensitivity at low frequencies may be a contributing factor to the manatees' inability to effectively detect boat noise and avoid collisions ⁽⁶⁾. Despite

(1) Cisse, I., Kpoghomou C.N., Diallo A., Dabo A., Bangoura C.A.K. (2006). Strategy Preliminaire de Conservation du Lamantin Ouest Africain (*Trichechus senegalensis*). Plan de Redaction des Rapports Nationaux. République de Guinée. Wetlands International et Programme des Nations Unies pour l'Environnement (PNUE).

(2) Powell, J. & Kouadio, A. (2008) *Trichechus senegalensis*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.1. <www.iucnredlist.org>. Downloaded on 29 July 2011

(3) Reynolds, J.E. III and D.K. Odell. (1991) Manatees and dugongs. Facts on File, New York. 192pp.

(4) Calleson, C.S. and Frohlich, R.K. (2007). Slower boat speeds reduce risks to manatees. *Endangered Species Research*, 3, 295-307.

(5) Deutsch, C.J., Self-Sullivan, C. & Mignucci-Giannoni, A. 2008. *Trichechus manatus*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.1. <www.iucnredlist.org>. Downloaded on 29 July 2011.

(6) Gerstein, ER., Gerstein, L., Forsythe, SE. and Blue, JE. (1999) The underwater audiogram of the West Indian manatee (*Trichechus manatus*). *Journal of the Acoustical Society of America*, Volume 105, Issue 6, pp. 3575-3583.

the uncertainty about the risk of collision it is not unrealistic to assume that during the period of construction and operation a manatee will be present in the path of a vessel.

A description of underwater noise sources and terms can be found in the *Section 5.11 Impacts to Fish from Marine Construction Works* above. West Indian manatees have a reported hearing ability of between 15 Hz and 46 kHz with the best sensitivity at 6-20 kHz ^{(1) (2)}. Other data suggest West Indian manatees are most sensitive around 1-1.5 kHz but are less sensitive at 4 kHz and even 8 kHz, although there was some sensitivity up to 35 kHz ⁽³⁾. Research has indicated that elevated sound levels affect the behavioural patterns of the Florida manatee (a subspecies of the West Indian manatee) ⁽⁴⁾.

Cetaceans (dolphins and whales) can also be affected by underwater noise, however, only the Atlantic humpbacked dolphin is likely to occur regularly in the Morebaya River and the nearshore area. Other species of cetacean have very large ranges and a pelagic distribution and are less likely to be found within the Project area. Underwater noise can elicit strong or mild responses from marine mammals depending on their hearing ability and the distance to the noise source. The behavioural response of the marine mammal not only depends on the properties of the sound source but also on the specific circumstance of the animal, such as age, condition, behaviour, season, social state and sex ⁽⁵⁾. Behavioural effects can range from a visible acknowledgement by an animal that it has heard the sound, such as a brief startle response to strong and prolonged avoidance. Most commonly, marine mammals react by changing their direction and/or speed of movement or behavioural activity or by changing how they vocalise (marine mammals only). In exceptional cases, underwater noise can result in physical effects. The zone of physical effects is the area near the noise source where the received sound level is high enough to cause auditory fatigue or tissue damage resulting in either temporary hearing loss or permanent hearing loss or even more severe damage.

The work of Southall *et al* (2007) ⁽⁶⁾ sets out criteria for damage and behavioural reactions of marine mammals to noise and has been used to derive criteria for the assessment of potential noise impacts from the proposed marine works on marine mammals. The criteria suggest that, in order to cause instantaneous injury to cetaceans resulting in a permanent loss in hearing ability, the sound level must exceed 230 dB re 1 µPa (peak). As *Table 5.9* indicates, dredging and shipping noise is typically much lower and only a behavioural response can be expected. Given the location of the piling operation, some 5 km upriver across a shallow river mouth, it is highly unlikely that whales or dolphins will come near damaging levels. An impact on cetaceans from underwater noise can therefore be excluded.

An exception is the Atlantic humpbacked dolphin (dauphin à bosse de l'Atlantique (Fr.), *Sousa teuszii*) which is generally found in coastal waters of less than 20 m deep ⁽⁷⁾. The species is listed as a species with a conservation status that corresponds to vulnerable (*Table 5.1*). The species belongs to the mid-frequency range hearing group (generally 150 Hz – 160 kHz). It would have to be very close to the actual piling operation for a physical impact. Taking into account the propagation and attenuation of sound in shallow water, behavioural impacts may occur over a larger distance in the order of up to 10 km in open water, likely in the form of an avoidance response.

(1) Richardson, J.W., Greene, C.R., Malme, C.I. and Thomson, D.H. (1995) *Marine Mammals and Noise*. Academic Press. 576 pages.

(2) Gerstein, E.R., Gerstein, L., Forsythe, S.E. and Blue, J.E. (1999) The underwater audiogram of the West Indian manatee (*Trichechus manatus*). *Journal of the Acoustical Society of America*, Volume 105, Issue 6, pp. 3575-3583.

(3) Gerstein, E.R., Gerstein, L., Forsythe, S.E. and Blue, J.E. (1999) The underwater audiogram of the West Indian manatee (*Trichechus manatus*). *Journal of the Acoustical Society of America*, Volume 105, Issue 6, pp. 3575-3583.

(4) Miksis-Olds, J.L. and Wagner, T. (2011) Behavioral response of manatees to variations in environmental sound levels. *Marine Mammal Science* Volume 27, Issue 1, pages 130–148.

(5) Thomsen, F., Lüdemann, K., Kafemann, R. and Piper, W. (2006) Effects of offshore wind farm noise on marine mammals and fish, Biola, Hamburg, Germany on behalf of COWRIE Ltd.

(6) Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas and P.L. Tyack. (2007). Marine mammal noise exposure criteria: initial scientific recommendations. *Aquatic Mammals* 33(4):411-522.

(7) Collins, T., Boumba, R., Thonio, J., Parnell, R., Vanleeuwe, H., Ngouessono, S. & Rosenbaum, H.C. The Atlantic humpback dolphin (*Sousa teuszii*) in Gabon and Congo: cause for optimism or concern? Report for the International Whaling Commission: SC/62/SM9. 19pp.

From the discussion above, it can be inferred that changes in water quality are not likely to affect marine mammals, but that underwater noise and risk collision may affect a number of species.

Impacts to the Atlantic humpbacked dolphin are limited to underwater noise from piling operations. Owing to the fact that piling is intermittent and of relatively short duration (less than 3 months) and that this species has a wide foraging range, it is unlikely that the behavioural response would have a lasting impact on the population. The magnitude of the impact is **very small**. Combined with a **medium** sensitivity / value for the Atlantic humpbacked dolphin, it can be concluded that there is the potential of a *minor* significant impact. Manatees may be affected by both underwater noise and collision. The likelihood for impacts is very small, but the potential for impact remains in view of the manatees' slow reproductive capability and small overall population. The magnitude of the potential impact is therefore considered **medium**. The manatee has **medium** sensitivity / value. The overall impact of vessel collision with manatees is assessed as being of *moderate significance*.

5.12.2 Mitigation Measures

Mitigation measures to reduce and avoid impacts to marine mammals from underwater noise will be the same as for fish (see mitigation measures in 'Noise and Vibration' and 'Biodiversity and Nature Conservation' sections within the SEMP for further measures). In addition, measures specifically designed to avoid and reduce impacts to manatees will be implemented. See the SEMP for full details.

5.12.3 Residual Impact

Following mitigation the overall residual impact of underwater noise and vessel collisions on marine mammals is considered to be of *minor* significance.

5.13 Impacts to Turtles from Marine Construction Works

5.13.1 Assessment of Impacts

Impacts to turtles may occur due to:

- changes in water quality due to increased turbidity from the sediment plume and routine discharges;
- underwater noise;
- light emissions; and
- collision and entrainment risk.

Impacts to water quality due to increased turbidity and contaminants from the sediment plume and / or routine discharges were assessed in *Chapter 4*. Potential impacts may result in decreased foraging success and the avoidance of areas with elevated turbidity levels that are well above natural background levels.

Turtles are not expected to occur as far into the estuary as the MOF site given that coastal habitats in the vicinity of the MOF are not suitable turtle nesting habitats and the MOF is 5 km up the Morebaya River. Dredging and vessel movements throughout the coastal waters, however, may cause some disturbance to turtles as artificial light is known to cause disorientation of hatchling sea turtles and other behavioural responses ⁽¹⁾. Light emitted by these vessels may result in some localised disturbance, but not to the extent that behavioural changes lead to adverse effects on the population of these animals.

Marine turtles may also be potentially disturbed by underwater noise, however, they are only likely to be affected by low frequency sounds that cause disturbance reactions. Physical damage is unlikely as sea turtles are considered to be less sensitive to noise than marine mammals. Behavioural reactions to noise include startle responses such as diving and noise avoidance.

(1) Longcore, T. and Rich, C. (2004) Ecological light pollution. *Frontiers in Ecology and the Environment* 2: 191–198.

As above, turtles are not expected to occur as far into the estuary as the MOF site, however, collisions with vessels moving to and from the MOF may occur. In the event of a collision it is possible that turtles will die from vessel strikes, even from relatively slow moving vessels. It has been shown that the proportion of green turtles (*Chelonia mydas*) that fled to avoid a vessel decreased significantly as vessel speed increased. Also turtles that fled from moderate and fast approaches did so at significantly shorter distances from the vessel than turtles that fled from slow approaches. Turtles should therefore not be relied on to actively avoid collision with vessels moving in excess of 4 km/h ⁽¹⁾.

The likelihood of a turtle resting in the active path of a dredger and the subsequent risk of entrainment into the drag head is very small. However, if entrainment were to occur there is a risk of injury or death to marine turtles and other marine fauna. Monitoring studies ⁽²⁾ of turtle entrainment by hydraulic dredgers carried out in the US from 1995-2008 suggest a maximum entrainment rate of 22 turtles per 1,000,000 m³ of dredge material. While turtles do not appear to be present in large numbers along the shore of Ile Kabak, these numbers do point to a possible negative impact.

The impact of changes in light emissions, changes in water quality, underwater noise, vessel collision and entrainment on marine turtle populations is of **very small magnitude**. Five of the marine turtles (see Table 5.3) are considered of **high sensitivity / value** given their conservation status, while the Olive Ridley sea turtle (tortue olivâtre (Fr), *Lepidochelys olivacea*) is of **medium sensitivity/value**. The overall impact of changes in water quality, underwater noise, collision and entrainment and entrainment on turtles is of *minor to moderate* significance with the exception for the Olive Ridley sea turtle, which is of *minor* significance.

5.13.2 Mitigation measures

Mitigation measures aimed at reducing sediment plumes, collisions and entrainment and underwater noise will be employed (see SEMP 'Marine Environment' and 'Noise and Vibration').

5.13.3 Residual Impact

Following the mitigation measures the residual impact to marine turtles from changes in water quality, underwater noise, collision and entrainment is of *minor* significance.

5.14 Impacts to Birds from Marine Construction Works

5.14.1 Assessment of Impacts

Impacts to birds may occur due to:

- noise disturbance; and
- light emissions.

Birds are likely to be present within the area during construction of the MOF, however, as described above most bird species that occur are common, while rare and endangered species are less likely to be present given the habitat types. Effects from noise disturbance can include a change in distribution, changes in behaviour, changes in avian demography and ultimately changes in population size ⁽³⁾. However, there is a large amount of evidence suggesting that disturbance is not a key issue for bird species using intertidal habitat and other studies ⁽⁴⁾ ⁽¹⁾ indicate that bird movements can be driven more by food resource issues than

(1) Hazel, J., Lawler, I.R., Marsh, H. and Robson, S. (2007) Vessel speed increases collision risk for the green turtle *Chelonia mydas*. *Endangered Species Research* 3: 105–113, 2007.

(2) Reine, K. and Clarke, D. (1998). Entrainment by hydraulic dredges-A review of potential impacts. Technical Note DOER-EI. U.S. Army Corps of Engineers, Environmental Laboratory, Vicksburg, MS.

(3) Gill, J.A. (2007). Approaches to measuring the effect of human disturbance on Birds. *IBIS*. 149 Suppl. 1 9-14.

(4) Gill, J.A. Norris, K. and Sutherland, W.J. (2007) 'The effects of disturbance on habitat use by black-tailed godwits *Limosa limosa*', in *Journal of Applied Ecology*, Vol 38, pp. 846-856.

anthropogenic disturbance. Given the limited time period of noise, especially piling which is intermittent and infrequent, and that only a group of localised individuals within a population may be affected, the **magnitude** of impact is **very small**.

At night the MOF and laydown areas (marine and onshore during both construction and operation) will be lit by outdoor artificial lighting. In addition vessels / vehicles working 24 hours a day or in poor weather conditions will also emit light. Nocturnal activities of many animals have been changed by artificial lighting ⁽²⁾. Birds are more attracted to artificial light during low cloud cover and overcast skies, especially foggy, drizzly conditions ⁽³⁾. Artificial light is known to cause deaths of migratory birds around tall lighted structures and behavioural responses ⁽⁴⁾. Impacts to birds include collision with structures causing mortality or injury, disruption to migration and changes to feeding behaviour (many species of bird have been recorded feeding in artificial lighting at the coast). Given the limited lighting required and that only a group of localised individuals within a population may be affected the **magnitude** of impact is **very small**.

Most bird species are considered to be of **low sensitivity / value**, however, some bird species are considered to be of **medium sensitivity / value** given their IUCN protection status. Bird species of conservation interest that are seasonally present at the MOF include the Eurasian curlew (courlis cendré (Fr.), *Numenius arquata*) and black-tailed godwit (barge à queue noire (Fr.), *Limosa limosa*). The overall impact of noise and light emissions on common birds is considered to be *not significant*, while for birds of conservation interest it is considered to be of *minor significance*.

5.14.2 Mitigation Measures

Mitigation measures to reduce and avoid impacts to birds from noise will be the same as for fish. See 'Noise and Vibration' section in SEMP for full list of mitigations). Several of these mitigation measures will also reduce airborne noise. In addition mitigation measures to avoid and reduce impacts to birds from light will be implemented (see SEMP 'Biodiversity and Nature Conservation').

5.14.3 Residual Impact

The residual impact on behavioural responses in birds from construction noise and light emissions is reduced but remains *minor* for birds of conservation interest.

5.15 Impacts to Marine and Coastal Ecosystem from Marine Construction Works

5.15.1 Assessment of Impacts

Impacts to the whole ecosystem in the Morebaya River estuary and surrounding area may occur due to:

- waste from food discharges and litter; and
- invasive species from other bioregions that affect local species and local ecosystems.

Waste is generated throughout the construction and operation phase. Any litter or waste introduced in the marine and littoral environment has the potential to harm marine fauna and avifauna through ingestion or trapping or entanglement in litter. Discarded food wastes will also attract vermin and gregarious birds to the local area, potentially displacing local species.

Invasive species can be introduced through ballast water exchange, infected equipment and hull fouling. Ballast water is carried by ships to provide stability and adjust a vessel's trim for optimal steering and propulsion. The use of ballast water varies among vessel types and with cargo and sea conditions. Ballast

(1) Stillman, R.A. West, A.D. Goss-Custard, J.D. McGorty, S. Frost, N.J. Morrissey, D.J. Kenny, A.J. and Drewitt, A.L. (2005) Predicting site quality for shorebird communities: a case study on the Humber Estuary, UK, in Marine Ecology Progress Series, Vol. 305: 203–217.

(2) Longcore, T. and Rich, C. (2006) The ecological consequences of artificial night lighting. Island Press.

(3) Longcore, T. and Rich, C. (2006) The ecological consequences of artificial night lighting. Island Press.

(4) Longcore, T. and Rich, C. (2004) Ecological light pollution. Frontiers in Ecology and the Environment 2: 191–198.

water often originates from ports and other coastal regions that host rich planktonic assemblages. As part of normal ship operations, ballast water can be discharged in ports, along coastlines and at sea, resulting in a diverse mix of organisms that are transported and released around the world. Ballast water appears to be the most important vector for the transfer of marine species throughout the world.

Organisms such as barnacles, mussels, sponges, algae and sea squirts attach themselves to the hulls of ships. This is commonly referred to as biofouling. The attached organisms are then carried by the vessel from one port to the next, thus entering new bioregions. Invasions can occur when fouling organisms come in contact with structures in a new port or release their larvae into its waters. Under the right conditions, these invaders may establish themselves in the new port and spread to nearby areas within that bioregion. Organisms may also travel between bioregions attached to marine equipment, such as dredging equipment or in sediment carried by a dredger or dredging equipment or on barges.

There is the potential for the marine ecosystem to be impacted if construction vessels cause invasive species to be introduced to Guinea. The potential effects of invasive species on the ecosystem include:

- competition for food and space;
- changes in habitat;
- changes in predator-prey interactions;
- parasitism;
- toxicity (toxic algae); and
- community dominance (major quantitative changes in community structure).

It is unlikely that invasive species brought in on Project vessels will establish viable populations. The consequence ranges from a relatively benign impact to large changes in ecosystem functioning. The impact of waste is generally confined to a small area. The combined impact is likely of a **very small magnitude** impact because of the limited duration of the construction activities and that provisions exist for waste management. Also, only a limited number of vessels used in construction will originate from seas with a distinct flora and fauna and volumes of ballast water are small. The overall **sensitivity / value** of the marine ecosystem is assumed to be **medium**. The overall impact to the marine ecosystem from invasive species is assessed to be of *minor significance*.

5.15.2 Mitigation Measures

Mitigation measures to reduce the risk of waste entering the marine and littoral environment are identified within the 'Resources and Waste' and 'Pollution of Soils and Water' sections of the SEMP. Measures to reduce the risk of introducing invasive species from other bioregions will also be implemented (see SEMP 'Marine Environment').

5.15.3 Residual Impacts

With the implementation of the above mitigation measures, the residual impacts from waste or the accidental introduction of invasive species that have the potential to affect the marine ecosystem are reduced to *not significant*.

5.16 Impacts to Habitats from Onshore Construction Works at the MOF

5.16.1 Assessment of Impacts

Impacts to terrestrial and littoral habitats may occur due to:

- blasting to quarry rocky outcrop;
- dewatering;
- presence of vehicles, vessels, machines and humans;
- dust and emissions from construction vehicles and site facilities;

- changes in water quality from pluvial flows and general construction site drainage; and
- changes in water quality from drainage from acid sulphate soil (ASS).

In contrast to the impacts to habitats discussed under *Land Use Change*, these impacts are of a temporary nature and last for the duration of construction.

Blasting to quarry the main rock outcrop will remove the rock habitat and may alter the local hydrological system around the vicinity of the rock. Construction of the access road, laydown areas and marine work areas will increase human, vehicle and machine use of areas and create dust and emissions. As stated above change in land use that are the direct result of the site selection and footprint of the Project is assessed separately, however, these activities generate noise and create disturbances to adjacent habitats, which reduces their quality. No noise modelling was carried out for the quarry, but Simfer has a policy that enforces an exclusion zone of maximum 500 m where noise levels may exceed the applicable standards. Increased human use of the habitats will also create an approximate 500 m radius zone of disturbance from the noise source / area of activity.

Hydrological changes brought about by the quarry operations and site preparation works includes the potential for diversions of surface water flows and temporary drawdown of the groundwater levels from dewatering operations. Dewatering at the quarry site will locally affect the hydrophilic habitats currently present adjacent to the rock outcrop. Owing to the naturally water logged nature of the salt marsh and mangroves around the quarry site and naturally occurring seasonal fluctuations in groundwater levels, dewatering of a granite quarry of this size is expected to affect a zone of up to 50 m around the quarry site.

Changes in water quality and quantity to other habitats, including rice fields, which are known foraging grounds for birds may result in a decrease in foraging resources if irrigation systems are adversely affected by the construction works. This may affect a wide extent of habitat linked by irrigation systems and natural streams, although is still likely to be only a small proportion of the available resource.

Emissions to air from generators, machinery use, transport of equipment and materials, vessels and construction works may affect adjacent terrestrial and littoral habitats within the vicinity of the construction area (ie up to 500 m ⁽¹⁾) due to dust, or particular matter (PM), and changes in air quality. The main sources of PM emissions include crushing, grinding, drilling, blasting, and transport. Dust tends to settle within a few tens to hundreds of metres of its source, depending on particulate size and wind. Toxic and nontoxic gases are normal by-products generated by blasting activities, regardless of the explosive materials used. Emissions of NO₂, CO, and NO are generated during the explosions.

Run-off from the construction site will include pluvial flows and construction site drainage, which if uncontrolled have the potential to introduce particulate matter, nutrients, and pollutants into local streams, groundwater, and mangrove creeks. This may include dust, fuels, oils and lubricants and heavy metals, flame retardant all of which could affect the quality of downstream habitats. The impacts can be exacerbated if earthworks and stockpiling of potential acid sulphate soil occurs. Run-off and leachate from acid sulphate soils can adversely impact aquatic communities.

Given the potential area that these types of impacts cover the **magnitude** of impact to terrestrial habitats from the above activities is considered to be **medium** as temporary changes will occur over a relatively wide area. Grassland savannah, secondary lowland forest and cropland/fallow land are considered to be of **low sensitivity / value**, while the rock outcrop, salt marsh and the small area of mangrove habitat are considered to be of **medium sensitivity / value**. The **overall impact** to habitats from onshore construction works of *minor significance*, except for impacts to rocky outcrop, salt marsh and mangrove habitats, which are considered to be of *moderate significance*.

(1) Ref: UK organisations including RSPB, BTO and Highways Agency

5.16.2 Mitigation Measures

Mitigation measures for avoiding and reducing impacts to habitats from onshore construction are presented in the SEMP. See SEMP for full details.

5.16.3 Residual Impact

Following the mitigation measures the residual impact from onshore construction to habitats is assessed as being of *minor significance* to mangroves, salt marshes and rocky habitat, with residual impacts to other habitats being *not significant*.

5.17 Impacts to Fauna from Onshore Construction Works at the MOF

5.17.1 Assessment of Impacts

Impacts to the mammals, birds, reptiles and amphibians may occur due to:

- disturbance and displacement from noise (including blasting and piling), light pollution and the presence of humans and dogs;
- air quality – dust and emissions;
- changes in water quality and quantity from construction site works; and
- direct loss of individual specimens during construction (including Road Traffic Collisions RTC).

Details of the anticipated nature and magnitude of blasting, piling and other construction activities are described in *Chapter 2 Project Description*. Given the distance of the rocky outcrop, that will be removed by blasting, to the Morebaya River no impacts to marine mammals are expected. Impacts from blasting on marine mammals are therefore not discussed.

Increases in dust and emissions to air from quarry operations, equipment and vehicles and changes in water quality and quantity may adversely affect mammals, birds, reptiles and amphibians in the vicinity of the site, displacing them from potential habitats. Similar habitat nearby will be unaffected and rice fields and mangroves frequented by birds are common in the vicinity of the MOF. Vehicle movements associated with the construction of the MOF have the potential to cause mortality to mammals, reptiles and low flying birds. Borrow pits, pipeline trenches or holes created during construction may trap, injure or kill fauna. The likelihood of these events is very small. General noise disturbance from construction activities may adversely affect mammals, reptiles and birds within the vicinity of the MOF site. The noise from blasting is intermittent. Beyond a distance of 500 m of the blasting site, likely effects on birds, reptiles and small mammals including common bat species are expected to be minimal ⁽¹⁾⁽²⁾, however, individuals within this zone may suffer injury and / or behavioural disturbance. Other disturbances to fauna arising from construction, including disturbance from light and disturbance and displacement from the presence of personnel and dogs used for security, are also likely limited to a 500 ⁽³⁾ impact zone.

Given the limited zone of disturbance and that only a group of localised individuals within a population of different mammal or bird species may be affected the **magnitude** of impact is **very small**. It is unlikely to threaten the long-term integrity of the bird, mammal, reptile and amphibian populations.

(1) Ruddock M. and D.P. Whitfield. (2007). A Review of Disturbance Distances in Selected Bird Species. Report prepared by Natural Research (Projects) Ltd for Scottish Natural Heritage.

(2) Lameed, G.A. and A. E. Ayodele. (2010). Effect of quarrying activity on biodiversity: Case study of Ogbere site, Ogun State Nigeria. African Journal of Environmental Science & Technology Vol. 4(11): 740-750.

(3) Ref: UK organisations including RSPB, BTO and Highways Agency

The mammals, reptiles, amphibians and most bird species are considered to be of **low sensitivity / value**, however, some bird species are considered to be of **medium sensitivity / value** given their conservation status. The **overall impact** to these faunal groups is *not significant to minor*.

5.17.2 Mitigation Measures

Mitigation measures for disturbance from dust, noise and light and traffic accidents will be implemented to reduce and avoid impacts to mammals and birds from onshore construction works (including blasting) (see 'Biodiversity and Nature Conservation', 'Noise and Vibration' and 'Air Quality' sections within the SEMP for further measures):

5.17.3 Residual Impact

Following the mitigation measures the residual impact to birds, reptiles, amphibians and mammals is *not significant*.

5.18 Impacts to Wider Terrestrial Ecosystem from Onshore Construction Works at the MOF

5.18.1 Assessment of Impacts

Impacts to the wider terrestrial ecosystem may occur due to:

- waste from food discharges and litter; and
- invasive species from other bioregions that affect local species and local ecosystems.

Waste will be generated during the construction and operation phase. If not properly managed and disposed off, waste will end up in the environment with potentially adverse impacts on fauna and flora. Discarded food wastes will also attract vermin and gregarious birds to the local area, potentially displacing local species. Plastics that are ingested may kill local birds and small mammals.

Invasive species can be introduced through the import of construction equipment and materials, in particular when the equipment has been used in different environments. For instance, under the right conditions, seeds or small plant saplings that are brought in may establish viable communities near the MOF and along the roads. Once firmly established, these species may spread and possibly transform the wider ecosystem. It is unlikely that invasive species brought in on Project equipment will establish viable populations. The consequence ranges from a relatively benign impact to large changes in ecosystem functioning. The impact of waste is generally confined to a small area. The combined impact is likely of a **very small magnitude** impact because of the limited duration of the construction activities and that provisions exist for waste management. Also, only a limited amount of equipment used in construction will have previously been used in areas with a distinct flora and fauna. The overall **sensitivity / value** of the terrestrial ecosystem is assumed to be **medium**. The overall impact to the terrestrial ecosystem from invasive species and waste is assessed to be of *minor significance*.

5.18.2 Mitigation Measures

Mitigation measures to reduce the risk of waste and invasive species entering the terrestrial environment will be adopted (see SEMP 'Resources and Waste' and 'Pollution of Soils and Water' sections for additional measures).

5.18.3 Residual Impacts

With the implementation of the above mitigation measures, the residual impacts from waste or the accidental introduction of invasive species that have the potential to affect the wider terrestrial ecosystem are reduced to *not significant*.

5.19 Impacts to Habitats from Road Construction and Upgrading

5.19.1 Assessment of Impacts

Impacts from the direct and indirect loss of habitats from land take and habitat fragmentation are described under *Section 5.5 Impacts to Habitats from Land Use Change*. Many of the road construction and upgrading impacts will be similar to those of the construction works at the MOF site. However, the roads represent a linear project that pass through different habitat types and therefore the impact magnitude and significance can differ.

Impacts to habitats, other than from changes in habitat availability, include:

- changes in water quality from drainage, run-off, routine discharge and acid sulphate soil (ASS) leachate;
- significant water usage in borrow pits and on roads for washing/damping down etc, requiring abstraction from local sources; and
- dust and emissions from construction vehicles.

Water from local surface and groundwater sources is important to habitats along the road alignment. Any change in water quality may reduce the quality of the habitat. Where polluted surface run-off accumulates in existing water courses or wetlands, there is the potential for impacts. The construction impacts will be temporary, typically a few weeks in each location along the alignment. The quality of wetlands and other aquatic habitats may temporarily deteriorate with knock-on effects on the associated flora and fauna. In view of the temporary nature of the construction, the extent of the impact is likely limited to a small area with limited flow at close distance from the road alignment.

Dewatering of borrow pits used in road construction results in a drawdown of groundwater around these pits. Borrow pits generally result in shallow depressions. The impact of drawdown is greatest when borrow pits are located adjacent to wetland areas.

Dust and emissions from construction vehicles potentially contributes to a local deterioration of the air quality while dust affects local vegetation along the road alignment. Winds can be expected to quickly disperse emissions to insignificant levels. Construction dust will likely affect a small strip alongside the road alignment.

It follows that habitats in the vicinity of the road alignment are potentially adversely affected by road construction works. The impact will be greatest in areas where the road alignment intersects or borders wetland area. The magnitude of the impact is small as only few wetland areas are present in the wider study area. Dust will only affect a small strip of land adjacent to the road. Mangrove habitat is less prone to the effects of changes in water quality, dust and drawdown. The magnitude is considered **small**. Wetlands are of **medium sensitivity / value** while other habitats are of **low sensitivity / value**. The impact on wetlands is of *minor significance*, while impacts on other habitats are considered *not significant*.

5.19.2 Mitigation measures

Mitigation measures relating to road construction and upgrading are included within 'Biodiversity and Nature Conservation', 'Air Quality', 'Noise and Vibration' and 'Soils, Run-off and Flooding' within the SEMP. Mitigation includes measures to avoid impacts to sensitive habitats and water resources, limit impacts to surrounding habitats, reinstatement of habitat, where possible, and minimisation of run-off and dust emissions.

5.19.3 Residual impact

Following the implementation of these mitigation measures, the residual impact of road construction and upgrading is considered of *not significant*.

5.20 Impacts to Fauna from Road Construction and Upgrading

5.20.1 Assessment of Impacts

Mammals, birds, reptiles and amphibians and fish are possibly affected by road construction through:

- creation of physical obstacles/barriers to the movement of fauna (eg fences, ditches, the presence of the road);
- disturbance from noise (including blasting and piling), light, humans, dogs;
- dust; and
- direct loss of individual specimens during construction (including Road Traffic Collisions RTC).

These impacts have a direct effect on the fauna. The upgrade and / or construction of roads has the potential to cause noise impacts through general construction activities (operation of vehicles and plant, shovelling, crushing, grading etc) and the establishment and operation of borrow pits (possible drilling, ripping, excavation). The construction noise will be temporary (typically lasting a few weeks in each location). Dust produced during earthworks is more intense during actual construction, but the problem is more likely to persist beyond that period particularly during the dry season. The noise and dust emissions are of small magnitude, for most species limited to a zone of up to 200 m along the road alignment and borrow pits. Wildlife will be disturbed and this could affect nesting success and / or foraging behaviour of different species. Birds and larger mammals will be most disturbed, but these species tend to have larger territorial ranges and may therefore avoid the area of disturbance if suitable habitat is available.

Direct injury and mortality of animals can be expected as a result of road traffic collisions or if animals get trapped ⁽¹⁾ in drainage channels, holes and borrow pits that are created during construction. For instance, there is a very small likelihood that snakes, small mammals and low-flying birds will cross the road and get hit by construction vehicles.

The **magnitude** of these impacts is **small** on account of the fact that only few individuals may actually be subjected to mortality, failure in reproduction or reduction in fitness. The viability of the population of any species is adversely unlikely affected. Terrestrial faunal species likely present along the road alignment are of low **sensitivity / value**. The overall impact from dust, noise and collision or entrapment is *minor*.

5.20.2 Mitigation measures

Mitigation measures relating to road construction and upgrading are outlined within 'Biodiversity and Nature Conservation', 'Noise and Vibration' and 'Air Quality' in the SEMP. Mitigation includes measures designed to keep noise to a minimum, avoid dust generation, avoid traffic accidents with fauna and allow animals to escape from trenches or holes created during site works.

5.20.3 Residual impact

Following the implementation of the mitigation measures, the residual impact to fauna from dust, noise and direct loss during construction is *not significant*.

5.21 Impact to Ecosystems from Non-routine Events during Construction

5.21.1 Assessment of Impacts

Impacts to ecosystems from non-routine events may occur due to:

(1) Doody, J. S. et al. (2003). Fauna by-catch in pipeline trenches: Conservation, animal ethics, and current practices in Australia. Australian Zoologist 32:410-419.

- accidental spillages to land;
- accidental spillages to marine waters; and
- excessive flood events.

Accidental spills may occur as a result of road accident, spillages at workshops and maintenance facilities. Spills to land can affect soils and groundwater and potentially run off into non-marine or marine waters, which can impact both terrestrial and aquatic ecosystems. Impacts to soils and groundwater from pollution events were assessed in *Chapter 4* to be of residual minor significance, however, in exceptional circumstances where large spills occur this may be increased to a residual moderate impact. Small spills to land from situations such as road accidents are unlikely to have significant impacts on terrestrial or aquatic ecosystems, although individuals may be affected. Large spills, however, are likely to have an impact on ecosystems given their ability to affect a range of fauna and flora across a widespread area and interrupt food chains. Impacts to terrestrial fauna and flora include toxic effects and potentially death from fumes and also through ingestion of contaminated food and / or contaminated fresh water resources. Ingestion may occur through direct contact of the spill onto the animal and subsequent cleaning. Aquatic fauna and flora may also suffer toxic effects through ingestion, contamination of the water column and smothering. Dependent on the size of the spill the impacts may persist for some time. Given that impacts from a large spill in the order of one tanker load of diesel to land may locally affect the ecosystem and that without mitigation a sizable area may be affected the **magnitude** of impact is **medium**. The terrestrial and aquatic ecosystems are considered to be of high value due to their function and services, however, as most of the components are not considered protected and the ecosystem is not geographically limited to the vicinity of a potential spill **value / sensitivity** is considered **medium**. If no controls are in place to reduce the risk of spills and other non-routine events in a project of this scale and duration then the likelihood of a spill occurring is high. The overall non-routine impact of accidental and uncontrolled large spill on the terrestrial and aquatic ecosystems is therefore of *moderate significance*.

Shipping-related accidental spillages may release pollutants to the marine environment, which can impact on water quality and consequently have impacts to marine ecosystems. Impacts on water quality from non-routine events were assessed in *Chapter 4* to be of residual minor significance, however, in exceptional circumstances this may be increased to a residual moderate impact. Small spills are unlikely to have significant impacts on the Morebaya River and coastal ecosystems, although individuals may be affected. However, large spills from ship collisions or groundings may have an impact on marine and coastal ecosystems. Impacts to marine fauna and flora are likely from reduction in oxygen and increase in contaminants (such as hydrocarbons and other pollutants). Given that impacts to water quality may affect the whole ecosystem and that without mitigation a large area may be affected the **magnitude** of impact is **large**. The ecosystem has a high importance due to its function and services, however, as most of its components are not considered protected and the ecosystem is not geographically limited to the vicinity of the potential spill the **value / sensitivity** is considered **medium**. If no controls are in place to reduce the risk of spills and other non-routine events in a construction phase of this scale and duration then the likelihood of a spill occurring during construction is probable. The overall non-routine impact of accidental and uncontrolled discharges on the marine ecosystem is therefore of *major significance*.

The effects of an excessive flooding caused by an extreme rain event, or extreme tides or storm surges (*ie* typically those that recur at intervals of 20 years or longer) on habitats and fauna may be exacerbated by run-off from new hard surfaces, elevated land and alterations to the hydrological regime from construction. Should such an event occur very large volumes of water may run-off from the Project site and drainage channels of which the course has been altered. This may adversely affect the whole terrestrial, aquatic and marine ecosystem through flooding of habitats and drowning / displacement of species. As described above the **value / importance** of the ecosystem is considered **medium**. The **magnitude** of such an event may be **medium or high** depending on the volume of water. The overall non-routine impact to habitats and fauna is of *moderate significance*.

5.21.2 Mitigation Measures

See mitigation measures as presented in *Chapter 4* for measures designed to avoid and reduce impacts from spills.

In addition to mitigation measures included within the Waste Management Plan (WMP), measures to ensure adequate drainage and an action plan for events that exceed planned for levels will be adopted. Further details on mitigation measures can be found in 'Resources and Waste' and 'Pollution of Soils and Water' within the SEMP.

5.21.3 Residual Impact

The mitigation measures are designed to prevent accidental and uncontrolled releases, or to facilitate the rapid clean-up of any discharges that cannot be contained. These mitigation measures are considered to be sufficient in preventing impacts to the terrestrial and marine environments in the majority of cases. Thus with good site practice and operating procedures in line with internationally accepted levels, as provided above, the probability of accidental and uncontrolled spillages or discharges is low. The residual non-routine impact from a large spill on marine ecosystems is reduced to *moderate significance*. Impacts from large spills on the terrestrial and aquatic environment are reduced to *minor*. In addition the mitigation measures presented above should be sufficient to handle excessive flood events. The Project-induced additional impacts on ecosystems in a situation of excessive flood events are assessed to be of residual *minor significance*, however, in exceptional circumstances this may be increased to a *moderate impact*.

5.22 Impacts to Habitats from the Physical Presence of the MOF and Roads

5.22.1 Assessment of Impacts

The long-term direct and indirect impacts of the MOF and roads to habitats have been discussed under impacts of *Land Use* above.

5.23 Impacts to Fish from the Physical Presence of the MOF and Roads

5.23.1 Assessment of Impacts

Impacts to fish may occur due to:

- underwater noise from the MOF and increased vessel presence;
- routine discharges.

Routine vessel discharges and emissions from sewage treatment plants during operations have the potential to affect water, which in turn could impact fish. However, the volume of discharges is small and will comply with standards. Impacts to water quality during operation are not expected, therefore no secondary impacts to fish are expected.

Vessel movements and maintenance dredging generate a certain amount of underwater noise, which can impact fish distributions and behaviour. The exact underwater noise characteristics of vessels depend on the ship type, size, mode of propulsion, operational characteristics and speed as well as other factors ⁽¹⁾. Much of the incidental noise results from propeller cavitation, though onboard machinery and turbulence around the hull can also result in underwater noise being transmitted. *Table 5.9* presented typical vessel noise for a range of vessel sizes that may occur in the Morebaya River and for dredging. Vessel movements as part of operation of the MOF are likely to increase the existing levels of underwater noise in the Morebaya River and estuary as the river is currently predominantly used by non motorised artisanal fishing vessels, although some do have motorised engines.

Increases in vessel traffic and maintenance dredging, which create underwater noise, are likely to be a medium term impact (over the life time of the project, ie 3 years) and intermittent. Mild behavioural reactions may occur, which are likely to be localised and temporary.

(1) Götz, T., Hastie, G., Hatch, L.T., Raustein, O., Southall, B.L., Tasker, M. and Thomsen, F. (2009) Overview of the impacts of anthropogenic underwater sound in the marine environment. OSPAR Commission Biodiversity Series.

Noise impacts on guitarfish and other fish species of conservation interest are assessed as a **very small magnitude** effect. The **sensitivity / value** of fish species in the Morebaya River is assessed as **medium** given their protection status. The overall impact of operational underwater noise and routine discharges to guitarfish is assessed as being of *minor significance*. Other fish species that may be present are considered of **low sensitivity / value** due to their importance to local fishermen. The overall impact to other fish from operational underwater noise and routine discharges is assessed as being *not significant*.

5.23.2 Mitigation Measures

Mitigation measures to reduce underwater noise from vessel use of the Morebaya River and nearby coastline are identified under 'Noise and Vibration' within the SEMP.

5.23.3 Residual Impact

The residual impact from the physical presence of the MOF on both fish species of conservation interest and other fish species following mitigation is considered to be *not significant*.

5.24 Impacts to Birds from the Physical Presence of the MOF and Roads

5.24.1 Assessment of Impacts

Impacts to birds may occur due to:

- noise from the MOF and increased vessel / vehicle presence;
- road traffic collisions; and
- light emissions.

Light emissions during operation of the MOF will be similar to those from construction, as the MOF and laydown area will still be lit and vessels operating at night or in poor weather conditions will use lighting. For an assessment of light impacts to birds see under *Section 5.14 Impacts to Birds from Marine Construction Works*.

Impacts from road traffic collisions will be similar to those that occur during construction. For an assessment of road traffic collision impacts to birds see under *Section 5.17*.

Birds are likely to be present within the area during operation of the MOF and roads, however, given the nature of the disturbance and the anticipated noise levels bird populations are not expected to be significantly impacted.

5.25 Impacts to Mammals from the Physical Presence of the MOF and Roads

5.25.1 Assessment of Impacts

Impacts to mammals may occur due to:

- underwater and airborne noise from the MOF and increased vessel / vehicle presence on roads;
- routine discharges;
- dust and emissions; and
- collision risk and road traffic collision.

Routine vessel discharges and emissions from sewage treatment plants during operations have the potential to affect water quality, which in turn could impact marine mammals, such as the manatee. However, impacts to water quality during operation are not expected (see *Chapter 4*), therefore no secondary impacts to mammals are expected. Marine mammals and terrestrial mammals may suffer from collision. The impacts

from collision risk during operation of the MOF will be the same as for construction. See *Sections 5.12 and 5.17* for an assessment of the impacts.

For a description of underwater noise sources and terms see *Section 5.23 Impacts to Fish from the Physical Presence of the MOF and Roads* above. Noise impacts on the West African manatee (*Trichechus senegalensis*), which may be present in the Morebaya River in the vicinity of the MOF, during operation are considered to be of **small magnitude** as only a specific group of localised individuals within a population may be affected over a short time period. Manatees have **medium sensitivity / value** given their conservation status. The overall impact of underwater noise on manatees is considered to be of *minor significance*.

Mammals occurring on land may be affected by operational noise and increases in vehicle presence at the MOF and on access roads. Dust from traffic also potentially affect mammals within roadside habitats. In view of the number of vehicles that pass the roads every day, the **magnitude** of impact is considered **medium**. Terrestrial mammals are considered of **low sensitivity / value**. The overall impact of noise and road traffic collision on other mammals is considered to be of *minor significance*.

5.25.2 Mitigation Measures

Mitigation measures to reduce and avoid impacts to mammals from underwater noise will be the same as for fish (see *Section 5.23*). Mitigation measures for noise and dust are outlined within the 'Noise and Vibration' and the 'Air Quality' Sections of the SEMP (*Annex D*).

5.25.3 Residual Impact

The residual impact from the physical presence of the MOF on mammals following mitigation will be reduced but still remain of *minor significance*.

5.26 Impacts to Turtles from the Physical Presence of the MOF and Roads

5.26.1 Assessment of Impacts

Impacts to turtles may occur due to:

- light emissions;
- underwater noise from the MOF and increased vessel presence; and
- collision risk.

Artificial light is known to cause disorientation of hatchling sea turtles and other behavioural responses ⁽¹⁾. However, given that coastal habitats in the vicinity of the MOF are not suitable turtle nesting habitats and the MOF is 5 km up the Morebaya River entrance it is unlikely any turtles will be present. Impacts to turtles from light emissions are therefore not considered further. Impacts from collision risk during operation of the MOF will be the same as for construction. See *Section 5.13 Impacts to Turtles from Marine Construction Works* for an assessment of the impacts of collisions of turtles with vessels.

Given that coastal habitats in the vicinity of the MOF are too disturbed to support significant number of nesting turtles, it is unlikely that turtles will be affected by airborne noise from the MOF. However, vessel movements will occur throughout the estuary and along the coast, which may cause some disturbance to turtles. Marine turtles may be potentially disturbed by underwater noise, which may cause a behavioural response. Physical damage is unlikely as sea turtles are considered to be less sensitive to noise than marine mammals. Behavioural reactions to noise include startle responses such as diving, and noise avoidance. The **magnitude** of effect is considered **very small** as underwater noise and collision risk may affect a specific group of localised individuals within a population over a short time period. On the basis of their conservation status, four species of sea turtles have **high sensitivity / value** while the Olive Ridley

(1) Longcore, T. and Rich, C. (2004) Ecological light pollution. *Frontiers in Ecology and the Environment* 2: 191–198.

turtle is of **medium sensitivity / value**. It follows that the overall impact of light, underwater noise and collision risk on turtles is considered to be of *minor to moderate significance*.

5.26.2 Mitigation Measures

Mitigation measures to reduce and avoid impacts to turtles from underwater noise will be the same as for fish (see *Section 5.23*). Measures to control levels of airborne noise are presented in the 'Noise and Vibration' section within the SEMP (*Annex D*).

5.26.3 Residual Impact

The residual impact from the physical presence of the MOF on turtles, be it from collision, light, underwater or airborne noise, is considered to be of *minor significance*.

5.27 Impacts to Ecosystems from the Physical Presence of the Roads and MOF

5.27.1 Assessment of Impacts

Impacts from waste and risk of invasive / introduced species during operation of the MOF will be the same as for construction. See *Section 5.15 Impacts to Marine and Coastal Ecosystem from Marine Construction Works* and *Section 5.18 Impacts to Wider Terrestrial Ecosystem from Onshore Construction Works* at the MOF for an assessment of impacts from invasive / introduced species on the marine and coastal and terrestrial ecosystem respectively.

5.28 Impacts to Habitats from Maintenance Dredging and Dredge Disposal

5.28.1 Assessment of Impacts

Impacts to habitats from maintenance dredging and dredge disposal may occur due to:

- substrate removal; and
- the sediment plume.

Impacts to habitats caused by maintenance dredging will be the same as those from dredging required during construction, except that the volume of dredge material is likely to be reduced. In total the estimated accumulated siltation volumes in the channel, turning basins and berthing pockets for the MOF within the Morebaya River are between 1.2 Mm³ and 3.0 Mm³ per year. A description of the impacts can be found in *Section 5.5 Impacts to Habitats from Land Use Change*.

As the estuary is large there is a widespread availability of subtidal habitat, dredging will not cause a significant loss of extent of the subtidal habitat, although as with the capital dredging the habitat type may be altered due to changes in sediment particle size distribution. The effect of habitat loss from maintenance dredging is limited to the access channel and turning circle for the MOF and is considered localised. The **magnitude** of impact is therefore considered **small**. The **sensitivity / value** of the subtidal habitat is **low** as it is not protected and is common in the vicinity of the MOF. It follows that the overall impact to the subtidal habitat is considered *not significant*.

5.28.2 Mitigation Measures

See mitigation measures as presented in *Section 5.5 Impacts to Habitats from Land Use Change* above. For additional mitigation measures refer to 'Marine Environment' within the SEMP (*Annex D*).

5.28.3 Residual Impact

Given mitigation measures to reduce and avoid impacts where possible the residual impact is reduced but remains *not significant*.

5.29 Impacts to Benthic Fauna and Flora from Maintenance Dredging and Dredge Disposal

5.29.1 Assessment of Impacts

Impacts to benthic fauna and flora from maintenance dredging and dredge disposal may occur due to:

- substrate removal; and
- the sediment plume.

Impacts to benthic fauna and flora caused by maintenance dredging will be the same as those from dredging required during construction, except the area and volume of dredge material is likely to be reduced. A description of the impacts can be found in *Section 5.8 Impacts to Benthic Communities from Land Use Change* above.

Maintenance dredging affects the area of dredging and the area where the dredge spoils are dumped. Benthic communities that are removed or smothered by dredging will begin to recover between dredging events, however, full recovery between events is unlikely. The impact to benthic fauna and flora from maintenance dredging is limited in aerial extent to the access channel and turning circle for the MOF and the disposal site. The impact is thus considered localised, although the plume will extend beyond the dredged area and disposal area. The **magnitude** of impact is therefore considered **small**. The **sensitivity / importance** of benthic fauna and flora is **low** as no species present are protected and they are common in the vicinity of the MOF. The overall impact to benthic fauna and flora from maintenance dredging is considered *not significant*.

5.29.2 Mitigation Measures

See mitigation measures as presented under *Section 5.8 Impacts to Benthic Communities from Land Use Change* above. For further mitigation measures refer to 'Marine Environment' and 'Biodiversity and Nature Conservation' sections within the SEMP (*Annex D*).

5.29.3 Residual Impact

Given mitigation measures to reduce and avoid impacts where possible, the residual impact is further reduced but remains *not significant*.

5.30 Impacts to Fish from Maintenance Dredging and Dredge Disposal

5.30.1 Assessment of Impacts

Impacts to fish from maintenance dredging and dredge disposal may occur due to:

- the sediment plume;
- entrainment; and
- underwater noise.

Impacts from the sediment plume caused by maintenance dredging will be the same as those from dredging required during construction, except the duration and volume will be reduced. Impacts to water quality from the sediment plume were assessed in *Chapter 4*. Residual impacts to water quality are considered not significant, therefore no secondary impacts to fish from water quality changes from the sediment plume during construction are anticipated (see *Section 5.11*).

Dredging activity can also affect fish and shellfish both directly through entrainment by the dredging process and also indirectly through movement and settlement of the sediment plume. Given that no significant effects are expected to fish due to the capital dredge programme it is unlikely there will be significant effects from the maintenance dredge programme as the duration and suspended sediment volumes are likely to be less.

Therefore secondary impacts to fish from the sediment plume during operation are also considered unlikely to occur.

The impacts from underwater noise caused by maintenance dredging and dredge disposal are discussed together with other sources of underwater noise during operation in *Section 5.11* above.

The combined impact of underwater noise from changes in water quality, entrainment on fish populations and underwater noise is assessed as being a **very small magnitude** effect. The **sensitivity / value** of guitarfish species and other species of conservation interest listed in *Table 5.5* in the Morebaya River is assessed as **medium to high** given their conservation status. Other species are of **low sensitivity / value**. Consequently, the overall impact of underwater noise, entrainment in dredging equipment and changes in water quality to fish species of conservation interest is assessed as being of *minor to moderate* significance. The overall impacts to other fish species is assessed as being *insignificant*.

5.30.2 Mitigation Measures

See mitigation measures as presented under *Section 5.8 Impacts to Benthic Communities from Land Use Change* and *Section 5.9 Impacts to Fish from Land Use Change* above. For further mitigation measures refer to 'Marine Environment' within the SEMP.

5.30.3 Residual Impact

Given mitigation measures to reduce and avoid impacts where possible the residual impact is further reduced to *minor* for species of conservation interest and remains *not significant* for other common species.

5.31 Impacts to Marine Mammals from Maintenance Dredging and Dredge Disposal

5.31.1 Assessment of Impacts

Impacts to marine mammals from maintenance dredging and dredge disposal may occur due to:

- underwater noise.

The impacts from underwater noise caused by maintenance dredging and dredge disposal are discussed together with other sources of underwater noise during operation in *Section 5.12* above.

5.32 Impacts to Ecosystems from Non-routine Events during Operation

5.32.1 Assessment of Impacts

Impacts from the accidental release of pollutants such as oil, fuel or chemicals during the operational phase will be of the same order of range as those potentially experienced during the construction phase. The only exception is that in the operations phase, a fuel barge will be in operation which introduces a risk of release of a larger volume of oil in the marine and coastal environment than road-based tanker traffic or leakage of fuel from construction vessels (eg dredgers). In view of the larger volume, the impact from large spills associated with a fuel barge spill are considered of *major significance*.

Impacts from excessive flood events during the operational phase are also comparable to those described for the construction phase. See *Section 5.21 Impact to Ecosystems from Non-routine Events during Construction* above for a description of impacts and impact significance.

5.33 Cumulative Impacts

Cumulative impacts are impacts that may arise when other activities and known or committed developments take place in the area of the Project at the same time. Within short distance of the proposed MOF location, there are no other major projects foreseen during the period of construction and initial 3 years of operation. However, there is some overlap with a separate early works component of the Simandou Project, the

temporary camps and logistic supply centres, which are planned further inland. During the operation period of the MOF, construction will also commence at other sites that are part of the overall Simandou Project. There will be extensive movements of vehicles, people and materials between the MOF and these other sites. The impacts of the temporary camps and logistic supply centres are assessed in a separate SEIA and are concentrated in an area that is geographically distinct to that covered by this SEIA in order to avoid overlap. As such no cumulative impacts with the temporary camps and logistic supply centres SEIA are predicted. Construction of roads and traffic between the MOF and the construction sites of the overall Simandou Project within the wider Kabak area are considered within this chapter.

Another mining company, Forécariah JV (with participation of Bellzone Mining PLC and Guinean Development Corporation), is developing an iron ore concession in the Forecariah district. However, this proposed development is unlikely to interfere with the MOF and its associated road network, therefore cumulative impacts are not predicted.

6 Impacts on the Human Environment

6.1 Introduction and Scope

This chapter presents a summary overview of the potential impacts of the proposed Marine Offloading Facility (MOF) to the human environment. The study area includes the MOF and associated new and upgraded roads that lie in the broader area of Ile Kabak. In particular this assessment considers impacts of the proposed scheme on:

- local economic development;
- labour and working conditions;
- community health, safety and security;
- development and livelihoods;
- demographics and social welfare
- cultural heritage; and
- landscape, seascape and visual resources.

The requirement for this assessment arises because of the scale of the development proposed and the nature of the receiving human environment and landscape. Key features of the development that will be introduced to the landscape as large man made and potentially prominent elements include a quay and adjacent laydown area. There will also be up to 40 km of new roads and the upgrading of an existing road. These will take place on a flat relatively open rural, estuarine landscape close to the mouth of Morebaya River and across Ile Kabak.

6.2 Methods and Sources of Information

The overall impact assessment methodology is presented in *Section 6.4 Prediction, Evaluation and Mitigation of Impacts*.

The Human Environment baseline has been informed by initial field visits by Simfer however limited baseline information has been collected so far specifically for the MOF area. To enable this impact assessment to be undertaken, baseline conditions have been inferred for the MOF area from field observations at the MOF site and surrounding area, and two reports on baseline surveys, which primarily focussed on areas further south on Ile Kabak, however given the similarities between the areas include observations applicable to the MOF area:

- Sabinot, C., Koppert, G. and Leclercq, M. et al. (2011), Simandou – Port and Rail Project in Kabak: Preliminary Report Fishing Villages, SNC Lavalin, Paris.
- Koppert, G. and Barry, M. (2010), Draft Report Value Enhancement Study: Rail Road and Port Site, GEPFE, Paris.

The information sources referred to above are considered to be the best available data existing at present to inform this assessment. Where supplementary information is used it is referenced in footnotes.

Throughout the baseline sections below, the phrases 'MOF footprint' and 'road footprint' refer to specific information about the areas directly physically impacted by construction of the MOF and road construction and upgrading. The phrase 'Ile Kabak area' or simply 'Ile Kabak' refers to broader information collected throughout Ile Kabak and which is deemed relevant to building an understanding of the human environment baseline for the MOF project, but may not specifically refer to the physical footprint area of the project, and is used to infer likely baseline conditions in the wider project area.

6.3 Baseline

6.3.1 Administrative and Leadership Structures

Overview

There are a number of co-existing administrative and leadership structures, which are described below.

Traditional Structure

The political organization at a local level is based on patrilineal villages, in which a land chief ('chef de terre') is in charge of distributing land and judges land conflicts, and a fishing/marine chief ('chef de port') in fishing villages who deals with fishing/marine related conflicts, including theft of fishing gear, theft or loss of fish at sea, and conflicts between fishermen. These two people are the most important in the village, however it is not clear if one has ultimate authority over the other, or if their separate jurisdictions are maintained. Unlike inland villages, fishing villages have different chiefs for different activities:

- A 'chef de secteur' (chief of sector) or 'chef de sous-secteur' (chief of sub-sector) and his assistant (this may be the same person as the 'chef de terre') like in other villages of the region – this person is designated by the president of the district.
- One or several 'chef de port' (chief of port) and his assistant(s) – this person is appointed for 5 years by the prefect and ANAM (Agence de Navigation Maritime, equivalent to the coastguard).

On arriving at port, each fishing team have to present their catch to the chef de port (the reason for this is unknown), but the chef de port does not control the amount that is landed (ie there are no fishing limits or quotas imposed).

In each village there is a place to discuss problems and find solutions, often a roofed structure or shaded tree. The 'chef de village/terre' ('district', 'secteur' or 'sous-secteur') handles most issues, except those directly related to sea activities which are administrated/arbitrated by the 'chef de port'. It is unclear who makes the ultimate decision in the case of conflict between the two chiefs.

Political Structure

The modern political structure of Guinea is based on regions, divided into prefectures, sub- prefectures, CRD: (Rural development community), districts, villages and quarters. The CRD is the main local administrative body, and groups together communities (villages, hamlets) in a recognised administrative structure. This more or less represents the various social layers of the local population, but suffers from lack of means, money and representativeness. Most communities have no contact with main government authorities, other than through the reinforcement of tax payments. Government services concerning health, livestock, fisheries, agriculture, women and young people exist, but are reported to have limited presence in the villages of Ile Kabak.

Villages are divided in hamlets or 'concessions' which group several households of a same lineage. Each of these households has a husband, spouse(s) and children. The village has a Doutigui (doti), appointed by the political administration, and a Sotigui who represents the traditional authority, and is the 'chef de terre', in charge of land.

Within each concession (hamlet), the head of concession manages relations between households, and capital in the form of cattle and accumulated dowries, whilst the head of individual households is in charge of the economy of that household and major expenditures, land distribution and pastures

Other Community Structures

Many groups and associations are present in most villages in the Ile Kabak area (except the smallest): associations of fishermen (men), association of cultivators (men and women) associations of fish smokers

(women). Associations of young people/youth also exist, notably sport associations. It is unknown what associations, if any, exist specifically in the villages closest to the MOF footprint and road widening areas.

Land Tenure

Traditionally all land is owned by the founding family of the village, and is acquired by households through heritage, gifts or otherwise through the extended family. Land is inherited through the sons, except where no male descendants are available. Women may have the usufruct (the legal right to use and derive profit or benefit from property that belongs to another person) of land and its proceedings, while girls inherit the possessions of their mothers. New land is most often acquired through gifts and then transferred to future generations through inheritance.

Renting and selling of land used to be rare but where land is scarce, the practice gains in importance. Land for annual crops is considered to return to the community after the harvest, while land with permanent crops is in individual ownership. In many villages unoccupied land is considered community land.

Land conflicts are usually resolved locally by the elders of the village ('chef de terre'), and no recourse to higher administrative authorities was observed during baseline studies (see *Section 6.2* for document references), indicating that the traditional system is still functioning in a satisfactory way.

6.3.2 Demographics

The population origin varied significantly in villages surveyed on Ile Kabak. In some villages, the majority of people were born in that village or another village nearby, with a minority from elsewhere in Guinea. In other villages, the majority of people were not local, coming either from elsewhere in Guinea or from Sierra Leone. There are an unknown number of Sierra Leoneans living and working as fishermen on Ile Kabak, some of whom settled many years ago, and some of whom are migrant workers with families still in Sierra Leone, with whom they spend part of the year, and the remainder working in Guinea. Amongst the villages surveyed on Ile Kabak, no noticeable distribution pattern was identified with regards to the location of villages with significant migrant populations. According to village surveys on Ile Kabak, whilst immigrants from Sierra Leone are still regarded as foreigners, relations with local people are generally good. During the Sierra Leone war, more significant numbers came as refugees but most have now returned.

Migration practices from Sierra Leone are well established and date back to approximately 1930. Some migrants are relatively recent whilst migration to the Port area has occurred over decades. With regard to the total population, 47.7 % of heads of household were migrants, suggesting that almost half the population may be of migrant origin. Amongst this group, 75.2 % of migrant heads of household have been migrating to Kabak Island for more than 20 years. Furthermore, 14.8 % have been migrating to the area for between ten and twenty years whilst the remaining 10 % have been migrating to the island for less than 10 years. This suggests that rates of migration related to fishing are relatively stable and possibly in decline.

Families are large, with on average around nine members, compared with the national average of six. The reasons for the comparatively large size of families are not known. Some people leave the village for the cities or to work as artisanal miners, however most come back (the normal age at which people leave and return is unknown) as the perceived quality of life and incomes are greater in Ile Kabak than many other parts of Guinea. There is therefore there is no reported significant net out-migration.

In Guinea, people belong to one of several ethnic groups: Peuhl 40 %, Malinke 30 %, Soussou 20 % and smaller ethnic groups 10 %. The representation of these groups in the Ile Kabak area is unknown.

6.3.3 Education

23 % of the adults surveyed have some formal education, of which 71 % is only primary school, usually incomplete. 77 % have never been to school. School attendance of children is reported to be low, but more precise figures are not available.

A typical school on Ile Kabak is shown in *Figure 6.1*.

6.3.4 Community Health and Health Facilities

The premature morbidity in the area is mainly due to malaria, pulmonary infections, diarrhoeas and bilharzias. HIV/AIDS is considered to be a taboo and data on prevalence is not available.

Amongst the villages surveyed elsewhere on Ile Kabak, 65 % of the households have latrines. Three health centres are located on Ile Kabak (the main hospital in Kabak centre, and health posts in Matakang and Yetiya) but they are only partially functioning: the buildings are in a good state of repair but they lack available qualified personnel and essential medicines.

People often consult a traditional 'marabout' when they are ill (this is an Islamic religious person; it is unknown if they also perform traditional medicine). Generally traditional midwives (sometimes elder women of the village, sometimes qualified midwives) are present in most villages but despite their presence, it was reported that in some villages women prefer to go to hospital for giving birth.

Other medical facilities used by the local communities are outside of the island: a public 'centre de santé' and a private pharmacy with a good stock of medicines in Maférinya (about 25 km), and a public hospital in Forécariah (more than 5 hours travel from Ile Kabak, depending on the boats). For serious illnesses or injuries people go to Maférinya or Forécariah. In village interviews Ile Kabak residents highlighted the difficulty of access to these facilities because they are quite far away and it costs money to reach them.

Figure 6.1 Medical Post (left) and Primary School (right) on Ile Kabak



Source: Sabinot, C *et al.* (2011).

6.3.5 Religion and Cultural Practices

The social baseline mapping survey identified numerous mosques all over Ile Kabak, however no churches were recorded. It is therefore reasonable to assume that the population is predominantly Muslim. No site specific baseline information on religion and cultural practices for Ile Kabak has been collected, so a country-wide overview ⁽¹⁾ is provided below and related to the Ile Kabak area where possible.

This religious breakdown is broadly representative of Guinea as a whole, where the population is Muslim 85 %, Christian 10 % and indigenous beliefs 5 %. Muslims in the country generally adhere to the Sunni branch of Islam; followers of the Shi'a branch remain relatively few, although they are increasing in number. Among the Christian groups, there are Roman Catholic, Anglican, Baptist, Jehovah's Witnesses, Seventh-day Adventist, and evangelical churches active in the country and recognized by the Government. No data is available on active participation in formal religious services or rituals; however, the National Islamic League (NIL), a government sponsored organisation, estimates that 70 percent of Muslims practice their faith regularly. Guinea's immigrant and refugee populations generally practice the same faiths as Guinean citizens, although those from neighbouring Liberia and Sierra Leone have higher percentages of Christians and followers of traditional indigenous religions. Since some villages on Ile Kabak are known to have

(1) US Department of State, 2003, *International Religious Freedom Report 2003: Guinea*.
<http://www.state.gov/g/drl/rls/irf/2003/23712.htm> Accessed 29 September 2011

significant Sierra Leonean populations this may suggest a higher prevalence of followers of Christian and traditional indigenous religions than might be typical elsewhere in Guinea.

The Constitution of Guinea provides for freedom of religion and the Government generally respects this right in practice. Both Muslim and Christian holidays are recognized by the Government and celebrated by the population. The government-controlled official press reports on religious events involving both Islamic and Christian groups.

6.3.6 Land Use and Livelihoods

Land Use

The wider Ile Kabak area in general is extensively used for agriculture and areas with rice paddies (see below). Within the MOF footprint (see *Figure 2.2*) there are areas which appear to be uncultivated or fallow and areas with rice paddies. The Ile Kabak area reportedly has some of the richest agricultural land in Guinea, and high added value crops are cultivated, providing local people with an income which is higher than the Guinean national average. The MOF footprint is currently partly uncultivated or fallow land (the reason for this is unknown) and partly covered with rice paddies.

Agriculture

Agriculture is the main livelihood source for Ile Kabak as a whole (with fishing the major activity for coastal villages), with rice being the major crop, although market garden crops (eg red pepper, aubergine, water melon, okra) are also a significant source of income for some people and are grown on small areas of high quality land. Inland on Ile Kabak, oil palm extraction is also frequently practised. Across most of Ile Kabak, there are two main land types and associated crops:

- *Bogoni* - rice fields in direct contact with the sea and sea channels, only used for rice cultivation. These fields need no rotations for fallow periods and are used every year. These fields are the most fertile ones as they receive silt from the rivers and sea, but are constrained by the needed balance of the salinity between sea water and rain water. The higher the rainfall the more fertile the Bogoni fields. The great value of the Bogoni fields is due to their fertility, relative rareness, and high productivity without external inputs for the local communities, which make them a unique economic asset that people draw significant income from.
- Dara - fields on plains not in direct contact with the sea, used mainly for rice. In some villages, fields are used for 4–5 years, and then left fallow for 2–4 years, in others they appear to be used continuously. There is no problem with salinity of the soil, but production is reported to be 20–30 % lower than on Bogoni.

Rice is sown during May to June in nurseries (the location of which is unknown) where it stays for 40 days before being transplanted into paddies, and is harvested around December. Usage of the paddies between January to April is unknown, however during this period some communities are engaged in salt collection (see below). In traditional agriculture there is mutual assistance, consisting of a common workforce that works successively in everybody's fields. Land for annual crops is considered to return to the community after the harvest, while land with permanent crops is in individual ownership.

Animal husbandry (mostly chickens, small livestock and some cattle) is a minor occupation in the area, and used only for ceremonies rather than for direct sale. Damage caused by marauding animals is a regular cause of conflict, and cited as a reason why the population owns so few animals.

The MOF area is partly covered by what appears to be unused grassland and partly covered with rice paddies (see *Figure 6.2*) of the *bogoni* type. It is not known to what extent they are presently cultivated. The unoccupied houses within the MOF footprint could indicate that the land has either been a) permanently abandoned as it is of comparatively poor quality (as has been observed elsewhere on Ile Kabak); b) seasonally abandoned at the time of field visits; or c) the land is currently in the fallow stage of the production cycle and is intended for further productive use in the future. It is common for land associated with villages

to be periodically occupied/ unoccupied in association with cycles of cultivation. The status of the land in and around the MOF footprint will be confirmed during stakeholder engagement.

Along the road from the MOF site to Maferinya and the stockyard site (which will require upgrading and widening), roadside land use is mostly plantation and fallow land. However, there are 1-2 pockets of settlements which may lie partially within the widened road footprint (depending upon the planned width of the road). The road width is currently 3-5 meters, and assuming that it will be widened to 10 meters, approximately 15-20 structures will lie within the widened footprint.

Figure 6.2 Agricultural Land Use on part of the MOF site

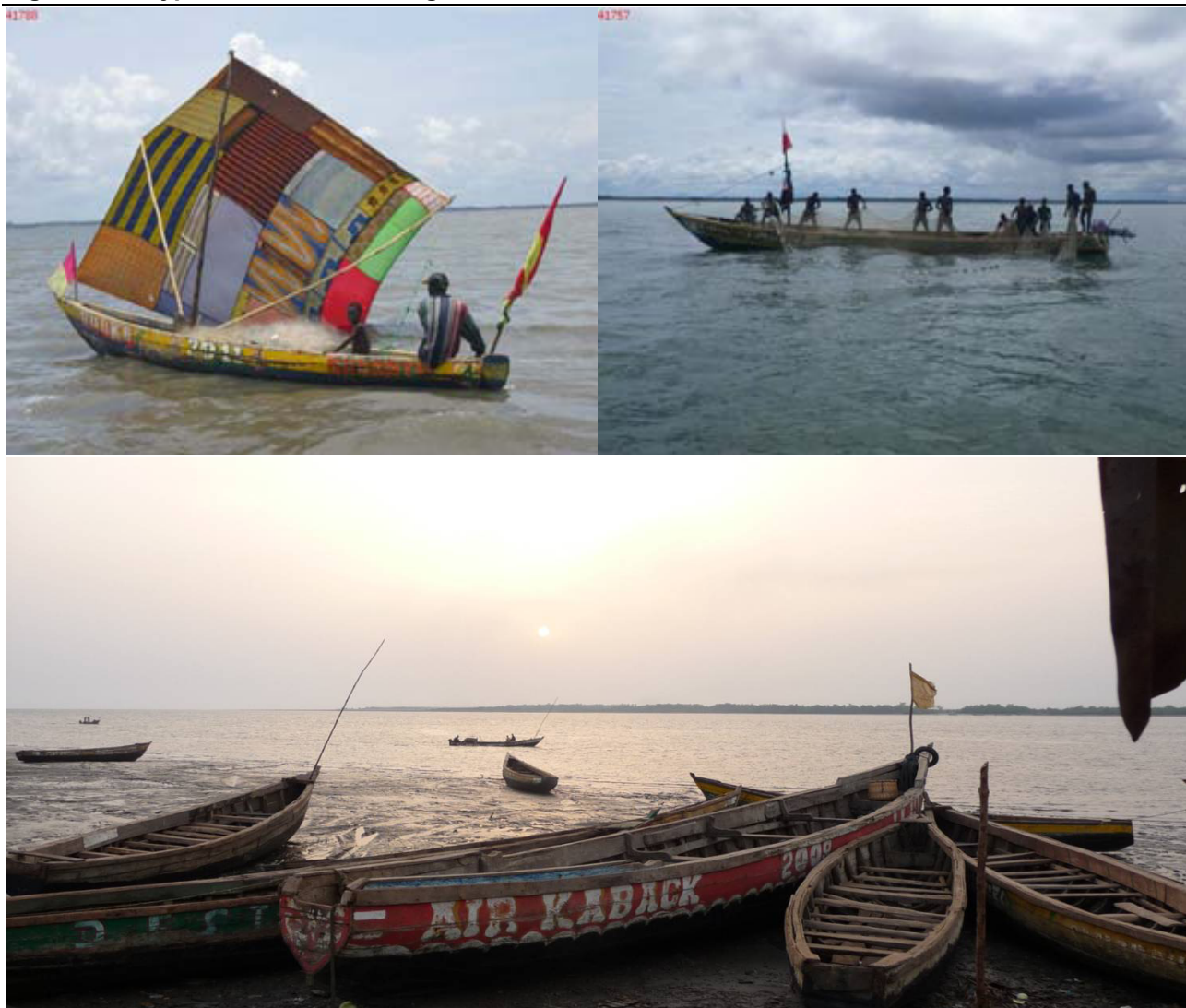


Fishing

Fishing is a major source of income for coastal people and sometimes a secondary source of income for people from inland villages. Whilst there are multiple recognised fishing areas around Ile Kabak, there are no designated fishing zones for each village/community or family and all fishing vessels are able to follow the fish wherever they go without conflict. By law, the six-mile zone of the Guinean exclusive economic zone is reserved for artisanal fishing. Fishing boats are powered by either outboard motors, sail or by paddle.

In fishing villages, it is common for a small number of people to own boats and outboard motors. Most boat owners have one boat, and will work with up to eight workers. Owners of several boats and outboard motors have an important role, as many people are dependent on these boat owners for obtaining work. Motorised boats normally have a crew of three to five (except when complex nets are being used which can require 20-25 crew), and sailing or rowing boats normally have a crew of two. Boat owners will sometimes go fishing with their crew and sometimes allow them out without them. The division between boat owners and workers is an important social and economic indicator, as fishing catches are split, with the boat owner retaining the greatest share or the highest value fish.

Figure 6.3 Typical Ile Kabak Fishing Boats



Source: Sabinot, C. et al. (2011) and Koppert, G. and Barry, M. (2010).

When fish is landed, due to the lack of electricity and means for cooling in most villages, much of the fish cannot be directly sold and is smoked for preservation before transport to market. The source of firewood for smoking was reported as being cut locally (from mangrove and mango trees) rather than imported from elsewhere and purchased.

In most fishing villages, fishermen sell their catch to women (usually their wife), and use the money to buy their staple food of rice. The women often then process and smoke the fish, often receiving more money from selling it on at market than they paid the fishermen and keeping the profit. The majority of fishermen then borrow money from women to buy fishing equipment or repair boats and nets. The money management in fishing households may be different from agricultural households because the tasks are clearly divided. Money transfer is common between spouses.

Secondary activities such as the processing and smoking of fish are normally conducted by women, who can earn more money as a result than the fishermen. Most of the women who live in fishing villages have a place for smoking fish such as an outdoor smokery or smoking house, which may be private or shared with several other women. Money raised from the sale of fish is used to buy either fishing gear or rice, or to loan back to the fishermen. Women never fish at sea, however do use their own fishing gear in the smaller rivers and in rice fields to catch fish and crabs and will collect oysters and shellfish along shores during lean periods.

Figure 6.4 Ile Kabak Woman with Small Fishing Gear



Source: Koppert, G. and Barry, M. (2010).

Figure 6.5 Ile Kabak Women Preparing Fish



Source: Koppert, G. and Barry, M. (2010).

For at least the last 10 years, commercial fishing companies (believed to be Korean owned) have operated on Ile Kabak. Rather than operating their own boats, they provide some fishermen with credit or directly supply them with equipment (boats, nets, engines etc) and in return the fishermen must sell the company their catch at a fixed price. Fishermen from other villages may not be given credit or equipment and this is reportedly a source of contention, although they are still able to sell fish to the companies if they choose to and are not bound by the same fixed price arrangement. The companies will provide cold storage facilities in most villages (old freezers or coffer-fish and ice) to allow fresh fish to be stored for a few days before it is collected, even in those villages where companies may not supply fishermen with credit or equipment. Aside from the contention around which villages have been given credit or equipment and which have not, village interviews did not report a clear opinion on whether the presence of the commercial fishing companies was considered positive or negative by local communities. To work in a village, fishing companies must pay taxes to the prefecture of Forecariah, and according to some sources, also to the 'chef de port' of the village.

In addition to fishermen, most fishing villages have one or more marine carpenters for boat repair, or workers specialised in making nets etc.

In the MOF area, there are no fishing villages that will be directly impacted by the footprint of the project, although there are a small number of fishing huts along the shoreline of the Morebaya River. It is likely that the river around the MOF area is used by people from other fishing villages further up or down the river and is known to be used for general transport of goods and people, particularly from the jetty at Touguyire, approx 2 km to the south of the MOF site.

Other Livelihoods

Agriculture and fishing (and related activities) are the main source of income and most people do some of both. There is little other commerce, which is restricted to sellers of gasoline and some small general shops. Hunting was cited as a regular activity at half the villages surveyed on Ile Kabak, with game usually sold to other villages rather than retained by the hunter's village. Types of animals hunted are unknown.

Some families also gather salt by boiling seawater, which is a labour intensive but sometimes lucrative process. In some villages on Ile Kabak this provides a major source of income. Salt production is undertaken immediately east and south of the MOF footprint. The preparation for salt collection is done in January-February (cleaning, building of the hangar). During this period, men begin to cut firewood (mango and mangrove wood, believed to be from local sources). By the end of March and during April, the entire household is involved in regularly forming piles of "dust" (a mixture of salt and ground) by scraping the saline crust. The bulk of the work is in April: boiling the filtrate obtained from a mixture of seawater and "dust" passed into a large strainer made of straw and wood. It takes three tonnes of wood to get a ton of salt. The resulting salt is sold between October and December.

In many of the villages of Ile Kabak, some people have some surplus income which they are able to save. Many rotational saving groups ('tontines') exist, sometime more than one in each village. The tontines encourage regular saving (every week, fortnight or month), with rotational payments of the total amount given to one of the members of the 'tontine'.

Figure 6.6 Salt Pans in the vicinity of the MOF Area



Source: Sabinot, C., *et al.* (2011).

Figure 6.7 Salt Production Activities (Filtering and Boiling)



Source: Sabinot, C. *et al.* (2011)

6.3.7 Infrastructure and Services

Social Infrastructure

Most social infrastructure and services are lacking in the villages. On Ile Kabak, 20 % of the villages have a school, 10 % have health facilities and 7 % have a market. On Ile Kabak, 63 % of the interviewed households have a school less than 3 km away, for 24 % this is 3 - 5 km, and for 18 % more than 5 km away. There are no known skills training centres in the area.

Drinking water supply is reported to be a major problem in all villages on Ile Kabak, as groundwater is brackish for much of the year and people have to travel farther inland to find suitable drinking water, which is then expensively sold on the island. In the MOF footprint there are two seasonal water wells and along the roads that will be widened there are several further seasonal and permanent water wells. No information on sewage collection is available, although 65 % of the households surveyed on Ile Kabak have latrines. No information on the use of existing roads is available, however they are generally narrow (3-5 m wide) and unsurfaced. No information on public transport is available.

Figure 6.8 Local Roads



Housing Infrastructure

There are a small number (thought to be three; this will be confirmed during stakeholder consultation) of fishing huts along the shoreline within the MOF footprint. These appear to be temporary (ie not in permanent use) as they are not obviously part of a village. There is also an abandoned village (Modeya/Tomboulea) within the MOF footprint (estimated at 7-10 structures, to be confirmed during stakeholder engagement). The abandonment may be permanent or temporary, as it is common for land associated with villages to be periodically occupied/unoccupied in association with cycles of crop cultivation. There are believed to be four households living on the rock outcrop which will be quarried. The nearest large villages are at Touguiyire (approx. 2 km south) and Senguilene (approx 1.5 km east); neither of these lie within the MOF footprint. In

villages surveyed elsewhere on Ile Kabak, 70 % of the households live in structures made with traditional materials (see *Figure 6.9*). Occasionally other material such as metal or plastic sheeting may be used.

Figure 6.9 Typical Ile Kabak Houses



6.3.8 Gender

Women are responsible for 80 % of agricultural production and play a major role in livestock breeding (although this activity is of low economic importance compared to fishing or rice growing). Men's activities are typically fishing, with some agricultural production. Though men manage the family budget, women usually have their own income which they manage (particularly in fishing villages, as a result of sales of smoked fish). Food processing and production (oil from oil palms, dehusing rice, fish smoking) are women's activities. They often engage in small commerce of food products and fish. Women often organize in mutual assistance groups, which perform agricultural tasks.

Among the main issues affecting women are the lack of education and the lack of ownership of agricultural land, though they do use land for their own benefit in most villages. Women have very few formal rights and though recent legislation has improved their legal rights, they are still rarely applied in day to day practice.

6.3.9 Cultural Heritage

Due to Ile Kabak's favourable combination of rich agricultural fields and marine resources, it is highly probable that earlier populations lived in the area prior to the start of the slave trade. Ile Matakang is mentioned by oral history to have been inhabited by Portuguese slave traders. On this island, there is a site known as the "Giant's Tomb" where two labourers were killed by the Portuguese.

A number of known heritage sites of historical importance are located further south elsewhere on Ile Kabak. They are by and large associated with the slave trade and include a slavers outpost and a jail dating between the 18th and 19th centuries. Given the importance that this coastal region played in the slave trade, it is likely that more related cultural resources are present including nautical archaeological resources (i.e. scuttled ships and wrecks). A map of nine cultural heritage sites in the Ile Kabak area exists, although the sites are not thoroughly described and it is not clear to which time period they belong.

No formally recognised cultural heritage sites have yet been identified in the MOF footprint although the coastal rock outcrop features two marks that are referred to as the 'Giant's Hand' and 'Foot' (see *Figure 6.10*). These are understood to represent the hand or foot print left on the rock by a mythical or spiritual being. The value associated with this to the local population of Guineans and the small extended family group from Sierra Leone currently living on the rock outcrop is not fully understood at this time. This will be evaluated further during the MOF stakeholder engagement activities planned for the project.

Figure 6.10 Giant's Hand (left) and Giant's Foot (right) on coastal outcrop near MOF



Additional undiscovered sites may also be present since this area would have been attractive to both pre-historic inhabitants and historic settlers but are as yet because the area has not been subject to archaeological field reconnaissance.

Another form of cultural heritage is represented by the intangible culture present in the wider Ile Kabak area. Two categories can be distinguished: cultural knowledge and cultural activity.

Cultural knowledge is defined as the belief systems or knowledge base that is maintained and passed down over multiple generations. This is reflected in religion, cosmology, cultural values, myths and stories of the group's history. It also refers to traditional technologies, fishing, hunting or agricultural techniques and knowledge of folk production techniques and traditional forms of social organization refers to how the community organizes itself and how power is shared among individuals or groups.

Cultural activity is defined as activities that represent expressions of social or cultural identity for a particular group in which multiple members of the community take part. Cultural activities are event based (i.e. they take place in a particular time and place) while cultural knowledge exists within the consciousness of a community. Examples of cultural activity can be seen in:

- Rituals, such as festivals, initiation ceremonies and mortuary rituals.
- Cultural expression including song, dance, clothing, and the production of folk art.
- Traditional life-ways such as lifestyle, means of subsistence, social and political activities and other daily activities which form the basis of cultural identity.

No specific information is available about the role of the Project site in the intangible culture of the local inhabitants.

6.3.10 Landscape, Seascape and Visual Resources

The receiving landscape and seascape comprise predominantly flat coastal land in use for agriculture, mainly as rice fields. The Morebaya River flows southwards following a sinuous course and broadening to form the estuary at the coast mangrove. Scattered clusters of mangrove vegetation are established. Large tracts of cover occur especially as linear vegetation strips on the banks of the river and the estuary at the coast. The agricultural field pattern is relatively strongly defined by earthen bunds characteristic of bogoni rice culture and follows a random pattern rather than a geometric field pattern.

The northern part of the local landscape features a large rock outcrop. This presents as a topographical landmark in this otherwise flat estuarine landscape. Clumps of woody vegetation fringe the lower slopes of

this outcrop. North of this rock outcrop, the farmed field pattern is present again as the dominant land cover. A second rock outcrop, smaller in size, lies immediately north of the proposed quay along the river bank.

The landscape is relatively open and from it, long range distant views are frequently available. The summit of the rock outcrop commands views out over the flat farmland, the estuary and the wider coastline and seascape further south.

Scattered dwellings are located in this landscape, one of which occupies the coastal rock outcrop along the river bank. Seemingly abandoned villages lies within the MOF footprint surrounded by planted trees. Those who view the area comprise mainly residents of the dwellings and those engaged in farming or coastal fishing. The existing visual amenity generally comprises an undeveloped landscape of rural and remote quality. Viewers located along the estuary and coast currently command views over the coastline and seascape and these also are of an undeveloped and rural quality, such viewer types include residents of the coastal rock outcrop and along the new road alignment.

6.4 Prediction, Evaluation and Mitigation of Impacts

The following sections assess the impacts to the human environment, subdivided into:

- Local Economic Development (*Section 6.5 to 6.7*)
- Labour and Working Conditions (*Section 6.8*)
- Community Health, Safety and Security (*Section 6.9 to 6.16*)
- Development and Livelihoods (*Section 6.17 to 6.22*)
- Demographics and Social Welfare (*Section 6.23 to 6.27*)
- Cultural Heritage (*Section 6.28*)
- Landscape, Seascape and Visual Resource (*Section 6.29*)

Best practice for the assessment of impacts to the human environment would be to divide the assessment into construction and operation impacts, as most impacts would occur during construction. Given the short construction and operation timeframe for the MOF, however, the impacts during construction and operation phases have been considered together on this occasion. Also, many changes that manifest themselves during construction will still be prevalent during operation.

6.4.1 Criteria for assessment

In evaluating social and socio-economic impacts the methodology outlined below has been applied along with professional judgement, informed by reference to legal standards, international standards (International Association for Impact Assessment (IAIA) and the IFC PSs), Guinean government policy, current good practice and the views of stakeholders.

Sensitivity of Resources With Respect to Social, Socio-economic and Health Impacts

For social, socio-economic and health impacts, the degree of sensitivity of a receptor is based on an individual's abilities to adapt to changes and maintain or improve their livelihood and health. A number of terms can be used to refer to this concept, for example 'sensitivity' or 'vulnerability'. The World Bank, for example, refers to 'vulnerability', noting that an assessment of social risk should examine 'the social groups vulnerable to stress and shocks and the underlying factors that contribute to this vulnerability'.

In this assessment we consistently use the term 'sensitivity' to address this concept which we define as: a stakeholder's (or groups of stakeholders') resilience or capacity to cope with change.

Stakeholders may be more sensitive for a variety of reasons and for the purpose of this Project the following factors have been considered:

- age, gender, race or religion;
- land rights and ownership patterns;

- income/employment/unemployment;
- livelihood (current and extent of livelihood alternatives);
- location/isolation;
- services, e.g. health, amenities (quality and access);
- access to, and use of, natural resources including water
- food security and reliance on subsistence farming;
- education/skills;
- health or disability;
- support networks; and
- marginalisation (e.g. degree of access to services and formalised rights).

Table 6.1 provides sensitivity criteria for human populations.

Table 6.1 Socio-Economic Sensitivity Criteria

High	An already vulnerable receptor with very little capacity and means to adapt to change and maintain/improve quality of life.
Medium	A receptor with some capacity and means to adapt to change and maintain/improve quality of life.
Low	A receptor with plentiful capacity and means to adapt to change and maintain/improve quality of life.

In summary, 'highly sensitive' refers to an already vulnerable receptor's lack of key resources that would help them to respond to or manage changes, which may affect their wellbeing. This lack of resources can act as a disadvantage, making accessing new knowledge or skills, which can help people to absorb and respond to change, more difficult. Often the highly sensitive stakeholders are those whose rights are not recognised or protected.

Sensitivity of Resources With Respect to Cultural Heritage

The sensitivity of known sites is determined by reference to their proximity to Project impacts and their cultural and/or scientific importance. The importance levels take into account both local and scientific stakeholders. The degree of protection of these sites has yet to be established, so if a site is likely to be affected by the Project, more investigation will be required to establish the site's importance and to determine an appropriate mitigation strategy.

Sensitivity of Resources With Respect to Landscape and Seascape

The sensitivity of a landscape or seascape is based on the extent to which it can accept change of a particular type and scale without adverse effects on its character including cultural heritage value. Sensitivity varies according to the type of development proposed and the nature of the landscape.

Sensitivity of viewers depends on the context of the viewpoint, the current occupation (resident communities or workers) and viewing opportunity of the groups of people being considered, and the number of people affected.

Magnitude of Social, Socio-economic and Health Impacts

Magnitude is determined by the degree of change that is brought about by a project. Characterization of the magnitude of an impact typically involves a consideration of the factors shown in *Table 6.2*. The scale of magnitude (from small to large) is defined differently according to the type of impact and a more or less detailed scale may be used for particular impacts depending on the circumstances. The detail of how magnitude is predicted is described in the analysis of each impact.

Table 6.2 Socio-Economic Magnitude Criteria

Magnitude – the degree of change brought about	
Nature	• Resources: The term resources is used to describe features of the environment such as water resources, habitats, species, landscapes, etc which are valued by society for their intrinsic worth and/or their social or economic contribution. For socio-economic assessment resources can be a business or community asset amenities and opportunities. These include existing and potential resources within the areas of influence such as local business customers, employment and training opportunities, agricultural, residential and commercial land values etc. • Receptors: The term receptor is used to define people and communities who may be affected by the Project.
Extent	• Local – impacts that affect an area in a radius of 10 km (within the Project nucleus) around the development area. • National – impacts that affect nationally important resources or affect an area that is nationally important/ or have macro-economic consequences • Transboundary/Regional– impacts that affect regionally important resources or are experienced at a regional scale (e.g. affecting Cote d'Ivoire, Liberia, Sierra Leone, Mali) or have transboundary consequences. • Global – impacts that affect globally important resources or have transboundary consequences.
Duration	• Temporary – impacts are predicted to be of short duration and are intermittent / occasional. • Short-term – impacts that are predicted to last for up to 1- 2 years. • Medium term – impacts that are predicted to last up to project life cycle. • Long-term – impacts that are predicted to last for up to 50 years. • Permanent – impacts that cause a permanent change in the affected receptor and resource. • Continuous – impacts that occur continuously or frequently. • Intermittent – impacts that are occasional or occur only under specific circumstances.
Probability	The likelihood that an impact will occur: • Unlikely - the impact is unlikely to occur. • Likely - the impact is likely to occur under most conditions. • Definite - the impact will occur.

Magnitude of Cultural Heritage Impacts

The magnitude or physical extent of impacts is predicted based on the proximity of sites of cultural interest to the Project area. Sites within the boundaries of the Project area are considered likely to be subject to direct impacts of a large magnitude. Sites outside the boundary of the Project area but within 2 kilometres of the Project area may experience small direct impacts or small to moderate indirect impacts on their setting.

Magnitude of Landscape and Seascape Impacts

The magnitude of change affecting landscape, seascape or visual receptors depends on the nature, scale and duration of the particular change that is envisaged in the landscape and the overall effect on a particular view.

Evaluation of Significance of Social, Socio-economic and Health Impacts

The degree of significance of an impact is defined based on the predicted magnitude of the impact and sensitivity of the receptor, as presented in *Table 6.2* and *Table 6.1* respectively. For this assessment, significance has been defined based on five levels described in *Box 6.1*

Box 6.1 Categories of Significance

Positive impacts provide resources or receptors, most often people, with positive benefits. It is noted that concepts of equity need to be considered in assessing the overall positive nature of some impacts such as economic benefits, or opportunities for employment.

Negligible impacts (or insignificant impacts) are where a resource or receptor (including people) will not be affected in any way by a particular activity or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.

An impact of minor significance (a 'Minor impact') is one where an effect will be experienced, but the impact **magnitude** is sufficiently small (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.

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

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

Evaluation of Significance of Cultural Heritage Impacts

The significance of impacts to archaeological sites and above ground historic structures is evaluated by considering the physical extent of the impact and the cultural importance of the affected site and can be classified based upon the categories of significance in *Box 6.1*.

The potential for significant impacts on as yet unknown intangible heritage or archaeology, ie undiscovered sites, is based on the potential of the study corridor as assessed.

Evaluation of Significance of Landscape and Seascape Impacts

Significance is determined by considering the sensitivity / value of the landscape, seascape or visual receptor and the magnitude of change expected as a result of the development and can be classified based upon the categories of significance in *Box 6.1*.

6.5 Local Economic Development

6.5.1 Impacts - Overview

The construction of the MOF and roads will employ a large number of workers and require considerable resources in terms of consumables (food etc), which has the potential to benefit the local economy. Potential impacts include:

- direct employment opportunities at the Project site; and
- income generation and indirect employment opportunities for local businesses supplying goods and services to the Project.

6.6 Direct Employment Opportunities

Residents of the Ile Kabak area have expressed considerable interest in employment on the Project. The levels of education and people with skills that are specifically relevant to the construction industry present challenges to local people gaining employment with the Project and school attendance/completion in the area is low. Currently, training opportunities in the area are understood to be very limited or non-existent. Unemployment is not believed to be a significant problem on Ile Kabak, as most families operate on a largely subsistence basis between fishing and rice production, selling any excess available.

The construction of the MOF and roads is expected to employ approximately 300-500 people, over a period of approximately 15 months. A resources plan will be prepared by the lead construction contractor to identify specific workforce needs and analyse local capabilities, with the aim of maximising local hiring and procurement, including within the wider area of Ile Kabak. An estimate of the breakdown of national, regional and local employees for construction is not yet available, however due to the short construction timeframe and limited availability to provide suitable skills training within this period, it is unlikely that there will be any significant local recruitment, particularly for skilled or semi-skilled workers, and any jobs would likely be temporary.

Given current understandings of local capabilities and skills specific to the construction industry, any employment opportunities for local people during construction are expected to be in the form of unskilled positions with some limited opportunities in semi-skilled positions that may not substantially contribute to the area's overall skills development. It is expected that a significant proportion of the skilled and semi-skilled workforce will be expatriates, possibly with a small number recruited from Guinea. The employment and related skills development for Guinean workers may spread some benefits at the national level, though this is likely to be limited due to the low number and temporary nature of the jobs. Even fewer opportunities may exist for employment during the MOF operational phase when an estimated 100 people will be employed with MOF and an unknown number of drivers responsible for the inbound transport of material and equipment for construction of the main Project. This may include longer term employment.

Households who secure employment - even temporary - on the Project may experience significant uplift in their economic status and their ability to secure future similar employment. At the regional level, households who receive employment will also benefit, but it is likely that the impact at the household level will be less significant as such workers are more likely to be skilled labourers. Employment opportunities will be limited to a few positions for local people over the short to medium term *ie* during construction and operation, meaning the **magnitude** of the impact is **small**. The magnitude of the impact reflects the fact that employment, while sizeable, are limited due to the timeframe of the construction and operation period and skill required. Given the importance local people are likely to place on local hiring, the **sensitivity** of local households in relation to employment is considered to be **high**. The impact is considered to be *minor positive*.

6.6.1 Mitigation measures

The specific measures to be implemented as part of the MOF project are described in detail in the SEMP which is appended to the SEIA (*Annex D*). The 'Local Employment and Procurement' section of the SEMP outlines mitigation measures which include local procurement and the employment of local people and contractors for work on all phases of the Project, firstly from Ile Kabak and then elsewhere in Guinea wherever practicable.

6.6.2 Residual impact

While mitigation measures will focus on maintaining a fair and open hiring process and improving the local skills base, there is not yet a final indication of the number of jobs that will be created within the Ile Kabak area. For this reason the *significance* of the impact is estimated to remain *minor positive*.

6.7 Local Business Development Opportunities

The majority of materials required for construction of the MOF will be transported to site by ship, as they are specialist components which are not available locally, so it is unlikely that significant opportunities will exist for local businesses to supply the Project. It has not yet been decided how to supply the construction workforce with consumables (food etc) however it is unlikely that significant quantities will be purchased locally during the construction phase, as the volumes required will be extremely large and it will not be possible to ensure sufficient security and quality of supply given the short timeframe before construction begins. There are little or no known existing businesses selling goods and services which could benefit from the presence of the project, however the potential exists for these to be established. It is currently envisaged that consumables will be transported from Conakry directly to the construction site by ship or by road in the initial stages. It is expected that the accommodation for construction workers (which may be either an onshore camp within or near the site perimeter or a 'flotel' moored in the Morebaya River) will be 'closed', that is workers will not be allowed outside the accommodation or work areas, and therefore there are unlikely to be any significant opportunities for workers to buy goods or services directly from local businesses.

It is unlikely that there will be any significant local business development opportunities, and any opportunities would be likely to be temporary or short term. With a foreseen reduction in workforce, even fewer opportunities may exist for business development during the MOF operational phase and these can be long term. The **magnitude** is **low**. The magnitude of the impact reflects the fact that economic opportunities are limited due to the timeframe of the construction and operation period. The **sensitivity** of local households to an increase in income from local businesses is **low**. The **significance** of the impact is expected to be *minor positive*.

6.7.1 Mitigation Measures

The specific measures to be implemented as part of the MOF project are described in detail in the SEMP (*Annex D*). The 'Local Employment and Procurement' section of the SEMP outlines the requirements of the Project in relation to local procurement and the employment of local people wherever possible.

6.7.2 Residual Impacts

With the mitigation measures outlined above in place, the anticipated impact on economic opportunities during construction and operation is expected to be *minor positive* for Ile Kabak, and *minor positive* at the regional and national level.

6.8 Labour and Working Conditions

6.8.1 Impacts - Overview

Considering the nature of the activities being undertaken during construction, worker health and safety is a key risk area. Consequently, major construction projects typically have policies, procedures and protocols in place to address all aspects of health and safety associated with each task / job undertaken with the aim of avoiding lost man hours and injuries.

With regard to labour rights, of the Project will observe Guinean labour laws and is committed to complying with relevant IFC Performance Standards governing labour and working conditions for all workers. The quality of accommodation provided to workers is another specific aspect that must be of an appropriate standard in order to protect the health and welfare of the non-local workforce. The Project plans to house non-local workers in either a worker camp, or a 'flotel' moored in the Morebaya River. Local workers will provide their own accommodation and live in their normal homes.

Workers being employed may range from unskilled workers who have potentially never had a contract (and are highly dependent on the job) to those skilled workers accustomed to working in similar workplaces (and with options for other employment). For unskilled workers, the vulnerability (and therefore sensitivity) to infringements of their rights will be **high**, while for skilled workers it will be **low**.

For those workers where this Project represents their first exposure to a highly structured employment environment where their rights are clearly articulated, they could receive a long term benefit as they will understand their legal rights under Guinean law. However, the number of people in this position is likely to be limited due to the low number of local workers employed during construction and operation.

Consequently the **magnitude** of the impact is considered **small** and the overall significance is therefore *minor to moderate positive*.

6.8.2 Mitigation Measures

The specific measures to be implemented are described in detail in 'Employment Terms and Working Conditions' and 'Human Rights' within the SEMP (*Annex D*). Working and living conditions for workers and contractors will be in compliance with the Guinean Law and the IFC Standards ⁽¹⁾, as outlined in 'Workers' accommodation: processes and standards'. A grievance mechanism will also be developed.

6.8.3 Residual Impacts

Despite implementation of the mitigation measures above, the number of local workers employed by the Project during construction and operation will remain low. The *significance* of the impact therefore is therefore considered to remain *minor to moderate positive*.

6.9 Community Health, Safety and Security

6.9.1 Impacts - Overview

The construction of the MOF, blasting of the rock outcrop and road construction and subsequent operation have the potential to impact on community health, safety and security through:

- increased road traffic movements;
- increased vessel movements;
- increased incidence of malaria and water borne diseases;
- increased risk of STIs including HIV/AIDS;
- changes in access to Health Care including Traditional Healers;
- changes to the environment, living conditions and access to resources; and
- presence of security personnel.

6.10 Increased Road Traffic Movements

During construction and operation there will be a significant increase in the number of vehicle movements. Traffic increases will occur as goods and materials are brought in to construct the MOF and roads. Once operational there will be an estimated 500 movements per day associated with the transport of materials and goods to and from the laydown yard.

Any increase in vehicle movements increases the risk of accidents which could result in injuries including long term disabilities or even death of community members. This is particularly likely where roads pass through communities. Furthermore, as the existing traffic levels are low, the level of awareness of risks is also low.

Amongst the most vulnerable road users are pedestrians, cyclists and those on motorbikes who have less protection in case of accidents and are therefore more likely to suffer serious injury.

In addition the increase in vehicle movements is likely to result in community severance thereby reducing access to networks of family and friends as well as facilities and services.

(1) IFC/EBRD (2009) *Workers' accommodation: processes and standards*. Public guidance note by IFC and the EBRD, [http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/p_WorkersAccommodation/\\$FILE/workers_accomodation.pdf](http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/p_WorkersAccommodation/$FILE/workers_accomodation.pdf)

The increased risk is likely to occur to local receptors over the short to medium term ie during construction and operation, meaning the **magnitude** of the impact is **medium**. The **sensitivity** of the receptors is considered to be **medium to high** depending on the road users ie those in vehicles will be medium whereas pedestrians etc are considered to be highly sensitive. The impact of increased road movements on community health and safety can therefore be considered to be of *major negative significance*.

6.10.1 Mitigation Measures

The 'Community Health, Safety and Security' section of the SEMP (*Annex D*) details the mitigation measures to be implemented including enforced security and management measures.

6.10.2 Residual Impact

Despite the proposed mitigation the potential for accidents to occur between project and non project related vehicles and / or members of the community with associated injury, including long term disability and fatalities, remains. Based on the number of vehicle movements the impact is still likely to occur to local receptors over the short to medium term. The sensitivity of receptors remains unchanged and as such the *significance* of the impact remains *major*.

6.11 Increased Vessel Movements

Along similar lines, there will be an increased risk of accident involving project and non project vessels resulting in drowning, death and disabilities with longer terms impacts on livelihoods. The potential of fatal injury or drowning is particularly high for fishermen with small fishing vessels that attempt to cross a path of an incoming or outgoing vessel, without realising that these larger vessels can not stop or manoeuvre away in time. The likelihood of such hazardous encounters during the construction and operation period is high over the lifetime of the Project is high but only rarely will such encounters lead to the loss of life or severe injury. The **magnitude** of the impact is therefore considered **medium**. The vulnerability (and therefore **sensitivity**) of the receptor **high**. The *significance* of the impact is *major*.

6.11.1 Mitigation Measures

The specific measures to be implemented as part of the MOF project are described in detail in the SEMP (*Annex D*). The 'Community Health, Safety and Security' section of the SEMP includes mitigations measures such as the implementation of patrol vessels in the work areas to warn fisherfolk about transport barges and larger vessels as well as the need for the Project to inform fishing communities about the construction of the MOF and associated risks.

6.11.2 Residual impact

With the mitigation measures implemented, it is likely that the risk of fisherfolk being at risk of collisions that lead to loss of life is substantially reduced. Over time, fisherfolk will adapt their sailing pattern to vessel movements and learn to avoid fishing in the approach channel. The *significance* of the impact is reduced to *minor*.

6.12 Malaria and water borne diseases

Malaria is endemic in Guinea with high levels of infection even in children. The use of mosquito nets and other preventative measures is known to be variable. The level of understanding of disease transmission routes among the population is also variable.

Any changes to the environment that increase the presence of stagnant water could create breeding grounds and habitats for mosquitoes. Such areas would facilitate the spread of Malaria in the area. In-migration of people into the area could also influence transmission patterns. Such changes could lead to increased incidence and prevalence of malaria in the area around the MOF and along the proposed roads.

Increased prevalence or incidence of malaria not only affects the health of the individual affected but could also result in increased absenteeism from work, decreased livelihoods for households (due to inability to work and the cost of access and receiving any treatment) and an increased burden on health care facilities in the area, which are already under resourced in terms of personnel and drugs.

The increased risk is likely to occur to local receptors over the short to medium term ie during construction and operation. The **magnitude** is **high**. The **sensitivity** of the receptors is considered to be **medium to high** as the disease is already endemic and the ability of communities to access treatment is limited due to the costs and availability of health care as such the *significance* of the impact is considered to be *major*.

6.12.1 Mitigation Measures

The specific measures to be implemented are described in detail in the 'Community Health, Safety and Security' section of the SEMP (*Annex D*). Mitigation measures to be implemented in order to fight against water born disease include appropriate induction training for Project personnel, site management measures to help avoid the creation of new breeding grounds for malaria (ie stagnant water).

6.12.2 Residual Impact

Despite the proposed mitigation the potential for transmission of malaria and other water borne diseases is still likely to occur to local receptors over the short to medium term, as such interventions have a lag period before the cycle of disease is broken. The **sensitivity** of receptors however should have decreased from high to **medium** as they have resources available to adapt to change as a result of preventative and treatment measures and as such the impact is considered of *moderate significance*.

6.13 Increased spread of STIs including HIV/AIDS

The increased population associated with the presence of workers and the influx of opportunistic job seekers has the potential to increase the spread of Sexually Transmitted Infections (STIs) including HIV/AIDS. The prevalence of HIV/AIDS in Guinea is 1.5 % ⁽¹⁾. HIV/AIDS is considered a taboo subject and knowledge around the disease and its transmission routes is generally poor. The presence of commercial sex workers in the area is not clearly understood, but is likely to increase either through in-migration or as women, especially vulnerable women, in the area perceive an opportunity to increase their incomes.

Projects such as the MOF and road construction and operation are frequently associated with an increase in the number of commercial sex workers, prostitution and an associated increase in transmission of STIs including HIV/AIDS. The road widening and construction and vehicle movements will create an opportunity for new transmission routes between communities due to improved access and associated with the drivers of vehicles if they stop at different communities or rest points along the roads and engage in sexual activities with commercial sex workers at various locations.

Any increased prevalence will affect workers and the community in particular vulnerable women as well as children, through vertical transmission from mother to child. Those known or thought to be suffering from HIV/AIDS may also be stigmatised within the community affecting their livelihoods and ability to support themselves and their families. Also as a result of the polygamy in the area it is possible for many members of the same family to be impacted.

Increased numbers of commercial sex workers or women having sex outside of marriage can also lead to increased numbers of pregnancies and children born out of wedlock. Such women may then be treated as second class citizens and suffer discrimination and prejudice as a result of their status.

The increased risk of transmission of STIs including HIV/ AIDS is certain to occur to national receptors over the short to medium term ie during construction and operation. The **magnitude** of the impact is therefore considered **medium**. However, the impact of an increased prevalence of STIs in a community could have longer term repercussions and may also contribute to the national profile and spread of the disease. The

(1) UN AIDS (2009), *HIV AND AIDS Estimates (2009)*, <http://www.unaids.org/en/regionscountries/countries/guinea/>

sensitivity of the receptors is considered to be **medium to high** due to the high prevalence of HIV/AIDS in Guinea and that the ability of communities to access treatment is limited due to the costs and availability of health care as such the impact is considered to be *major*.

6.13.1 Mitigation Measures

The specific mitigation measures to be implemented at are described in detail in the 'Community Health, Safety and Security' section of the SEMP (*Annex D*). These include the Project implementing training, in partnership with specialist organisations, and awareness programmes. In order to minimise worker-community interactions all camps will be operated as 'closed' camps.

6.13.2 Residual Impact

The increased risk is likely to occur to local receptors over the short to medium term ie during construction and operation. The **sensitivity** of the receptors is considered to be **medium** as community-worker interactions will be limited and communities and workers will be informed about the risks through education and awareness raising measures and have access to treatment and prevention measures. As such the impact will be of *moderate significance*.

6.14 Changes in access to Health Care including Traditional Healers

Levels of access to health care in the area are generally low as with the rest of Guinea. Local facilities are only able to offer primary health care. Emergency treatment while limited is offered at larger centres. However, access is also a problem in terms of ability to travel to health care centres and the cost of treatment at facilities.

Any increase in demand for the use of health care facilities and resources will put additional pressure on resources that are already overstretched due to lack of personnel, diagnostics and treatments. An influx of people is likely to play a role in decreasing access through increased demand. It is unlikely that facilities will be able to plan for or make the changes necessary to cope with future demand on services which are currently limited. In addition changes to the environment, if not carefully managed, may also play a role in increased disease transmission and the need for services.

Should there be further restrictions on access to health care this is likely to negatively impact on the health of the community in particular vulnerable groups such as pregnant women (as maternal mortality rates are high) and others with pre-existing conditions.

The use of traditional healers is known to occur although is poorly understood in the area around the MOF. Their importance is therefore unknown. If there is a lack of access to health care facilities this could result in increased use of traditional healers with the potential for worse health outcomes as opposed to using conventional medicine. Increased use of traditional healers also has the potential for putting pressure on natural resources associated with the project.

The increased risk for health care facilities is likely to occur to local receptors over the short to medium term ie during construction and operation. The **magnitude** of the impact is therefore considered **low to medium**. The **sensitivity** of the receptors is considered to be **high** as the community and the facilities have very limited or no capacity to adapt to change due to lack of funding and personnel or alternative health care facilities. As such the impact will be of *moderate significance*.

In terms of traditional healers the nature of any impact is poorly understood at the present time due to lack of knowledge around their presence, importance and use. However, if appropriate measures are adopted to prevent loss of access to facilities this may reduce potential impacts associated with the use of traditional healers.

6.14.1 Mitigation Measures

The specific mitigation measures to be implemented are described in detail in the 'Community Health, Safety and Security' section of the SEMP (*Annex D*). Measures include the provision of appropriate medical facilities. Measures to manage and limit the influx of people into the area as detailed in the 'In-migration' section of the SEMP should also be implemented.

6.14.2 Residual Impact

The implementation of the proposed mitigation will ensure that facilities have the ability to adapt to changes and as such access to health care facilities will at the least be maintained at current levels. As such the impact to access to health care facilities is unlikely to occur to local receptors over the short to medium term ie during construction and operation. The **sensitivity** of the receptors is considered to be **low-medium** as the community and the facilities will have the capacity to adapt to change due to the provision of appropriate support although specific vulnerabilities for some aspects of the community may remain. As such the impact will be *minor*.

6.15 Changes to the environment, living conditions and access to resources

The construction and operation of the MOF along with the road construction and widening and movements as well as any influx of people however minimal will change the living environment of local communities. Such changes will include:

- Increased noise leading to annoyance and potentially disturbance to activities such as sleep, religious, recreational and educational activities.
- Decreased air quality with the potential to impact on respiratory and cardiovascular conditions.
- Potential for increased pollution of water sources used for drinking and cooking.
- Decreased access to sanitation resulting in pollution of water and spread of communicable diseases eg cholera.
- Increased pressure on land leading to issues of food security and decreased nutrition.
- Overall changes to the living environment impacting on sense of place and therefore wellbeing.

These changes are likely to negatively impact the overall health and wellbeing of the community as they will change the nature of the lives that people live and introduce new disease pathways or exacerbate existing ones. It is assumed that noise and air quality will be managed to ensure they are compliant with national and appropriate international thresholds however health changes in particular to wellbeing are likely to result. Increases in the number of people in the area may also lead to pressure on resources, overcrowding within households and generalised degradation of the living environment. In terms of health this is most likely to manifest itself through diseases associated with inadequate water, sanitation and nutrition. Such diseases include cholera, dysentery, tuberculosis, malnutrition, anaemia and specific vitamin deficiencies. These changes may also influence people's sense of place and wellbeing.

The increased risk is likely to occur to local receptors over the short to medium term ie during construction and operation. The **magnitude** of the impact is considered **medium**. The sensitivity of the receptors is considered to be **medium to high** as communities will have limited opportunity to adapt to these changes due to existing vulnerabilities, limited space and that such changes will be outside of their direct control. The impact of increased road movements on community health and safety can therefore be considered to be of *major significance*.

6.15.1 Mitigation Measures

The specific mitigation measures to be implemented are described in detail in the 'Community Health, Safety and Security' and 'In-migration' sections of the SEMP (*Annex D*). Mitigation measures identified include the need for the Project to monitor population change and to implement a grievance mechanism. Mitigation measures around the need for the Project to minimise the influx of people into the area are discussed in the 'Development and Livelihoods' section below.

6.15.2 Residual Impact

The increased risk is likely to occur to local receptors over the short to medium term ie during construction and operation. The **sensitivity** of the receptors is considered to be **low** as communities will have the resources need to adapt to the changes and systems to register concerns over time. The impact can therefore be considered to be of *minor significance*.

6.16 Presence of Security Personnel

The facilities such as the MOF, laydown yards and camps will be patrolled by security personnel. There is the potential for negative interactions between the community and any security forces used especially if community protests etc occur.

Use of inappropriate force by security personnel in the event of an incident could compromise the safety and security of individuals from local communities. This in turn could have impacts on the reputation of the Project both nationally and internationally and set the tone for future phases of development. Such activities would constitute abuses of human rights as determined by IFC PS 4.

Without adequate screening or training or if personnel are able to carry weapons etc opportunities for incidents are likely to occur, taking into account the existing security situation in Guinea as a post conflict country.

The increased risk is likely to occur to local receptors over the short to medium term ie during construction and operation. The **magnitude** of the impact is **medium**. The sensitivity of the receptors is considered to be **high** as communities will have limited resources to adapt to the changes as well as fears around the consequences of reporting any such activities. The impact can therefore be considered to be of *major significance*.

6.16.1 Mitigation Measures

The specific mitigation measures to be implemented are described in detail in the 'Community Health, Safety and Security' and 'Human Rights' sections of the SEMP (*Annex D*). Mitigations include the need for the Project to supervise and control security personnel. An appropriate disaster and emergency response plan should also be developed.

6.16.2 Residual Impact

The increased risk is unlikely to occur to local receptors over the short to medium term ie during construction and operation. The **sensitivity** of the receptors is considered to be **low** as communities will have the resources needed to adapt to the changes and systems to register concerns over time and the security personnel will be adequately trained. The impact can therefore be considered to be of *minor significance*.

6.17 Development and Livelihoods

6.17.1 Impacts - Overview

The proposed project activities associated with the MOF will have an effect on the development and livelihood activities of the broader Ile Kabak area. The project activities that will impact on the current livelihood activities include:

- Dredging and dredge disposal for an approach channel.
- Quay development on the Morebaya River.
- Construction and operation of extensive laydown areas for storage of construction materials and equipment (likely to be used for the duration of the Project).
- Rock quarrying operations (with 500m exclusion zone) to supply aggregate material for construction.
- Road widening and upgrade of an existing public road from MOF to Maferinya to proposed stockyard.
- Construction of a new road from MOF across agricultural land/mangroves to stockyard and then down to Ile Matakang across Ile Kabak.

The proposed Project activities will cause permanent (and some temporary) loss of access to livelihoods, on land and in the Morebaya River and coastal waters. There will also be some permanent displacement of people from their houses resulting from the land loss. The potential impacts that will occur include:

- Loss of and disruption to land-based livelihoods, most notably resulting from land take of agricultural land;
- Loss of and disruption to fishery-based livelihoods as a result of restricted access to and use of the Morebaya River and coastal waters for fishing;
- Disruption to access routes resulting in restricted access to markets;
- Decrease in food security and supply resulting from loss of subsistence and in-migration and Project induced increase in price of food (rice or fish); and
- Loss of physical infrastructure.

In addition to the Project activities, these impacts are likely to be exacerbated by the anticipated in-migration of job-seekers. The history of the port area as an *established migrant destination* is likely to shape forms of project-induced in-migration as outlined in below.

In-Migration

- The area affected by the port is likely to attract significant numbers of in-migrants. Levels of in-migration are likely to increase rapidly during construction and are likely to persist into the operational phase. This will partly be fuelled by the existence of the port area forming a vibrant site of productivity and trade, and an ethnically diverse population.
- In-migration may be driven directly by perceptions of project-related opportunities such as employment. It may also, however, be encouraged by experiences of indirect benefits related to the development of the port, such as the establishment of a new market for local goods and services.
- The location of the port along the coast and its proximity to neighbouring states of Sierra Leone and Liberia suggests that there may be a significant percentage of foreign-born in-migrants, enabled proximity and a history of migrant access to the area. This may comprise a mixed population of documented migrants, as well as refugees.

6.18 Loss of, and Disruption to, Land-Based Livelihoods

The loss of, and disruption to, land-based livelihoods, most notably agriculture and agriculture related activities, will be directly affected by land take and temporary exclusion zones. Agriculture (specifically rice production) is the primary livelihood activity in the area. Other livelihoods that may be affected include salt production as a result of possible changes to irrigation channels.

The land in the proposed Project area is intensively used for agriculture; rice being the major crop. The *bogoni* rice fields (the most productive areas) are located on the coast in close proximity of tidal creeks. An estimated 16 ha of rice cultivation area will be permanently lost to the MOF footprint and another 57 ha of rice cultivation area will temporarily become unavailable as it lies within the 500 m exclusion zone of the proposed quarry. These fields need no rotations for fallow period, and are used every year. The highly productive and relatively rare *bogoni* are a unique economic asset which are intensively used and unlikely to be replaced.

Following the progressive excavation (and blasting) of the rock outcrop, the exclusion zone can possibly be reduced in size or removed rendering some land within the former exclusion zone available for new use. *Dara* rice cultivation areas are located on plains further inland not in direct contact with the sea. *Dara* rice requires two year fallow periods after four years of use and production is approximately 20 to 30 percent lower than on *bogoni*.

The new road will be constructed from the MOF across agricultural land/mangroves to the proposed stockyard and then down to Ile Matakang across Ile Kabak. The route alignment has not been established. Using the maximum parameters approach (See *Chapter 1*), one can argue that in a worst case scenario of a maximum length of the road of approximately 40 km, a Right of Way of 32 m and a construction buffer of 10 m along both sides of the road, through agricultural land, a total area of 208 ha of agricultural land may be lost. Indirectly, the road is likely to disrupt irrigation channels primarily used to water salt pans and rice fields. This will inevitably have an additional impact on the productivity of these lands that is impossible to quantify. A large number of households depend on this land.

Land surrounding the Project infrastructure appears to be intensively used, and it is therefore possible that no suitable replacement land of equal quality will be available.

The loss of and disruption to land-based livelihoods will occur for the duration of the construction and operation phase activities and is likely to extend into the life of the project. The loss of livelihoods will have a negative and direct impact on the affected people and be one of **large magnitude**.

The extent of the impact will be experienced at the local level and the duration will be short-term for the exclusion zone surrounding the quarry during the construction period and medium to long-term for the permanent land take (duration of the project) and rehabilitation time. The impact will definitely occur. The land users in the project area are highly dependent on the land for their livelihoods. Agriculture is the primary activity for most households. Receptor **sensitivity** is **medium-high** given the high reliance on agriculture-based subsistence activities and the lack of capacity to adapt and change without intervention. It is possible that some of the affected people will have other agricultural land.

The impact will be of *major negative* significance. The degree of confidence in prediction is medium.

6.18.1 Mitigation Measures

The specific measures to be implemented as part of the MOF project are described in detail in the SEMP which is appended to the SEIA (*Annex D*). The 'Physical and Economic Displacement' and 'In-migration' sections of the SEMP outline measures including siting the Project to avoid displacement and limit the extent of the project footprint on productive agricultural and compensate populations according to the Resettlement and Compensation Policy Framework for Early Works (see *Annex F*).

6.18.2 Residual Impact

Following implementation of the above mitigation measures, it is possible that the impact can be reduced from major to **moderate negative** significance.

6.19 Loss of and Disruption to Fishery-Based Livelihoods

The MOF and associated vessel traffic, including dredging and freight vessels, have the potential to affect fishery-based livelihood activities in the broader Ile Kabak area. Potential impacts include:

- loss of and displacement of traditional fishing grounds;
- collision between fishing vessels and/or equipment with Project vessels;
- reduction of fish stocks / fish productivity due to ecosystem impacts (ie dredging impacts); and
- loss of fish stocks / fish productivity due to additional demand set by in-migration.

Fishing communities that traditionally fish along the Morebaya River will be deprived of access to that section of the riverbank within the MOF footprint (including a small number of fishing huts) and to the river itself as it

is likely that a no entry zone will be enforced around the quay. This may also impede access to fishing areas downstream and upstream from the MOF.

It is likely that the small number of Morebaya River fisherfolk displaced by the MOF will be able to find alternative fishing grounds nearby without conflict, provided that free access to these grounds can be guaranteed and the work area is limited to that which is strictly required from a navigational safety perspective. In this case the impact is limited to minor inconvenience as fisherfolk will have to travel larger distances.

The situation is different in the coastal waters near the approach channel. From interviews with fishing communities, it is apparent that different fishing villages hold traditional use rights in fisheries in Ile Kabak. The area of the approach channel is intensively fished by nearby fishing communities of Ile Kabak. If an exclusion zone is declared around a work area, these fisherfolk will be forced to fish in another area which may lead to disagreements with neighbouring fishing communities.

Fishing activities will be impacted by increased vessel movements caused by the construction of the MOF and also by dredging activities associated with dredging of the berths and navigational channel. These activities have the potential to disrupt normal fishing operations and create navigational hazards. The increased vessel presence associated with MOF construction presents a collision risk to fishing vessels and equipment. Artisanal fishing methods such as gill nets are commonly fixed in position for 3 to 5 hours.

Should a Project vessel come into contact with these nets it is likely to cause substantial damage. Common practice is that fisherfolk are compensated for loss of or damage to nets. Once it is known that the Project will compensate for loss of fishing gear, people may take advantage of the situation by deliberately putting obsolete or previously damaged nets in the area. Not only will this compromise navigation of Project vessels, but it also puts the same fishermen at increased risk of collision. Fisherfolk commonly use small craft with basic propulsion methods (eg sails and oars) and should such a craft inadvertently collide with a larger vessel it will likely be destroyed. Collision risk resulting in potential injury or loss of life of fisherfolk on the water is discussed under Section *Community Health, Safety and Security*.

Dredging may cause a temporary loss of benthic productivity in affected areas. This loss may affect fish stocks that are of interest to the artisanal fishery, particularly bottom-dwelling fish species such as croakers (bars (Fr.)), soles and grunts (grondeurs (Fr.)). The potential impact to fish stocks as a result of dredging is discussed in Section 5.4.2 *Land Use* which concludes that the change to fish stocks will be of minor significance and short to medium term duration.

Project-induced in-migration can indirectly affect fishery-based livelihoods by increasing the demand for fish and putting additional strain on potentially already overexploited fishery resources. The assessment of significance of this impact is discussed in the section on *Demographics and Welfare* below. Loss of and disruption to fishery-based livelihoods will occur for the duration of the construction and operation phase activities. The loss of and disruption of livelihoods will have a negative and direct impact on the affected people and be one of **medium-high magnitude**.

The extent of the impact will be experienced at the local level and the duration will be short to medium for the duration of the project. The impact will definitely occur. Receptor **sensitivity** is likely to be **medium** given that fisherfolk have a choice in where they fish, but are likely to require assistance to access alternate fishing areas or they may actively seek compensation. Some people will have higher levels of sensitivity if they do not own a boat themselves, or do not have the means to travel further distances.

The impact will be of *moderate-major negative* significance. The degree of confidence in prediction is medium.

6.19.1 Mitigation Measures

The specific mitigation measures to be implemented are described in detail in the 'Marine Environment' and 'Physical and Economic Displacement' sections of the SEMP (*Annex D*). These include ensuring designated work areas and exclusion zones will not prevent passage of fishing boats up and down the river. Where

displacement of fishing communities is unavoidable, the Project will develop a compensation plan in accordance with the Resettlement and Compensation Policy Framework for Early Works (see *Annex F*).

6.19.2 Residual Impact

Following implementation of the above mitigation measures, it is possible that the impact can be reduced from moderate-high to **moderate-minor negative** significance.

6.20 Disruption to Access Routes

Construction of the MOF and associated infrastructure has the potential to disrupt access routes currently used by the community. The MOF footprint will permanently remove access to a stretch of riverbank, and the blasting exclusion zone will temporarily remove access to land within the exclusion zone. Access to the river will still be available from the adjacent riverbanks, and access will be available to other land areas by detouring around the MOF boundary and exclusion zone.

The existing public road widening and new road construction may cause temporary disruption to access routes. During the operation phase, the access routes will experience few disruptions; community safety as related to the roads is addressed in the section on Community Health, Safety and Security above. The disruption to access routes will occur for the duration of the construction phase and to a limited extent during operations. The disruption will have a negative and direct impact on the affected people. This impact will be experienced at the local level and will definitely occur. Receptor **sensitivity** will be **medium** as the affected people will be able to adapt to the disruptions by using alternate routes/ access points. The **magnitude** of the impact will be **medium** and the significance will be of *moderate negative significance*.

6.20.1 Mitigation Measures

Mitigation measures include avoidance of disruption to significant access routes on land, or alternative safe access points to the river or across the road construction route will be provided. Full details of specific measures to be implemented are described in the 'Physical and Economic Displacement' section within the SEMP (*Annex D*).

6.20.2 Residual Impact

Following implementation of the above mitigation measures, it is possible that the impact can be reduced from moderate to *minor negative significance*.

6.21 Decrease in Food Security and Supply

The loss of some agricultural land currently used for rice production may result in reduced access to subsistence for a number of households. Owing to the influx of people in search of employment, there will be an increased demand for food, which may have the effect of increasing food prices through inflation. This increase could be further compounded if the Project purchases large quantities of food locally. The poverty levels in the area are high with little to no disposable income, this will make it difficult for the population to adapt to higher prices.

People who lose agricultural land are likely to lose both a source of food and a source of income formerly gained from selling excess produce. Those people who do not lose land may benefit, as their excess rice may sell at a higher price due to increased demand.

The decrease in food security and supply will occur for the duration of the construction and operation phase activities. The decrease in food security will have a negative and direct impact on the affected people and be one of **medium magnitude**.

The extent of the impact will be experienced at the local level by the households directly affected by land loss and those subject to the potentially higher food prices. The duration will be short-term for some receptors as some land will become available for use following removal of the exclusion zone, and long-term for those

whose land will remain under the permanent MOF and road footprint and who are subject to the increased food prices. The impact will definitely occur given the heavy reliance on the land for home consumption and income and the finite supply of produce. Receptor sensitivity is **medium-high** given the high reliance on the produce and the lack of capacity to adapt and change without intervention. The impact will be of **moderate-major negative** significance. The degree of confidence in prediction is low.

6.21.1 Mitigation Measures

The specific measures to be implemented are described in detail in the 'Local Employment and Procurement' section of the SEMP (*Annex D*). These measures include monitoring rice prices to identify any areas where local availability of resources has been adversely affected by Project procurement.

6.21.2 Residual Impact

Following implementation of the above mitigation measures, it is possible that the impact can be reduced from moderate-major to **minor negative** significance.

6.22 Loss of Physical Infrastructure

The loss of physical infrastructure will be limited in terms of the MOF footprint. There are four households reportedly living on the coastal rock outcrop within the quarry exclusion zone, these households will have to be relocated on a temporary basis. There is also a seemingly abandoned village within the MOF footprint, and possibly a number of houses located within the road widening footprint, these will be permanently lost. The status of the abandoned village needs to be verified, as it is not clear whether the village is no longer in use, or whether it provides habitation to people on a temporary or seasonal basis. The new road route still needs to be determined; as such the extent of infrastructure loss is still unknown.

Land is relatively densely used on Ile Kabak and suitable land for relocation may not be readily available. The impact to each individual being resettled is likely to be of major significance.

The loss of physical infrastructure will occur for the duration of the construction and operation phases. The loss will have a negative and direct impact on the affected people and the **magnitude** will be **medium** given the relatively small number of affected households.

The extent of the impact will be experienced at the local level and the duration will be short-term for the houses located in the exclusion zone and medium-term for the permanent infrastructure loss. The impact will definitely occur. Receptor **sensitivity** is **high** given their high levels of poverty and the lack of land available to rebuild their houses.

The impact will be of *major negative significance*. The degree of confidence in prediction is medium.

6.22.1 Mitigation Measures

The specific mitigation measures to be implemented are described in detail in the 'Physical and Economic Resettlement' section of the SEMP (*Annex D*). Measures include siting of roads and infrastructure to avoid displacement wherever possible as well as compensation for temporarily or permanently resettled population in accordance with the Resettlement and Compensation Policy Framework for Early Works (see *Annex F*).

6.22.2 Residual Impact

Following implementation of the above mitigation measures, it is possible that the impact can be reduced from major to minor negative significance.

6.23 Demographics and Social Welfare

6.23.1 Impacts – Overview

There will be a change in the social and economic demographics and existing social welfare systems and infrastructure of the broader project area resulting primarily from the in-migration of job-seekers. Some of the Project infrastructure will also add additional strains on existing infrastructure e.g. roads, water and power requirements. The majority of these impacts will occur as a result of indirect and cumulative factors, as outlined below, not as a direct result of the Project activities.

The potential impacts that are likely to occur as a result of the Simfer activities and the indirect in-migration of job-seekers include:

- increased pressure on local infrastructure (for example water, health, roads);
- increased demand for land and natural resources;
- changed quality of life and social dynamics between locals and in-migrants; and
- pressure on administrative capacity (government and traditional) to deliver.

6.24 Increased Pressure on Local Infrastructure

Significant levels of in-migration are usually associated with large projects of this nature. Historically there has been a high level of in-migration to Ile Kabak and significant in-migration has also been linked to the Project activities at the mine site. As such, it is anticipated that in-migration will continue and possibly increase to the area of the MOF and broader Ile Kabak. Migrants originate from many areas of Guinea as well as from neighbouring Sierra Leone. This rapid increase in the population will place a high level of pressure on the already limited local infrastructure and services. In particular, housing (potential increase in informal settlements), water and sanitation, education and health care facilities, and roads will be placed under severe strain.

Construction workers employed by the Project will be housed in worker accommodation (either in an on-site construction camp or a 'floatel' moored in the Morebaya River) and will not be housed in local villages. It is envisaged that the camps will be 'closed' (i.e. workers will not be allowed outside the accommodation or work areas), and will be provided with all necessary services (utilities, medical facilities etc). Therefore it is not expected that there will be any additional demand on local infrastructure as a direct result of construction workers.

The increased pressure on local infrastructure will occur for the duration of the construction and operation phase activities and is most likely going to extend beyond the life of the project. The increased pressure on infrastructure will have a negative and direct impact on the local population and in particular, the most vulnerable people (e.g. women, children, and refugees). This impact will be one of **large magnitude**. The extent of the impact will be experienced at the local level and the duration will be long-term to permanent. This impact will definitely occur given the history of in-migration and significant in-migration linked to the other Project components (i.e. mine). Receptor sensitivity is **high** given the high levels of poverty, already poor infrastructure and their lack of capacity to adapt without significant levels of intervention. The levels of government capacity to respond to this influx are low.

The impact will be of *critical negative significance*; this is an indirect impact that will require partnerships with the government of Guinea to address. The degree of confidence in prediction is medium.

6.24.1 Mitigation Measures

Mitigation measures include the development by the Project, in partnership with local authorities and traditional leaders, of strategies and plans to address in-migration and identify opportunities where the project can support the development of local community, such as employment. Populations changes will also be monitored. Further mitigation measures are outlined in the 'In-migration' and 'Local Employment and Procurement' sections of the SEMP (*Annex D*).

6.24.2 Residual Impact

Following implementation of the above mitigation measures, it is possible that the impact can be reduced from critical to **moderate-major negative** significance. This impact will be more difficult for Simfer to manage as it will rely on significant levels of support and commitment from the government; as such it is difficult to reduce the significance of the impacts further through mitigation.

6.25 Increased Demand for Land and Natural Resources

The land loss associated with the Project infrastructure and compensation, in combination with the anticipated in-migration will result in significant demand for land. The area is already intensively used and the land on Ile Kabak is unique to this location in terms of productive potential.

The increased population will also place significantly higher demand on all other natural resources including water, firewood and fish. The natural resources are already strained and further uncontrolled exploitation could be detrimental to the resources as well as to the livelihoods of those already dependent on them. The increased demand for land and natural resources will occur for the duration of the construction and operation phase activities and will extend beyond the life of the project. The increased pressure will have a negative and direct impact on the local population and in-migrants. This impact will be one of **large magnitude**.

The extent of the impact will be experienced at the local level and the duration will be long-term to permanent. This impact will definitely occur given the anticipated immigration and already strained land and natural resources. Receptor **sensitivity** is **high** given the high levels of poverty, already strained resource availability and the lack of capacity to adapt without significant levels of intervention.

The impact will be of *critical negative significance*. The impact related to in-migration is indirect and will require partnerships with the government of Guinea to address. The degree of confidence in prediction is medium.

6.25.1 Mitigation Measures

The specific measures to be implemented as part of the MOF project are described in detail in the SEMP (*Annex D*). The 'In-migration' and 'Physical and Economic Resettlement' sections of the SEMP outline relevant mitigation measures including compensation of the local community for the land and resource losses due to the project, in accordance to the Resettlement and Compensation Policy Framework for Early Works (see *Annex F*).

6.25.2 Residual Impact

Following implementation of the above mitigation measures, it is possible that the impact can be reduced from critical to **moderate-major negative** significance. This impact will be more difficult for Simfer to manage as it will rely on significant levels of support and commitment from the government; as such it is difficult to attain a lower level of significance.

6.26 Changed Quality of Life and Social Dynamics

The levels and types of activity in the broader Ile Kabak are currently limited to mainly small-scale subsistence activities and a few commercial operations as described in the baseline section. These activities and associated social dynamics are organised and administered through traditional organisations and the village heads (including the 'chef de terre', and 'chef de port'), in consultation with village associations (e.g fisherfolk; fish smokers and youth) and other individuals considered as important stakeholders in the communities.

The project activities and impacts associated with the construction and operation of the MOF will result in many changes to the current way of life and the social dynamics in the area. These changes will be in the form of the direct Project activities (including the dredging, quay development on the Morebaya River,

construction and operation of lay down areas, rock quarrying and road widening, upgrade and construction) as well as the direct and indirect impacts associated with these. These will include increased traffic, noise, dust, safety impacts and general high levels of activity in comparison to the current way of life. The quality of life in terms of pace, nuisance impacts, exposure to risks and general level of activity is expected to change quite dramatically. The current inhabitants will be exposed to activities, nuisance factors and risks that they may not have previously encountered, bringing potential stress and discomfort to community members. This will be particularly significant for vulnerable groups such as the elderly, who are less likely to be able to adapt to the changes.

In addition to the general activities and associated impacts, the construction labour force, anticipated in-migration and swell in population will affect the existing social dynamics. The construction labour force is likely to come from other countries and/or other parts of Guinea, and are most likely have had experience and exposure to other countries, cultures and ways of operating. In addition, migrants from other parts of Guinea as well as neighbouring countries will introduce different social and cultural norms into the existing ways of life, lines of respect, authority and organisational structures. Although there has been a pattern of in-migration into Ile Kabak in the past over a period of several decades, the scale of inflow is expected to have an impact on these social dynamics as in-migrants bring in their own sets of values and expectations of authorities, with potential for disrespect for the existing *modus operandi*. Certain vulnerable groups may be particularly affected, such as young women, who may be easily influenced by these new ways of life. Should the authorities be unable to manage these changes in an appropriate way, conflicts may arise between locals and in-migrants, as well as amongst the in-migrants.

The changed social dynamics and increased conflict will occur for the duration of the construction and operation phase activities and is likely to extend into the life of the project. The changes to quality of life and social dynamics will have a negative and direct impact on the affected people and be one of **medium magnitude** given that it will likely affect all the communities, but with some positive effects as well as the negative ones.

The extent of the impact will be experienced at the local level and the duration will be medium to long-term as the activity associated with the MOF and then the ongoing activities of the project continue, also continuing to attract migrants into the area. The impact is likely to occur.

The **sensitivity** of the receptors is **low to medium** due to their previous exposure to migrants into the area. While some receptors may experience the changes to quality of life and social dynamics as a positive change, some receptors such as the elderly and some youth (females in particular) will be more sensitive to these changes than others and may struggle to adapt to these changes.

The impact will be of *moderate negative significance*, with some positive aspects. The degree of confidence in the prediction is medium.

6.26.1 Mitigation Measures

The specific mitigation measures to be implemented are described in detail in the 'Community Health, Safety and Security' and 'In-migration' sections of the SEMP (*Annex D*) which is appended to the SEIA. Mitigations identified within of the SEMP include avoiding or minimising and supervising interaction between workers and the local community, the provision of training and code of conduct to all workers and the development of a grievance mechanism.

6.26.2 Residual Impact

Following implementation of the above mitigation measures, it is possible that the impact can be reduced from moderate, to *minor negative* significance.

6.27 Pressure on Administrative Capacity (Government and Traditional)

Ile Kabak and its villages are administered through the political and traditional administrative structures as per the rest of Guinea. Services are administered through the Prefectures and Sub-Prefectures, and more locally the Rural Development Communities (CRDs) who have devolved decision-making powers and autonomy in terms of financial allocation for administration. Government services concerning health, livestock, fisheries, agriculture, women and young people exist, but are reported to have limited presence in the villages of Ile Kabak. As with other such institutions across Guinea there is a lack of institutional and organisational capacity, insufficient budgets and relatively poor management, exacerbated by low levels of education, poverty and literacy. The anticipated inflow of migrants attracted to the area as a result of the project will put additional pressure on the already constrained capacity of the government bodies to deliver services to the area. The budgets are already not sufficient to meet the peoples' needs for service delivery and infrastructure and the significant addition of project activities and administrative requirements, as well as the burden placed by in-migrants and associated impacts, will put severe pressure on this administrative capacity.

From a traditional and economic perspective, the head of the village is the 'chef de terre', and in fishing villages, also the 'chef de port'. There are also heads of concessions within the villages, who manage relationships between households and capital distribution, amongst other duties. There are also a number of associations for various activities such as fishing, fish smoking and the youth. These structures and organisations are currently respected by the members of the communities on Ile Kabak, and the societies function based on this organisational framework. The additional burden of the in-migrants and associated service and organisational requirements may lead to increasing ineffectiveness of these structures as they decreasingly represent the interests of the population.

The pressure on the administrative and organisational capacity to deliver will occur increasingly for the duration of the construction and operation phase activities and is likely to extend into the life of the project. The loss of capacity will have a negative and indirect impact of **medium magnitude** on the affected people. The extent of the impact will be experienced at the local level. The duration will be medium to long-term as the activity associated with the MOF and subsequently the ongoing activities of the Project continue to attract migrants into the area. The impact is likely to occur.

The **sensitivity** of the receptors is **medium to high** due to their existing limitations in capacity. The impact will be of *moderate to major negative significance*. The degree of confidence in prediction is medium to high.

6.27.1 Mitigation Measures

The specific mitigation measures to be implemented are described in detail in the 'Physical and Economic Resettlement' and 'Local Employment and Procurement' sections of the SEMP (*Annex D*). Measures include consultation with the communities and local administration.

6.27.2 Residual Impact

Following implementation of the above mitigation measures, it is possible that the impact can be reduced from moderate to major to *moderate to minor negative significance*.

6.28 Cultural Heritage

This section presents a summary overview of the potential impacts of the proposed port and associated roads on cultural heritage. In particular, it considers impacts of the proposed scheme on:

- recorded tangible cultural heritage features;
- other tangible cultural heritage features; and
- intangible cultural heritage.

Key features of the development that have the potential to affect cultural heritage will be the large amount of earth works and overall footprint of the site and associated roads, the change in the character of the landscape and the changes in potential for access to sites or areas of importance.

Other proposed changes in the area which are potentially of significance are the increased level of background noise and change in noise character of the area.

6.28.1 Impacts - Overview

All sites, known or unknown are likely to be impacted physically by the Project, where ground-disturbing activities are undertaken. The extent of the impacts will depend on the proximity of the site to the Project area and whether it falls directly within the Project footprint.

Impacts could include direct disturbance of a site or indirect damage from physical impacts by construction equipment and vehicles or vibration from the passing of large construction vehicles. Although mitigation of cultural heritage impacts is possible, Project impacts to archaeological resources would be irreversible. The most likely causes of impacts are excavation and grading with mechanical equipment, both of which are essential to construction processes.

For sites that have above ground or built components, as well as historic and archaeological sites with visible landscape components or intangible cultural values attached to them, impacts from both construction and operation of the MOF and associated roads are listed below:

- damage to sensitive and fragile sites from vibration and ground effects from construction equipment and traffic;
- reduction in the amenity and attractiveness of sites of recreational, touristic or cultural importance;
- change in the setting and physical context of a site, building or monument;
- increase in noise, air pollutants, soiling, dust and human traffic in the vicinity of a site; and
- potential disruption of access of local populations to living cultural heritage sites.

Sites lying outside of the Project footprint are not likely to be directly impacted, as ground disturbance in the wider area will be limited. Indirect impacts to both tangible sites and intangible cultural heritage are likely, resulting from the influx of outside populations into the Project areas. Potential impacts include human interference with previously undisturbed archaeological sites and a shift in local traditions in response to immigration.

Known sites located in the wider Project area that could be affected include the Giant's hand and foot print (see *Figure 6.10*) that are located on the coastal rock outcrop immediately north of the proposed quay. The importance of these sites to local communities is not known. The rock outcrops in themselves may also be important in cultural traditions and customs of local communities. The proximity of these features to the MOF site and the proposed quarrying of the main rock outcrop with unknown cultural value to local communities suggest a large magnitude impact.

No known cultural heritage sites have yet been identified within the MOF site perimeter and within the road corridor, however future stakeholder consultation with communities will seek to identify and investigate such sites.

Taking a conservative approach, the unmitigated impacts to cultural heritage could permanently impact a **sensitive** resource of local to nationally significant importance, resulting in adverse impacts that are considered of *major significance*.

6.28.2 Mitigation Measures

The 'Cultural Heritage' section of the SEMP (*Annex D*) outlines planned mitigation measures including development of a Chance Find Programme which will be implemented in order to address construction phase heritage impacts in accordance with Guinean law and international standards.

6.28.3 Residual Impacts

Wherever a cultural heritage site can be physically avoided by design or planning of construction activity, this approach should be adopted to leave the resource intact and accessible to visitors. Visitors include local people, cultural and scientific researchers who study archaeological sites and historic architecture, and national and international tourists who may visit the Project area and its surrounding region to appreciate its historic sites and character. Depending on the degree to which actual damage to cultural heritage can be avoided, the residual impacts to cultural heritage will still be of *moderate* to *major significance*.

The most likely residual impacts will come from:

- Mitigation of impacts to known archaeological or built heritage by removal, as removal cannot achieve the same level of preservation as avoidance.
- Archaeological chance finds, as these will require management by study and rapid removal, where appropriate. An asset management plan should be prepared for each find detailing the management to be undertaken.
- Partial destruction of resources due to unavoidable lapses of contractor control or failure to recognize chance finds in a timely manner.
- Disruption of traditional customs and beliefs that are closely linked with the land lost to the Project or that are prone to the effects of in-migration.

6.29 Landscape, Seascape and Visual Resources

6.29.1 Impacts - Overview

Significant impacts will arise in the landscape of the site and immediate surrounding area. The main direct impacts on landscape are as follows:

- Displacement of an area of undeveloped land to accommodate the footprint of the proposed quay and laydown area and road infrastructure.
- Displacement of an area of estuary to accommodate the edge of the port and mooring area.
- Large scale changes to the topography of a rock outcrop as a result of the proposed quarrying activities.

Changes to the character of the receiving landscape and seascape will arise as a result of the visibility of the proposals or indeed proposed changes from the surrounding area. These include:

- Loss of local hill rock outcrop which was formerly a landmark and point of reference for viewers in the area. This will alter the character of the local landscape.
- Visibility of moving vessels at the port and along the estuary and coastline. This will alter the character of the estuary and receiving seascape.
- Introduction of the MOF quay, buildings, new road and laydown area.

In addition to the above, there is potential for changes or impacts to landscapes or landscape features of a cultural heritage value. For instance in the Mande tradition in Guinea, locations which represent nodes of

intense spiritual power or features such as hilltops are deemed sacred. It is not known whether specific locations in the landscape of the site and surrounding area hold such cultural significance.

To local communities, the apparent change of landscape character may also be viewed as a positive impact because of the perception that the transformation of landscape preludes an era of economic development and prosperity in the area.

The landscape of the site and surrounding area is considered to be of **high sensitivity** to the proposed change. It is a scenic, rural landscape with little man made development. It is a visually open landscape and apart from some vegetation cover, it has little capacity to absorb large scale developments without its character becoming significantly altered.

This assessment of sensitivity applies to the landscape and viewers around the site extending to at least 3.5 km. Beyond this distance, vegetation cover serves as a visual screen. Further west, the seascape of the estuary and coastline is by nature visually exposed.

The direct and indirect changes are expected to cause a **large magnitude** of change to the character of the receiving landscape and seascape resulting in an impact of *major significance*. Similarly a **large magnitude** of change is expected for viewers living and working in the immediate area resulting in an impact of *major significance*.

6.29.2 Mitigation measures

The specific measures to be implemented as part of the MOF project are described in detail in the SEMP which is appended to the SEIA (*Annex D*). The 'Landscape, Seascape and Visual Resources' section of the SEMP outlines mitigation measures designed to minimise the impact of its installations through material selection, painting, lighting and tree planting. Access to areas of cultural or special significance to local communities should also be maintained through the use of suitable fencing and alignment of roadways for the facility.

6.29.3 Residual impact

The mitigation measures will to some extent alleviate the impact, but they cannot replace the landscape features that are lost. From this perspective, the residual impact is still considered of **major significance**.

6.30 Cumulative Impacts

Cumulative impacts are impacts that may arise when other activities and known or committed developments take place in the area of the Project at the same time. Within short distance of the proposed MOF location, there are no other major projects foreseen during the period of construction and initial 3 years of operation. However, there is some overlap with a separate early works component of the Simandou Project, the temporary camps and logistic supply centres, which are planned further inland. During the operation period of the MOF, construction will also commence at other sites that are part of the overall Simandou Project. There will be extensive movements of vehicles, people and materials between the MOF and these other sites. The impacts of the temporary camps and logistic supply centres are assessed in a separate ESIA and are in an area purposely distinct to that covered by this ESIA in order to avoid cumulative impacts. As such no cumulative impacts with the temporary camps and logistic supply centres SEIA are predicted. Construction of roads and traffic between the MOF and the overall Simandou Project port and stockyard area are considered intrinsically within this chapter.

Another mining company, Forécariah JV (with participation of Bellzone Mining PLC and Guinean Development Corporation), is developing an iron ore concession in the Forécariah district. Current understanding is that this development is unlikely to interfere with the MOF and its associated road network, therefore cumulative impacts are not predicted.

In-migration is intrinsic to the Project, is discussed inherently within this chapter and is not considered a cumulative impact.

Annex A

Study Team

A1 SEIA Study Team

Topic	Name	Organisation	Role/ Title	Qualifications	Years
Project management	Karen Raymond	ERM	Project Director and Environmental Impact Lead	BSc Chemistry MSc Environment and Pollution Control IEMA Principal EIA Practitioner IEMA EIA Practitioner Examiner	38
	Sabine Hoefnagel	ERM	Social Impact Lead	Masters in Law University of Amsterdam Masters in Law, University of New York	15
	Richard Fontaine	SNC-Lavalin	Baseline Study Team Director	BSc.A. (Forest Eng.), L.L.B. (Law), M.B.A	21
	Robert Auger	SNC-Lavalin	Baseline Study Team former Project Manager	BEng., MSc.A. (Civil Eng.)	21
	Libby Schroenn	ERM	SEIA Social Lead	BE Economics, Industrial Psychology BCom Economics, Environmental Economics	15
	Alec Martin	ERM	SEIA Environment Lead	BSc Geography Hons Physical Geography MSc Sustainable Management of Water Environment	10
	Colin Maciver	ERM	Project Manager	MA Environmental Planning	4
Mine Team	Peter Southern	ERM	Component Director	B. Sc Murdock University	30
	Camille Maclet	ERM	Component Manager	MEng Environmental and Earth Resources Engineering	15
Rail Team	Eamonn Barrett	ERM	Component Director	BA Anthropology PhD Tropical Ecology	25

Topic	Name	Organisation	Role/ Title	Qualifications	Years
	Sarah Dewsbury	ERM	Component Manager	BA Geography MSc Coastal Zone Management	10
Port and Marine Offloading Facility Team	Maarten Kuijper	ERM	Component Director	MSc Marine Biology MSc Tropical Coastal Management	19
	Alec Martin	ERM	Component Manager	BSc Geography Hons Physical Geography MSc Sustainable Management of Water Environment	10
Early works and Infrastructure Team	Caroline Kennedy	ERM	Component Manager	BSc Environmental Science MSc Environmental Management	6
Social Impact Specialists	Philippa Spence	ERM	In-Migration	BA Social Anthropology and English BA Hons Social Anthropology PDM Human Resources	10
	George Koppert	SNC-Lavalin	Social Baseline	BSc Maths applied to Social Sciences MSc Human Nutrition and Applied Statistics PhD Anthropology	14
	Catherine Sabinot	SNC-Lavalin	Social and Fishers	BSc Biology of Organisms MSc Environmental Science PhD Ethanoecology	12
	Mark Divall	SHAPE Consulting Ltd	Health	MB, ChB PG diploma in Anaesthesia PG diploma in Occupational Medicine and Health	14

Topic	Name	Organisation	Role/ Title	Qualifications	Years
	Graeme Rodgers		In-Migration	B.A. (Hons) Social Anthropology and Psychology M.A. Social Anthropology Ph. D Social Anthropology	15
	Callie Phillips	ERM	Health, Safety and Security Lead	B. Med.Sc Medical Science MSc Epidemiology	5
	Michael Hall	ERM	Land Use, Impact Assessment	BSc Zoology MSc Environmental Technology	4
Socio-economics	Kerryn McKune Desai	ERM	Socio-economic	B.Soc.Sc Environmental & Geographical Science, Social Anthropology, Archaeology B.A Hons Environmental & Geographical Science MA Geography of Third World Development	10
	-	Cabinet AMERA	Environmental and socio-economic expertise	-	-
	-	LA Granada Enterprises Inc.	Social sustainable development	-	-
	Susan Novak	SNC-Lavalin	Baseline Socio-economist	MEDes, B.Arch., B.A. (philosophy)	25
	France Séguin	SNC-Lavalin	Socio-economic Baseline	Master (International Development), B.A. (Communication)	20
	Julie Forget	SNC-Lavalin	Socio-economic Baseline	M.A.(Development Economics), B.Eng.(Industrial Eng.)	15
	Caroline-Anne Perreault	SNC-Lavalin	Socio-economic Baseline	M.Sc.(Urban Studies), B.A.(Geography)	10
	Brigitte Ditner	SNC-Lavalin	Socio-economic Baseline	Ph.D. (Sociology)	35

Topic	Name	Organisation	Role/ Title	Qualifications	Years
	Fodé Mamadou Camara, Dantily Diakité, Amadou Diallo, Maïmouna Diallo, Mady Diawando, Mohamed Lamine Dioubaté, David Niéréké , Niabalamou, Massa Guilavogui Abdoulaye Ibrahima Touré, Augustin Sakouvogui	SNC-Lavalin	Baseline Sociologist	Various	
Geology, Hydrology, hydrogeology	Mark Raynor and Peter Baur	Water Management Consultants (now Schlumberger Water Services (SWS))	Development, management, and environmental protection of water resources	Various	
	Peter Southern	ERM	Soils and Geology	BSc Murdock University	30
	Hugo Marais	ERM	Groundwater and Hydrogeology	BSc Geology, Zoology BSc (Hons) Hydrogeology MSc Geology	10
	Tim Smith	ERM	Inland freshwater	BSc Physics MSc Engineering Hydrology CEng Chartered Engineer	22
Marine Environment	Maarten Kuijper	ERM	Marine Environment	MSc Marine Biology MSc Tropical Coastal Management	19
	Alec Martin	ERM	Marine Biodiversity	BSc Geography Hons Physical Geography MSc Sustainable Management of Water Environment	10
Noise	Rod Linnett	ERM	Noise and Vibration	Mech eng associate diploma	18
	Claude Chamberland	SNC-Lavalin	Noise Baseline	B.Sc., M.Sc. (Mechanical Eng.)	21
Air Quality	Chris Hazel-Marshall	ERM	Air Quality	BSc Environmental Risk Management Ph.D Air pollution and cardiovascular health effects	13
	Alexandre Couture	SNC-Lavalin	Air Quality and Noise	-	-

Topic	Name	Organisation	Role/ Title	Qualifications	Years
Climate	Kate Fradley	ERM	Microclimate	BSc Physics with Satellite Technology MSc Applied Meteorology	1
	Karen Fisher	ERM	GHG and Global Climate	BSc (Hons) Biology MSc Aquatic Resources Management Postgraduate certificate Environmental life cycle management	8
Biodiversity	Eamonn Barrett	ERM	Biodiversity	MA, PhD	25
	Beth Seldon	ERM	Terrestrial/ Freshwater Biodiversity	BSc Wildlife Biology MSc Wildlife Conservation and Management	4
	Helen Temple	The Biodiversity Consultancy	Biodiversity Specialist	BSc (Animal & Plant Biology), Sheffield, 1st class PhD (Zoology), Cambridge	16
	Véronique Tuffeli	SNC-Lavalin	Biologist	B.Sc., M.Env. (Biology)	28
	Jonathon Ekstrom	The Biodiversity Consultancy	Biodiversity	B.Sc, M.Sc	12
	Chantal Roy	SNC-Lavalin	Biodiversity Specialist	B.Sc. (Biology)	24
	Dominique Auger	SNC-Lavalin	Biologist	B.Sc, M.Env. (Biology)	10
Specialist information on biodiversity provided by individual scientists					
Amphibian and reptile	Christian Brede	University of Würzburg, Experimentelle Stammzell		PhD	-
	Annika Hillers	Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam		-	-
	Mohamed Alhassane Bangoura	Programme de conservation de la biodiversité des Monts Nimba		-	-
	Joseph Doumbouya	Centre d'Etude et de Recherche en Environnement (CERE), Université de Conakry		-	-

Topic	Name	Organisation	Role/ Title	Qualifications	Years
	Eli Kpogomou	Centre de Gestion de l'Environnement des Monts Nimba et Simandou (CGENS)		-	-
	Kaman Camara	SNC-Lavalin	Herpetofauna Specialist	-	-
	Bernard Doré	Programme de conservation de la biodiversité des Monts Nimba		-	-
	Gaspard Théa	SNC-Lavalin	Herpetofauna Specialist	-	-
Freshwater Fish	Philippe A. Lalèyè	Faculty of Agriculture Sciences University of Abomey-Calavi		Diploma (Agronomy)	22
	Mambi Magassouba	Centre National des Sciences Halieutiques de Boussoura (CNSHB)		M.Sc. (Ichthyology)	29
	Sékou Camara	Centre National des Sciences Halieutiques de Boussoura (CNSHB)		-	-
Flora	Martin Cheek,	Royal Botanic Gardens, Kew		B.Sc (Hons), M.Sc, D.Phil	20
	Susana Baena, Yvette Harvey, Xander van der Burgt, Charlotte Couch, Laura Pearce, Iain Darbyshire, Sharon Laws	Royal Botanic Gardens, Kew		Various	
	Barthelemy Tchiengue, Gaston Achoundong	Herbier National Camerounais		Various	-
	Martin Etuge	Conservation Research on Endangered Species (CRES)	-	-	-
	Elias Ndive	Limbe Botanic Garden	-	-	-
	Jean-Louis Holié, Nicolas Delamou	N'Zérékoré Forestry Center	-	Various	-

Topic	Name	Organisation	Role/ Title	Qualifications	Years
	Thomas Williams Seydou Cissé	Rio Tinto Environment Department	-	Various	-
	Alphonse Traoré, Fatoumata Fofana, Pépé Haba, Pierre Haba	Guinée Écologie	-	Various	-
	Boubacar Diallo	Herbier de Séré	-	--	-
Use of Natural resources	Watta Camara	N'Zérékoré Forestry Centre		-	-
	Salim Kouyaté	N'Zérékoré Forestry Centre		-	-
Ecosystems Services	Emily Cooper	ERM	Ecosystem Services	BA Biology MSc Environment and Development	7
Landscape	Peter Austin	ERM	Landscape and Visual Impacts	BSc Urban and Regional Planning, Landscape Architecture Graduate Diploma Landscape architecture, Masterplanning. Urban Design	30
Cultural Heritage	Doug Park	ERM	Cultural Heritage	B.Sc, PhD	10
	Djibril Tamsir Niane	SNC-Lavalin	Historian	-	-
Legal Framework	Monya Pelchat	SNC-Lavalin	Environmental Analyst	B.Sc.A, B.A., M.Sc. (Civil Eng. & Geographer)	15
	Laurent Lopez-Parodi	ERM	Government Relations	L.L.M. (Law)	8
GIS	Ingrid Gjrov	ERM	GIS Manager	B.Sc Planning for tourism and area analysis M.Sc Urban Planning	4
	Christian Laliberté, Laurence Bathalon, Mélanie Dupré, Christian Laroche, René Aubut	SNC-Lavalin	GIS Specialists	Various	

Annex B

Policy, Administrative & Regulatory Review

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B1 Introduction

This annex sets out the legal and administrative context for the Project, including brief summaries of selected legislation and standards concerning environmental and social issues that may be applicable. It does not seek to provide comprehensive details of all relevant Guinean legislation.

Simfer, as part of the Rio Tinto Group, through its application to construct and operate the Project, is committed to meeting the spirit and intent of a number of international, national, provincial policies, guidelines, laws and regulations. These include the following.

- Internal Corporate mandates, policies and best practices commitments;
- Guinean legislation and regulations including all necessary permits and approvals;
- International law;
- IFC Performance Standards; and
- Good International Industry Practice (GIIP) that helps define leading industry practices.

This regulatory and administrative framework is described in the following sections, along with the targets for environmental and regulatory compliance and a summary of the status of project permitting.

B2 Corporate Commitments

Rio Tinto is a world leader in finding, mining and processing the earth's mineral resources. Key Rio Tinto operating principles include protecting the health & safety of its employees, contributing to sustainable development and conducting business with integrity. Rio Tinto aims to work closely with host countries and communities, respecting their laws and customs and ensuring a fair share of benefits and opportunities ⁽¹⁾. Rio Tinto's reputation for acting responsibly is embedded in the way Rio Tinto operates and is based on Rio Tinto's core values of Accountability, Respect, Teamwork and Integrity. These values are expressed through the principles and standards of conduct set out in *The Way We Work*. These define the way Rio Tinto manages the economic, social and environmental challenges of its operations and are important to fulfilling Rio Tinto's commitment to contribute to sustainable development. The key principles set out in *The Way we Work* can be summarised as follows.

- **Safety-** We are committed to an incident and injury free workplace. Our Goal is zero harm.
- **Health-** We are committed to protecting health and wellbeing.
- **Employment-** We respect the right and dignity of employees throughout our own operations and those of our business partners.
- **Drugs and alcohol impairment-** We must not possess or consume illegal drugs, or be impaired by alcohol or drugs, while working on Rio Tinto business or premises.
- **Security and business-** We are committed to protecting our employees, assets and reputation, and ensuring the resilience of our operations when confronted by crises, site disasters or any instance that might affect business continuity.
- **Human Rights-** We support and respect human rights consistent with the Universal Declaration of Human Rights and actively seek to ensure we are not complicit in human rights abuses committed by others.
- **Communities and indigenous peoples-** We set out to build enduring relationships with our neighbours that demonstrate mutual respect, active partnership, and long-term commitment.
- **Land access-** We seek to get the widest possible support for our proposals throughout the lifecycle of our activities.
- **Environment-** Excellence in environmental performance and product stewardship is essential to our business success.

As the developer of the Simandou Project, Simfer will abide by the Rio Tinto values and will comply with *The Way We Work*. In abiding by these values and by complying with *The Way We Work*, Simfer is committed to the sustainable development of Guinea and its people and aims to protect and develop Guinean's environmental resource and its people over the long term. Simfer is committed to the health & safety of its employees and the wider communities on which its activities will have an impact.

Simfer intends to implement systems for managing environment, health and safety and community issues across the Simandou Project based on corporate principles embedded in *The Way We Work*. Simfer will develop the capabilities and support mechanisms necessary to administer its social and environmental management plans. Implementation will be based on raising the level of awareness of social and environmental requirements, expectations, and benefits throughout the Project. Health, safety, environmental and community protection and development are amongst the highest Project priorities.

(1) Rio Tinto, "*The Way We Work*", our global code of business conduct; December 2009

In addition to *The Way We Work*, Rio Tinto also supports a number of international voluntary commitments, agreements and conventions as follows.

- Extractive Industries Transparency Initiative
- Global Sullivan Principles of Social Responsibility
- International Chamber of Commerce Charter for Sustainable Development
- International Council on Mining and Metals Sustainable Development Framework
- International Labour Organisation (ILO) Declaration on Fundamental Principles and Rights at Work
- International Labour Organisation Convention 169: Concerning Indigenous and Tribal Peoples in independent Countries
- Kimberley Process
- OECD Convention on Combating Bribery of Foreign Public Officials in International Business Transactions
- OECD Guidelines for Multinational Enterprises
- Transparency International
- Business Principles for Countering Bribery
- United Nations Global Compact
- United Nations Universal Declaration of Human Rights
- Sources Voluntary Principles on Security and Human Rights
- World Economic Forum- Global Corporate Citizenship Initiative CEO Statement
- World Economic Forum- Partnering Against Corruption Initiative (PACI)
- Principles for Countering Bribery.

Rio Tinto has taken into the above into account when setting out its proposals for the Project.

B3 Guinean Government and Administration

B3.1 Government Structure

The Government of Guinea is lead by a president elect for five year terms. Presidential candidates must receive a majority of the votes cast to be elected president and it is possible for the president to be elected for a second term. Once a winning candidate has been announced, The President appoints a Prime Minister who nominates 33 ministers who form the government. Alongside the elected President, the system requires that the Minister of Defence and Commander in Chief of the Army jointly lead the government for the duration of the term.

In March 2010, a 155 member National Transition Council (CNT) was appointed and has since acted as the national legislature. CNT members come from a diverse background, including academics, opposition party members, trade unionists and representatives of civil society groups. Legislative elections are scheduled for December 2011 and will see the CNT dissolved and new government created.

Guinea operates a civil law system based on the French model. It accepts the International Criminal Court systems and implements International Court of Justice requirements with reservations. The most recent constitution is dated 7 May 2010.

Guinea has a hierarchal system of government delivered through eight Regions, each led by a Governor and 33 Prefectures and 1 'special zone' (Conakry) each prefecture led by a Prefect supported by a council of appointed ministers. The prefectures are subdivided into 335 sub-prefectures. There are also 33 Urban Districts (*Communes Urbaines*) headed by elected mayors and 304 Rural Development Communities (CRDs *Communautés Rurals de Développement*) headed by elected presidents.

B3.2 Institutional Framework

The government has established a number of Ministries led by appointed Ministers and Ministers of State. Each Ministry delivers and implement specific responsibilities on behalf of The President. The Ministers have the authority to issue consents for development which relate to their administrative areas The key Ministers who may be involved in regulation and granting permits and other approvals relevant to the Simandou Project include, but are not limited to, the Ministers of Mines and Geology, Environment, Territorial Administration and Decentralisation Habitat, Urbanism and Construction, Health and Public Hygiene, Transport and Agriculture.

B4 Legislative Framework Applicable to the Project

B4.1 Environmental Legislation and Policy

The Code for the Protection and Development of the Environment, Ordinances 045/PRG/87 and 022/PRG/89 (also known as the Environmental Code) establishes the administrative and legal framework in Guinea to enable the Guinean State to deliver on its constitutional obligation to provide for a clean and healthy environment to every person in Guinea.

The Environmental Code is the cornerstone of environmental protection in Guinea and sets out the fundamental legal principles to be complied with to ensure the protection of environmental resources and the human environment.

Title I sets out the general principals applicable in relation to environmental protection in Guinea and sets out the administrative structures in charge of administering environmental protection activities in Guinea and provides that the Ministry for natural resources, energy and the environment is the key administrative institution for the protection and management of environmental resources in Guinea. The Act creates a National Committee to help the Ministry in formulating the national policy for environmental protection. Title II provides for the protection of specific resources such as the soil and sub-soil; inland waters; the sea and its resources and the air.

Title III provides for the protection and valorisation of environmental resources and the human environment. Title IV deals with nuisance and covers a broad range of topics. Chapter I deals with waste management; of particular interest Article 60 provides that waste must be treated to eliminate or reduce the negative impacts on human health, natural resources, fauna, flora and the overall quality of the environment. Article 66 provides that wastewaters and other liquid wastes originating from industrial or commercial installations such as quarries or mines must be treated by physical, biological or chemical means before being disposed of. Chapter II deals with installations requiring an environmental permit (also known as classified installations) and provides that these installations must obtain a permit before construction or operation commences. This permit is delivered jointly by the Ministry of Environment and the Ministry of Industry and Small and Medium Enterprises. Chapter III deals harmful or dangerous chemical substances and Chapter IV deals with noise and odour nuisance.

Title V provides for the administrative procedures and financial arrangements applicable in Guinea. Chapter I establishes the procedure for environmental impact assessment. Article 82 sets out that the developer or the project manager must submit an environmental impact study to the relevant regulatory authority for projects, structures or installations that may, by their size or the nature of their activities, have an impact on the environment. Article 83 of the Environment Code provides for a Ministerial Decree to set out a list of activities that may require an environmental impact study and also provide for a Ministerial Order to provide the content, methodology and the procedure to follow in relation to the environmental impact study. Article 83 provides, however, that the study must include a baseline assessment of the site and the environment the proposed development will be located in; an assessment of the foreseeable impacts that the Project/development may have on the natural and human environment; a synopsis of the mitigation measures proposed by the developer to eliminate, reduce or compensate the negative impacts that the Project may have and an estimate of the costs associated with these measures. A description of the alternatives and the reasons why, from an environmental protection perspective, the Project envisaged was selected. Chapter II of Title V deals with emergency plans and Chapter III provides for a financial fund dedicated to environmental protection.

Title VI deals with offences and penalties and Title VII deals with miscellaneous arrangements.

B4.2 Environmental Planning and EIA Legislation

Article 82 of Title V of the Environmental Code (Ordinances 045/PRG/87 and 022/PRG/89) sets out that the developer or the project manager must submit an environmental impact study to the relevant regulatory authority for projects, structures or installations that may, by their size or the nature of their activities, have an impact on the environment. Article 83 of the Environmental Code then provides for a

Ministerial Decree to set out a list of activities that may require an environmental impact study and also provide for a Ministerial Order to provide the content, methodology and the procedure to follow in relation to the environmental impact study.

Presidential Decree 199/PRG/SGG/89, made under Article 82 of the Environmental Code, sets out the projects which require an environmental impact assessment (EIA) study ⁽¹⁾. This is a framework Decree in relation to EIA. It sets out the projects that require an EIA and the content of the EIA study. Simfer activities that are likely to fall under the scope of the EIA Decree include the construction and/ or development of harbours; mining and quarrying activities; construction of airports, railway lines and roads; and all sites that would be classified as a Class I classified installation.

Order 990/ NRNE/SGG/90, made under Art 7 of Decree 199/PRG/SGG/89, establishes the content, methodology, and procedures to be complied with when carrying out an environmental impact assessment. This Order sets out that the Environmental Impact Study must have five sections:

- The first section must summarily describe the Project including its aim(s); geographical location; estimated build costs; the date the investment decision was made and the timeline for the Project.
- The second section should describe the baseline of the site and the surrounding environment, concentrating especially on the aspects that may be affected by the Project such as sites, natural resources, landscapes, and the socio-economic and cultural landscape of populations). Topics to be covered in relation to the Project include geology and pedology; hydrogeology; hydrology; fauna and flora; landscape and visual; air pollution and noise/ odour nuisance; traffic and infrastructure; social and socio-economics.
- The third section should assess the impacts of the Project on the environment in respect of, in particular, landscape and visual; fauna and flora, the natural environment and biological interactions and, if applicable, nuisances (noise, vibration, odour etc); on public hygiene and the cultural heritage.
- The fourth section sets out the reasons why, especially from the point of view of the protection of the environment, the Project, in its present form, has been selected. In particular, this section should address the selection of the site and the selection of the various production processes that have been chosen.
- The fifth section details the measures envisaged by the developer to eliminate, reduce, or mitigate the negative impacts of the Project, including cost estimates to put these measures into action.

Environmental impact studies that do not provide sufficient details in the sections detailed above will be required to justify and explain the gaps by citing the costs or technical implications that would be involved in closing these gaps as per Art.3 and 4 of Decree 199/PRG/SGG/89. The National Directorate for the Environment may however, in compliance with Art.4 of Decree 199/PRG/SGG/89 request additional submissions to be made to complement the environmental impact study.

Article 9 of Order 990/ NRNE/SGG/90 provides for the publicity arrangements depending on whether the Project is to be (or not) subjected to a public enquiry.

Chapter II of Order 990/ NRNE/SGG/90 deals with the procedure relating to the environmental impact study. Article 10 states that all environmental impact assessment studies must gain the approval of the Environmental Minister (on the recommendation of the National Directorate for the Environment) within three months or within the timeline fixed by other relevant legal texts as necessary. Article 11 provides for work to be suspended by Order of the Environment Minister if an environmental impact assessment study has not been submitted or if the procedure for submitting such a study has not been complied with. Article 12 establishes the role of the National Directorate for the Environment in ensuring that mitigation measures presented in the environmental impact study and agreed upon in the planning Order are complied with.

(1) Note that this assessment is entitled a Social and Environmental Impact Assessment and is designed to meet the Guinean requirements for EIA and also IFC and Rio Tinto corporate policies requiring consideration of social as well as environmental issues.

B4.3 Interaction between Environmental Planning and Permitting Legislation

Presidential Decree 200/PRG/SGG/89, made under Article 73 of the Environmental Code, on the Regulatory Regime for Classified Installations in relation to the Protection of the Environment sets out the administrative and financial provisions applicable to classified installations. Classified Installations are installations which by the nature of their activities or the actual volume of activities undertaken require permitting under Guinean environmental legislation.

Order 03/8003/PRG/SGG lists all industrial activities which fall under the scope of Decree 200/ PRG/SGG/89 and for which an integrated permit is required. This Order sets, for each industrial activity, thresholds that reflect the level of potential harm arising from the activity and for which different obligations will apply. Industrial sites are classified as Class I or Class II sites depending on the level of harm to the environment.

Simfer activities that may potentially fall under the scope of the classified installation regime include vehicle maintenance workshops (category 23); any activities involving the crushing, screening of rocks or mineral or associated activities (category 29); treatment of waste including land filling of waste or incineration of waste (category 42); the storage of explosives (category 45); the storage of heavy fuel (category 49) and/ or LPG (category 50); the storage of fuel (59 to 62); the washing of minerals (category 65).

Article 2 of Presidential Decree 200/PRG/SGG/89 provides that the owner or the operator of a classified installation must request its environmental permit at the same as its building permit. A building permit will need to be obtained prior to the construction of any building as per Article R221-1 of the Urban Development Code. However, a building permit can only be obtained only after the environmental permit for a classified installation has been obtained.

B4.4 Land Law and Policy

There are a number of Guinean laws applicable to the Project that control the use of land and the built environment. The role of land law legislation in Guinea is three fold:

- Ensure that environmental protection is considered at the level of policy making. These plans set the basic ground rules for action on the environment in any particular area. These plans are generally drafted at the national and/ or regional levels and must be read in conjunction with central government policy documents;
- Ensure control over the development process through the use of planning permission/ building permit which needs to be obtained from the local planning authority before development can take place. In most instances, a building can only be obtained if the authorities have given a positive decision to the development through the environmental impact assessment process; and
- Ensure environmental protection through the use of conditions, agreements etc. related to environmental protection on a grant of planning permission/ building permit via, for example, the need to obtain an environmental permit (also known as a classified installation permit) before production can begin.

The Urban Code (Law L/98 No 017/98) sets out that the Guinean State is responsible for the management and development of the national territory. This control is exercised through the national land development plan (also known in French as the *Schéma National d'Aménagement du Territoire-SNAT*) and the Regional Development Master Plans (*Plans Directeurs d'Aménagement Régionaux, PDAR*), which provide the different level of governments with the tools to influence development at a policy making level.

In addition to the Urban Code, the Guinean Government has published the Declaration of Land Policy in the Rural Environment (Decree D/ 2001/037/PRG) which is aimed at promoting rural economic and social development by securing rural land rights and rules in favour of agricultural development, improving sustainable resource management, and allowing the development of a transparent and equitable land market. This Decree is the strategic framework for rural land management.

At a local level, the Code on Local Government, which provides for the decentralisation of powers from Central Government defines the local communities' competencies, missions, domain and assets as well as the boundaries for community intervention. This Code defines the local communities' roles and responsibilities in land use management. The local council must give its opinion prior to every investment projects and all soil occupation / exploitation. Local communities share with the State the responsibility for land use management.

The cornerstone of property rights in Guinea is the Fundamental law of the Republic of Guinea which proclaims that the right to own property is guaranteed. This law expressly recognises the right to private property ownership in Guinea. With regards to expropriation, it states that: "no one can be expropriated if it is not for the wider public interest and only if it is accompanied by fair and prior compensation."

The Land Code (L/99/013/AN) sets out the over-arching legal framework that sets out the rules applicable to land in Guinea. It reinforces and underlines the right of private ownership in accordance with the general principle set forward by the Fundamental law. The Land Code primarily deals with registered properties and provides for the registration of properties through the use of titles, leases and deeds. It defines two land registration procedures:

- Through the land ownership plan: it is a simple administrative document, not in itself a property title, which is held at the urban municipality level for towns and at the rural development community level for rural areas; and
- Through the land ownership registration: this results in the deliverance of a full ownership deed and the document will be held by the land ownership conservation service.

In practice, these land registration procedures have not been comprehensively implemented in rural areas. Although most of the Land Code provisions relate to registered property, Article 39 can be interpreted as recognising customary rights. It defines land owners as physical persons or legal entities that can demonstrate peaceful, personal, continuous (in excess of thirty years) and bona fide occupation of a dwelling as an owner.

The Land Code also sets out provisions for expropriation in the public interest. The Land Code does not however provide detailed provisions with regards to the level of compensation over and above the general principal of fair compensation set out in Article 55. Article 69 also states that: "compensation must cover the whole of the quantifiable and known loss incurred as a direct result of the expropriation".

The Land Code also provide for the need to obtain a building permit before building occurs.

B4.5 Mining Legislation and Policy

Law L/95/036/CTRN of 30 June 1995 relating to the Mining Code of the Guinean Republic, and subsidiary legislation made under this law, establishes the legal framework relating to the ownership and rights to minerals and covers prospection, exploration, exploitation, storage, transport, commercial exchange and transformation of mineral substances and the tax system associated with these activities. Liquid and gaseous hydrocarbons do not fall under the scope of this Law.

Article 16 of the Mining Code sets out that mining or quarrying activity must be undertaken in an environmentally friendly way in compliance with the requirements of the Environmental Code. Firms must take necessary measures to prevent pollution of the environment; treat waste, emissions to air and discharges to the environment; protect forests and water resources.

The Mining Code also sets out requirements, in Chapter II on health & safety at work, applicable to the health & safety of workers (see *Section 2.4.8*).

Article 11 of the Mining Code on Mining Conventions provides that a mining convention will be drawn for all mining permits and mining concessions. This document will set out the rights and obligations of all parties

participating in a mining project and will set-out the legal, financial and fiscal and social framework applicable to these parties for the duration of the Convention.

Rio Tinto signed with the Government of the Republic of Guinea a framework mining convention on the 26th November 2002. This Convention provides the legal, administrative, financial, tax and customs and social framework in which Simfer will be able to carry out its research and prospection activities within the limits of its exploration concession in order to determine the presence of iron ore that may be exploited on a commercial basis. This Convention provides for Simfer activities to include iron ore concentration and transportation activities with a view to allow the efficient workings of the iron ore and allows for Simfer to set-up and manage the necessary heavy infrastructure for the transport and onward distribution of the iron ore. This Convention also sets out the general and business conditions under which the Project will be undertaken. This Convention is established under the Mining Code and deals with iron ore.

This Convention will be, alongside the Mining Code, the primary legal instrument that will regulate Simfer early work activities in relation to the Simandou Project. Article 37 of this Convention deals with the protection of the environment and cultural heritage and provides that Simfer must comply with the applicable Guinean environmental, health & safety, security and well-being legislation and international best practices as applicable to the mining sector.

Article 37.2 of the Mining Convention provides that Simfer must, for all investment programmes relating to mining projects in the Concession area carry out an environmental and social impact assessment. The assessment will include mitigation measures to reduce the negative impacts of the Project including a programme to rehabilitate impacted sites. The assessment will also include a monitoring programme. The scope of these assessments will be agreed between Simfer and the State within 6 months of the Mining Convention being signed.

Article 37.4 provides that in the instance that an archaeological find is made within the Concession area, an appropriate assessment by a competent person will have to be carried out prior to the production phase and costs will have to be born by Simfer. If Simfer discovers archaeological artefacts, it must ensure that these are not moved or removed and that the administration is contacted as soon as possible. Simfer also pledges to participate financially, to a reasonable level, to any rescue attempt.

B4.6 Forestry Legislation and Policy

The Forestry Code (81/PRG/SGG/89) sets out the legal framework in Guinea with regards to the protection of forests. It is the cornerstone of forestry legislation in Guinea and covers all aspects of commercial, conservation and community use of forests. The Forestry Code details the requirements relating to the classification, management, usage, protection and replanting of Guinean forests. It also sets out the role of the Forestry police. Article 58 provides that trees (with very few exceptions) cannot be felled without a licence. When trees are located in an area covered by a forestry management plan, the felling licence can only be in line with the forestry management plan (Art. 59).

Section 2 of the Forestry Code deals with the protection of forestry resources.

Section 3 deals with bush fires.

Section 4 deals with reforestation.

Section 5 deals with customary rights.

Section 6 sets up the national forestry fund.

Section 5 establishes the forestry police and provides for the procedure when investigating offences, sets out the types of offences, the punishment linked to these offences (typically monetary fines, custodial sentences or remedial works).

Section 6 provides for the final administrative provisions with regards to this Code.

B4.7 Biodiversity Legislation and Policy

The Code of Protection of Wildlife and Rules of the Hunt (L/99/038/AN) sets out the legal framework for the protection, conservation and management of wildlife and its habitats; and provides for the right to hunt to be

recognised. This text also provides for some rules on hunting and aims to promote the sustainable use of animal species and ensure their sustainability for the satisfaction of human needs.

B4.8 Marine Legislation and Policy

Decree 201/PRG/SGG/89, made under Articles 32 to 39 of the Environmental Code, sets out the legal framework for the control of pollution in the marine environment. Article 4 of the Decree sets out that all vessels, within Guinean territorial waters must comply with the Guinean Environmental Code, this Decree and all applicable legal texts made under these. A vessel is defined as any type of structure used in the marine environment including ships, submarines, platforms, fixed and floating structures.

Chapter II deals with discharges from vessels and accidents at sea. Article 14 of the Decree prohibits hydrocarbon releases to the marine environment except under very specific circumstances.

Chapter III deals with discharges from land based structures to the marine environment. Chapter III makes provisions for discharges from land-based structures that have the potential to impact the marine environment to be prohibited or permitted by the Environmental Regulator.

Chapter IV deals with discharges from offshore platforms or structures used for exploration or extraction purposes. Article 30 prohibits any hydrocarbons or mixed discharges that may impact public health, marine fauna or flora; or impact the coastal economic development or tourism.

Chapter V deals with marine wrecks.

Annex I of the Decree lists substances for which discharges are prohibited, while Annex II lists substances for which discharges subject to permitting.

B4.9 Guinean Extractive Industries Transparency Initiative (ITIEG)

Guinea was accepted as an EITI Candidate country on 27 September 2007, but temporarily suspended its EITI Candidate status in December 2009, with EITI Board's approval, in view of the difficult political situation in the country. Following a request from the democratically elected Guinean government, Guinea's suspension was lifted and its candidate status reinstated by the EITI Board on 1 March 2011.

The Extractive Industries Transparency Initiative (EITI) is a global standard that promotes revenue transparency. It is founded on a process initially developed from the EITI Principles at the EITI Conference in 2003 ⁽¹⁾. The Standard is underpinned by the EITI Principles and the EITI Criteria. In short, the EITI requires companies to publish what they pay in taxes and royalty payments and governments to publish what they receive by applying a robust yet flexible methodology for monitoring and reconciling company payments and government revenues at the country level. The process is overseen by participants from the government, companies and national civil society. The EITI Board and the International Secretariat are the guardians of the EITI methodology internationally ⁽²⁾.

The aims of the EITI are to:

- ensure the transparency of the payments and revenues made by companies in the extractive industry and the payments received by governments by the companies in the extractive industry;
- make this information public and to enhance dialogue with civil society and the general public; and
- ensure the good use of the wealth generated as an engine for growth and to contribute to sustainable development and poverty reduction.

(1) <http://eiti.org/eiti/principles>

(2) EITI Factsheet, 3 May 2011

The ultimate aim of a candidate EITI country is to achieve compliant status under the Standard. This is achieved by undergoing validation against the EITI Standard, which provides an independent assessment of the status of a country implementing the EITI and what measures they should take to make better and faster progress. This assessment is carried out by an independent auditor, using the Validation Grid and Indicator Assessment Tools as outlined in the EITI Rules. The EITI Board, through the EITI Secretariat, oversees the Validation process. The EITI Board reviews all Validation Reports. To achieve Compliant status a country must complete an EITI Validation within 2 years of becoming a Candidate Country. Once a country is Compliant, the country must undergo Validation at least every 5 years, or upon the request from the EITI International Board.

If the Board considers that the country meets all of the EITI Indicators, the country will be designated as EITI Compliant. Where the validation report shows that a country has made progress but does not meet all the EITI Indicators, the country will remain a Candidate. Where Validation shows that no meaningful progress has been achieved, the Board may revoke the country's candidate status.

The administrative structures of the EITI in Guinea (also known as EITIG) were created as early as June 2005 and immediately started work on implementing the ITIE Principles and Standard. These structures are as follows.

- The Overseeing Committee. Its role is to exercise strategic oversight of the Steering Committee. It reviews progress against the plan and the budget to achieve validation against the Standard. Its aim is to remove any roadblocks;
- The Steering Committee, is a multi-stakeholder group in charge of implementation and follow up of the EITI in Guinea. It comprises 24 members, including 12 members from the Civil Service. It includes the Ministers in charge of mines and economy and finance; the president of the chambers of mine and the president of the national civil societies. It is chaired by the Prime Minister ;
- The Executive Committee was eliminated and replaced by two commissions in charge of the collection, processing and the audit of payment data ; and the other one responsible for communicating and capacity building; and
- The Executive Secrétariat is in charge of managing, organising and carrying out the activities of the ITIE in Guinea.

B4.10 Workers Protection

The Social Security Code (L/94/006/CTRN) is the primary source of legislation in Guinea for the protection of workers and their families against economic or social poverty and hardship that could result from any significant loss of earnings. This Code sets out the legal framework to protect workers and their families from such hardship and provides for a number of social protection regimes including retirement pension funds, invalidity funds and survivors funds; work accidents and occupational illnesses funds; family support fund, illnesses fund and sanitary and social fund. All workers, falling under the scope of the Work Code, will fall under the scope of the social security regime. The Code provides for indemnities to be collected from employees and employers; and also provides for the redistribution of monies collected via a number of indemnities to be paid out when employees fall ill, retire, raise children etc. Simfer will ensure that employees are registered as per the requirements of the Code.

Decree D/253/24/PRG on Occupational health creates a national department of occupational medicine within the Guinean Health Ministry; and sets out the roles and responsibilities of this Department. This Decree also sets a number of key requirements in relation to the monitoring of employees health in relation to medical exams (pre-employment and on an annual basis, whilst in employment; or when returning to work following a period of illness in order to determine the employee's fitness to work)

In addition to the Social Security Code, the National Framework Convention on mining and quarrying activities and the mining industry and Order 1386/MASE/DNTLS on the categorisation of workers in the private sector regulates the relationship between the employers who have signed the Convention and the

unions for mines, quarries and the mining industry for companies that principally operate in the mines, quarries and mining industry sector. Simfer, as an employer that has signed the Convention, will fall under the scope of the Convention.

Key requirements under the Convention include the following.

- The requirement for Rio Tinto to comply with the current framework, set out by legislation and convention, with regards to work hours, compensation (in terms of time off) and overtime.
- The requirement for Rio Tinto to comply with current health & safety legislation and set-up health & safety committees whose purpose is to support the set-up of health & safety management programmes, their management and implementation to protect workers.
- The Requirement for Rio Tinto to comply with the relevant health & safety legislation, including Art.193 & 194 of the Work Code on occupational health medicine. Simfer is not limited by the law and can offer additional benefits over and above what is prescribed by law.

B4.11 Health, Safety and Environment

The Labour Code is the primary source of legislation governing employment practices and labour relations in Guinea. The Code does not apply to civil servants, but applies to all private sector employees. It prohibits forced or compulsory labour. It establishes the rules for hiring and termination of employment; rules in relation to work conditions including salary entitlement, maximum work hours and overtime; employee benefits such as holiday pay and retirement pay. The Code also sets out requirements in relation to the health & safety protection of employees. It makes provisions for the creation of employers unions and trade unions and sets out rules for trade union representation within the workplace; employee membership in labour unions, as well as setting out rules for dispute negotiations and collective bargaining. It provides for the creation of a specialised administrative branch of the state (Work Inspectorate) and a specialised branch of the legal system to deal with the implementation of, and compliance with, Labour laws.

In addition to the Labour Code, the Mining Code also sets out requirements, in Chapter II on health & safety at work, applicable to the health & safety of workers. Article 133 of the Mining Code provides that persons (including bodies corporate like Simfer) undertaking mining or quarrying activities must comply with the highest standards of health & safety as set by the Mining Ministry in collaboration with the Ministry in charge of Public Health and the Work Ministry. Companies are required to submit their health & safety policy (describing their health & safety arrangements) to the National Directorate of Mines. Article 134 provides a mechanism for addressing any sub-standard health & safety performance in the mining or quarrying sector. Article 135 prohibits under sixteen year olds from working in the mining or quarrying industry.

B4.12 International Obligations and Commitments

In addition to its national laws, Guinea is a signatory to a number of international conventions, co-operative agreements and legal obligations concerned with environmental and social issues (see *Table B4.1*), which have contributed to shaping and influencing the development of policy, guidelines and regulations that are applicable to the Project.

Table B4.1 Main International Conventions and Agreements Signed by Guinea

Convention	Date of Ratification/ Accession	Key Objectives
Convention on Climate Change	Guinea ratified the Convention in May 1993 and it entered into force in March 1994.	192 countries around the world joined an international treaty, the United Nations Framework Convention on Climate Change, that sets general goals and rules for confronting climate change. The ultimate objective of the Convention is to stabilise greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system. The Convention provides that countries must meet the Convention objectives primarily through national measures.
Kyoto protocol to the United Nations Framework Convention on Climate Change	Guinea accepted the Kyoto protocol in September 2000.	This Protocol has been accepted by the Guinean Government in September 2000 and it came into force in February 2005. Guinea is not an Annex I Party to the Protocol and therefore does not, currently, have to meet a specific greenhouse gas emission reduction target. There is currently no Guinean specific legislation implementing the Kyoto Protocol in Guinea.
Vienna Convention for the Protection of the Ozone Layer	Guinea acceded to the Vienna Convention in June 1992 and the Convention came into force in September 1992.	Guinea ratified the Vienna Convention and the Montreal Protocol in June 1992. The Convention provides for the international legal framework to protect the ozone layer. Guinea has not, to date, adopted specific legal instruments to implement the Convention in its legal system.
The Montreal Protocol on Substances that Deplete the Ozone Layer	Guinea ratified the Montreal Protocol in June 1992.	The Montreal Protocol on Substances That Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer) is an international treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. The treaty was opened for signature on September 16, 1987, and entered into force on January 1, 1989. Guinea ratified the Montreal Protocol in June 1992. The Protocol provides for the international legal framework to protect the ozone layer by setting out phasing-out targets and schedules for the substances (chlorofluorocarbons and hydro chlorofluorocarbons) listed in the Protocol. The Protocol allows developing countries (meeting specific requirements listed in the Protocol), in order to meet their basic domestic needs, to delay for ten years their compliance with the control measures set out in the Protocol. This means that the implementation of the Montreal Protocol in Guinea may occur in the future. In addition, the Protocol is addressed to the signatory States and does not directly apply to Simfer's activities in Guinea. Simfer's activities could be indirectly impacted by the Protocol if Guinea had adopted specific legal instruments to implement the Protocol in its legal system, however, there is currently no Guinean specific legislation implementing the Montreal Protocol in Guinea.
Convention on the Conservation of Migratory Species of Wild Animals	Guinea is a party to this Convention which came into force in August 1993.	The convention aims to ensure the conservation of Migratory Species and Natural Environment by an intergovernmental co-operation. The convention sets out to conserve wild flora and fauna and their natural habitats; promote co-operation between states; monitor and control endangered and vulnerable species; and to assist with the provision of assistance concerning legal and scientific issues. This convention was transposed into Guinean legislation via the Guinean Code of Protection of Wildlife and Rules of the Hunt.

Convention	Date of Ratification/ Accession	Key Objectives
Convention on Biological Diversity	Guinea ratified this Convention in May 1993.	The objective of this Convention is to develop national strategies for the conservation and sustainable use of biological diversity. It is often seen as the key document regarding sustainable development. The Convention has three main goals: conservation of biological diversity (or biodiversity); sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources. This Convention has been transposed at a national level in Guinea with the Code of Protection of Wildlife and Rules of the Hunt.
African Convention for Nature Conservation and the Conservation of Natural Resources	Not yet ratified by Guinea.	This Convention aims for the conservation and rational use of soil, water, flora and fauna resources. The objectives of this Convention are: to enhance environmental protection; to foster the conservation and sustainable use of natural resources; and to harmonize and coordinate policies in these fields with a view to achieving ecologically rational, economically sound and socially acceptable development policies and programmes. It has not been possible to confirm, based on publicly available information, whether Guinea has ratified this Convention and/ or whether it has transposed the requirements of this Convention into Guinean legislation.
Convention concerning the Protection of the World Cultural and Natural Heritage	Not yet ratified by Guinea.	This Convention aims to protect the world cultural and natural heritage. This Convention provides for the creation of an intergovernmental committee for the protection of the world cultural and natural heritage and its associated fund. Information available in the public domain shows that Guinea has not ratified the Convention to date. Guinea is therefore unlikely to have transposed the Convention in its national legislation at this moment in time.
Ramsar Convention on Wetlands	Guinea is a party to this Convention, which came into force in March 1993.	The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Convention uses a broad definition of the types of wetlands covered in its mission, including lakes and rivers, swamps and marshes, wet grasslands and peatlands, oases, estuaries, deltas and tidal flats, near-shore marine areas, mangroves and coral reefs, and human-made sites such as fish ponds, rice paddies, reservoirs, and salt pans. Guinea has signed and ratified this Convention and it came into force in March 1993. Guinea has submitted national reports on the implementation of the RAMSAR Convention in Guinea which show that the Guinean government has taken some steps to implement the Convention; however it appears that Guinea does not have a national policy on the management of wetlands.
Basel Convention	26.04.95 (accession but not ratification)	Control of Transboundary Movements of Hazardous Wastes and their Disposal.
United Nations Convention on the Law of the Sea	Guinea ratified this Convention in September 1985 and the Convention came into force in November 1994	The United Nations Convention on the Law of the Sea (UNCLOS), also called the Law of the Sea Convention or the Law of the Sea treaty, is the international agreement that defines the rights and responsibilities of nations in their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. It has not been possible to confirm, based on publicly available information, whether it has transposed the requirements of this Convention into Guinean legislation.

Convention	Date of Ratification/ Accession	Key Objectives
Convention for the Cooperation in the Protection and Development of the Marine and Coastal Environment of the Western and Central African Regions	Guinea is a party to this Convention. The Convention came into force in August 1984.	The Convention for the Cooperation in the Protection and Development of the Marine and Coastal Environment of the Western and Central African Regions (also known as the Abidjan Convention) covers the marine environment, coastal zones and related inland waters falling within the jurisdiction of the States of the West and Central African Region, from Mauritania to Namibia inclusive. It is a comprehensive umbrella agreement for the protection and management of the marine and coastal areas and lists the sources of pollution which require control: pollution from ships, dumping, land based sources, exploration and exploitation of the sea-bed, and pollution from or through the atmosphere. It also identifies environmental management issues from which co-operative efforts are to be made: coastal erosion, specially protected areas, combating pollution in cases of emergency; and environmental impact assessment. There are also articles on scientific and technological co-operation and liability and compensation. It has not been possible to confirm, based on publicly available information, whether the Guinean Government has transposed the requirements of this Convention into Guinean legislation.
Convention to Combat Desertification (A/AC.241/27)	Guinea has signed and ratified this Convention and it came into force in September 1997.	The objective of this Convention is to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa. The Convention aims to achieve this through effective action at all levels, supported by international cooperation and partnership arrangements, in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas. Guinea has signed and ratified this Convention and it came into force in September 1997. Guinea has also produced a national action plan against desertification. It appears, from a review of Guinean legislation that there is no specific additional national legislation dealing with desertification, but that the aims and objectives of the Convention have been incorporated into existing legislation such as the Environmental Code, the Mining Code etc.
Extractive Industries Transparency Initiative	Guinea is a candidate country under the EITI	Guinea's candidate status was reinstated on 1 March 2011, following the temporary suspension of its candidate status in 2009 in light of the political difficulties experienced by the country. The aim of the EITIG is to ensure the transparency of the payments and revenues made by companies in the extractive industry operating in Guinea and the payments received by the Guinean government from these companies.

Convention	Date of Ratification/ Accession	Key Objectives
World Heritage Convention (UNESCO)	The Convention came into force in 1975. Guinea ratified the Convention in March 1979.	The Convention aims to promote cooperation among nations to protect the world's natural heritage and cultural properties that is of such outstanding universal value that its conservation is important for current and future generations. The Convention defines the kind of natural or cultural sites which can be considered for inscription on the World Heritage List; and sets out the duties of States Parties, of which Guinea is one of, in identifying potential sites and their role in protecting and preserving them. By signing the Convention, each country pledges to conserve not only the World Heritage sites situated on its territory, but also to protect its national heritage. The <i>Mount Nimba Strict Nature Reserve</i> was established by Decree in 1944 and declared as a biosphere reserve in 1980. Guinea has listed the <i>Mount Nimba Strict Nature Reserve</i> on the list of world heritage in danger in 1992. The Guinean government has also listed the cultural landscape of the <i>Mount Nimba</i> range on the tentative list of cultural sites to be protected under the Convention.
Freedom of Association and Collective Bargaining, Convention 1948 (87)	Guinea ratified Convention 87 in January 1959.	The Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87) establishes the right of all workers and employers to form and join organizations of their own choosing without prior authorization, and lays down a series of guarantees for the free functioning of organizations without interference by the public authorities. It has not been possible to confirm, based on publicly available information, whether the Guinean Government has transposed the requirements of this Convention into Guinean legislation.
Right to Organise and Collective Bargaining Convention 1949 (98)	Guinea ratified Convention 98 in March 1959.	The Right to Organise and Collective Bargaining Convention 1949 (98) provides for protection against anti-union discrimination, for protection of workers' and employers' organizations against acts of interference by each other, and for measures to promote and encourage collective bargaining. It has not been possible to confirm, based on publicly available information, whether the Guinean Government has transposed the requirements of this Convention into Guinean legislation.
Elimination of Discrimination in Respect of Employment and Occupation (111)	Guinea ratified Convention 111 in September 1960.	The Convention on the Elimination of Discrimination in Respect of Employment and Occupation provides that member states pursue a national policy designed to promote, by methods appropriate to national conditions and practice, equality of opportunity and treatment in respect of employment and occupation, with a view to eliminating any discrimination in respect thereof. It has not been possible to confirm, based on publicly available information, whether the Guinean Government has transposed the requirements of this Convention into Guinean legislation.
Worst Forms of Child Labour Convention 1999 (182)	Guinea ratified Convention 182 in June 2003.	The Worst Forms of Child Labour Convention 1999 provides that each member who ratifies the Convention must take immediate and effective measures to secure the prohibition and elimination of the worst forms of child labour as a matter of urgency. This includes slavery, trafficking, prostitution and pornography, forced labour and recruitment into militia, as well as occupations that harm the child's safety, morals or health. It has not been possible to confirm, based on publicly available information, whether the Guinean Government has transposed the requirements of this Convention into Guinean legislation.

Convention	Date of Ratification/ Accession	Key Objectives
Minimum Age Convention 1973 (138)	Guinea ratified Convention 138 in June 2003.	The ILO Minimum Age Convention, 1973 (No.138) sets the age below which children should not be in work at 15 (or 14 if a country's economic status requires that in the short term). Two years before they reach this minimum legal age, children can do 'light work' -- non-hazardous work for no more than 14 hours a week, and that does not interfere with schooling. Children under the minimum working age who are engaged in more than light work are in child labour. UNICEF additionally considers a child to be in child labour if they do domestic work for 28 hours or more a week.
Safety and Health in Mines Convention 1995 (176)	Guinea has not, to date, ratified this Convention.	The Convention applies to all mines (except mines that have been exempted by a competent national authority where the protection afforded at these mines under national law and practice is not inferior to that which would result from the full application of the provisions of the Convention). Each State which ratifies the Convention, must following consultations with the most representative organizations of employers and workers concerned, formulate, carry out and periodically review a coherent policy on safety and health in mines.

B5 International Standards Applicable to the Project

B5.1 Applicable IFC Performance Standards and EHS Guidelines

International Finance Corporation (IFC) Performance Standards, and accompanying Guidance Notes, are utilised by financial institutions to define clients' roles and responsibilities for managing social and environmental risks and impacts of their projects. These standards are internationally recognised and are therefore also regularly applied to projects that are not necessarily seeking IFC support. IFC Performance Standards relate to both conducting an SEIA as well as to the technical performance standards of the Project.

The IFC Performance Standards comprise:

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

The social dimension of these standards encompass (i) labour standards and working conditions including occupational health and safety and (ii) community impacts such as public health, safety and security, gender equality, impacts on Indigenous Peoples and cultural heritage, involuntary resettlement, and affordability of basic services.

The Project will also demonstrate best practice in relation to a number of voluntary IFC General and Industry Sector EHS Guidelines. The EHS Guidelines contain performance levels and measures that are generally considered to be achievable in new facilities at reasonable costs by existing technologies ⁽¹⁾. The Project proponent is thus aiming to conform to the intent and spirit of these standards and guidelines. The Project Proponent will work in partnership with the Guinean government, communities and other stakeholders to address relevant and applicable specific recommendations from these standards and guidelines. A high level summary of the requirements of the IFC Performance Standards that are applicable to the Project, is presented in *Table B5-1*.

PS7 will not apply as there are no defined indigenous peoples in Guinea.

(1) Application to existing facilities may involve the establishment of site-specific targets.

Table B5-1 Applicable IFC Performance Standards

Performance Standard	Requirements	Relevant Requirements
<i>Performance Standard 1: Social and Environmental Assessment and Management System</i>	- Establish and maintain a Social and Environmental Management System incorporating: (i) Social and Environmental Assessment; (ii) management program; (iii) organizational capacity; (iv) training; (v) community engagement; (vi) monitoring; and (vii) reporting; - Social and Environmental Assessment to be based on: accurate project description; appropriate social and environmental baseline data; and consider applicable laws and regulations, conventions; - Analyse key risks and impacts within project's area of influence: (i) the primary project site(s) and related facilities; (ii) associated facilities (iii) areas potentially impacted by cumulative impacts; and (iv) areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; - Risks and impacts will also be analysed for the key stages of the project cycle; - Avoid, minimize, mitigate, or compensate adverse impacts; - Project-affected groups and local NGOs must be consulted about the potential effects; - Public Consultation and Disclosure Plan (PCDP) which establishes the framework for executing public consultation in a way which is transparent and captures relevant stakeholder feedback. - Establish and manage a program (Management Program) to consist of operational policies, procedures, mitigation and performance improvement measures and actions that address the identified social and environmental risks and impacts.	- International SEIA in line with international expectations (IFC) - Regulatory EIA which meets Guinean requirements - SEMS and SEMP identifying how adverse impacts and risks will be managed and mitigated - SEP that will be updated throughout SEIA process to reflect ongoing stakeholder engagement - Grievance Procedure - Timely Disclosure of impacts and proposed mitigation measures - Stakeholder comments to be integrated into final SEIA and SEMP
<i>Performance Standard 2: Labour Conditions</i>	- Create good working conditions and manage the worker relationship; - Protect the work force, do not employ child or forced labour; - Provide workers with a safe and healthy work environment; - Use commercially reasonable efforts to contract non-employee workers; - Consider any adverse impacts associated with supply chains.	- Health and safety procedures to be incorporated into SEMP - Where feasible execute a preferential employment policy that gives local workers an opportunity to benefit from the project

Performance Standard	Requirements	Relevant Requirements
<i>Performance Standard 3: Pollution Prevention and Abatement</i>	• Apply pollution prevention and control technologies and practices that are best suited to avoid, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective. • Energy Efficiency: Examine and incorporate in its operations resource conservation and energy efficiency measures, consistent with the principles of cleaner production. • Promote the reduction of project-related GHG in a manner appropriate to the nature and scale of project operations and impacts; • The project-specific pollution prevention and control techniques should be applied during the entire project life-cycle.	• SEIA to consider environmental standards set out in national law and in IFC General and relevant sectoral EHS Guidelines, 2007 • Comply with International Standards for Energy Efficiency and Cleaner Production • Quantify emissions • Evaluate options for reducing of offsetting disturbance and emissions
<i>Performance Standard 4: Community Health, Safety and Security</i>	• Evaluate the risks and impacts to the health and safety of the affected community throughout whole life cycle from both routine and non-routine circumstances; • Establish appropriate preventive measures to address them; • Infrastructure and Equipment Safety: Design, construct, and operate and decommission project in accordance with good international industry practice. • Hazardous Materials Safety: Prevent or minimise the potential for community exposure to hazardous materials that may be released by the project. Special attention to delivery/removal of hazardous waste/ products along transportation routes. • Environmental and Natural Resource Issues: Avoid or minimise the exacerbation of natural hazards, such as landslides or floods that could arise from land use changes • Community Exposure to Disease: Prevent or minimise the potential for community exposure to water-borne, water-based, water-related, vector-borne disease, and other communicable diseases that could result from project activities. • Where specific diseases are endemic in communities in the project area of influence, the client is encouraged to explore opportunities during the project life cycle to improve environmental conditions that could help reduce their incidence. • Emergency Response Plan: Inform affected communities of significant potential hazards in a culturally appropriate manner. Assist and collaborate with the community and the local government agencies in their preparations to respond effectively to emergency situations. • Employee/Contractor safety: provide security safeguards based on international practices in terms of hiring, rules of conduct, training, equipping and monitoring of such personnel and applicable laws	• Health and safety procedures to be incorporated into SEMP • Design project elements, especially Tailings Storage Facility, Waste Rock Disposal Facility, Flood Water Catchments & Diversion structures etc. to minimise risk from natural hazards such as flooding, soil erosion, earthquake • Disease and Health Management Plan which covers all workers for the Project • Pre-employment medicals • Access to medical check-ups, education about communicable diseases (such as STDs) • Emergency Response Plan: to be prepared in consultation with communities and local government • SEP to include plan for stakeholder engagement on emergency response issues •

Performance Standard	Requirements	Relevant Requirements
<i>Performance Standard 5: Land Acquisition and Involuntary Resettlement</i>	• Compensation and Benefits for Displaced Persons: When displacement cannot be avoided, the client will offer displaced persons, and communities, compensation for loss of assets at full replacement cost and other assistance to help them improve or at least restore their standards of living or livelihoods. • Where livelihoods of displaced persons are land-based, or where land is collectively owned, the client will offer land-based compensation, where feasible. • Mitigate socio-economic impacts from land acquisition; • Improve livelihoods of those displaced and living conditions at resettlement sites; • Special requirements for Physically and Economically Displaced Persons; • If resettlement is required, these requirements are achieved through the development of a Resettlement Action Plan (RAP) which incorporates: consultation, compensation, income restoration, monitoring.	• Project Design: Avoid or at least minimize involuntary resettlement • Inform groups who may be affected by land acquisition • SEP to include plan for consultation with those affected by land acquisition and resettlement • Special grievance procedure to be established for persons affected by physical or economic displacement • Demonstrate that due process has been followed for compensating existing land users
Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management	• Evaluate project impacts on biodiversity (during SEIA) and adopt measures to eliminate or reduce, paying particular attention to the problems of habitat destruction; • Special requirements for “protected areas” and “critical habitats”.	• Evaluate impacts on biodiversity (during SEIA) • Adopt measures to eliminate or reduce adverse impacts
<i>Performance Standard 8: Cultural Heritage</i>	• Comply with relevant national law on the protection of cultural heritage • Cultural Heritage impacts during the impact assessment process, and (ii) include a “Chance-find Procedure” for archaeological relics; • Consult with affected communities if the project may affect cultural heritage.	• Cultural Heritage Investigation • Chance-find Procedure to be implemented during construction

B6 Mining Concession and Mining Convention

Simfer S.A., a member of the Rio Tinto Group, holds a mining concession for iron ore over the Southern part of the Simandou mountain range in the Republic of Guinea.

A mining agreement convention between the Guinean government and Simfer S.A., which was ratified by a law passed and signed in February 2003 (Mining Convention), as well as a Settlement Agreement signed between the same parties on 22 April 2011, defines the legal framework applicable to the Simandou project.

The mining concession for the exploration and mining of iron ore over the Southern part of Simandou was granted by decree (Decree D/2011/134/PRG/SGGD2006/008/PRG/SGG) to Simfer on April 22, 2011. This decree was issued pursuant to the Mining Convention and the Settlement Agreement.

Annex C

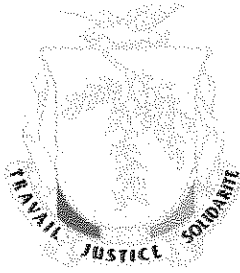
Terms of Reference

Approval by Government of Guinea Ministry of Environment

Part A Proposed SEIA Overview and Methodology

Part C Marine Offloading Facility

Stakeholder Engagement Records



Conakry, le 12 OCT. 2011

MINISTRE DELEGUE A L'ENVIRONNEMENT
AUX EAUX ET FORÊTS

Le Ministre

N° . 0630 /MDEEF/CAB/2011

A

Monsieur Andrew TAPIN
Directeur Général par intérim
Rio Tinto- SIMFER S.A.

CONAKRY

Objet : Approbation des Termes de
Référence de l'EIES du projet SIMFER.

Monsieur,

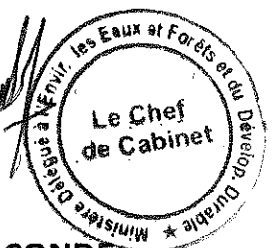
Suite à votre courrier N/R-334/2011/AT/SIMFER, j'ai l'honneur de vous informer qu'après analyse des termes de référence (TDR) de l'étude d'impact environnemental et social du projet cité en objet par les services compétents de mon Département, lesdits TDR sont jugés conformes à la législation environnementale et ainsi, ils peuvent être jugés recevables.

Par ces motifs, le promoteur peut entreprendre les activités nécessaires à la réalisation des études d'impact environnemental et social du projet conformément à la procédure en vigueur.

Veuillez recevoir, Monsieur le Directeur Général, l'expression de ma franche collaboration.

P/LE MINISTRE P.O
Le Chef de Cabinet

Elhadj Mamady CONDE



Simfer SA

Simandou Project

Social and Environmental Impact Assessment Terms of Reference

PART A

Proposed SEIA Overview and Methodology

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A1 Introduction

The Simandou Project ("Project") is located in eastern Guinea, approximately 600km from the Guinean coast and 400km from the Liberian coast. The concession licence-holder and project company is Simfer S.A., which is currently owned 5% by International Finance Corporation (IFC) and 95% by the Rio Tinto Group. In April 2011, the Republic of Guinea and Simfer S.A. (Simfer) signed a Settlement Agreement, which confirms Simfer's title to a southern part of Simandou. The Settlement Agreement provides the Republic of Guinea with the right to progressively take a stake of up to 35% in Simfer (the Mine) and, a 51% stake in a separate company to be created (known as a special purpose vehicle the "SPVA") to build, own and operate the Project's (Rail & Port) Infrastructure. The Settlement Agreement also acknowledges the proposed participation by Aluminium Corporation of China Limited (Chinalco) through a Joint Venture with Rio Tinto.

Significant high grade resources have been determined by Simfer., which are expected to form the basis of a mining operation with an estimated resource capacity of 95Mpta. The Project will produce a high grade "sinter fines" product. The open pit could be mined by conventional truck and shovel methods although in-pit crushing and conveying options are currently being assessed. Simfer plans to use a combination of hydropower and diesel powered generation to provide electricity to on-site processing plant. The transport infrastructure requirements for the project involve a new port and up to 700km railway to the Project site.

The Simandou Project will be subject to the Guinean Environmental Code and to subsidiary decrees, orders and guidance¹ which require Environmental Impact Studies to be completed before the development can commence. Rio Tinto's own corporate policies and standards also require a comprehensive Environmental Impact Study to be undertaken as part of project planning and decision-making, as do the policies and standards of IFC². In line with corporate and international standards Simfer proposes that its impact studies will address social as well as environmental issues. The term Social and Environmental Impact Study (SEIA) is therefore used throughout the remainder of the present document.

In accordance with Guinean law and guidance the first step in the SEIA procedure is for the Minister for the Environment to issue a Terms of Reference for the studies. The aim of the Terms of Reference is to ensure that the SEIA covers all the aspects of the project and all the potential significant impacts at a level of detail that is sufficient to allow an informed decision to be made about approval of the project. To do this, the Terms of Reference will define the project and its potential impacts on the environment and communities, and set out the proposed approach to the Impact Study, the experience that is needed to prepare the study and the timetable for its completion.

This document presents a draft of the Terms of Reference for the Project for consideration by the Minister for the Environment. Following issue of the Final Terms of Reference by the Minister, Simfer will complete the preparation of impact studies in compliance with the requirements of the Republic of Guinea.

In order to meet the target for first commercial ore production by mid 2015, set out in the Settlement Agreement, the SEIA is being undertaken in a number of parts to allow certain works to start in advance of the main Project. This Draft Terms of Reference is therefore presented in a number of parts relating to different components of the works for which separate SEIA Reports will be submitted. The timetable for each SEIA is set out in the individual Terms of Reference for each component. The main Simandou Project SEIA is programmed to be submitted in March 2012 and will incorporate the results of the earlier assessments.

The components for which Terms of Reference are presented here are:

- The main Simandou Project, including the Mine, Railway and Port

1 Code de l'Environnement of the Republic of Guinea; Presidential Decree 199/PRG/SGG/89 on Environmental Impact Studies; Arrêté 990/ NRNE/SGG/90 establishing the content and methodology for Environmental Impact Studies; and Ministère de l'Agriculture de l'Elevage de l'Environnement des Eaux et Forêts, Service National des Etudes et d'Evaluation Environnementale « Les Etudes d'Impact sur l'Environnement : Termes de Reference pour les Etudes d'Impact Environnemental & Social & Guide d'Evaluation » ; Version 03/2007.

2 Simfer will follow the policies and guidance established by its joint venture partner IFC (the International Finance Corporation) in its Policy on Social & Environmental Sustainability 2006 and the supporting Performance Standards, Environmental, Health and Safety Guidelines, and other referenced sources of guidance. Reference will also be made to the currently proposed updates to the IFC's policy and performance standards – see <http://www.ifc.org/ifcext/policyreview.nsf/Content/Home>

- A Marine Offloading Facility required for construction; and
- Construction Workforce Accommodation and Logistic Supply Centres.

Further Terms of Reference will follow relating to a hydroelectric project at Lolema, and further possible construction-related early works such as quarries, road improvements, and water supply.

These Draft Terms of Reference have been prepared by the international specialist consultants Environmental Resources Management (ERM). ERM has been appointed by Simfer to undertake the SEIA for the Project including development of the Draft Terms of Reference. The international consulting firms SNC Lavalin, Tractabel, Schlumberger Water Services, The Biodiversity Consultancy and several other international specialist organisations and individuals, are also involved in the studies, as are a number of Guinean organisations who are undertaking baseline surveys and other research for the assessment.

The remainder of Part A of this document provides an overview of the general approach to the SEIA and is organised as follows:

- Section A2 provides an overview of the main project;
- Section A3 presents the legal and regulatory context for the SEIA for all components of the works; and
- Section A4 describes the general approach and methodology to be adopted for the SEIA.

Parts B to D then present more specific details for each project component covered by this document:

- Part B: The Simandou Project Mine, Railway and Port Development.
- Part C: The Pioneering Marine Offloading Facility; and
- Part D: Construction Workforce Accommodation and Logistical Support Centres.

In each case the following information is presented:

- Sections B1 – D1: a description of the proposed works;
- Sections B2 – D2: the proposed scope of the assessment
- Sections B3 – D3: the planned SEIA Report structure;
- Sections B4 – D4: the SEIA team; and
- Sections B5 – D5: the SEIA timetable.

If as planning for the Simandou Project proceeds it proves necessary to propose other advance works which require SEIA, for example relating to dredging, supply of materials, development of supporting infrastructure (roads, etc) or early development of other elements of the main project, further Terms of Reference for these additional early works will be prepared, as adjuncts to this document, for Government consideration and approval.

A2 Main Project Overview

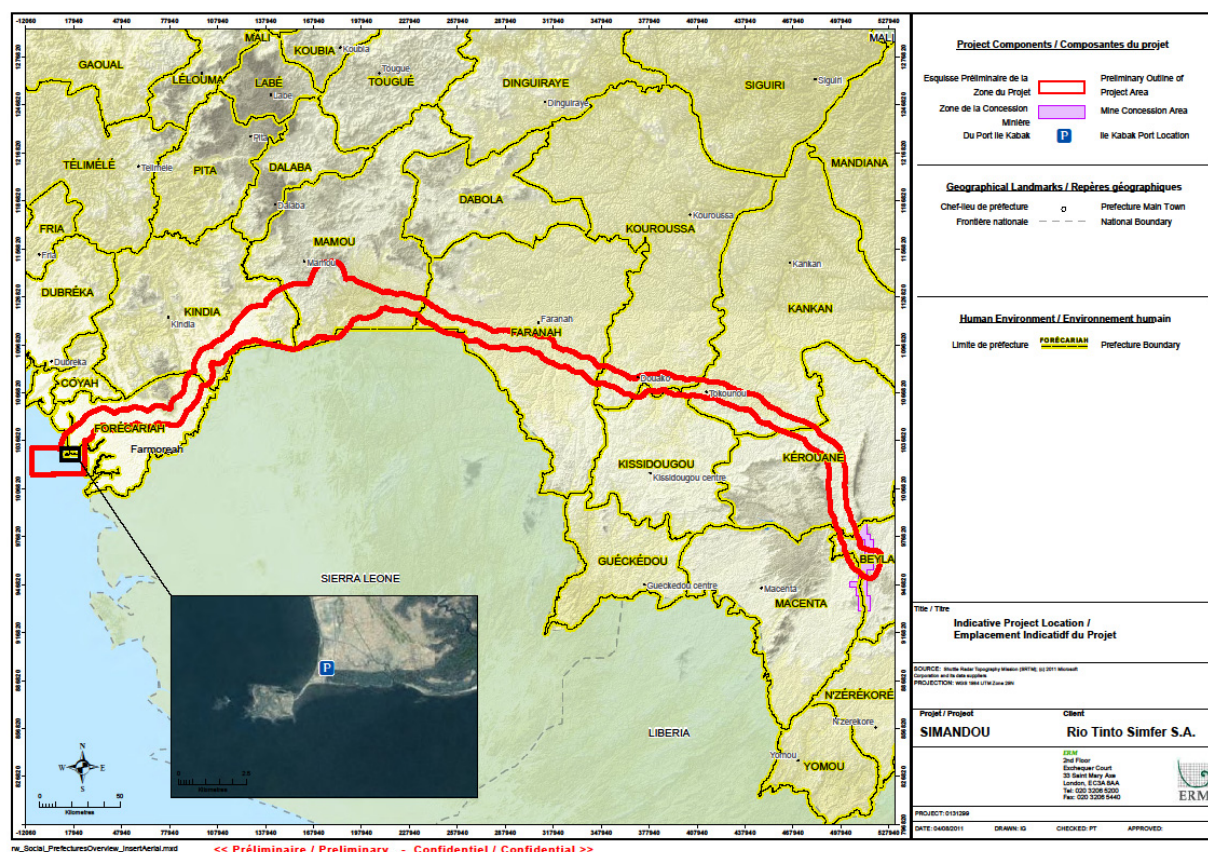
The Simandou Project comprises three main components:

1. an iron ore mine in the Simandou Range in south-eastern Guinea with an estimated resource capacity of 95MTpa;
2. a Trans-Guinean railway of up to 700 km to transport the ore from the mining concession to the Guinean coast;

3. a new deepwater port currently planned to be located south of Conakry in the Forécariah prefecture.

The location of the mining concession and indicative locations for the rail line and port area are illustrated in *Figure A2.1*. Further details of the main Project are provided in Part B.

Figure A2.1 Overview of the Simandou Project



A3 Legal and Regulatory Context

The Code for the Protection and Development of the Environment, (Ordinances 045/PRG/87 and 022/PRG/89) also known as the Environmental Code sets out the fundamental legal principles to be complied with to ensure the protection of environmental resources and the human environment. Article 82 of Title V of the Environmental Code imposes an obligation on developers of projects which are likely to have a significant impact on the environment, to conduct an Environmental Impact Study and submit this to the Minister for the Environment prior to the construction of a Project, allowing evaluation of the direct and indirect impacts of the Project on the ecological equilibrium of the environment of Guinea, the quality of life of the people and the protection of the environment.

Presidential Decree 199/PRG/SGG/89 issued under Article 82 of the Environmental Code sets out the projects which by virtue of their size or nature of their activities require an Environmental Impact Study. The list of works for which an impact study is required is set out in the Annexe to the decree and includes:

- 2e: Works for the construction and management of ports;
- 4e: Mines
- 5e: Construction of railways.

An Environmental Impact Study is therefore required for all main components of the Simandou Project.

The subsequent *Arrêté* 990/ NRNE/SGG/90 issued under Art 7 of Decree 199/PRG/SGG/89, establishes the content and methodology for environmental impact studies.

The procedure for an EIS provides for the Minister for the Environment to issue a project-specific Terms of Reference which provides details on the project to be assessed, the issues to be addressed, the environmental experts who will conduct the EIS and the steps to be followed. This document presents a draft of the Terms of Reference for consideration by the relevant authorities.

A4 Approach and methodology to be adopted for the SEIA

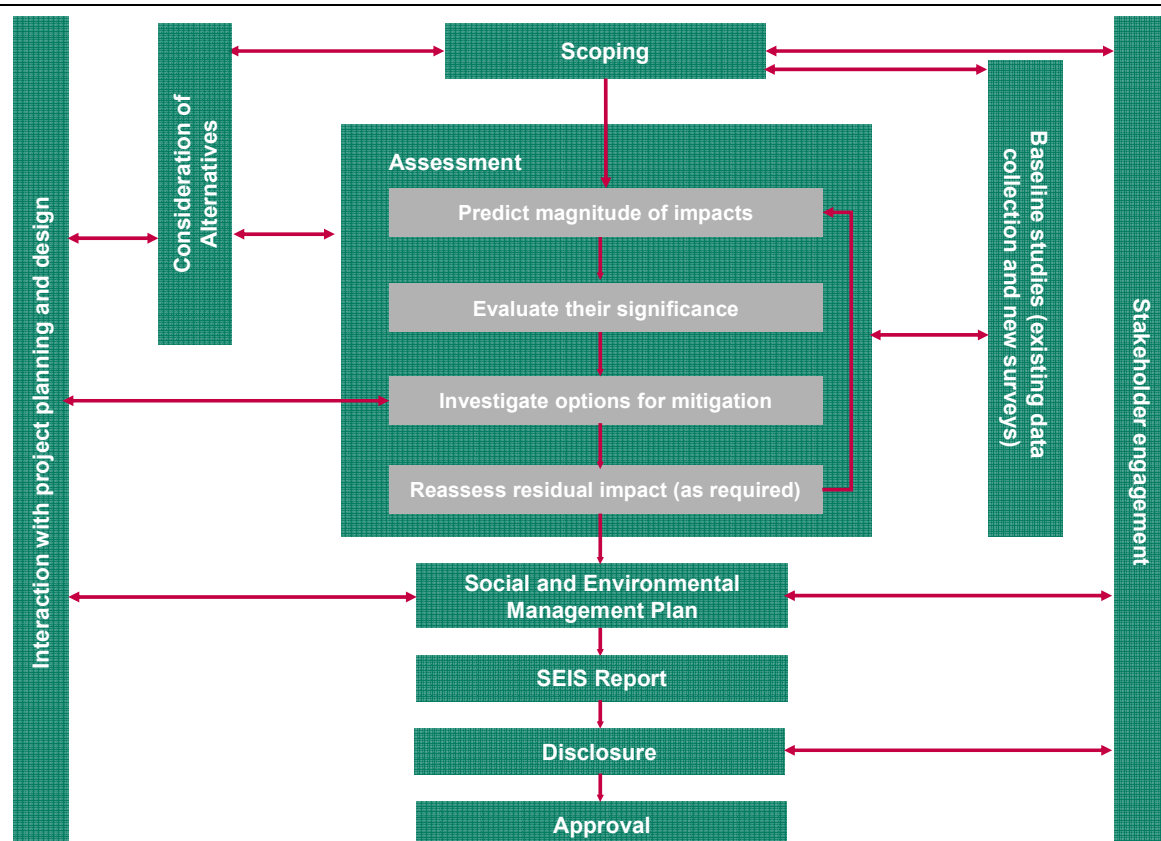
A4.1 Overview of Methodology

The social and environmental impact assessment for the Project will be undertaken in accordance with the guidelines and procedures identified in this Terms of Reference. It will follow a systematic process of:

- establishing baseline conditions in the physical, natural, cultural, social and socio-economic environment of the area potentially affected by the Project;
- predicting and evaluating the positive and negative changes in these baseline conditions that will result from construction, operation and closure of the Project, i.e. the impacts of the Project ; and
- identifying the measures that Simfer. will take to avoid, reduce, remedy, offset or compensate for adverse impacts, and to provide or enhance benefits from the project.

The proposed approach for the assessment is shown schematically in *Figure A4.1* and the key steps are described below.

Figure A4.1 SEIA Approach



The key steps in the process are outlined in *Table A4.1* and detailed further below.

Table A4.1 Summary of the SEIA Process

Stage	Summary of Approach
Scoping	Scoping is designed to ensure the process is focused on the significant environmental and social impacts which may arise from the Project. It involves a systematic consideration of the potential for interaction of project components and activities with features in the environment to identify where significant impacts are likely to occur. The results of scoping are presented in this Draft Terms of Reference and for the basis for planning the assessment studies. The scope will be kept under review and updated as new data emerges from baseline studies and as the SEIA proceeds. The SEIA will also take into account the results of consultations undertaken on the Project.
Baseline development	For the key issues identified in scoping, available information on the current environmental and social conditions will be gathered. Particular emphasis will be placed on sensitive aspects which are potentially affected by the Project including its immediate location and the surrounding environment. Baseline field studies and surveys will be conducted where necessary. The future development of baseline information in the absence of the Project will also be considered. This future No Project scenario will provide the baseline against which the impacts of the Project will be predicted and evaluated. (Note: a substantial programme of baseline survey work has already been completed for the Simandou Project and further surveys are currently underway to address the outstanding gaps in knowledge).
Alternatives	Where alternatives exist for the siting or design of particular components of the Project these will be considered in collaboration with the engineering design team. The SEIA will appraise the environmental and social impacts of these alternatives as an input to the selection of preferred options. The results will be presented in the SEIA report. The rationale behind siting of the project and selection of the proposed design and construction techniques will be presented from a technical, environmental and social perspective.

Stage	Summary of Approach
Impact assessment	This stage is focused on predicting how environmental and social conditions will change from the baseline as a result of constructing and operating the Project and where relevant decommissioning, closing and rehabilitating the site. Quantitative and qualitative information on the nature, magnitude, spatial extent, duration and likelihood of change will be predicted and each impact will then be evaluated to determine its significance for the environment and society by reference to established standards and norms. The focus will be on identifying the significant impacts (ie the most important and the impacts with the potential to cause greatest harm). The assessment will also review all possible impacts in order to determine which are likely to be significant. Positive benefits provided by the Project will be identified.
Mitigation measures	Measures to avoid, reduce or remedy adverse effects, and where this is not possible to provide compensation by offering resources or facilities to replace those that are lost will be identified and agreed with the Project engineering team and Simfer. These mitigation measures may include amendments to the Project design or methods to be adopted during construction or operation of the Project. The aim is to minimise adverse effects and provide or enhance environmental and social benefits.
Assessment of residual impacts	Where feasible mitigation measures are identified impacts will be reassessed to determine residual impacts after mitigation.
Social and Environmental Management Plan (SEMP)	All mitigation measures will be presented in a Social and Environmental Management Plan (SEMP). These will be set out as commitments made by Simfer. The SEMP will also describe how the measures will be implemented during the detailed design, construction and operation of the Project. It will detail the responsibilities and resources for implementation, the timing, and monitoring and auditing to be carried out to ensure all mitigation commitments are met. The SEMP will also identify requirements for training and capacity building within the project and amongst other stakeholders including government. The social aspects of the SEMP will incorporate a Land Acquisition, Compensation and Resettlement Policy Framework detailing how expropriation of land for the Project will be managed in accordance with international good practice. The SEMP will also reference more detailed supporting plans for managing particular aspects of the social and environmental impacts of the project including plans for influx management, cultural heritage, community development, waste and water management, and detailed land acquisition, compensation and resettlement.
Consultation and Stakeholder Engagement	During the SEIA the team will seek the views of interested parties. This information will be taken into account in the assessment and reflected in the proposals for mitigation. Once complete the SEIA Report will be disclosed for comment from all interested stakeholders. All comments will be considered in finalising the Project proposals and the SEMP. The SEMP will be accompanied by a Stakeholder Engagement Plan. This plan will detail how the Project will continue to engage with stakeholders during development including operation of a Grievance Mechanism to handle complaints from affected people.
Reporting, Disclosure and Approval	The final stage in the SEIA process is the preparation of the SEIA Report presenting all the findings of the impact studies. This will be submitted to Government for consideration. The report will be disclosed to the public and other stakeholders for review and comment. Once the disclosure and consultation process is complete the findings of the studies and the results of consultation will be taken into account by Government in making its decision on whether to approve the project and on any conditions to be attached to that approval.

A4.2 Scoping

During Scoping the Project and predicted interactions with communities and the environment will be reviewed to determine what are likely to be significant impacts, and to plan the work required to assess these impacts. This Terms of Reference has been produced following Scoping.

To undertake scoping effectively it is important to clearly define the Project, how the area of influence is defined, and the broad types of impacts that need to be considered in the assessment. The approach that will be followed in defining the Project, the resultant area of influence and the types of impacts to be addressed within the SEIA are described below.

Definition of the Project and its Area of Influence

In the SEIA a **Project** should be clearly defined to include all actions and activities which are a necessary part of the development. This will include all the main components of the Project and also any related and ancillary facilities without which the Project cannot proceed. This includes utilities, infrastructure, accommodation, etc. It should also include any other developments or activities which can be expected to follow as a necessary consequence of the Project even if not within the responsibility of Simfer. Examples may include migration of people into an area or new roads built by the government to meet increased demand for traffic caused by the project. This approach will be followed for all components of the Simandou Project.

Impacts will also be assessed for all **Phases** of the Project from initial site preparation and advance works, through construction and operation to closure, decommissioning and restoration of sites.

Impacts will be assessed throughout the **Area of Influence** of the Project. This will vary depending on the type of impact being considered, but in each case the area will be defined to include all that area within which it is considered that significant impacts could occur. This will take into account:

- the physical extent of the proposed works, defined by the limits of land to be acquired or used temporarily or permanently for the construction and operation of the Project;
- the nature of the baseline environment, the source of impact and the manner in which the impact is likely to be propagated beyond the Project boundary.

For example, losses of existing land uses are likely to be confined to those areas physically disturbed by the works, whilst the effects of noise could be experienced at some distance, and air pollution may be dispersed over long distances or even have regional or global effects. The proposed area of influence (study area) for each type of impact will be defined in the respective chapters of the SEIA Report.

Some impacts could extend across national boundaries, for example as a result of changes in animal migration or patterns of cattle herding, and the assessment will include these **Trans-Boundary** effects.

Types of Impact

The assessment will consider both **Positive and Negative** impacts on all aspects of the **Physical, Natural, Cultural, Social and Socio-Economic** environment.

Positive or beneficial impacts will be those which are considered by the SEIA team, taking in to account the views of external stakeholders, to present an improvement on the situation without the Project (the baseline) or to introduce a new desirable factor. Negative or adverse impacts will be the reverse.

Aspects of the environment to be considered will include:

- the physical environment including:
 - geology and soils;
 - land and topography;
 - hydrology and hydrogeology;
 - microclimate and global climate
 - surface and ground water resources including marine and freshwater;

- air quality;
- noise, vibration, light and other forms of radiation;
- the biological or natural environment including:
 - aquatic and terrestrial habitats and ecosystems;
 - flora and fauna and their biodiversity;
 - protected areas;
 - useful services provided by natural systems (referred to as ecosystem services)
- the cultural environment including:
 - tangible and intangible sites and features of archaeological, historic, traditional, cultural, aesthetic interest;
 - cultural traditions, practices and events;
 - the landscape and visual amenity;
- the social and socioeconomic environment including:
 - people and their homes, lands, other resources and assets;
 - the characteristics and structures of communities;
 - population and demographics;
 - human health, welfare, amenity, safety and security;
 - lifestyles including livelihoods, employment and incomes;
 - economic activities including industry and commerce, tourism, fisheries, agriculture and forestry;
 - community facilities such as schools, hospitals and leisure facilities;
 - utilities and infrastructure (power, water, sewerage, waste disposal, transport);
 - services such as health care, education and access to goods;
 - local, regional and national economies.

When discussing different aspects of the environment we will distinguish between **Resources** that is features of the environment such as soils, water resources, habitats, species, etc which are valued by society for their intrinsic worth and/or their social or economic contribution, and **Receptors**, that is people and communities who may be affected by the Project.

Timeframe

The assessment will address impacts with different temporal characteristics:

- **Permanent** impacts that will arise from irreversible changes in conditions such as the removal of physical features during construction;
- **Temporary** impacts that will arise during **short term** activities such as construction and decommissioning; and
- **Long term** impacts that will arise over the **operation** of the Project or occur as the environment recovers after its **closure**.

Short term, temporary impacts will cease on completion of the relevant activities although there may be a period before the environment returns to its previous condition. Long term impacts will continue over the life of the Project and during restoration, and may vary during this period, but will ultimately cease when the Project ceases although the environment may take some time to recover.

Other temporal characteristics of impacts (continuous or intermittent, one-off or recurrent) and their frequency and timing (e.g. seasonality) will also be taken into account.

Routine and Non-Routine Impacts

Development of the Project raises the potential for impacts to arise from both planned and unplanned events. The SEIA will therefore assess both:

- **routine** impacts resulting from planned activities within the Project; and
- **non-routine** impacts arising from:
 - unplanned or accidental events within the Project such as accidents involving spills of hazardous substances;
 - natural hazards and other external events affecting the Project such as seismic activity and flooding.

The impact of non-routine events will be assessed in terms of the Risk ie taking into account both the consequence of the event and the probability of occurrence (Risk = probability x consequence).

Direct, Indirect and Induced Impacts

Impacts can also be characterised according to whether they are **direct** (primary) impacts arising from activities associated with the Project or **indirect** (secondary and higher order) impacts that follow on as a consequence of these. So for example construction can lead to emissions of dust with a direct effect on air quality. Dust dispersion can then affect nearby agricultural fields possibly causing adverse effects on the quality and/or quantity of crops and the livelihoods of farmers. Dust can also result in soiling of buildings and materials with effects on amenity for users and added costs for maintenance.

Projects can also have **induced** impacts by stimulating other developments to take place which are not directly within the scope of, or essential to, the development of the Project. So for example, road improvements may encourage people or businesses to move into an area, and as a result lead to building of new homes which will have their own impacts. Whilst these possible developments are not part of the Project, they are caused at least in part by the Project and they will therefore be considered in the assessment.

Cumulative Impacts

The potential for the Project to have **cumulative** impacts with other activities and with known or committed developments such as other major mines or more informal artisanal mining, taking place in the area at the same time will also be taken into account in the assessment. Where other developments are already underway or committed they will be addressed by incorporating them into the future baseline for the Project (ie the No Project situation against which the impacts of the Project are assessed). If there are other developments which are still in planning but have yet to be formally approved the impacts of these will be considered alongside the impacts of the Project so that a full picture is provided of the possible future situation.

A4.3 Baseline Studies

To provide a baseline against which the impacts of the Project can be assessed, an important part of the SEIA will be to establish the conditions that would prevail in the absence of the Project – the Baseline. Baseline studies have already been undertaken in particular areas and additional baseline data is being collected, drawing upon information from:

- existing sources including government agencies, research organisations, publications;
- consultations with stakeholders;
- review of maps, satellite images and aerial photographs of the Project location and its surrounding area; and
- field studies designed to fill gaps in the data where this is needed to enable assessment of impacts.

The details of sources and survey methods will be fully described in the SEIA Report.

When assessing the impacts of projects, it is important to recognize that the baseline is likely to change significantly from the existing situation, as a result of changes in population, land use and economic activity, and through other developments independent of the Project. The baseline for this Project will therefore be defined by considering how current conditions will develop in the future without the Project (the “No Project” scenario).

A4.4 Assessment of Impacts

A4.4.1 Introduction

The assessment of impacts will follow an iterative process considering four questions:

1. Prediction - What will happen to the environment and communities as a consequence of this Project?
2. Evaluation - Does this impact matter? How important or significant is it?
3. Mitigation – If it is significant can anything be done to avoid or reduce adverse effects or enhance benefits?
4. Residual Impact – Is the impact still significant after mitigation?

The approach to these steps is outlined below.

A4.4.2 Predicting the Magnitude of Impacts

The impact assessment will describe what will happen to the environment and communities by predicting the magnitude of impacts and quantifying this to the extent practicable. The term “magnitude” is used here to encompass various possible dimensions of the predicted impact including:

- the nature of the change (what is affected and how);
- size, scale or intensity;
- geographical extent and distribution;
- duration, frequency, reversibility, etc; and
- where relevant, the probability of the impact occurring as a result of accidental or unplanned events.

It will also include any uncertainty about the occurrence or scale of the impact¹. Magnitude therefore describes the actual change predicted to occur in a resource or receptor (e.g. the area and duration over which air or water become polluted and the increase in concentration of the pollutant; the degree and probability of impact on the health or livelihood of a local community; the probability of injuries or deaths as the result of an accident).

Magnitude can be predicted using a range of different methods depending on the nature of the impact. As an example, noise and air quality impacts are typically predicted using standard mathematical models developed for calculating the effects of sources on ambient noise levels and concentrations of air pollution. Direct impacts on land use and habitats can be calculated from maps of the project footprint. However, some impacts which are less amenable to mathematical or physical representation are predicted using the professional knowledge and experience of experts, for example in areas such as biodiversity. The approach employed for this Project will be detailed for each type of impact in the relevant chapters of the SEIA.

To assist in the next step of evaluating significance (see A4.4.3), the magnitude of impacts will be graded taking into account all the various dimensions, to determine whether an impact is of small, medium or large magnitude. This scale is defined differently according to the type of impact and depending on the circumstances. For quantifiable impacts such as noise, numerical values are used whilst for other topics a qualitative classification is necessary.

The details of how magnitude is predicted and described for each impact will be explained in the relevant chapters of the SEIA Report.

A4.4.3 Evaluation of Significance

The next step in the assessment will be to take the information regarding the magnitude of impacts, and explain the importance to society and the environment. This will allow stakeholders to understand how important issues are when considering the Project. This is referred to as Evaluation of Significance.

There is no statutory or agreed definition of significance however, for the purposes of this assessment, the following practical definition is proposed:

An impact will be judged to be significant if, in isolation or in combination with other impacts, it should, in the judgement of the SEIA team, be reported in the SEIA Report so that it can be taken into account in the decision on whether or not the Project should proceed and if so under what conditions.

This recognises that evaluation requires an exercise of judgement and that judgements may vary between parties involved in the process (including regulators, experts, affected people and the general public). The evaluation of impacts that is presented will be based on the judgement of the SEIA Team, informed by reference to legal and international standards and policy, current good practice and the views of stakeholders as expressed through the consultation process.

Criteria for assessing the significance of impacts will be clearly defined for each type of impact taking into account whether the Project will:

- Cause legal or accepted environmental standards to be exceeded – e.g. air, water or soil quality, noise levels – or make a substantial contribution to the likelihood of standards being exceeded; or
- Adversely affect protected areas or features or valuable resources – these include protected nature conservation areas, rare or protected species, historic features, important sources of water supply; or
- Conflict with established government or international policy e.g. to reduce greenhouse gas emissions, recycle waste, improve health, protect human rights, etc.

(1) A distinction is made here between the probability of impact arising from a non-routine event such as a seismic event or fire, and the uncertainty inherent in making predictions about what will happen in the future. For example it may not be certain that health will be affected by air emissions or that jobs will be obtained by local people. This is different from estimating the probability of an unplanned event occurring. Uncertainty can be expressed by describing the predicted outcome using a range rather than a single value, by placing confidence limits around the prediction, or by estimating the likelihood of the prediction being correct.

Where standards are not available or provide insufficient information on their own to allow evaluation of impacts, significance will be evaluated taking into account the magnitude of the impact and the value or sensitivity of the affected resource or receptor. Magnitude will be defined as described in the previous section (A4.4.2). The value of a resource will be judged taking into account its quality and its importance as represented, for example, by local, regional, national or international designation, its importance to the local or wider community, or its economic value. The sensitivity of receptors, for example a household, community or wider social group, will take into account their likely response to the change and their ability to adapt to and manage the effects of the impact.

Magnitude and value/sensitivity will be looked at in combination to evaluate whether an impact is significant and if so its degree of significance. The principle is illustrated in *Figure A4.2*. The grades apply to both positive and negative impacts.

Figure A4.2 Evaluation of Significance

Sensitivity/Value of Resource/Receptor	Magnitude of Impact		
	Small	Medium	Large
Low	Not significant	Minor	Moderate
Medium	Minor	Moderate	Major
High	Moderate	Major	Critical

The specific criteria used to evaluate significance for each type of impact will be clearly defined in the impact assessment. It should be made clear that the distinctions between grades cannot be considered as clear cut and judgments as to magnitude, value or sensitivity, and significance involve careful weighing up of a range of factors by the SEIA Team.

A4.5 Mitigation

Impact assessment is designed to ensure that decisions on Projects are made in full knowledge of likely impacts on the environment and society. A vital step within the process is the identification of measures that can be taken to ensure impacts are as low as reasonably practicable.

This will be done by identifying where significant impacts could occur and then working with the Project team to identify reasonably practical ways of mitigating those impacts as far as possible. These measures will be agreed with Simfer and integrated into the Project proposals.

Where a significant impact is identified, a hierarchy of options for mitigation will be considered to identify the preferred approach:

- Avoid at source – remove the source of the impact, for example by relocating a component of the Project to avoid a sensitive site.
- Abate at source – reduce the source of the impact, for example by controlling the emission of dust or noise.
- Attenuate – reduce the impact between the source and the receptor, for example by installing a noise barrier between an industrial facility and neighbouring communities.
- Abate at the receptor – reduce the impact at the receptor, for example by providing noise insulation in nearby buildings.
- Remedy – repair the damage after it has occurred, for example by cleaning up accidental spills during construction.

- Compensate / Offset – replace a lost or damaged resource with a similar or a different resource of equal value, for example by resettling displaced businesses into new premises, or providing monetary compensation for loss of business.

Mitigation will also include measures to provide or enhance positive benefits from the Project, so for example by providing employment opportunities, and improving the chances of these being available to local people by setting up training in the required skills.

Consideration will be given to achieving mitigation of impacts by various means including:

- Changes in the design of the Project, for example relocating structures, incorporating noise barriers into the design, and designing structures to minimise their visual impact.
- Selection of particular approaches and methods for construction, for example using bored rather than driven piling or electrical rather than diesel powered equipment.
- Adoption of measures to control impacts during construction and operation, such as covering of dusty materials, installation of oil interceptors, adoption of emergency spill plans, and traffic management.

All these types of measures will be considered in the assessment and proposals discussed and agreed with Simfer. and presented in a Social and Environmental Management Plan (SEMP) for the Project. Where detailed measures cannot be presented as formal commitments at this stage in the Project, a clear commitment will be given to achieving a specified level of environmental performance and to finalizing specific measures at a later stage. Proposals will also be set out for monitoring implementation of mitigation and providing regular reports for external stakeholders as part of the Social and Environmental Management System for the Project. The SEMP will also identify means to build capacity in Guinea manage and regulate potential impacts.

A4.6 Assessing Residual Impacts

Following agreement on feasible mitigation the SEIA team will re-assess the impacts taking into account the mitigation adopted within the Project. Where significant residual impacts remain after mitigation further options will be examined and impacts re-assessed in consultation with the Project team. This will continue until they are considered to be as low as reasonably practicable. The significant residual impacts remaining at the end of this process will be described in the SEIA Report with commentary on the proposed mitigation. The degree of significance attributed to residual impacts will reflect the level of consideration the SEIA team considers should be given in reaching decisions on the Project.

- **Critical** impacts will be avoided.
- Any residual **Major** impacts, whether positive or negative, will warrant substantial consideration, when compared with other environmental, social or economic costs and benefits, in deciding whether or not the Project should proceed. Conditions should be imposed to ensure adverse major impacts are strictly controlled and monitored and beneficial impacts are fully delivered.
- Residual **Moderate** impacts are considered be of reducing importance to the decision, but still warrant careful attention to conditions regarding mitigation and monitoring, to ensure best available techniques are used to keep adverse impacts as low as reasonably practicable, and to ensure beneficial impacts are delivered.
- **Minor** impacts will be brought to the attention of the decision-maker but are identified as warranting little if any weight in the decision. Adequate mitigation should be achieved using normal good practice and monitoring should be carried out to confirm that impacts do not exceed predicted levels.

A4.7 Interface with the Design Team

The SEIA team will gather information for the assessment on the design, construction and operation of the Project. As impacts are investigated the results will be discussed with them and feasible mitigation measures discussed and integrated into the Project where possible. All agreed measures will be described in the SEIA Report and SEMP.

A4.8 Stakeholder Engagement

During the SEIA the team will also consult with stakeholders to understand their views and concerns relating to the Project and to collect information about the local environment and community. This information will be taken into account in the assessment and in the identification of appropriate mitigation measures for the Project.

Once the SEIA Report is completed and submitted to Government for review and approval it will be made widely available for public comment and its findings will be disseminated to affected communities. All comments made on the Project, its impacts and the proposed mitigation will be considered in finalising the Project design, the methods for construction and operation, and the detailed Social and Environmental Management Plan.

Simfer SA

Simandou Project

Social and Environmental Impact Assessment Terms of Reference

PART C

Marine Offloading Facility

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- facilities for sewage treatment, potable water supply, electricity generation, waste management and storage;
- worker accommodation; and
- laydown areas.

The Project will also include:

- dredging of channels to access the MOF from the nearest deepwater;
- the development of roads to access the MOF from the nearest existing road at Maferinya and to provide access from the MOF to the proposed railhead and deepwater port, together with upgrading of existing roads to enable passage of heavy vehicles;
- development of quarries and borrow pits; and
- helipads.

Depending on the location of the MOF, two further Project components are foreseen:

- if the MOF is north of Sankia, the Project will include an upgrade of an existing jetty at Toguigire; and
- if the MOF is at Île Matakang, a causeway will be constructed to the MOF from Île Kabak.

C1.7 Construction

The MOF will be constructed in two phases. The first phase is planned to involve the following activities:

- construction of temporary accommodation for some 350 construction workers (in accordance with *IFC and EBRD Guidance Note on workers' accommodation; processes and standards*);
- dredging of an approach channel to a depth of 8.5 metres Below Chart Datum (BCD) and disposal of the dredged material at a yet to be designated offshore location at depths in excess of 15 m BCD (in accordance with *IFC EHS Guidelines for Ports, Harbours and Terminals*);
- bringing in shallow draught landing craft and barges for initial offloading of equipment for building the MOF;
- operation of quarries and borrow pits;
- clearing, levelling and fencing of a main site of approximately 2.25 km²;
- construction of quays, creation of hardstanding areas for offloading operations and installation of cranes and other equipment;
- installation of facilities for site drainage, sewage treatment and disposal, desalination plant, potable water supply, power generation by diesel-powered generators, lighting, fuel unloading, storage and distribution, waste management and storage (all construction and operation undertaken in accordance with *IFC General EHS Guidelines*); and
- construction of temporary buildings.

In the second phase new roads will be constructed to the proposed railhead and to the deepwater port location, and existing roads to the site including the road from Maferinya may be upgraded to carry heavy construction traffic.

Construction equipment will include earthmoving equipment for site preparation, shallow draught barges for transport of equipment and materials, mobile jack-up rigs for piling operations, graders and trucks and other road construction equipment. Piling will be carried out for the quay and in areas where ground-bearing

capacity is insufficient. Buildings, storage tanks and sewage treatment units will be brought in as pre-fabricated modules.

Construction material for site preparation and roads will be sourced from within the site perimeter or from established suppliers or by developing new quarries to supply the works. If new quarries are required these will be included in the SEIA. Any waste that is produced onsite will be transferred to a waste disposal facility that is part of the nearest Logistic Supply Centre developed as part of the Construction Workforce Accommodation and Logistical Support Centres (see Part D). The two phases of construction are estimated to take 15 months.

C1.8 Operation

Once construction is complete the MOF will operate for the duration of the main Simandou Project construction phase (approximately 3 years). The MOF will act as a transit point for construction equipment and materials. It will operate on a roll-on roll-off and basis for movable equipment and load-on load-off for handling of bulk goods or containers. Facilities will include customs clearance, storage and servicing of equipment and handling of construction materials. Tug boats and service vessels will operate from the MOF in support of planned maritime construction activities. The fuel barge will be used to store and transfer diesel to onshore tanks for filling of road tankers for distribution to Project refuelling areas. The fuel barge will be refilled offshore from contracted tanker vessels. Maintenance dredging may be required to ensure safe navigation.

On completion of construction of the main Port, the MOF will remain in service, although the operations will become part of the main Simandou Project. The MOF SEIA will include the first three years of operation but will not include operations undertaken following completion of the Port element of the Simandou Project. Once mining ends and the MOF is no longer needed for the Simandou Project, if the government wishes, arrangements may be made for transfer of the MOF to a port authority or private port operator rather than closing and decommissioning the facility.

C2 Proposed scope of the assessment

The primary purpose of the Draft Terms of Reference is to identify the likely significant impacts of the MOF so that assessment of these can be planned as part of the SEIA. This section outlines what are expected to be the impacts from each phase of development of the camps and centres, providing an initial view on the likely magnitude and significance of impacts and outlining how they will be assessed. In undertaking this initial assessment consideration has been given to the guidance provided by the Ministry of Environment on Environmental Impact Studies ¹, together with the international standards for SEIA established by IFC and Rio Tinto's own corporate policies and standards. The methodology for the SEIA is described in Part A of this document and the work schedule is presented in Section C5. The likely significant impacts have been elaborated on in *Table C2.1*. The key topics of interest are:

- Geology, Soils and Contaminated Land;
- Marine Environment;
- Surface Water (Hydrology) and Ground Water (Hydrogeology);
- Biodiversity, Nature Conservation and Ecosystem Services;
- Landscape and Visual Impacts;
- Cultural Heritage and Archaeology;
- Noise and Vibration;
- Air Quality and Climate;

¹ Ministère de l'Agriculture de l'Élevage de l'Environnement des Eaux et Forêts, Service National des Etudes et d'Évaluation Environnementale ; Les Etudes d'Impact sur l'Environnement : Termes de Référence pour les Etudes d'Impact Environnemental & Social & Guide d'Évaluation ; Version 03/2007

- Traffic;
- Displacement of Land Uses, Property and People;
- Community Health and Safety;
- Social and Socio-Economic Impacts; and
- Employment and Working Conditions.

The following information is provided for each topic:

- **Sources of impact:** The potential causes or sources of impact during construction and operation (impacts from Decommissioning are not considered here as this will be covered in the SEIA for the main Simandou Project);
- **Potential impacts of significance:** discussion of the types of impact that could occur from construction or operation of the Project based on available information on the Project and the baseline environment;
- **Proposed assessment approach:** an outline of the work required to complete the assessment.

Table C2.1 Potential Significant Effects of the MOF

Topic	Sources of impact	Initial assessment of likelihood of significant impacts	Proposed approach to assessment
Geology and Soils	Removal of topsoil during site clearance and preparation	There is the potential for loss of soil resources from the main MOF site, along route of new roads and in laydown areas. If there are soil resources of high value for agriculture on site this could be significant. There is also the potential for acid-sulphate soils that may adversely affect local water resources.	The assessment will consider the quality and use of soil resources at the site and determine whether these are considered to be significant. If so measures will be identified to mitigate this loss.
	Dewatering and drainage during construction and operation		
	Spills of hazardous materials and disposal of waste on land during construction and operation	Intentional or accidental discharges of liquid waste or deposit of solid waste on land could cause contamination of soils affecting ecosystems, underlying groundwater and future use of the land for agriculture or other land uses after closure of the MOF.	The assessment will consider the types of materials to be used and handled on site during construction and operation and where there is the risk of significant impacts from accidental or intentional releases to the environment, measures to mitigate these will be identified.
Marine Environment	Marine works, dredging and dredged spoil disposal during construction	Marine works, dredging of a channel, disposal of spoil and the associated dredge plume will have an impact on the seabed and water quality. There is also potential for changes in shoreline and seabed morphology and sediment conditions with potential effects on aquatic ecosystems and fishing. The impacts could be significant if sea water quality, species of conservation interest or local fisheries are affected.	The assessment will provide an assessment of the magnitude and extent of changes in the marine and coastal environment, and uses of that environment including fishing, evaluate the impact against the background of natural changes in the marine environment and identify measures to mitigate the impact.
	Maintenance dredging and disposal during operation		
	General marine operations during construction and operation		
	Spills and site run-off during construction and operation	Intentional and accidental spills of hazardous materials and site run-off have the potential to impair sediment and water quality and the aquatic ecosystem. Discharges of effluents not complying with Guinean and international standards could cause significant impact on the water quality, on users of water resources and on ecosystems, fauna and flora.	The assessment will consider the types of materials to be used and handled on site during construction and operation and where there is the risk of significant impacts from accidental or intentional releases to the environment, measures to mitigate these will be identified.

Topic	Sources of impact	Initial assessment of likelihood of significant impacts	Proposed approach to assessment
Hydrology and Hydrogeology	Site clearance and levelling during construction	If occupation of the Project site displaces or required the diversion of surface water resources or the abstraction of groundwater this could have an impact on existing uses of those resources on site or downstream and on downstream aquatic flora and fauna and fisheries. The MOF is close to the coast and the likelihood of such impacts is considered to be small.	The assessment will confirm whether there are important surface water and groundwater resources which could be affected by the Project.
		Development of the site could displace boreholes or other sources used by the local community for water supply. Loss of this resource could be a significant impact.	The assessment will confirm whether there are boreholes within the Project sites and if so measures to mitigate their loss will be identified in consultation with communities and other user groups.
	Marine works and dredging during construction	Dredging of an approach channel may lead to saline intrusion in adjacent groundwater bodies and increased flood risk.	The assessment will assess whether the extent of dredging and marine works has the potential to affect groundwater and flood risk within or near Project site.
	Discharges of liquid effluents to surface and ground water during construction and operation	Intentional or accidental discharges of liquid waste or deposit of solid waste on land could cause contamination of soils. Discharges of effluents not complying with Guinean and international standards could cause significant impact on the water quality, on users of water resources and on ecosystems, fauna and flora	The assessment will include an inventory of hazardous products, rules for management of said products to prevent spillage risks, and a contingency plan in case of spill to minimise impacts..
Biodiversity and nature conservation	Site clearance and levelling, marine works and road construction during construction	Development of the MOF and laydown areas and road infrastructure has the potential to affect important natural habitats such as mangroves, forests, wetlands, wildlife corridors and coastal and marine habitats and their flora and fauna including endangered plant and animal species, or that provide ecosystem services to users of a specific resource (fuel wood, medical plants, food etc).	Appropriate habitat characterisation and mapping of important and sensitive habitats and species will be carried out within the study area. The assessment will also consider the impact of land take on the provision of services by ecosystems affected by the Project, taking into account the value provided by those services to local communities and user groups. This will confirm the presence of species or habitats of conservation interest. An assessment will be carried out to establish the magnitude of the impacts on biodiversity and nature conservation and measures will be identified to mitigate the impacts.

Topic	Sources of impact	Initial assessment of likelihood of significant impacts	Proposed approach to assessment
	Dredging and dredged spoil disposal during construction and operation	Dredging, dredge disposal and associated sediment plumes could potentially have adverse impacts on benthic habitats, flora and fauna, coastal/mangrove areas and endangered species. Dredging and resulting sediment plumes could cause adverse changes to the mangrove ecosystem.	Appropriate habitat characterisation and mapping of important and sensitive habitats and species, and uses of that environment including fishing, will be carried out within the study area. The assessment will also consider the impact of dredging and dredge disposal on the provision of services by ecosystems affected by the Project, taking into account the value provided by those services to local communities and user groups. This will confirm the presence of species or habitats of conservation interest and measures will be identified to mitigate the impacts.
	Construction and operational traffic	Noise, dust and road traffic accidents have the potential to adversely affect plant, animal and human populations in the area of the MOF, the laydown areas and along roads used by MOF-related traffic.	Appropriate habitat characterisation and mapping of important and sensitive habitats and species will be carried out within the study area. The assessment will also consider the impact of traffic on the provision of services by ecosystems affected by the Project, taking into account the value provided by those services to local communities and user groups. This will confirm the presence of species or habitats of conservation interest and measures will be identified to mitigate the impacts.
	In-migration during construction and operation	The Project may displace people and attract new settlers who, if uncontrolled, may encroach on existing natural habitats and add pressure on existing natural resources.	Appropriate habitat characterisation and mapping of important and sensitive habitats and species will be carried out within the study area. The assessment will also consider the impact of in-migration on the provision of services by ecosystems affected by the Project, taking into account the value provided by those services to local communities and user groups. This will confirm the presence of species or habitats of conservation interest and measures will be identified to mitigate the impacts.
	Introduction of alien species during construction and operation	Materials and equipment may be brought into Guinea during both construction and operation of the MOF, and could be contaminated with alien invasive or predatory species which could be introduced into and harm local ecosystems	Impacts from alien introductions will be examined by reference to experience elsewhere in Guinea and worldwide and a quarantine system will be developed to minimise to risks

Topic	Sources of impact	Initial assessment of likelihood of significant impacts	Proposed approach to assessment
Landscape and visual impacts	Change in land form and use and introduction of built features into landscape during construction and operation	The MOF and associated facilities will change the landscape and visual character of the local area. In view of the scale of the MOF and laydown area, the impact may affect the visual environment for local communities.	An assessment will be made of the changes to the landscape and views for local people. Where mitigation is warranted, suitable measures will be identified in consultation with affected communities and other land users.
Cultural heritage	Site preparation and levelling during construction Impacts may not become apparent until during operation	The area of the MOF, laydown and road may include sites and features of cultural importance. Sites of tangible cultural heritage (historic buildings, buried archaeology) located within the Project footprint would be directly affected and sites nearby could be indirectly affected by impacts depending on their setting. The Project could also cause impacts on sites or practices of importance for their intangible cultural heritage values through direct impacts, disturbance to the setting of locations, and changes in communities and socio-economic conditions. This in turn may put the customs and practices associated with these sites and with traditional ways of life at risk. Intangible cultural heritage may also be affected due to in-migration of people from elsewhere disturbing local cultures and traditions. Positive impacts could also occur if sites that are currently under threat can be protected effectively.	Sites of importance for cultural heritage will be mapped and characterised through field work, consultation and modelling. Develop mitigation measures in consultation with affected groups and users taking into account their concerns. Direct impacts through land take will be identified and indirect effects through changes in setting and socio-economic and demographic conditions will be assessed. Mitigation measures will be set out in a Cultural Heritage Management Plan including prior investigation of high priority sites and operation of a chance find procedures for the protection or preservation of any sites of value and intangible cultural heritage discovered during construction or operation.
Noise and vibration	Site preparation, earthworks, piling, dredging and other operations during construction Traffic during construction and operation MOF operations and shipping	Construction and operational activities have the potential to cause noise impacts in areas where ambient noise pollution levels are currently very low. Noise during the night is likely to be particularly evident in residential areas.	The impacts of noise emissions on ambient noise levels will be predicted and compared established IFC and WHO noise thresholds. Measures will be identified to mitigate significant impacts.
Air quality	Site preparation, earthworks, piling, dredging and other operations during construction Traffic during construction and operation MOF operations and shipping	MOF construction and operation activities and associated traffic have the potential to cause air impacts in areas where ambient air pollution levels are currently very low. Dust arising from road construction and transport could have adverse impacts on nearby residential areas and on agriculture.	The impacts of air emissions on ambient air quality will be assessed to establish the likely impact of these emissions in sensitive areas along the roads and in the vicinity of the MOF and laydown areas in comparison with national and international (IFC and WHO) standards.. Measures will be identified to mitigate significant impacts

Topic	Sources of impact	Initial assessment of likelihood of significant impacts	Proposed approach to assessment
Traffic	Shipping and dredging during construction and operation	Dredging operations and increased shipping traffic in the approaches to the MOF will increase the risk of incidents in the coastal area and near the MOF with resulting risks to life, obstruction of existing navigation, fisheries and the marine environment.	The assessment will investigate existing navigation and traffic movements and assess increased risk of collisions and implications of obstruction. Measures will be identified to mitigate significant impacts.
	Road transport of materials, equipment and personnel during construction and operation	Development of the MOF will introduce significant new traffic to the local area and require substantial improvements to existing road infrastructure. This will bring benefits to local communities and the local economy by improving access but there could be increased congestion on existing roads and increased risks from traffic accidents affecting other traffic, local people and animals. The construction of roads may cause the severance of traditional community access routes.	Requirements for new and improved roads will be defined and estimates will be made of traffic flows. Benefits for local people and businesses in terms of improved accessibility on local roads and adverse impacts from severance and traffic accidents will be assessed and mitigation identified where appropriate. Community views on perceived risks to access and needs for emergency preparedness will also be taken into account.
Displacement of land uses, property and people	Permanent and temporary land take for the construction of the MOF and associated facilities.	Permanent and temporary land take to facilitate construction and operation of the MOF, will result in economic and/or physical displacement of people living in or using the impacted area. Where they are dependant on subsistence farming or other land-based resources loss of land will have a particular adverse impact on livelihoods.	The assessment will identify existing land ownership and land use within the permanent and temporary Project footprint. An assessment will be carried out to determine the impact on the residents, farmers, other users of land-based resources and on their associated livelihoods. Mitigation measures including compensation and resettlement in accordance with international standards will be identified. The assessment will include engagement with the affected groups to ensure their participation in impacts and mitigation measures.
	Dredging, dredged spoil disposal and shipping traffic during construction and operation	Dredging and shipping associated with the development of the MOF has the potential for significant impacts on access to traditional fishing grounds, fishing practices and livelihoods and knock-on effects on communities. Fishing is understood to be a major source of livelihood in the areas with many associated cultural and ritual aspects.	The assessment will identify and map existing fishing practices, customary fishing rights and economies, to determine the impact on the fishing community and associated livelihoods. Mitigation measures including compensation for will be identified where significant impacts are expected.

Topic	Sources of impact	Initial assessment of likelihood of significant impacts	Proposed approach to assessment
Community health and safety	Hazards associated with traffic, in-migration and social tension during construction and operation	There may be increased risks to community health and safety around the MOF area with introduction of international shipping traffic, increased road traffic, introduction of new disease hazards and potential public health impacts (including vector borne diseases and communicable infectious diseases such as water-borne diseases, food-borne diseases, respiratory diseases and sexually transmitted diseases), in-migration, reduced access to potable water, deteriorating housing conditions and potential for antisocial activities in local communities.	The assessment will include a review of community health baseline surveys to ensure that adequate information is available regarding health status and disease prevalence at household level and indicate potential community health risks. This will include risks from vector borne, water borne, food borne, respiratory and sexually transmitted diseases. Assessment of health care systems and services. Safety statistics will be analysed to identify safety hazards or hotspots. Measures will be identified to mitigate the impacts.
Social and socio-economic impacts	Presence of project, changes in access to land and resources, monetisation during construction and operation.	Socio-economic transformation related to the presence of the Project in the form of in-migration, monetisation, inflation, economic growth, expectations for and conflict over jobs, land and resources have the potential to cause a breakdown in traditional social structures and value systems, causing changes in social roles and status (such as those of women and youth seeking wage employment). This may undermine traditional family and community support networks and change the situation of women and vulnerable groups in the population.	An assessment will be carried out of potential vulnerabilities based on socio-economic profiling, household level surveys and consultation. The nature and magnitude of changes in current social networks, traditional structures, social cohesion, security, and economic welfare will be determined. This will include consideration of perceived impacts on social conditions, taking into account views expressed through consultation. Mitigation measures will be identified that increase community resilience to social and socio-economic changes.
	In-migration	In-migration is predominantly associated with individuals seeking work and significant potential risks include pressure on land and natural resources, shortages of social services and amenities, pressure on housing conditions and public sanitation, social unrest and impacts on intangible cultural heritage, spread of infectious diseases, pollution of water sources and threats to biodiversity.	The scale and character of potential in-migration will be assessed by reference to past experience at Simandou, and experience elsewhere in Guinea and internationally and by considering the accessibility and attractiveness of the Project location for potential migrants from within and outside Guinea. The Project's existing Influx Management Plan will be developed to address the level of influx predicted to occur and the manage the potential adverse effects and maximise the benefits for local communities, resources and the environment. The IFC guidance document <i>Projects and People: A Handbook for Addressing Project-Induced In-migration</i> will be referred to

Topic	Sources of impact	Initial assessment of likelihood of significant impacts	Proposed approach to assessment
	Pressure on infrastructure and services during construction and operation.	Project activities and increased population will generate increased demand and pressure on infrastructure and services such as roads, electricity, water supply and social services such as education and healthcare. Currently there is poor distribution of, and limited access to these services. Population increases from the Project workforce, local economic growth and in-migration could place further pressure on an already strained situation.	Existing capacity will be identified and requirements for expansion and upgrading will be defined. The Project will identify the scope for partnering with government to manage pressure on infrastructure and services.
	Governance and Institutional Capacity during construction and operation.	Capacity in some government institutions and civil society in Guinea is limited. This creates challenges for the implementation of regulatory controls, environmental and social management measures and development strategies in order to mitigate project impacts and maximise benefits.	The capacity of key government and civil society institutions will be assessed and an Institutional Capacity Plan proposed for local and national government and civil society institutional strengthening, capacity building and partnerships.
Employment and working conditions	Employment of local, regional and foreign workers during construction and operation	The Project will create some opportunities for employment of local people and Guinean/West African nationals in accordance with Rio Tinto policies but expectations of jobs may not match actual Project needs. In creating employment the Project will need to comply with national legislation and international standards regarding employment conditions.	The assessment will identify the potential for employment of local workers and consult on requirements for training and capacity building or safety nets to support communities transitioning into wage employment. Mitigation measures for managing expectations for employment and ensuring appropriate working conditions will be developed.
	Opportunities for local employment and provision of good and services to the MOF.	The establishment of the MOF in the vicinity of existing settlements will offer the potential for local people to be employed in suitable positions and for local businesses to provide goods and services. This will be of benefit to the local economy and communities and benefits can be improved by focus to local procurement where this is feasible.	The assessment will investigate the scope for local procurement of workers, goods and services for the MOF and identify measures that can be taken to maximise these opportunities.

C3 SEIA Report structure

The proposed structure of the MOF SEIA Report is outlined in *Table C3.1*. The proposed outline covers the requirements of *Arrêté 990/ NRNE/SGG/90* in a structure designed to ensure all the required information is provided in a convenient and easily understandable manner. A discussion of alternative locations, design and construction methods will be included in the Project description. The impact chapters will present the assessment findings including topic specific scoping outcome, baseline information, methods of baseline data collection, gaps and uncertainties, assessment of impacts, mitigation measures proposed and residual impacts.

Table C3.1 Proposed Structure MOF SEIA Report

Structure	
0. Non-Technical Summary	Provides a concise and easy to understand summary of the findings of the SEIA
1. Introduction	Includes background to the Project, the proponent, the legal context and need for a SEIA and the methodology adopted. Detailed information on environmental and social legislation applying to the Project and the administrative and policy context will be provided in an annex.
2. Project description,	The Project description will provide details of the location, design, construction and operation of the Project and explains the background to its development and alternatives considered. The estimated costs for development of the project will be mentioned, as well as the schedule for completion. Further information on appraisal of alternatives will be presented in an annex, as well as the reasons why, from an environmental perspective the Project was retained.
3. Scoping and Stakeholder Consultations	This chapter will present the results of the current scoping studies and summarise the views and concerns of external stakeholders as expressed during the SEIA consultations. The views of stakeholders will be taken into account in the following assessment chapters. A full report on the results of stakeholder consultations will be presented in an annex.

Structure	
Impact Chapters by topic 4. Impacts on Land Use and Property 5. Geology and Soils 6. Hydrology and Hydrogeology 7. Marine Physical Environment 8. Marine Biodiversity, Flora and Fauna 9. Terrestrial Biodiversity, Flora and Fauna 10. Landscape and Visual Impacts 11. Archaeology and Cultural Heritage 12. Noise and Vibration 13. Odours, Air quality and Climatic Factors 14. Traffic and infrastructure 15. Social and Socio-Economic Impacts	Each topic chapter will provide the following information: • an introduction to the topic and to the sources and types of impact addressed in the chapter (ie the scope); • a description of methods and sources used to characterise the baseline and to predict and evaluate impacts with a note of any difficulties or limitations; • a description of the baseline relevant to the topic; • a description of the impacts, planned mitigation and how this will avoid or reduce impacts, and evaluation of the significance of the residual impacts after mitigation; • discussion of cumulative impacts, where relevant; and • Supporting information will be provided in annexes where needed.
15. Social and Environmental Management Plan	This section will provide a framework for the mitigation measures to be implemented, including a policy framework for land acquisition, compensation and resettlement planning and a stakeholder engagement plan and grievance policy for the remaining stages of the work. A detailed Social and Environmental Management Plan describing all the proposed mitigation measures from the Impact Assessment will be presented in an annex. The costs associated to each of these mitigation measures will be described.
Annexes	

C4 Proposed SEIA Tam

The SEIA team will be led by Environmental Resources Management Limited (ERM)¹ and will include specialists in the following disciplines which are considered to be relevant to the assessment of impacts from the MOF identified in Section C2:

¹ ERM is a member of the UK Institute of Environmental Management and Assessment EIA Quality Mark Scheme. ERM's Project Director is a registered as a Principal EIA Practitioner and is a Practitioner Examiner with the Institute.

- Marine environment – oceanography, sediment dynamics, water quality and ecology;
- Biodiversity;
- Geology, soils and erosion;
- Hydrology and surface water resources;
- Hydrogeology and groundwater resources;
- Noise and vibration;
- Air quality;
- Landscape and visual impact;
- Cultural heritage;
- Land use and resettlement;
- Socio-economic impact, development and livelihoods;
- Community health and safety; and
- Employment and working conditions.

The SEIA Team will be led by environmental professionals with more than 25 years experience in the field and all specialists studies will be undertaken under the supervision of suitably qualified experts with at least 15 years experience.

C5 Proposed SEIA Timetable

The proposed schedule for completion of the SEIA is set out in *Figure C5.1*. The current planned schedule envisages submission of the SEIA Report to the Minister of the Environment in October 2011 and issue of approval for the MOF by January 2012.

Figure C5.1 SEIA Schedule

Activity	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Agreement on Terms of Reference							
Baseline data collection							
Stakeholder consultations							
Appraisal of alternatives and selection of preferred site							
Impact assessment and mitigation planning							
SEIA Report and SEMP submission to Government							
SEIA disclosure and consultation							
Government review and decision-making							

Stakeholder Engagement Records

Compte-Rendu du Processus de Participation

Evénement / Event	Conférence Nationale de Lancement de l'Etude d'Impact Social et Environnemental (EISE) pour le Projet Simandou National Conference for the launch of the Social and Environmental Impact Assessment (SEIA) for the Simandou Project
Lieu / Location	Hotel Novotel
Date	19 Sept 2012
Durée / Time	10.30am - 5.30pm
Président / Chair	Ministry of Environment and the Ministry of Mines
Liste des présents / Attendance List	
<i>Approximativement 200 personnes ont participé à l'atelier. Parmi les personnes présentes, on peut citer :</i> <i>des représentants du Gouvernement guinéen (Ministère des Mines, Ministère de l'Environnement, Ministère de l'Urbanisme, Ministère de l'Agriculture, Ministère de la Décentralisation) ;</i> <i>des représentants du BGEEE et du CNSES ;</i> <i>les gouverneurs de Kindia, Mamou et N'Zérékoré;</i> <i>les préfets ou leur représentant de Forécariah, Kindia, Mamou, Faranah, Kouroussa, Kankan, Kissidougou, Macenta, Kérouané and Beyla;</i> <i>les sous-préfets de Ouré-Kaba, Banankoro, Konsankoro, Sikhourou, Douako, Moussayah, Sandeniah, Tiro, Marella, Heremakonon, Soyah, Madina Oula, Tokonou, Kérouané, Nionsomoridou, Kaliah, Albadariah</i> <i>les maires de Forecariah, Beyla;</i> <i>des représentants des organisations onusiennes (UNHCR, ONUSIDA, UNESCO, UNICEF, UNDP, FAO) ;</i> <i>des représentants d'ONG (Ecologie, Faisons Ensemble, AVODEK, Pride Guinée) ;</i> <i>des représentants d'institutions internationales de financement (SFI, AFD, GIZ) ;</i> <i>des représentants de la presse ;</i> <i>des représentants de Rio Tinto Simfer (relations gouvernementales, approbations environnementales, communications, communautés etc); et</i> <i>des représentants du cabinet ERM.</i> Approximately 200 people participated in the workshop. Among the attendees were: - representatives from the Government of Guinea (Ministry of Mines, Ministry of Environment, Ministry of Urbanism, Ministry of Agriculture, Ministry of Decentralisation); - representatives from the BGEEE and the CNSES; - the governors of Kindia, Mamou and N'Zérékoré; - the prefets or prefets' representatives of Forécariah, Kindia, Mamou, Faranah, Kouroussa, Kankan, Kissidougou, Macenta, Kérouané and Beyla; - the sous-prefets of Oure-Kaba, Banankoro, Konsankoro, Sikhourou, Douako, Moussayah, Sandeniah, Tiro, Marella, Heremakonon, Soyah, Madina Oula, Tokonou, Kérouané, Nionsomoridou, Kaliah, Albadariah - the mayors of Forecariah, Beyla; - UN representatives (UNHCR, ONUSIDA, UNESCO, UNICEF, UNDP, FAO); - representatives from NGOs (Guinée Ecologie, Faisons Ensemble, AVODEK, Pride Guinée); - representatives of international financing organisations (IFC, AFD, GIZ); - representatives from the press; - representatives from Rio Tinto Simfer (Government Relations, Environmental Approvals, Communications, Communities etc); and - representatives from ERM.	

Résumé des questions et des commentaires reçus / Summary of Questions and Comments Received

Les questions et préoccupations des participants de la conférence de Conakry ont essentiellement porté sur:

- *l'emplacement exact du Projet (et notamment l'alignement du rail) ;*
- *la protection de l'environnement (et notamment la protection des forêts classées et de la biodiversité) ;*
- *le processus de consultation qui sera mené par le Projet (quand et de quelle manière ce processus sera-t-il réalisé ?) ;*
- *la proximité de corridor du train avec la frontière sierra-léonaise ainsi que les problèmes de sécurité que cela pourrait entraîner ;*
- *le processus de l'EISE (comment une EISE est-elle réalisée ?) ;*
- *le processus du PARC (notamment le processus de compensation et l'implication des populations dans le processus) ; et*
- *une recommandation : les TdRs devraient être largement publiés et distribués aux autorités locales.*

The principal questions and concerns related to:

- the Project's exact footprint (and mainly the rail alignment);
- the protection of the environment (mainly for the protection of classified forests and for the biodiversity);
- the consultation process that is going to be undertaken by the Project (when and how is it going to be undertaken?);
- the proximity of the rail alignment with the Leonese border and the safety issues that it could create;
- the SEIA process (how is a SEIA being undertaken?);
- the PARC process (mainly about the compensation process and the population's involvement); and
- a recommendation: the ToRs should be widely publicised and distributed to all local authorities.

Événement / Event	<i>Atelier préfectoral de lancement de l'Etude d'Impact Social et Environnemental (EISE) du Projet Simandou, Forécariah, le 22 septembre 2011.</i> Prefecture Workshop for the launch of the Social and Environmental Impact Assessment (SEIA) for the Simandou Project
Lieu / Location	Hotel Malaika à Forécariah Malaika hotel in Forecariah
Date	22 nd September, 2011.
Durée / Time	10am to 4pm
Président / Chair	Mme Cissé Sarangbè Camara, Gouverneur de Kindia et Mme Hadja Leno Mariama, Préfet de Forécariah Mrs Cissé Sarangbè Camara, Governor of Kindia and Mrs Hadja Leno Mariama, Prefet of Forécariah
Liste des présents / Attendance List	
<i>Approximativement 170 personnes ont participé à l'atelier. Parmi les personnes présentes, on peut citer:</i> <i>la Gouverneure de la Région de Kindia;</i> <i>la Préfet de Forécariah;</i> <i>les sous-préfets de Kaback et Maférényah;</i> <i>le maire de la commune urbaine de Forécariah;</i> <i>un représentant du Ministère des Mines;</i> <i>un représentant du Ministère de l'Administration du Territoire et de la Décentralisation;</i> <i>des représentants des services techniques préfectoraux (agriculture, éducation, santé, agriculture etc);</i> <i>des représentants de la police et de la gendarmerie nationale;</i> <i>le directeur de la radio rurale locale;</i> <i>des représentants de Rio Tinto Simfer (relations gouvernementales, approbations environnementales, communications, communautés etc); et</i> <i>des représentants du cabinet ERM.</i> Approximately 170 people participated in the workshop. Among the attendees were: - the Governor of Kindia region; - the Prefet of Forecariah; - the sous-prefets of Kaback and Maférényah; - the Mayor of the urban district of Forécariah; - a Ministry of Mines' representative; - a Ministry of Territorial Administration and Decentralisation's representative; - representatives of the prefectural technical services (Agriculture, education, health, etc.); - representatives of the police and the gendarmerie; - the local rural radio director; - representatives from Rio Tinto Simfer (Government Relations, Environmental Approvals, Communications, Communities etc); and - representatives from ERM.	
Résumé des questions et des commentaires reçus / Summary of Questions and Comments Received	
<i>Les questions et préoccupations des communautés de la préfecture de Forécariah ont essentiellement porté sur:</i> <i>les opportunités d'emploi offertes par le Projet, notamment pour les jeunes;</i> <i>l'appui que Rio Tinto compte apporter aux organisations et associations locales ainsi qu'aux activités génératrices de revenus;</i> <i>le processus de compensation en cas de réinstallation (comment seront fixées les compensations ? existera-t-il des différences entre les familles ?);</i> <i>le choix des sites de réinstallation en cas de réinstallation (les populations seront-elles impliquées dans ce choix ? comment éviter les mauvaises expériences passées ?); et</i> <i>la protection de l'environnement le long du rail et en mer pour les pêcheurs (quelles mesures seront-elles prises pour la protection et la restauration des couverts végétaux ? les pêcheurs pourront-ils continuer à pêcher ?).</i>	

The communities' principal questions and concerns related to:

- the Project's employment opportunities, particularly for the young;
- Rio Tinto's support to local organisations and associations and for income generating activities;
- the resettlement compensation process (how will the compensation rates be set? will there be differences between families?);
- the selection of host sites in case of resettlement (will the local population be involved in the choice? how will bad experiences from the past be avoided?); and
- the protection of the environment alongside the rail and at sea for fishermen (what measures will be taken for the protection and restoration of plant cover? will the fishermen still be able to go fishing?).

Annex D

Social and Environmental Management Plan

D1 Management of Social and Environmental Impacts and Risks

D1.1 Introduction

This chapter sets out how the Project will deliver the mitigation measures identified in the preceding chapters and any site specific additional mitigation identified for the Marine Offloading Facility (MOF). This will be done through the Project's overarching Management System and a Social and Environmental Management plan (SEMP) for the MOF.

Simfer has been operating in Guinea for more than 10 years. Over that period, robust procedures have been developed to manage social and environmental risks and impacts associated with exploration activities. These procedures form part of an integrated Health, Safety, Environment and Communities Management System (HSEC-MS) that has been developed to conform to relevant Rio Tinto ⁽¹⁾, IFC ⁽²⁾ and legal requirements. This HSEC-MS provides a framework to ensure systematic identification and management of social and environmental aspects of the Project in accordance with the requirements of the international standard for Environmental Management Systems ISO14001. The HSEC-MS sets out:

- the Project's policy, objectives, programme and targets for achieving continuous improvement in social and environmental performance;
- the way in which the Project identifies its social and environmental impacts and risks and the legal and other requirements that apply to each;
- the allocation of roles and responsibilities for social and environmental performance and how the Project ensures that people are qualified and competent to fulfil these responsibilities;
- how the Project communicates internally and with its external stakeholders;
- how the project achieves operational control over its performance and prevents and responds to emergencies through detailed plans and procedures; and
- how the Project monitors and evaluates its performance.

This Management System will apply at the MOF and will be used to ensure that all the mitigation measures identified in this SEIA, together with any other requirements deriving from national legislation, or from international conventions and other agreements or standards relevant to the Project, are implemented during the design, construction, operation and, where appropriate, closure of the facilities.

D1.2 The Social and Environmental Management Plan for the MOF

To support the management system, all the mitigation measures identified here, and all other requirements from legislation and standards, will be captured in a Social and Environmental Management Plan (SEMP) for the MOF. This document will comply with the standards set out in *Table D.1*.

Table D.1 Summary of Relevant Requirements Relating to SEMP's and Action Planning

Source	Relevant Requirements
IFC Performance Standard 1	A Social and Environmental Management Plan will: ▪ be consistent with the organisation's policy and objectives ▪ describe mitigation and performance improvement measures and actions with a view to addressing all relevant social and environmental risks and impacts; ▪ incorporate/reflect a combination of operational procedures, practices, plans, legal agreements and other related supporting documents; ▪ be applied across the project and organisation taking into account primary suppliers and contractors affiliated with the company, as well as encompassing all sites, facilities and activities relating to the project; ▪ reflect the outcome of any relevant consultations with affected communities;

(1) Rio Tinto HSEQ Management System Standard (Rio Tinto Group, Version 2, 2006 which is consistent with ISO 14001 (Environment), OHSAS 18001 (Health and Safety), AS/NZS 4801 (Health and Safety) and ISO 9001 (Quality)

(2) International Finance Corporation, (2012), Performance Standard 1: Assessment and Management of Social and Environmental Risks and Impacts

Source	Relevant Requirements
	▪ facilitate compliance with applicable national and international laws and regulations, as well as with the requirements of IFC Performance Standards (PS) 1-8 ⁽¹⁾; ▪ be developed to a level of detail and complexity commensurate with the risks and impacts identified; and ▪ include mechanisms by which individuals can respond to the results of ongoing monitoring and review, and any unforeseen events or changes in circumstances.
	A SEMP will include: ▪ required actions and/or required outcomes as and where appropriate; ▪ prioritisation of actions; ▪ measures of performance, where possible, using a combination of performance indicators, targets, or acceptance criteria to facilitate ongoing mitigation and monitoring over defined time periods; ▪ estimates of suitable resources required for implementation; and ▪ clear definition of responsibilities recognising, where relevant, the role of third parties.
Rio Tinto's HSEQ Management System Standard	Action plans will include: ▪ clear identification and categorisation of actions; ▪ formal agreement that the actions will be implemented; ▪ prioritisation of actions; ▪ assignment of responsibilities, resources and schedules for implementation; ▪ implementation of actions; ▪ tracking and reporting against implementation; ▪ monitoring and verifying the effectiveness of the actions implemented and ongoing communication of action status; and ▪ analysis of trends to communicate long term performance.

D1.3 Resources and Responsibilities

Simfer will be responsible for ensuring that the environmental and social standards and commitments described in this document are implemented by all parties involved in the work, including contractors and subcontractors.

A Project Director has been appointed with overall accountability for the Project HSEC-MS. The Project Director will have overall accountability for ensuring that all activities are carried out in compliance with legal requirements, international standards, the HSEC-MS and the SEMP. As part of this role, the Project Director will ensure that adequate financial and technical resources are allocated to ensure appropriate development, maintenance and implementation of the SEMP for the MOF.

The Project Director will also ensure that appropriate arrangements are made to maintain training, competency and awareness for all Project personnel. Competency profiles and selection criteria will be developed for all roles in consideration of requisite training, education, skills and/or experience. Health, Safety, Environmental and Social Specialists will support the ongoing operation of the HSEC-MS and ensure that all relevant requirements are clearly communicated to Project personnel. Procurement Specialists and Human Resources Specialists will support the development of effective and transparent systems for management of suppliers and contractors and for labour-related issues. These specialists will regularly audit and inspect activities to verify and communicate compliance with legal requirements, international standards (including IFC and Rio Tinto standards) and Project-specific requirements. At a local level, Site Managers will be responsible for implementation of all required measures and for ongoing supervision of day-to-day activities. At various stages of the project, contractors will be commissioned to undertake specific activities. These contractors will only be engaged on the condition that they operate at all times in accordance with the Project HSEC-MS, take ownership of the risks and potential

(1) International Finance Corporation Updated Sustainability Framework, 2012

impacts associated with their activities and implement the mitigation measures detailed in the SEMP. Site Managers will provide sufficient oversight to ensure that this occurs and social and environmental impacts and risks are managed in an appropriate manner.

D1.4 Management of Change

If circumstances at a site change, the Site Manager will be responsible for ensuring that the SEMP is reviewed so that it remains appropriate to the impacts and risks arising at the site. All changes in the SEMP will be documented, communicated and approved prior to implementing the change in accordance with the Project HSEC-MS. The Action Plan will also be reviewed in the event of any adverse occurrences or incidents, to ensure that appropriate measures are taken to prevent recurrence. Information will be shared with other sites so that they can also implement necessary measures.

D1.5 Monitoring and Audit

Monitoring and auditing processes will be implemented to check the implementation and effectiveness of mitigation measures and determine compliance with agreed procedures and standards set out in *Chapters 4, 5 and 6*. The monitoring and audit plan will ensure significant risks are adequately monitored and actions taken. This will include weekly site inspections to check implementation of mitigation measures at a local level, quarterly site audits and an annual review of the adequacy of the HSEC-MS.

Site Inspections will check that measures are being implemented on a routine basis.

Quarterly site audits will check that the SEMP is being implemented. The scope of these audits will be clearly defined using a risk-based approach and will focus on high-risk areas and activities. An audit team will be appointed and will develop an audit programme and protocol covering the MOF. Audits will examine:

- management plans or other documents: where specifically required under the SEMP eg Waste Management Plan, monitoring plans, procedures;
- specifications, drawings and finished works: to show that mitigation measures have been planned into the design of the works and implemented in the finished structure;
- permits demonstrating that appropriate authorisations have been obtained prior to work commencing;
- monitoring records: to check that environmental standards are being met;
- incident records: verifying that incidents are being reported effectively, and appropriately investigated and corrective and preventive actions identified; and
- other records: to demonstrate that required activities have been carried out eg inspection reports, reports of pre-construction surveys, records of community liaison, training records.

Annual reviews will check that the project's policy, objectives and targets are being met and will include assessment of:

- the effectiveness of the Project HSEC-MS, including procedures relating to definition of responsibilities, allocation of resources and verification of competency;
- implementation of mitigation and monitoring measures set out in the SEMP;
- compliance with legislative and regulatory requirements and standards, including any licences, permits and obligations arising from these;
- implementation of resettlement and compensation of people affected by physical or economic displacement in accordance with the Resettlement and Compensation Policy Framework and with detailed resettlement and compensation plans;

- implementation of appropriate actions for engagement with external stakeholders in compliance with the Simandou Project Stakeholder Engagement Plan;
- satisfactory operation of the Grievance Procedures for external stakeholders and workers; and
- implementation of corrective actions identified through the site inspections and audits.

The results of annual reviews will be made available to the public as part of the annual Sustainable Development Report for the Simandou Project.

Appropriate corrective and/or preventive measures will be defined, initiated and tracked through to completion for all issues identified during the course of any inspection, audit or review, in accordance with procedures laid out in the Project HSEC-MS.

Table D1.2 Summary of Mitigation Measures Required to Manage Social and Environmental Risks and Impacts

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
Geology and hydrogeology	1. Water abstraction will minimise impacts on other uses including community and habitats. Water abstraction activities will be conducted in line with the Project-wide Water Strategy.	Siting
Geology and hydrogeology	2. The area of hardstanding within sites will be kept to the minimum necessary for the works in order to maintain natural recharge of the water table.	Design
Geology and hydrogeology	3. Where practical borrow pits will not be excavated below the water table.	Siting Design
Soils, Run-off and Flooding	4. The area to be cleared at each site (including for roads) will be kept to the minimum necessary for the works and will be clearly demarcated to prevent unnecessary disturbance of soils outside the boundary.	Design
Soils, Run-off and Flooding	5. Land susceptible to flooding will be avoided. Where this is not possible, drainage and flood protection measures will be implemented to reduce the risk for communities and Project facilities.	Siting
Soils, Run-off and Flooding	6. Disturbance of soils will be avoided during heavy rainfall. Activities with the potential to cause significant erosion will be carried out during the dry season as far as possible.	Construction
Soils, Run-off and Flooding	7. Site and road drainage will be designed to minimise the potential for uncontrolled run-off.	Design
Soils, Run-off and Flooding	8. Impacts of site and road run-off on surface waters will be managed by use of appropriate measures. Where possible, outlets will discharge into vegetated areas or Morebaya river and not to exposed soil or cultivated areas. Riparian vegetation and vegetation along drainage lines, gullies and gorges, will be protected and retained where practical to provide natural attenuation of flows.	Design
Soils, Run-off and Flooding	9. Cleared areas will be tilled, and re-vegetated as soon as possible after completion of construction to minimise areas of exposed, bare soil.	Construction
Soils, Run-off and Flooding	10. Construction activities, operations and movement of vehicles outside designated areas and transport routes will be prohibited.	Construction Operation
Soils, Run-off and Flooding	11. Where possible topsoil will be removed and stockpiled separately for future use.	Construction

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
Soils, Run-off and Flooding	12. Long-term soil stockpiles will be located and designed to avoid compaction, and covered or seeded to prevent erosion.	Design
Soils, Run-off and Flooding	13. Where there is the potential for slope instability measures will be taken to minimise risk of slope collapse and associated impacts on soils.	Design
Soils, Run-off and Flooding	14. Once operation of the Simandou Project is complete, all facilities will be decommissioned by either handing over the facilities to the local administration and community for future use or removed and the site rehabilitated. Site rehabilitation will include appropriate measures to ensure that natural drainage patterns are reinstated as far as possible and no impacts on drainage or flooding persist after the site has been decommissioned.	Closure
Soils, Run-off and Flooding	15. The Project will use excavated soils in the Project area as far as possible and seek alternative uses for surplus spoil where practicable to minimise the requirements for off-site disposal.	Site preparation Construction
Soils, Run-off and Flooding	16. Necessary measures will be constructed to maintain the operation of existing irrigation channels.	Construction
Soils, Run-off and Flooding	17. Changes in the local hydrology and flows will be minimised with appropriate measures to maintain flows through embankments when flood plains are cut off.	Design
Soils, Run-off and Flooding	18. Villagers will be granted periodic access to bogoni areas within the quarry safety zone to enable maintenance of surface water drainage systems. This will be of particular importance if the area is handed back to the local population for use after the quarrying has ceased.	Construction Operation
Soils, Run-off and Flooding	19. The Project will be designed to minimize risks of flooding and an Emergency Response Plan will be prepared that addresses flooding events.	Design
Pollution of Soils and Water	20. As far as possible no work will be undertaken within 50 m of any surface waterbody. Where this is not possible, additional measures will be taken to ensure that pollution of water resources does not occur.	Design Construction Operation

1. Physical Environment																																
Topic	Mitigation	Stage/ Phase																														
Pollution of Soils and Water	21. Sewage will be collected and treated in sewage treatment plants to achieve the following discharge standards prior to release into the environment. <table border="1"> <thead> <tr> <th colspan="3">Sewage Treatment Plant Discharge Criteria for the MOF</th></tr> <tr> <th>Parameter</th><th>Units</th><th>Discharge Limit Value</th></tr> </thead> <tbody> <tr> <td>pH</td><td>pH units</td><td>6 – 9</td></tr> <tr> <td>Chemical Oxygen Demand (COD)</td><td>mg/l</td><td>125</td></tr> <tr> <td>Total Nitrogen</td><td>mg/l</td><td>10</td></tr> <tr> <td>Total Phosphorus</td><td>mg/l</td><td>2</td></tr> <tr> <td>Oil and Grease</td><td>mg/l</td><td>10</td></tr> <tr> <td>Total Suspended Solids</td><td>mg/l</td><td>50</td></tr> <tr> <td>Total Coliform Bacteria</td><td>MPN/100 ml</td><td>400</td></tr> <tr> <td colspan="3">Source: IFC General EHS Guidelines April 2007</td></tr> </tbody> </table>	Sewage Treatment Plant Discharge Criteria for the MOF			Parameter	Units	Discharge Limit Value	pH	pH units	6 – 9	Chemical Oxygen Demand (COD)	mg/l	125	Total Nitrogen	mg/l	10	Total Phosphorus	mg/l	2	Oil and Grease	mg/l	10	Total Suspended Solids	mg/l	50	Total Coliform Bacteria	MPN/100 ml	400	Source: IFC General EHS Guidelines April 2007			Design Construction Operation
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Source: IFC General EHS Guidelines April 2007																																
Pollution of Soils and Water	22. All treatment plants and discharge points will be regularly inspected and maintained and monitoring of discharge quality will be undertaken to ensure correct operation.	Construction Operation																														
Pollution of Soils and Water	23. An emergency response plan will be developed for accidental spills and discharges. Spill kits will be available in areas where spills could potentially occur and will be appropriate for the volume and types of hazardous material in use.	Construction Operation																														
Pollution of Soils and Water	24. The use of any hazardous substance on site will be approved by a site manager. Hazardous substance will be clearly labelled and stored in safe and appropriate locations in accordance with MSDSs. Storage areas will be located in well-ventilated area as far as possible from sensitive receptors including offices, heavily trafficked areas or areas where people eat, smoke or sleep, and away from ignition sources. Storage and handling of hazardous substances will take place in areas with secondary containment. Secondary containment will be designed to contain 110% of the largest tank or 25% of the combined tank volumes and will be made of impervious, chemically resistant material and will be designed to prevent contact between incompatible materials in the event of a release.	Design Construction Operation																														

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
Pollution of Soils and Water	25. Refuelling, maintenance and washdown of vehicles and equipment will only occur in designated areas (at least 50 m from the nearest waterbody) that are provided with appropriate secondary containment measures. Only approved chemicals will be used and biodegradable lubricants will be used if possible.	Construction Operation
Pollution of Soils and Water	26. An effective preventative maintenance programme will be established to ensure that all equipment that uses or contains any hazardous materials (including fuel, oil, <i>etc</i>) is inspected regularly and maintained in good working order. Inspection and maintenance records will be available for review.	Construction Operation
Pollution of Soils and Water	27. Where practical all equipment, containers and distribution lines (including pipes, valves and taps), containing hazardous materials, will be located above ground. These will all be provided with appropriate containment to minimise the risk of uncontrolled or undetected releases of hazardous materials. Storage areas will be located at least 50 m from any surface water.	Design
Pollution of Soils and Water	28. Site and road drainage systems and bunds shall be inspected, cleaned as necessary and properly maintained. All waste and effluent from these operations shall be collected for safe disposal. Inspections for leaks on all flanges and valves on over-ground pipes used to transport materials other than water will be carried out at regular intervals.	Construction Operation
Pollution of Soils and Water	29. Project workshop, warehouse, offices and stores will have surface drainage such that uncontaminated surface water is directed away from sources of contamination, and appropriate stormwater drainage will be used to prevent uncontaminated rainwater from coming into contact with contaminated water from the workshop or adjacent hydrocarbon storage facilities.	Design Construction
Pollution of Soils and Water	30. Measures will be implemented to deal with acid sulphate soils in accordance with a Project-wide Acid Sulphate Soils Management Plan.	Construction Operation
Pollution of Soils and Water	31. Project personnel will be required to report any pollution related incidents and these will be subject to investigation and remedial and preventive actions will be taken.	Construction Operation

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
Marine Environment	32. Monitoring of selected parameters will carried out prior to, during and post-dredging and dredge disposal. Pre-dredge operations will be monitored and audited for: • Pre-dredge water quality monitoring (turbidity, temperature, conductivity, dissolved oxygen, pH, light penetration, potential dissolved contaminants, Total Suspended Solids (TSS) and sedimentation); • Infauna communities • Particle size distribution at the spoil grounds; • Bathymetry of the spoil grounds; • Sediment particle size with distance from the development; • Benthic primary producer habitat mapping; • Sensitive species health (eg benthic habitats, mangroves); and • Sampling and analysis of soil material in risk areas for acid sulphate soils. Dredge operations will be monitored and audited for: • Water quality (as for pre-dredge survey); • Invasive species on dredging equipment (during mobilisation); • Overflow from the hopper to ensure excessive sediment is not discharged; • Aerial photography during intensive plume monitoring surveys; • Sensitive species health (eg benthic habitats, mangroves); and • Water quality monitoring for disturbance of acid sulphate soils. Post-dredge environment will be monitored and audited for: • Water quality (as for pre-dredge survey); • Infauna communities • Particle size distribution at the spoil grounds; • Sediment particle size with distance from the development;	Construction Operation

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
	• Sediment stability at spoil ground; • Presence of invasive alien species • Bathymetry of the spoil grounds; and • Sensitive species health (eg benthic habitats, mangroves).	
Marine Environment	33. Programme of monitoring of coastline changes and beach profiles will be carried out.	Construction Operation
Marine Environment	34. The Project will ensure that impacts to the abundance, diversity and geographic distribution of sensitive fauna are reduced as far as reasonably practicable.	Construction Operation
Marine Environment	35. The Project will use fully equipped dredger(s) that meet the standards expected of best available technology and best environmental practice.	Construction Operation
Marine Environment	36. Impacts from collision with turtles and marine mammals will be mitigated by: • Vessel operators and crews will maintain a vigilant watch for marine mammals and sea turtles and slow down or stop their vessel to avoid striking conservation priority species. • All personnel associated with the Project will be instructed about the presence of and necessary adherence to speed zones and the need to avoid collisions with and injury to manatees / turtles. • When sea turtles, small cetaceans (eg dolphins) or manatees are sighted, attempt to maintain a distance of 50 m or greater whenever possible. • All vessels will operate at speeds with no wake at all time while in the vicinity of manatee habitat and while in water where the draft of the vessel provides less than a 1.5 m clearance from the bottom. • All vessels will follow routes of deep water wherever possible. • All in water operations will be shut down if a manatee comes within 50 m of the operation. Activities will not resume until the animal(s) has moved at least 50 m away from the operation or until 30 minutes have passed without sighting of the animal within the 50 m safety zone. Animals must not be harassed or herded away. • Vessel crews will report sightings of any injured or dead conservation priority species immediately, regardless of whether the injury or death is caused by their vessel.	Construction Operation

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
Marine Environment	37. The risk of introducing marine invasive species will be reduced by the following: - For construction vessels coming from other bioregions, an Invasive Species Management Plan for the Project will be developed (taking into consideration the “IMO Guidelines for the Control and Management of Ships’ Ballast Water to Minimise the Transfer of Harmful Aquatic Organisms and Pathogens”) and the IMO International Convention on the Control of Anti-fouling systems on ships (AFS). Ballast water will not be discharged into or near coastal waters and appropriate reception and treatment facilities will be provided. - Hull fouling control for vessels– cleaning of sea chests, cleaning of dredging equipment, and regular cleaning of vessel hull / propeller.	Construction Operation
Marine Environment	38. Appropriate measures for the transport and subsequent disposal of dredge spoil will be implemented: - Hopper door seals will be maintained in good condition to ensure minimum loss of material during transport; - Within operational constraints, sailing routes to the disposal areas will be planned to minimise propeller wash (for example, utilisation of the channel where possible); - Hopper dewatering will be confined to areas away from sensitive receptors and where practical will only occur within the dredging and spoil disposal areas; - Reduce navigation speed and use lower fill levels of laden barges and hoppers during bad weather to avoid excessive spillage; - Avoid sediment losses during transport via the Trailing Suction Hopper Dredgers (TSHD) by ensuring the level of the overflow pipe will be raised to its highest point to avoid spillage; - When use is made of floating pipelines, these will not obstruct fishing activities or commercial vessels; - Control and monitoring system will be used to alert the crew to pipeline leaks or any other potential risks; - All pipe leakage will be repaired promptly and plant will not be operated with leaking pipes. - Use of lateral containment in open water disposal to prevent horizontal and/or vertical spread of spoil after placement; - Use of submerged diffusers to place spoil low in water column; and - Minimise use of temporary spoil sites.	Construction Operation

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
Marine Environment	39. A vessel exclusion zone will be in place around the construction, dredging and dredge disposal operations. This zone will have a safe radius to be determined in consultation with the relevant authority prior to construction. The Project will inform shipping control networks, shipping companies, local fishing communities, fishery organisations, navies, etc. regarding the exclusion zone.	Construction Operation
Marine Environment	40. Procedures will be in place to protect the marine environment from oil pollution. The Project will implement spill prevention control associated with the transport, storage, use, transfer and disposal of hazardous materials, including failures of secondary containment structures.	Construction Operation
Marine Environment	41. Effective containment barriers will be installed to prevent spills of hazardous material from reaching the marine environment.	Construction Operation
Air Quality	42. Long term soil stockpiles and stores of friable material will be covered or vegetated to reduce the potential for dust where possible. Vehicles carrying friable materials will be enclosed or sheeted in dry and windy weather.	Construction
Air Quality	43. Speed controls will be implemented where appropriate to minimise dust creation by vehicles travelling on un-made roads. Driver training will include awareness-raising regarding appropriate driving speeds to minimise dust emissions during different weather conditions.	Construction Operation
2. Air Quality	44. Loading, unloading and handling of dusty materials will only be carried out in designated areas. Drop heights will be minimised and where necessary windshields will be fitted (skirts, shrouds or enclosures) to control windblown dust.	Construction Operation

1. Physical Environment																									
Topic	Mitigation	Stage/ Phase																							
Air Quality	45. For operational phase, the following ambient air quality targets will apply at the nearest sensitive receptor. If ambient pollutant levels exceed these guideline values, the Project will endeavour to limit this increase to less than 25% increase in measured ambient levels. <table> <tr> <th>Pollutant</th><th>Averaging Period</th><th>Guideline value in µg/m3</th></tr> <tr> <td rowspan="2">Particulate Matter (PM10)</td><td>1-year</td><td>20</td></tr> <tr> <td>24-hour</td><td>50</td></tr> <tr> <td rowspan="2">Particulate Matter (PM2.5)</td><td>1-year</td><td>10</td></tr> <tr> <td>24-hour (1)</td><td>25</td></tr> <tr> <td rowspan="2">Sulphur Dioxide (SO2)</td><td>24 hour</td><td>20</td></tr> <tr> <td>10 minute</td><td>500</td></tr> <tr> <td rowspan="2">Nitrogen Dioxide (NO2)</td><td>1-year</td><td>40</td></tr> <tr> <td>1-hour</td><td>200</td></tr> </table> (1) PM 24-hour value is the 99th percentile Source: IFC Environmental, Health and Safety Guidelines 2007	Pollutant	Averaging Period	Guideline value in µg/m3	Particulate Matter (PM10)	1-year	20	24-hour	50	Particulate Matter (PM2.5)	1-year	10	24-hour (1)	25	Sulphur Dioxide (SO2)	24 hour	20	10 minute	500	Nitrogen Dioxide (NO2)	1-year	40	1-hour	200	Operation
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Air Quality	46. All equipment will be maintained in good working order for the duration of its use and does not adversely impact air quality due to inadequate maintenance or damage.	Construction Operation																							
3. Air Quality	47. Concrete batching, and crushing and screening plants (including mobile plants) will be fitted with dust extraction and/or suppression systems.	Design																							
Air Quality	48. Storage facilities such as bunkers, tanks and silos will be operated to reduce fugitive emissions of dust.	Design Construction Operation																							
Air Quality	49. Use of ozone depleting substances such as chlorofluorocarbons (CFCs), halons, carbon tetrachloride, trichloroethane and halogenated hydrobromofluorocarbons (HBFCs) will not be permitted.	Construction Operation																							

1. Physical Environment													
Topic	Mitigation	Stage/ Phase											
Air Quality	50. To avoid black smoke from laying of asphalt, bitumen will not be heated with open flame burners or overheated, pots/tanks of bitumen will be covered, and any spills will be contained and immediately cleaned up.	Construction Operation											
Air Quality	51. Strict controls will be in place to minimise the risk of bushfires caused by Project activities including: • a ban on unauthorised open fires; • storage of flammable substance will include fitting flame arresting devices to vents, segregation of incompatible substances, engineered earthing and lightning protection; • fitting of earthing and lightning protection to structures vulnerable to lightning strike; • control of hot work such as welding using a strict permit to work system; and • creation of a 20 m wide firebreak in the buffer zone outside the site boundary.	Construction Operation											
Air Quality	52. Emergency response plans and fire fighting arrangements will be put in place to respond to fire including natural bushfires. Trained fire crews will be available and all personnel will be trained in communication of fire-related hazards and first response. Adequate water supplies for use in the case of a fire will be established in critical locations.	Construction Operation											
Air Quality	53. Vessels, vehicles and generators will only be in use when necessary preventing unnecessary emissions.	Design Construction Operation											
Noise and vibration	54. All facilities will be designed and operated to ensure that noise levels do not exceed the following thresholds at the nearest sensitive receptor during normal construction and operation. Sensitive receptors include accommodation units within the site. If existing noise levels exceed these threshold values, the Project will not cause more than a 3dB increase in measured ambient levels. <table border="1"> <thead> <tr> <th rowspan="2">Project Phase</th><th colspan="2">Ambient Noise Threshold Values</th></tr> <tr> <th>Daytime (07.00 – 22.00)</th><th>Night-time (22.00 – 07.00)</th></tr> </thead> <tbody> <tr> <td>Construction</td><td>75 dB(A) LAeq (daytime period)</td><td>50 dB(A) LAeq (night-time period)</td></tr> <tr> <td>Operation</td><td>55 dB(A) LAeq (1 hr)</td><td>45 dB(A) LAeq (1 hr)</td></tr> </tbody> </table> Source: IFC Environmental, Health and Safety Guidelines 2007	Project Phase	Ambient Noise Threshold Values		Daytime (07.00 – 22.00)	Night-time (22.00 – 07.00)	Construction	75 dB(A) LAeq (daytime period)	50 dB(A) LAeq (night-time period)	Operation	55 dB(A) LAeq (1 hr)	45 dB(A) LAeq (1 hr)	Design Construction Operation
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1. Physical Environment		
Topic	Mitigation	Stage/ Phase
Noise and vibration	55. Advance notice will be given to communities if short-term activities are to take place which could cause noise threshold levels to be exceeded.	Construction Operation
Noise and vibration	56. Measures to minimize noise during construction and from activities taking place in the open air during operations will include: • locating and orientating equipment to maximise the distance, and to direct noise emissions away from sensitive areas; • using buildings, earthworks and material stockpiles as noise barriers where possible; • soft starting of equipment and turning off equipment when not in use.	Design Construction Operation
Noise and vibration	57. Noise and vibration potential will be considered when purchasing vehicles and equipment in accordance with Rio Tinto's established Buy Quiet policy. Equipment that emits tonal or low frequency noise will be avoided where possible.	Design
Noise and vibration	58. Equipment located near sensitive receptors will be fitted with appropriate noise and vibration abatement devices such as silencers, mufflers and noise enclosures.	Design
Noise and vibration	59. All equipment will be maintained in good working order for the duration of its use so it does not emit excessive noise or vibration due to inadequate maintenance or damage.	Construction Operation
Noise and vibration	60. All personnel will be made aware of the importance of minimising noise and the measures that are required to achieve this.	Construction Operation
Noise and vibration	61. Where new roads are created wherever possible they will be located away from communities in order to reduce the risk of significant noise impacts.	Siting
Noise and vibration	62. Roads will be designed so that day time noise levels outside the nearest noise sensitive building will not exceed 70 dB(A) measured as LAeq(daytime), or if existing noise levels exceed this figure, so that noise levels will not increase by more than 3 dB. (Source: IFC EHS Guidelines for Toll Roads, 2007)	Design
Noise and vibration	63. Where possible to avoid unacceptable noise levels within communities a bypass will be provided to take Project traffic away from communities.	Design
Noise and vibration	64. Controls on routeing of Project-traffic will be implemented as a means of managing traffic flows along designated routes and at times that limit impacts on communities.	Construction Operation

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
Noise and vibration	65. All drivers will be trained in good driving practice to minimise noise and vibration from vehicles.	Construction Operation
Noise and vibration	66. All Project vehicles and roads will be maintained to prevent excessive noise and vibration caused by inadequate maintenance or damage.	Construction Operation
Noise and vibration	67. Quarry operations will be supervised to ensure best practice is complied with. Best practice measures will include: • blasting will be limited to dedicated blasting times which shall be negotiated with the affected communities in order to protect the people and minimize nuisance. • development of specific blasting plans and charging procedure. • usage of delayed, micro-delayed, or electronic detonators to reduce individual charge mass to safe limits.	Construction
Noise and vibration	68. Advance notice will be given to communities about any piling operations. Best practicable means will be implemented to reduce noise and vibration impacts. The following mitigation measures to reduce and avoid impacts from ambient and underwater noise will be implemented: • Use a vibratory hammer when driving piles whenever possible. • Monitor peak Sound Pressure Levels (SPL) during pile driving to ensure that they do not exceed the 180 dB re 1 µPa peak threshold for harm to marine mammals. • If sound pressure levels exceed acceptable limits, methods to reduce the sound pressure levels will be employed. These include: • Use a hydraulic hammer if impact driving cannot be avoided ; • Use of a noise reduction device in the form of a shroud or physical screen around the anvil, pile sleeves and pile caps; • Driving piles when the current is reduced in areas of strong current to minimise the number of fish exposed to adverse levels of underwater sound; • Use of bubble curtains to prevent physical damage to fish and minimise disturbance of fish and marine mammals. • Regular maintenance of all equipment, machinery, engines and thrusters that generates underwater noise to minimise underwater noise and vibrations.	Construction

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
	If manatees or any other marine mammal or turtles are detected in the vicinity of the piling operations, the operations will be halted and will not resume until the animal(s) has moved at least 50 m away from the operation or until 30 minutes have passed without sighting of the animal within the 50 m safety zone. Animals must not be harassed or herded away.	
Noise and vibration	69. If underwater blasting is required for removal of rock, the Project will: - stem boreholes after placing the charge, - use delayed detonation, - use side scan sonar of the blasting zone to ensure that no concentration of fish or marine mammals are present in the immediate vicinity of the blast, - use noise generating devices or pingers to scare fish away, and - use an air bubble curtain to reduce mortality where the tidal current regime permits.	Construction
Resources and Waste	70. All materials and equipment used for the project will be of the highest efficiency in terms of energy and water use, GHGs emissions and waste generation.	Design
Resources and Waste	71. Measures to reduce energy use will be implemented where feasible including avoiding unnecessary operation of equipment, vehicles and lighting.	Construction Operation
Resources and Waste	72. Microclimatic factors at the MOF site (eg prevailing winds, solar aspect, elevation, shade) will be taken into account in developing layouts to take advantage of natural factors that will reduce energy use.	Design
Resources and Waste	73. Trees will be retained within the site boundary where possible, to take advantage of natural shade.	Design
Resources and Waste	74. Water and energy use will be monitored to identify trends and opportunities for improvement.	Construction Operation
Resources and Waste	75. Water meters will be installed on all abstraction points and water use will be monitored and recorded to maximise efficiency of water use and minimise waste.	Design
Resources and Waste	76. Preventative maintenance and regular inspection of water tanks and pipes will be undertaken to minimise the risk of leaks and remedial actions will be implemented as soon as possible.	Construction Operation

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
Resources and Waste	77. Recycling of water will be undertaken where practical and safe.	Construction Operation
Resources and Waste	78. A Waste Management Plan (WMP) will be established for the construction and operation of the Project and will include the following measures: • All wastes will be collected and managed in facilities providing for segregation of inert, non-hazardous and hazardous wastes. • Waste collection stations will be positioned in easily accessible locations close to the point where waste is generated and will be clearly marked for segregation of waste. • Waste will be removed from work areas at regular intervals and will not be allowed to accumulate on-site in undesignated areas. Inspections will be carried out regularly to identify and rectify inappropriate practices, including littering. • Inert construction and demolition waste will be used in site preparation where possible. Other wastes will be re-used or recycled wherever possible. • All residual wastes will be treated and disposed of at facilities providing appropriate means for safe disposal. • Landfilling of waste will only be permitted if all other options to reduce, reuse or recycle have been exhausted, and will be used only for disposal of inert and non-hazardous wastes. If landfills are required, they will be small, shallow sites (located above the water table) and will be designed and operated in accordance with best practice requirements including the IFC EHS Guidelines for Waste Management Facilities (2007). • Burning of waste will not be permitted except in purpose built incineration facilities. • Medical wastes will be disposed of in an appropriate manner and in a suitable manner. • Procedures for management of hazardous wastes encountered during demolition and site clearance will be clearly defined. • Accurate records will be maintained for waste materials entering and leaving worksites, to ensure traceability of waste material from source to final destination. Records will detail the source, type and quantity of waste as well as the date of transport, the carrier being used to transport the waste, and the final destination. • Materials will be ordered on an 'as required' basis, to prevent over-supply and materials will be selected to reduce the need for on-site processing that can generate waste e.g. purchasing materials so as to avoid off cut waste.	Construction Operation

1. Physical Environment		
Topic	Mitigation	Stage/ Phase
	- Materials will be stored correctly to reduce damage and waste. - All personnel will be trained in the appropriate management of waste in accordance with the WMP. - Any organisations contracted to transport, manage or dispose of waste, and any facility used for the processing, storage or disposal of waste, will be in the possession of all necessary permits and authorisations. The Company will confirm this prior to using any external facility and will audit their operations to ensure compliance with Project requirements. - Waste materials that can be safely reused or recycled may be donated to local communities following an appropriate risk assessment by HSEC personnel. All donations will be managed through Simfer's Communities Team.	

Biological Environment		
Topic	Mitigation	Timing
Biodiversity and nature conservation	79. Loss of critical habitat (as defined by IFC PS6) will be minimised through design. Where this loss cannot be avoided, the Project will implement mitigation, management or offsetting measures in line with the Project Biodiversity Action Plan (BAP).	Design
Biodiversity and nature conservation	80. Where possible, new borrow pits will be located at least 250 metres from conservation priority habitats and at least 500 metres if a borrow pit occupies more than 1ha.	Siting
Biodiversity and nature conservation	81. Driving within watercourses, or on their banks, will be forbidden, except where necessary. If work in watercourses is required, measures will be implemented to avoid significant impacts on aquatic habitats.	Construction Operation
Biodiversity and nature conservation	82. Ground clearing in sensitive areas upstream of habitats of high conservation value for biodiversity will only be permitted with an appropriately engineered drainage design.	Construction
Biodiversity and nature conservation	83. Measures will be implemented to ensure that cleared areas are rehabilitated as soon as possible.	Construction
Biodiversity and nature conservation	84. Areas used by important or sensitive fauna will be demarcated and clearly signposted and access will be prohibited.	Construction Operation
Biodiversity and nature conservation	85. Where possible, areas to be cleared will be worked from one side to another, or from the centre out, to prevent animals becoming trapped.	Construction
Biodiversity and nature conservation	86. Trenches or holes created during site works will be rendered safe for fauna when unattended through covering or provision of an egress ramp.	Construction
Biodiversity and nature conservation	87. Snakes and other conservation priority or dangerous species, occurring within work areas, will only be captured by trained personnel and will be released unharmed, where possible.	Construction Operation

Biological Environment		
Topic	Mitigation	Timing
Biodiversity and nature conservation	88. Severance of routes used by conservation priority species will be avoided. If avoidance is not feasible, consideration will be given to crossing facilities designed to allow the movement of animals including aquatic species along water courses.	Siting Design
Biodiversity and nature conservation	89. Strict procedures will be implemented to avoid the spread of invasive alien species for all imported equipment used on site. All vehicles and machinery will be inspected and cleaned to ensure decontamination prior to mobilisation between high risk areas. A washdown pad will be installed where vehicles undergo a thorough 'quarantine' cleaning wash. Any weeds, seeds or soil materials that are thus removed will be stored and disposed off in a controlled manner to prevent the risk of spreading. Appropriate documentation will be provided as evidence that this process has been completed.	Construction Operation
Biodiversity and nature conservation	90. All plant species introduced for the Project will be reviewed and approved by specialists prior to use on site. Non-native species will not be authorised unless a formal risk assessment has been completed and approved by relevant stakeholders and appropriate mitigation measures have been put in place to minimise the risk of adverse impacts.	Construction
Biodiversity and nature conservation	91. Ongoing maintenance and monitoring of work areas will include regular inspections for invasive, non-native species including weeds and measures will be implemented to remove unwanted species. Method used to control or prevent such species will not cause adverse impacts on the environment or communities.	Construction Operation
Biodiversity and nature conservation	92. Induction training for all personnel will include appropriate information regarding invasive, non-native fauna and flora and the importance of reporting in this regard.	Construction Operation
Biodiversity and nature conservation	93. Burning of waste or vegetation will only occur in designated and approved facilities.	Construction Operation
Biodiversity and nature conservation	94. Measures will be taken to minimise the risk of collisions between animals and vehicles. Signposts and speed limits will be established where necessary to alert drivers to risks of fauna crossing roads.	Construction Operation
Biodiversity and nature conservation	95. Induction training for all Project personnel will facilitate identification of conservation priority species by all personnel. Project personnel will be provided with appropriate instruction regarding the procedures to be followed if important fauna or flora are encountered during the course of work.	Construction Operation
Biodiversity and nature conservation	96. Worker accommodation camps will be gated and movement of Project personnel of site will be restricted to essential trips only.	Construction Operation

Biological Environment		
Topic	Mitigation	Timing
Biodiversity and nature conservation	97. Worker accommodation camps will include onsite catering facilities. Purchase or sale of bushmeat by or within these facilities will be strictly forbidden. Local Project personnel will also be strictly forbidden from engaging in selling or purchasing bushmeat. Local resources will only be used by the Project if the resources can be used in a sustainable manner.	Construction Operation
Biodiversity and nature conservation	98. Induction training for all Project personnel will include communication of relevant information regarding bushmeat hunting and important local resources. Project personnel will engage local stakeholders to manage potential impacts in this regard.	Construction Operation
Biodiversity and nature conservation	99. Impacts from light emissions will be minimised through: • use of low emission lighting; • use of directional lighting, aimed towards the area where light is needed and away from any sensitive receptors; and • restrictions on non-essential travel after dark. If any driving after dark is required, drivers and operators will use low beam headlights as much as possible.	Design Construction Operation

Human Environment		
Topic	Mitigation	Timing
Physical and Economic Displacement	100. Displacement of homes and community facilities will be minimised. Where displacement is unavoidable, relocation and compensation will be undertaken in accordance with the 'Principles and Approach to Resettlement and Compensation for Early Works'. Local authorities and communities will be informed of decisions on siting of facilities to accommodate views and minimise adverse impacts.	Siting
Physical and Economic Displacement	101. The Project and associated road infrastructure will be sited to minimise impact on highly productive agricultural land such as rice fields, community forests and land used for hunting and gathering food and other produce. Water bodies used for community water supply will also be avoided where possible.	Siting
Physical and Economic Displacement	102. If road improvements cannot be completed without significant physical or economic displacement, wherever possible temporary bypasses will be built for Project traffic.	Siting
Physical and Economic Displacement	103. Access by boat up and down the river will not be prevented by designated work areas and exclusion zones. Disruption to significant access routes on land will be avoided, or alternative safe access points to the river or across the road construction route will be provided.	Construction Operation
Cultural heritage	104. Field surveys and consultation with local communities will be undertaken to identify any sites or features of importance for cultural heritage. This will include both tangible features or sites and locations of intangible cultural importance.	Siting
Cultural heritage	105. To the extent possible, facilities will be located at least 100 metres from sites of cultural importance. Where this distance cannot be achieved, effective management measures will be devised on a case-by-case basis in consultation with the local community.	Siting
Cultural heritage	106. The location of any identified sites will be recorded using GIS for future reference when planning site developments and ground disturbance. The exact location and significance of any sites will be communicated on a "need-to-know" basis and restricted to the minimum number of people required to ensure effective protection of the area.	Design
Cultural heritage	107. If a cultural heritage site is damaged in any way, this will be treated as an incident, investigated and managed in accordance with the approved incident management procedures established for the Project. If any grievance will arise in this regard, this will be managed in accordance with the approved Grievance Procedure established for the Project.	Construction
Cultural heritage	108. The Project will operate a Chance Finds Procedure in accordance with IFC Performance Standard 8. If any finds are encountered, work will cease immediately and temporary protection of the area will be established. The find will be reported and relevant specialists will be appointed to determine an appropriate course of action.	Construction
Cultural heritage	109. All Project personnel will be required to respect local cultural traditions and religious festivals, funerals and other traditional events. Induction training for all personnel will include appropriate cultural awareness training.	Construction Operation

Human Environment		
Topic	Mitigation	Timing
Landscape and visual	110. The Project will minimise the impact of the facility on the aesthetics of the surrounding countryside by: - ensuring that buildings are painted in muted colours over bright colours using non-reflective surfaces; - using lighting that is directed downwards and shielded to avoid night time glare and spillage; - use of suitably aligned fencing and roadways where access to areas of cultural or special significance to local communities is to be maintained.	Construction Operation
Community Health, Safety and Security	111. Pools of standing water will be drained to minimise the availability of breeding grounds for mosquitoes.	Construction Operation
Community Health, Safety and Security	112. Ongoing maintenance of work areas will include regular inspections for pest species. Appropriate management strategies will be implemented to manage any pests that may arise and may include use of approved pesticides. Methods used to control or prevent pests will not cause adverse impacts on the environment or communities.	Construction Operation
Community Health, Safety and Security	113. Risk of water-borne diseases will be minimised using appropriate treatment methods for water used for workers within the project site.	Construction Operation
Community Health, Safety and Security	114. A health management system will be established to ensure that all individuals are fit for work and illnesses are not introduced by Project personnel coming into contact with local people.	Construction Operation
Community Health, Safety and Security	115. When undertaking risk assessments for occupational health hazards, potential impacts on community health and safety will be considered alongside worker health and safety, and mitigation measures will be adopted, including health surveillance where appropriate, to provide appropriate levels of protection.	Construction Operation
Community Health, Safety and Security	116. The MOF will include medical facilities and services appropriate to the nature and scale of activities carried out at that site and surrounding areas.	Design
Community Health, Safety and Security	117. All Project personnel will be made aware of the closed camp policy, health hazards, including HIV/AIDS and malaria along with the prevention and mitigation measures required.	Construction Operation
Community Health, Safety and Security	118. Workers will attend HIV Awareness, Prevention and Treatment Programmes offered by the Company Awareness posters regarding relevant hazards, including HIV/AIDS and malaria, will be posted and maintained in areas regularly used by workers.	Construction Operation

Human Environment		
Topic	Mitigation	Timing
Community Health, Safety and Security	119. Partnerships will be actively sought with specialist external organisations to deliver HIV education, awareness raising and treatment to employees, their dependents and the broader community.	Construction Operation
Community Health, Safety and Security	120. Measures will be taken to minimise the potential risk of non-routine events such as fires, floods and road accidents and ensure that Project personnel have the capacity to respond to any such events in an appropriate manner and mitigate the potential for harm to communities.	Construction Operation
Community Health, Safety and Security	121. Access to all sites will be strictly controlled using appropriate security provisions. Work areas will be clearly demarcated and signposted using pictorial signage to indicate and communicate hazards.	Construction Operation
Community Health, Safety and Security	122. All risk assessment and emergency response planning will consider potential impacts on local communities and measures needed to ensure the safety and security of individuals.	Construction Operation
Community Health, Safety and Security	123. Local authorities and affected communities will be provided with appropriate on-going information on the nature and extent of any potential risk and impacts resulting from Project activities and procedures to be followed in the case of an unplanned accident or emergency. Training will be organised where necessary as identified by a risk assessment.	Construction Operation
Community Health, Safety and Security	124. Site security will be managed in accordance with the Voluntary Principles on Security and Human Rights (VPSHR) for the extractive sectors. Security arrangements will be explicitly communicated to all relevant stakeholders including workers and representatives of affected communities.	Construction Operation
Community Health, Safety and Security	125. Security personnel will be screened prior to employment by means of detailed interviews and enquiries will be made to investigate previous employment experience and records (including criminal record etc.) to avoid those who have previously been involved in abuse or violation of human rights.	Construction Operation
Community Health, Safety and Security	126. Security personnel will adhere to RT's Code of Conduct.	Construction Operation
Community Health, Safety and Security	127. The Project will develop appropriate disaster and emergency response plans. Security personnel will receive appropriate training regarding the different security-related scenarios that might arise, procedures to be followed in the case of each scenario, their roles and responsibilities during an emergency/security incident, and appropriate responses to different emergency scenarios that might arise.	Construction Operation

Human Environment		
Topic	Mitigation	Timing
Community Health, Safety and Security	128. Appropriate supervision will be provided by senior competent personnel to ensure that established procedures are being applied by security personnel and training has been understood by the relevant security personnel. If community members express grievances in relation to the conduct of security personnel or activities, the Project will respond to the grievance in accordance with the Project's established Grievance Procedure.	Construction Operation
Community Health, Safety and Security	129. Firearms will be strictly forbidden at any work area or facility. Security personnel will not be permitted to carry firearms or knives.	Construction Operation
Community Health, Safety and Security	130. Patrol vessels will be used to enforce work area exclusion zones, announce entry of large vessels and advise fisherfolk to vacate the area when necessary.	Construction Operation
Community Health, Safety and Security	131. Local fishermen will be informed about construction activities and the dangers of being in the vicinity of marine activities. Approach channels will be demarcated with buoys and navigation aids to warn fisher men using the channels.	Construction Operation
Community Health, Safety and Security	132. Roads will be located and designed to prevent impoundment and formation of stagnant waters that can act as breeding grounds for malarial mosquitoes and other disease vectors.	Design Construction
Community Health, Safety and Security	133. An Emergency Response Plan will be developed that addresses preventive and mitigation measures to reduce the probability and impact of potential hazardous events (fire, floods, spills, collisions, groundings, equipment failure). The emergency response plan will also provide provisions to notify the authorities and the public in case of such emergencies.	Construction Operation
Community Health, Safety and Security	134. The risk of accidents due to the project related traffic increase will be reduced by: • Implementation of speed limits, particularly in populated areas • Installation of signal to warn local communities of the increase in traffic and the risks • Provision of information and awareness rising in communities about road safety • Provision of safety training to all drivers	Construction Operation
In-migration	135. All employment will be managed via the Local Employment Office in Forecariah. Any individuals who approach the MOF facilities will be referred to the local Employment Office. No employment will be offered directly at the Project site.	Construction Operation

Human Environment		
Topic	Mitigation	Timing
In-migration	136. An influx/in-migration management plan will be developed for the Project in consultation with the relevant local authorities setting out measures to manage in-migration so as to avoid adverse impacts on local communities.	Construction Operation
In-migration	137. Changes in local populations and demographics will be monitored where in-migration is considered to be a significant risk.	Construction Operation
Local Employment and Procurement	138. Supplies for the MOF will be obtained locally where there are sustainable local sources available.	Construction Operation
Local Employment and Procurement	139. An Employment Plan will be developed to define requirements and procedures to be followed by all Project personnel when identifying and developing employment opportunities, managing employees, recording and reporting employment data, terminating work contracts, and other labour-related issues.	Construction Operation
Local Employment and Procurement	140. The Employment Plan will take into account expected fluctuations in demand for employment and local community expectations during different phases of development.	Construction Operation
Local Employment and Procurement	141. The Employment Plan and any local employment opportunities will be communicated in a transparent and culturally appropriate manner.	Construction Operation
Local Employment and Procurement	142. When advertising employment opportunities, the Project will clearly define the skills, qualifications and experience required for the available positions.	Construction Operation
Local Employment and Procurement	143. All employment-related decisions, including hiring, placement, remuneration, promotion, benefits, training, discipline and dismissals, will be based solely on the skills, experience, performance and qualifications of employees and applicants.	Construction Operation

Human Environment		
Topic	Mitigation	Timing
Local Employment and Procurement	144. Unskilled labour will be preferentially hired from the local communities.	Construction Operation
Local Employment and Procurement	145. A training plan will be provided to the local population to increase their chances of obtaining employment. In addition, employees will receive skills training to allow them to progress from unskilled to semi-skilled/skilled positions.	Construction Operation
Local Employment and Procurement	146. The Project will work with suitable partners in Guinea to identify suitable suppliers and, where relevant, implement initiatives to support local capacity building. Where appropriate, procurement targets will be defined in consideration of what is possible and in consultation with potential suppliers.	Construction Operation
Local Employment and Procurement	147. Local prices will be monitored to identify any areas where local availability of resources has been adversely affected by Project procurement.	Construction Operation
Human Rights	148. The Project will: • Comply with the Universal Declaration of Human Rights and Rio Tinto's Global Human Rights Policies; • Comply with all relevant legislation (including the Guinean Labour Code) and International Labour Organisation (ILO) conventions; • Comply with IFC Performance Standard 2 (Workers); and • Adhere to the VPSHR, as devised by companies in the extractive sectors together with governmental and non-governmental organisations.	Construction Operation
Human Rights	149. Use of child labour will be strictly forbidden. Contractors, suppliers and recruitment agencies will not hire workers under the age of 16, which is the minimum working age according to the Guinean Labour Code. Employment of young workers between 16 and 18 years will only be for non-hazardous work, where the work does not interfere with education, and is not dangerous or harmful to the physical, mental or moral development of young workers.	Construction Operation
Human Rights	150. Use of forced labour will be strictly forbidden. Everyone will be allowed free choice to accept or reject opportunities of employment.	Construction Operation

Human Environment		
Topic	Mitigation	Timing
Human Rights	151. Labour and working conditions will be clearly communicated to potential workers as part of the recruitment process and will include communication of conditions relating to the closed camp policy and key relevant worker hazards and risks.	Construction Operation
Human Rights	152. Workers will have the right to form and to join trade unions and create their own worker committees and worker representatives in accordance with the requirements and rights set out in the Guinea Labour Code.	Construction Operation
Human Rights	153. Salaries will be just and favourable ensuring the worker and the worker's family have an existence worthy of human dignity.	Construction Operation
Human Rights	154. Discrimination because of race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, actual or perceived HIV status or other status will be strictly forbidden.	Construction Operation
Human Rights	155. HIV/AIDS screening will not be a requirement for recruitment or a condition of employment.	Construction Operation
Human Rights	156. Requirements relating to Human Rights will be clearly communicated to all relevant personnel as part of training, and incorporated into labour contracts.	Construction Operation
Human Rights	157. Appropriate levels of auditing and verification will be carried out to monitor compliance with these requirements.	Construction Operation
Human Rights	158. The Project will establish appropriate procedures facilitating the reporting of non-compliances and grievances by Project personnel and stakeholders and ensuring that any reported incidents are addressed in an appropriate and culturally sensitive manner.	Construction Operation
Employment Terms and Working Conditions	159. Employment practices and working conditions will conform to the requirements of IFC Performance Standard 2 (Labour and Working Conditions), the Government of Guinea Labour Code and ILO Standards.	Construction Operation
Employment Terms and Working	160. Worker accommodation will be designed taking into account 'guidelines developed by the IFC and European Bank for Reconstruction and Development (EBRD).	Design

Human Environment		
Topic	Mitigation	Timing
Conditions		
Employment Terms and Working Conditions	161. Prayer rooms and other related facilities will be made available to meet the religious needs and customs of the workforce.	Design
Employment Terms and Working Conditions	162. Appropriate recreational facilities and rest and recreational time will be provided.	Design
Employment Terms and Working Conditions	163. Rules with respect to alcohol consumption and drug prohibition will be defined, to ensure that all Project personnel are fit for work and do not pose a danger to themselves or others.	Construction Operation
Employment Terms and Working Conditions	164. Strict procedures will be adopted for hazard identification and risk assessment and for definition and implementation of appropriate mitigation measures to ensure a safe workplace. Relevant information will be communicated to all Project personnel.	Construction Operation
Employment Terms and Working Conditions	165. The Project will establish strict procedures facilitating the reporting of health and safety incidents and ensuring that any reported incidents are addressed in an appropriate and culturally sensitive manner.	Construction Operation
Employment Terms and Working Conditions	166. A fair, transparent, culturally appropriate and accessible Grievance Procedure will be available to all workers.	Construction Operation

Human Environment		
Topic	Mitigation	Timing
Grievance procedure	167. All complaints and grievances related to the Project will be received and resolved in line with the Simandou Project Grievance Procedure. Individuals or groups will be able to file complaints through any of the following methods: • At any of Rio Tinto's offices either to a community representative in the office or through a grievances box; • Through any Project staff, either in writing or verbally ; • Through traditional local authorities or community groups; and • Through Rio Tinto community staff. The following steps will be followed for the resolution of grievances and complaints: • Once the grievance is received by any project staff, it will be channelled to the Community Team who will record it and provide an acknowledgement that the complaint has been received; • The grievance will be registered in the Social Management Information System; • A site inspection will be undertaken within 7 days to validate the validity and severity of the grievance; • If the grievance is valid, it will be dealt with according to the mitigation measures that are contained in the Simandou Project Grievance Procedure. Rio Tinto has a commitment to resolve 90% of grievances within 30 days of initiating the complaint.	
Stakeholder engagement	168. Community and stakeholder engagement throughout the Project will be undertaken in accordance with the Simandou Stakeholder Engagement Plan (SEP). The SEP sets out Rio Tinto's requirements for consultation and engagement and aims to ensure that all people and organisations affected or with an interest in the Project are as fully informed and able to participate as possible. Stakeholder engagement will be a two-way discussion which will cover all issues, priorities and concerns and will be undertaken using a range of methods. As well as the statutory consultation on the SEIA, formal and informal engagement will be carried out regularly with communities and other stakeholders throughout the life of the Project. Rio Tinto will ensure that consultation and information activities are conducted in a culturally appropriate way and that all sections of the community, including marginalised groups, are represented. All comments and feedback will be received, document and addressed.	Construction, Operation, Closure

Table 1.3 Summary of Monitoring Commitments

	Performance Indicator	Monitoring Objective	Sampling Location	Monitoring Frequency	Sampling Analysis / Method	Performance Standard	Responsibility for Execution
Surface Water	Water quality: - Suspended matter - Oils and grease	Protect water quality downstream from the work (village water supply locations).	Waterways near to MOF	Quarterly	Total suspended solids (TSS): Differential gravimetry (APHA, 1995). Oil and grease: Extraction and evaporation (APHA, 1995). Appropriate procedures will be developed	TSS: 25 mg/ L (Rio Tinto) Oil and grease: 10 mg/L (BM) Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Environmental specialist
	Water quality: - BOD - pH - Faecal coliforms - Nutrients - Suspended matter	Protect quality at point of discharge of effluent from wastewater treatment system.	At MOF discharge outfall location	Quarterly	Appropriate procedures will be developed	Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Environmental specialist
Surface water (Marine)	Water quality: - Turbidity; - Temperature; - Conductivity; - dissolved Oxygen; - pH; - Light penetration; - Potential dissolved contaminants; - TSS; and - Sedimentation	Protect water quality at, and downstream from, dredging operations (including disturbance of acid sulphate soils).	Dredging location and nearby surrounding waterways	Quarterly (survey to be conducted prior to dredging, throughout dredge operations and post-dredge operations)	Appropriate procedures will be developed	Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Environmental specialist OR Dredger (if built into contract)

	Performance Indicator	Monitoring Objective	Sampling Location	Monitoring Frequency	Sampling Analysis / Method	Performance Standard	Responsibility for Execution
Drinking water	Water quality: - Microbiological parameters - Chemical parameters - Physical parameters	Prevent consumption of contaminated water.	At MOF wastewater treatment site outfall location	Quarterly	Appropriate procedures will be developed	Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Environmental specialist
Accidental spillages	Spill parameters: - Source and characteristics - Size / Volume / Duration - Location	Protect soil and water quality	Locations dependent on event	Annually	Appropriate procedures will be developed	Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Environmental specialist
Marine biodiversity	Biology: - Infaunal communities - Particle size distribution at the spoil grounds - Benthic primary producer habitat mapping; and - Sensitive species health (eg benthic habitats, mangroves)	Understand impact to marine benthic flora and fauna during dredging operations and subsequent recovery	Dredging location and nearby surrounding waterways	Yearly (survey to be conducted prior to dredging, throughout dredge operations and post-dredge operations)	Appropriate procedures will be developed	Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Environmental specialist OR Dredger (if built into contract)
	Peak Sound Pressure Levels (SPL)	Prevent harm to marine mammals during pile driving	At 10 m of piling operation	During pile driving activities	Appropriate procedures will be developed	Not to exceed 180 dB re 1 µPa (peak threshold for harm to	Rio Tinto – Environmental specialist

	Performance Indicator	Monitoring Objective	Sampling Location	Monitoring Frequency	Sampling Analysis / Method	Performance Standard	Responsibility for Execution
		activities				marine mammals)	
Nuisance	Traffic movements	Minimise impacts on residents close to the MOF.	In villages along the road	Daily records of traffic leaving MOF site with destination / route Quarterly noise measurement in fixed locations	Note times when noise is generated and residents' complaints. Record noise levels at fixed locations	Compliance with WHO noise standards	Rio Tinto – Community liaison officers
	- Noise and Vibration - Air quality	To monitor ongoing performance, where relevant following risk assessment	Dependent on findings of risk assessment	Dependent on findings of risk assessment	Dependent on findings of risk assessment	Dependent on findings of risk assessment	Rio Tinto – Environmental specialist
Management of wastes and hazardous materials	Solid waste	Reduce impacts on environment.	MOF	Monthly	Visual inspection	Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Environmental specialist
	Hazardous material	Reduce impacts on environment.	MOF	Monthly	Visual inspection	Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Environmental specialist
	Hydrocarbons	Reduce impacts on environment.	MOF	Monthly	Visual inspection	Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Environmental specialist
Erosion	Coastline changes Beach profile	To ensure dredging activities do not result in increased erosion and removal of beaches	Coastline position (MSL) and beaches within 15 km of the project	Quarterly (throughout dredge operations)	Visual inspection of aerial photography Transects for beach slope	In comparison with known current erosion rates	Rio Tinto – Environmental specialist

	Performance Indicator	Monitoring Objective	Sampling Location	Monitoring Frequency	Sampling Analysis / Method	Performance Standard	Responsibility for Execution
Efficiency of resource use	- Water usage - Energy usage	Identify trends and opportunities for improvement.	MOF operations	Quarterly	Meters and monitoring at selected locations	Sustainability Performance	Rio Tinto – Environmental specialist
Local content	- Number and origin of local people in the construction workforce (including subcontractors) - Amount of local procurement.	Ensure local employment and procurement levels identified within the SEP are met.	In villages close to the MOF	Quarterly	Monitor Rio Tinto hiring procedures and its contractors.	SEP	Rio Tinto – Community liaison officer
Population	- Total population per village - Number of new arrivals per village - Origin and socio-economic profile of new arrivals - Changes in socio-economic profile of local communities	Monitor migration rate in zone of influence of MOF early works.	In villages close to the MOF	Quarterly	Conduct surveys in villages.	In-migration strategy	Rio Tinto – Community liaison officer
Community projects	Completion of commitments agreed with community (Resettlement and Compensation Framework & SEP)	Audit compliance with community commitments	At selected locations	Annually	Visual inspection Interviews	Register of commitments	Rio Tinto – Community liaison officer

	Performance Indicator	Monitoring Objective	Sampling Location	Monitoring Frequency	Sampling Analysis / Method	Performance Standard	Responsibility for Execution
Health and Safety	Prevalence of disease: - Malaria - Diarrheal diseases - Legionnaires' disease - STDs/HIV	Minimize impacts on health and safety of workers and residents.	Medical clinic	Monthly	Consult clinic health records.	Zero accidents and occupational diseases	Rio Tinto
	- Number of occupational accidents and near misses/month - Number of incidents reported/month		Medical clinic	Monthly	Consult monthly statistics supplied by contractor about number of accidents/incidents in terms of number of hours worked		Rio Tinto Contractors
Vegetation	Rehabilitation: Area rehabilitated (ha)	Rehabilitation of sites disturbed by temporary work.	Borrow pits Temporary access roads Temporary work areas	Annually	Visual analysis	100% of temporarily disturbed sites will be restored to conditions similar to previously present	Rio Tinto Contractors
	Invasive, non-native species	Minimise spread of invasive species	MOF	Annually	Visual analysis	Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Environmental specialist
Grievances	Numbers and categories % acknowledged within 7 days % resolved within 30 days	Address sources of community concern Reduce the numbers of grievances and complaints	Conform the Grievance Procedure	Annually	Analyse and consult statistics	Appropriate standards will be identified as part of the procedures to be developed	Rio Tinto – Community liaison officer

Annex E

Non Routine Impacts

E1 Introduction

The objective of this study is to conduct a risk assessment assess the impact of non-routine events of construction and operational activities arising from the proposed development of the MOF and Stockyard facilities. This assessment will qualify the risk of occurrence of potential major and moderate incidents related to the following categories:

- Marine-based traffic accidents;
- Hazards associated with the use of heavy equipment;
- Traffic accidents on land;
- Fuel/chemical spills and leaks; and
- Natural hazards and disasters.

Based on this study a number of mitigation measures have been identified in relation to non-routine events. These have been included within the Social and Environmental Management Plan (SEMP) (Annex D).

E2 Facility Risk Analysis Process

In this preliminary risk analysis, it was considered appropriate to carry out a screening level hazard review of the project. As such, a screening level hazard identification was carried out using available information, in the absence of complete design documentation.

In a general terms, risk is defined as the multiplication of the frequency of occurrence and the severity of the consequence of a hazardous event: Risk = Frequency * Severity of the consequence. (Refer to RioTinto Guidelines for Predicting the Magnitude of Impacts).

Table E.1 Predicting the Magnitude of Non-Routine and Uncertain impacts

		Consequence			
Likelihood		Very Small	Small	Medium	Large
		Near-source confined and promptly reversible impact (typically one day)	Near-source confined and short-term reversible impact (typically a week)	Near-source confined and medium-term recovery impact (typically a month)	Impact that is unconfined and requiring long-term recovery, leaving residual damage (typically years)
Very Unlikely	Almost impossible < 1/10 years or < 1% chance of occurrence	Very Low	Very Low	Low	Medium
Unlikely	Possible sometime 1/ year – 1/10 years or 1 – 10% chance of occurrence	Very Low	Low	Medium	High
Probable	Isolated incidents 2/year – 1/year or 10 – 25% chance of occurrence	Low	Medium	Medium	High
Highly likely	Repeated incidents > 2/year or > 25% chance of occurrence	Low	Medium	High	High

The table on the following page summarises a range of scenarios that have been identified to reflect the non-routine events that could occur from operations at the MOF and Stockyard. The scenarios are subdivided on the basis of the following categories.

- Personal Injury;
- Pollution;
- Collisions;
- Groundings;
- Swamping and Foundering;
- Fires and Explosions; and
- Navigation

Event Category	Ref.	Hazard	Causes	Risk Analysis			Impact
				Likelihood	Consequence	Risk Rating	
Personal Injury	1.	Persons engage in swimming at a location or time when it is inappropriate to do so.	Swimming in vicinity of vessel movements. Lack of clear signposting of dangers presented by swimming. Strong wind / tide.	Unlikely	Large	High	Several swimmers are swept away in tide and not recovered before one or more of them succumbs. Lead item, national and local media. Lengthy investigations by police, etc.
	2.	Personal injury as the result of falling overboard.	Sudden movement of vessel. Inexperience. Failure to use appropriate safety equipment. Operations in adverse weather conditions.	Probable	Large	High	Person falls off vessel and is struck by propeller of own boat or rescue boat, or is struck by boom on head. Fatal injuries received.
	3.	Fuel barge in collision with breakwater.	Misjudgement of manoeuvre in tidal stream/wind. Adverse weather / tidal conditions. Movement attempted in restricted visibility, lack of visual cues. Tug not used in adverse wind and/or strong tidal stream. Tug operational failure or miscommunications between Pilot and tug Master. Other craft obstructs manoeuvre on approach, or impedes assisting vessels. Propulsion/steering or bow thrust failure at critical stage.	Unlikely	Large	High	Heavy single-point landing on fender. Member of crew on deck (line handler) seriously injured, potential fatality.
	4.	Persons fall or jump from wharf structures.	Poor lighting / fencing. Trips, falls, congestion on footpaths.	Probable	Medium	Medium	Person suffers Injury.
	5.	Malfunctioning of heavy lifting equipment (i.e. cranes) on board dredging barges / cargo vessels or forklifts on quayside.	Human error. Lack of safety measures.	Probable	Medium	Medium	Injuries to operators and vessel crews. Death of operators and vessel crews.

Event Category	Ref.	Hazard	Causes	Risk Analysis			Impact
				Likelihood	Consequence	Risk Rating	
Pollution	6.	Release of diesel during unloading of cargo vessel at berth for wider distribution.	Split priming tank. Failure to secure the end cap connecting to the pipe, which drains into wharf. Failure to drain hose on completion. Failure to fit gaskets. Failure of hose. Damaged by vehicle, life expired, incorrect design for type of fuel. Bunker tanks overfilled. Human error. Poor communication with shore control.	Highly Likely	Medium	High	Several hundred tonnes of diesel discharged on flooding tide, slick carried up river to return on ebb. Major incident declared. Diesel will have a toxic effect on marine life. Note: Spilled diesel will have a toxic effect on marine life. Mangroves are an important resource for the locals, and have a high biodiversity. The recovery time for a mangrove forest from oil pollution ranges from 20 – 30 years.
	7.	Cargo vessel grounding.	Misjudgement of manoeuvre in tidal stream/wind. Adverse weather / tidal conditions. Vessel stands in too close prior to pilot boarding. Lack of support from Bridge Team poor. Failure to monitor position in channel. Over-reliance on GPS.	Unlikely	Large	High	Hull damage. Bunker fuel tanks punctured. Increased draught strands vessel at low tide, increasing damage as vessel pitches in swell. Lightening required for salvage. Several hundred tonnes of HFO spilled. Slick rapidly spreads under the influence of wind and currents. Major incident declared. Release of HFO has a smothering effect on marine life, Birds may be impacted. There is the possibility that the oil may sink, impacting benthic organisms.
	8.	Rupture of flexible transfer hose during refilling operations from the fuel barge to the MOF diesel tank.	Lack of maintenance Mismatch between the transfer hose and the fuel barge pump discharge pressure/capacity.	Probable	Medium	Medium	Several hundred litres of diesel released. Note: Spilled diesel will have a toxic effect on marine life.

Event Category	Ref.	Hazard	Causes	Risk Analysis			Impact
				Likelihood	Consequence	Risk Rating	
Pollution	9.	Rupture of flexible transfer hose during refuelling of tugs, rescue boats and service boats via diesel storage tank.	Lack of maintenance. Human error (negligence). Incompatibility of the discharge hose or of the hose connectors.	Probable	Medium	Medium	Several hundred litres of diesel released. Note: Spilled diesel will have a toxic effect on marine life.
	10.	Oil / water separator on cargo vessel used incorrectly.	Valve in incorrect position causing bilge water to be directed into full separated oil tank instead of the partially full sullage tank. Human error.	Probable	Very Small	Low	Separator operated in faulty mode for less than an hour. Small quantity of bilge oil discharged. Quickly disperses.
	11.	Vehicle accidents involving collisions and rollover in vicinity of the MOF or along the road.	Flat tire and skids which do not compromise the structural integrity of the truck and the load.	Probable	Medium	Medium	Major vehicle accidents could potentially lead to a spill and fire. Any spill of fuel from trucks or spill of flammable liquids during truck accidents have the potential migrate to the waterways and may have a significant impact on the local communities (subsistence famers, fishers). Potential pollution of drinking water.
	12.	Overfill of fuel storage tanks during discharge operations.	Human error/ negligence Lack of maintenance	Unlikely	Medium	Medium	Soil contamination. Fuel released have the potential migrate to the waterways.
	13.	Loss of contents of fuel storage tanks due to a rupture.	Design defaults Lack of maintenance	Unlikely	Large	High	Soil contamination. Fuel released have the potential migrate to the waterways and may have a significant impact on the local communities (subsistence famers, fishers). Potential pollution of drinking water.

Event Category	Ref.	Hazard	Causes	Risk Analysis			Impact
				Likelihood	Consequence	Risk Rating	
Pollution	14.	Fuel leaks from transfer flexible hose connections during refuelling operations.	Lack of maintenance Human errors Unsuitable coupling connection between the flexible hose and the vessel.	Probable	Very small	Low	Release of a few litres of diesel. Product will evaporate in a few hours. Diesel may have a toxic effect on marine life.
Collisions	15.	Collision between a cargo vessel and fuel barge entering / leaving MOF.	Failure of propulsion or steering at inopportune time. Disregard Port Control. Advice regarding potential traffic conflict. Misjudgement or mis-communication by either/both vessels. Low powered vessel has difficulty in clearing path of larger. vessel committed to channel in heavy weather. Failure to plan passage.	Unlikely	Large	High	Very close quarter situation, potential minor injuries / damage due to emergency manoeuvres. Both vessels damaged, potential for one to founder and block channel. Several hundred tonnes of HFO and diesel spilled. Slick rapidly spreads under the influence of wind and currents. Major incident declared. Release of HFO has a smothering effect on marine life, Birds may be impacted. There is the possibility that the oil may sink, impacting benthic organisms. Spilled diesel will have a toxic effect on marine life.
Navigation	16.	Dredging barge strikes drift wood.	Aftermath of severe weather; heavy rain (flooding), strong winds. Spring tides. Dumping of forestry waste in river.	Probable	Medium	Medium	Serious damage to hull. Release of several hundreds tonnes of diesel. Crew onboard suffer moderate to serious injuries. Spilled diesel will have a toxic effect on marine life.

Event Category	Ref.	Hazard	Causes	Risk Analysis			Impact
				Likelihood	Consequence	Risk Rating	
	17.	Cargo vessel collides with the breakwater.	Misjudgement of manoeuvre in tidal stream/wind. Adverse weather / tidal conditions. Over-reliance on autopilot. Lack of knowledge or experience. Judgement impaired due to fatigue. Inadequate /out of date charts. Manoeuvre to avoid fishing vessel.	Unlikely	Large	High	Vessel strikes breakwater with sufficient force to puncture hull. No injuries. Vessel in no immediate danger of foundering. Potential loss of HFO. Release of HFO has a smothering effect on marine life, Birds may be impacted. There is the possibility that the oil may sink, impacting benthic organisms.
Groundings	18.	Berthed vessel breaks away from mooring.	Larger vessel passes vessel alongside at close range and interaction occurs. Moorings of berthed vessel slack or not tended Poor deck watch. Tidal surge. High wind. Wash from emergency response craft.	Unlikely	Medium	Medium	Moored tanker breaks from berth, drifts and runs aground. Release of release of HFO and diesel. Release of HFO has a smothering effect on marine life, Birds may be impacted. There is the possibility that the oil may sink, impacting benthic organisms. Spilled diesel will have a toxic effect on marine life.
Fire and Explosions	19.	Fire on cargo vessel whilst berthed at jetty.	Failure to conform with international fire prevention standards. Smoke sensors / alarms disabled. Smoking in crews' accommodation. Lightening strike. Sabotage. Galley fire.	Unlikely	Large	High	Fire develops and spreads beyond capabilities of those onboard to control. Major incident declared, local population evacuated.
Swamping and foundering	20.	Dredging barge / tug boat/ service boat sinks whilst alongside the quay or on a mooring buoy.	Vandalism; release of mooring ropes. Severe weather/ Flooding.	Probable	Large	High	Vessel founders and blocks berth until recovered. Damage to onboard equipment due to the effects of water immersion. Vessel laden with fuel founders. All fuel lost. Berth blocked until recovery can be completed. Spilled diesel will have a toxic effect on marine life.

Annex F

Policy Framework for Resettlement and Compensation for Early Works

F1 Introduction

This document provides an overview of the proposed methodology to mitigate the adverse impacts of physical and economic displacement which are likely to occur during the pre-construction phase of Early Works for the Simandou Project. The policies, approach and implementation mentioned herein have been developed from the Draft “Plan d’Action de Réinstallation et de Compensation”, i.e. the Resettlement and Compensation Framework required to be implemented for the Simandou Project ⁽¹⁾. This document references the International Performance Standard 5 ⁽²⁾ on “Land Acquisition and Involuntary Resettlement” and related guidance notes and the Rio Tinto Communities’ Policies ⁽³⁾.

It should be noted that the responsibility of acquisition of land needed to develop the project components under Early Works rests with Simfer S.A. Simfer S.A. is currently in the process of drafting a Memorandum of Understanding (Projet de Protocole d’Accord) with the Ministry of Mines, Ministry of Energy and Environment and the Ministry of Urbanism, Habitat & Construction which will define the legal framework and the modalities of implementation of land acquisition, compensation and resettlement for Early Works of the Simandou Project.

This document highlights the principles and approach to resettlement for Early Works that the project is committed to. In parallel, each project component under Early Works, i.e. the Pioneering MOF, the Worker Camps, the Quarries etc. will each have a separate “Plan d’Action de Réinstallation et de Compensation” which will provide specific details of the project affected families, the nature and intensity of displacement (physical and/or economic), the compensation details at a community and household level and resettlement and rehabilitation.

F1.1 Principles of Resettlement and Compensation

Simfer S.A will commit to the following key principles to acquire land and implement resettlement and compensation for the Early Works of the Simandou Project:

1. Minimization of adverse impacts: Negative/ adverse impacts of the project will be avoided or minimized, to the extent possible;
2. Minimization of displacement: Where feasible, avoid or at least minimize physical and economic displacement by exploring alternative project designs and locations wherever feasible;
3. Consideration of both physical and economic displacement: impacts from permanent or temporary land acquisition (*please refer to temporary land access procedure developed for the project attached as annexure*) on assets and livelihoods will be mitigated, with both physical and economic displacement (severance of livelihoods) taken into consideration;
4. Compensation at Replacement Value: The project will compensate both physical and economic impacts of land acquisition at full replacement value;
5. Opportunity Cost: The determination of compensation will take into account the opportunity cost of the land and/or asset affected to the extent feasible;
6. Livelihood restoration: Affected livelihoods will be restored as a minimum, or preferably improved, and living conditions of affected households will be improved. A robust monitoring mechanism will ensure that livelihood restoration is regularly tracked;
7. Recognition of customary rights: The project will recognize customary land ownership, and to the extent

(1) The PARC Framework covers the whole project and “establishes principles, procedures, entitlements, eligibility criteria and broad implementation plan” that will be valid for the duration of the entire project;

(2) The Simandou Project commits to plan, document and implement any resettlement in accordance with the spirit and tenets of the updated IFC OS 5 that will be applicable from January 2011 onwards;

(3) http://www.riotinto.com/documents/Library/Communities_policy.pdf

feasible, align with, the different layers of land rights identified in the local land tenure system and develop appropriate entitlements and compensation plans;

8. Consultation and Disclosure: The project will be transparent in disclosing information related to the project and entitlements and people's participation will be sought across the lifecycle of the project. Consultations will continue during the implementation of resettlement and rehabilitation works;
9. Grievance Mechanism: An effective and accessible grievance redressal mechanism will be established at the project level to ensure speedy resolution of grievances/disputes. Representation of the community will be ensured in the grievance redressal mechanism;
10. Minimizing impacts on Heritage Sites and Community Assets: The project will to the extent possible and feasible avoid impacts on cultural and heritage sites as well as community assets;
11. Vulnerable Groups: The project will recognize that vulnerable groups have special needs and require specific measures and safeguards to ensure they are not further marginalised;
12. Timely Compensation: The project will avoid construction activities prior to completion of compensation and full resettlement

Simfer will also ensure that:

1. The compensation is paid only the rightful and eligible person. It will be ensured that compensation is delivered directly to affected households or individuals rather than to a third party (village elder or a government official etc) for further distribution to affected households or individuals;
2. To the extent possible/ feasible and acceptable to PAPs offer resettlement housing including provision of agricultural land by prioritizing land for land exchanges (of equivalent potential and size to the lost land and closer to their habitation);
3. PAPs' are assisted in restoring their affected livelihoods. Provisions of transitional assistance, rehabilitation grant etc will be considered for ensuring livelihood restoration to pre project levels;
4. The implementation of RAP and its outcomes is monitored and evaluated as part of a transparent process involving independent parties;
5. Impact on host communities and neighbouring villages is minimized to the extent possible;
6. Adverse impacts on access routes, common property resources and other community sensitivities are minimized to the extent possible. Wherever unavoidable the project will provide alternatives for such losses and restore/strengthen community resources

F1.1.1 Applicable Regulatory Framework

The land acquisition, resettlement and compensation for Early Works for the Simandou Project will be developed and implemented in accordance with the following:

- The Land Rights and Domanial Code (1992) which applies to urban and rural land and to both private and domanial (public) land - articles 54 to 83 contain detailed provisions related to expropriation for public interest.
- The Mining Code (1995) which sets out provisions for land occupation and compensation as relevant to mines and quarries and which is likely to be revised/amended in the near future.
- Relevant customary and traditional laws.

- IFC's Performance Standards (and the revised standards, applicable from January 2012), in particular the provisions of the fifth Performance Standard (IFC PS 5) on Land Acquisition and Involuntary Resettlement.
- Rio Tinto's global Communities Standard.

There is an established institutional and legal framework for the expropriation of land and assets in the Republic of Guinea as defined by the Land Rights and Domanial Code (1992). According to the Fundamental Law (revised by the decree of May 2002) *"no one can be deprived of property except where public interest has been established, and this only subject to fair and prior compensation."* For the Early Works, Simfer S.A. intends to acquire land through negotiated settlements and have thus committed compliance to the IFC Performance Standards which necessitate measures additional to those required by the Guinean legal framework.

Notably, areas wherein the Resettlement and Compensation Policy for Simandou adopts extended requirements are in provision for:

- land-for-land compensation rather than cash compensation provided by Guinean law;
- provision of compensation is at replacement cost and is viewed as one of many elements within a comprehensive rehabilitation strategy ("no worse-off if not better-off" requirement);
- whatever the legal recognition of their occupancy, all people must be compensated following the same principles as legally recognized owners ("treat customary and formal rights equally to the extent possible in devising compensation rules and procedures". The Land Code (1992) recognizes the rights of "bona fide" occupants;
- loss of opportunity cost must be taken into account in compensating impact on land-use, commercial assets etc;
- prior consultation and consideration of alternatives with the affected parties and development of a specific Resettlement Action Plan for each affected party;
- special consideration of vulnerable groups and indigenous people;
- a grievance mechanism; and
- monitoring and final check on completion.

F1.2 Eligibility and Entitlements

The nature and type of land-based impacts due to the land requirement for components under the Early Works will be identified through the Social and Environmental assessment process. These impacts are likely to include, but not be limited to:

- physical and/or economic displacement of owners, occupiers and users of the land;
- adverse land-based impacts of marginalization of land-holdings, landlessness; and
- impacts on access/severance to common property resources and community-owned assets.

The land requirements for Early Works has the potential to lead to impacts on several stakeholders who can be identified in the following broad groups as potentially eligible for entitlement and other benefits:

- general community/villagers;
- lineage elders and founding families;
- individual or a nuclear family unit;
- fishing communities;

- a household or *concession* which may be composed of several families;
- land users and occupants such as tenants, sharecroppers etc;
- transhumant herders;
- vulnerable communities and families;
- users of common property resources; and
- sacred, religious, cultural and heritage sites.

A site specific *Plan d'Action de Reinstallation et Compensation* (PARC) will be developed for each element of the Early Works and will detail the extent and severity of these impacts at the particular site, the units and the proposed entitlements, in accordance with the broad principles outlined in this document, on the basis of which the affected persons will typically be entitled to the following types of compensation and assistance:

- compensation for loss of land, crops / trees etc;
- compensation for structures (residential/ commercial) and other immovable assets;
- preferential employment and skill building support;
- compensation and assistance for loss of income;
- wage-based and enterprise-based loss of income and opportunity;
- compensation and assistance for loss of common resource (like sea, forest) dependent livelihoods;
- assistance for resettlement, relocation and rehabilitation;
- replacement and shifting of community assets;
- strengthening/rebuilding and/or restoration of community resources/ assets/facilities.

F1.3 Resettlement and Compensation Process

The proposed process to be followed for the resettlement and rehabilitation of project affected families for Early Works is described in this section and specific responsibilities are identified in *Figure A.1*. It should be noted that this process does not replace the existing legal mechanisms and hence a “*Project de Protocole d’Accord*” has been initiated to provide a legal basis for this approach.

F1.3.1 Responsibilities

The land acquisition for Early Works will be undertaken on the basis of negotiated settlements with project-affected families and communities and hence it is not directly linked to the government-led expropriation process under the “*Project d’Interet Nationale* (PIN)” and the “*Decret d’Utilite Publique*” (DUP). In accordance with the “*Project de Protocole d’Accord*” that is being finalized, the responsibilities for planning resettlement and compensation will be shared between Simfer and the Government of Guinea.

Simfer will be obliged to identify and inform the Government of the exact technical details and land requirements in order to fulfil its obligations for the construction and operation of the Early Works. Simfer will undertake the processes prior to resettlement and compensation, i.e. identification of land parcels and owners, planning compensation and resettlement options, agreement on resettlement options. The implementation of the PARC will then be coordinated with the relevant authorities of the Government of Guinea, particularly the Ministry of Urbanism, Habitat & Construction and the authorities at the level of each prefecture and sub-prefecture. Simfer will complete the required land transaction procedures and ensure that all project affected families are adequately compensated and resettled (if required) prior to start of onsite construction activities.

F1.3.2 Disclosure and Agreement of the PARC Framework

The PARC Framework for the entire Simandou Project (inclusive of the Early Works) is currently being reviewed. This will be discussed and agreed with the Government as the overall Framework for all resettlement and compensation required for the Simandou project. A series of consultations have been planned to disclose the PARC Framework at a prefecture level and obtain inputs on the principles and entitlements of the same.

F1.3.3 Land & Asset Inventory and Socio-economic Survey

This stage will identify affected people, communities and economic interests impacted by the specific land requirements for Early Works. As land tenure and management in the Republic of Guinea is customary a census and survey will be conducted to cover all affected people including private landowners, tenants, other holders of rights to land and any person occupying or using the land for shelter, business or other sources of livelihood including squatters.

Prior Information to the Affected Communities

Simfer S.A Communities' staff will inform the communities in the project area about the Simandou project, the proposed dates of the survey and its purpose. This process will also request the village leaders/founding fathers to deliberate among themselves the customary processes they would like to trigger in deciding land ownership and rights as well as entitlements. There is a strong possibility that many areas will have ambiguous land ownership as well as land access/user rights and the majority of claimants may not have a legal or documented evidence of land they claim to own or have rights to use so preparing the communities for these deliberations will be crucial as to not lose time during the surveying period.

Survey, Census and Inventory

The teams will simultaneously conduct (a) a survey of affected land parcels; (b) a household survey of the land owner, user, occupier etc; and (c) an asset inventory of land-use, number of assets, trees etc. This is likely to kick-start with visits/discussions with the village chief and council of elders. The survey will also include/document all cultural assets that may be affected as a part of the resettlement process.

Verification of the Survey and Inventory

On the basis of the survey/census and asset inventory, the field team will be required to develop a *proforma/land and asset description* which should be verified by the land owner/user and vetted by the government representative. The survey will also include community consultations to understand community impacts and to identify the vulnerable groups in addition to the PAFs.

Box F.1 Establishment of a Cut-off Date

Eligibility for resettlement and compensation will be determined by a cut-off date which shall be the last date of the census and asset inventory survey specific to each project component and each project location due to the geographical extent and spread of the project. The census and survey will identify only those affected parties with interests in the land on or before that date to avoid unnecessary and potentially fraudulent claims for compensation.

Persons who encroach on the area after the cut-off date will not be entitled to compensation or any other form of resettlement assistance (this applies in particular to persons informally/ illegally occupying land). The concept of the cut-off date will be communicated potential affected persons and the local authorities prior to the survey and the actual cut-off date will be subsequently communicated across prefectures and sub-prefectures. The local community will be allowed to put forth all claims and grievances which will then be addressed through the Grievance Mechanism that is formulated by Simfer.

F1.3.4 Valuation of Affected Assets

The valuation of land and assets to be impacted will be undertaken through a specific Market Valuation study and will be linked to the Ministry of Agriculture. The valuation study will establish replacement value for all structures, assets and land that can be potentially impacted and these will be vetted by the representatives of the relevant government authorities. The valuation study will also define methods for establishing monetary compensation but also options.

F1.3.5 Resettlement Options and Entitlements

Design Entitlements Resettlement Measures

The information obtained through the census survey will be analyzed for sources of primary, secondary and supplementary income. This will be carried out in parallel with surveying and analysing the current socio-economic contexts of the project area, demand for goods and services, availability of support services like credits and current skill pool and labour requirements (to match with what the displaced families have). The PARC team in consultation with the affected persons will also need to identify new economic opportunities, such as land based opportunities, strategic opportunities in the project, or skill based livelihood opportunities.

Developing income/livelihood restoration programmes

Other livelihood restoration measures are also expected to be important elements of the mitigation strategy. These packages will be developed including specific actions to enable people to restore and where possible enhance their existing livelihoods, or to allow them to develop new skills and capacities suited to alternative livelihoods. The livelihood restoration programmes will emphasize on specific provisions for vulnerable groups, women etc.

Identification of relocation sites

If temporary or permanent physical resettlement is the preferred solution, potential host sites will be identified and where appropriate outline plans prepared in consultation with the host area administration. This would also include plan for housing, environmental management, infrastructure and social services at the resettlement site to cater to both the affected families as well as the impacted host community. The proposal for relocation sites will be discussed with the respective host communities in order to consider their feedback on the same.

F1.3.6 Public Consultation and Participation

Consultation and participation by the affected communities and individuals is an essential element of the land acquisition, compensation and resettlement process. Throughout the process there will be consultation and involvement of affected parties. Affected parties will be made aware of, and understand:

- the plans for development of the property or land;
- their options and rights pertaining to resettlement and compensation;
- technically and economically feasible options for compensation and resettlement;
- the process of and proposed dates for compensation and resettlement;
- the availability of compensation at full replacement cost for loss of assets and services; and
- other assistance available to maintain or improve their living standards.

F1.3.7 PARC Preparation

Considering the project components' diversity and their locations, separate PARC plans are being envisaged for each aspect of the Early Works under the umbrella of the PARC framework agreed with the Government. Each Plan will have a baseline, an entitlement matrix, specific institutional arrangements, resettlement process details and rehabilitation measures. The overarching entitlement framework, processes and management measures will have already been defined in the PARC framework such as consultation, disclosure, grievance redress. A household-level entitlement plan for each family will be prepared detailing the exact entitlements due to each family.

The details of entitlement frameworks, livelihood restoration plans and framework of the household level plans will be disclosed and approved by the affected communities. Consultations will be carried out at the sub-prefecture and/or CRD level across the footprint area for each project component.

Simfer will agree the Entitlement Matrix of each of the PARCs for the specific Early Works Components with Government and thereafter disclose the plans to the project affected families across the project components and seek feedback and comments.

F1.3.8 Implementation

After the finalisation of the household level plans, Simfer will implement these, including ensuring that each Project Affected Person has received compensation and other entitlements and there is formal sign off by Government and Simfer, rolling out the other entitlements and rehabilitation measure, physical resettlement, any grievances are in parallel addressed, getting physical possession of the land. Simfer will also be advised and guided by the Government of Guinea on the physical resettlement aspects of the PARC, (i.e. construction of transit accommodation; demolition of structures; construction of permanent resettlement sites and shifting of people) if these are required for Early Works.

F1.3.9 Grievance Process

Throughout the PARC process for Early Works, affected parties and the local community in general, will have access to Simfer's established Grievance Mechanism that has been developed to be consistent with Performance Standard 1 and will be in addition to existing legal institutions, such as the Land Commissions. The procedure will receive and address any concerns about land requirement, measurement, census and compensation that are raised by displaced parties or affected communities.

It will cover grievances concerning the conduct of any aspect of the resettlement process including non-fulfilment of contracts, levels of compensation, or seizure of assets without compensation. It will also be available for raising complaints about any other aspect of the development including concerns from neighbours or other external parties about disturbance during construction, aspects of the design, traffic issues, jobs or impact on local services or amenity.

The grievance process will be administered by the Simfer Communities Team in consultation with the local authorities and traditional village councils where relevant. The grievance will be simple and will seek to resolve issues informally as far as possible.

F1.3.10 Monitoring and Evaluation

The PARC for each project component under Early Works will include a mechanism (established under the PARC framework) to monitor progress against its implementation. Monitoring indicators of the PARC process for will be derived from the socio-economic baseline survey for the project impacted people. The indicators in *Table A.1* illustrate how the resettlement process and impact mitigation can be tracked.

Table F.1 Indicative Monitoring Indicators

Aspect	Monitoring Indicators
Impact Indicators	
Identification of Project Affected Families	- Number of PAFs to get physically displaced/ economically displaced/ physically and economically displaced; - Loss of income/livelihood sources (at family/household as well community level); - Resolution of grievances (number of grievances, resolution time, satisfaction levels, awareness etc).
Residual Impacts	- Have special needs of vulnerable groups been addressed?; - Absorption of affected people into project/ancillary activities; - Extent of replacement for natural resource dependence.
Compensation	- Timing of compensation payment (before/after acquisition); - Any deductions and associated transaction costs of compensation payments; - Comparison of compensation vis-à-vis replacement value by tracking other land transactions.
Process Indicators	
Resettlement	Is there any transparent mechanism for dispute settlement?

Aspect	Monitoring Indicators
Planning & Implementation	• Is the resettlement process in accordance to local regulatory requirements? • Has the entitlement framework been vetted by the local community/impacted persons? • Criteria for choice of resettlement/relocation site.
Grievance Mechanism	• What types of grievances have been identified & what were outcomes? • Percentage of grievances resolved by traditional channels versus government channels versus project-specific.
Outcome Indicators	
Livelihood Restoration	• Change in the average income per person, per household; • Change in source of income; • What livelihood restoration initiatives have been implemented specifically targeting vulnerable groups? • Have the project-affected families benefited from the Project related activities? • Has the community benefited from the community development programmes?
Satisfaction levels of PAPs	• How do PAPs assess the extent to which their quality of life & livelihood has been restored? • Satisfaction with compensation/entitlements/process; • Do they feel they have been actively involved in the process?

At the end of the PARC implementation for each sub-component, a third-party/independent audit will be undertaken to determine whether the process of implementation and outcomes of the land acquisition and resettlement comply with the project's legal frameworks and principles.