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Environmental and Social Impact Assessment of the CBG Mine Expansion Project

Chapter 4 - Biological Impact Assessment

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Compagnie des Bauxites de Guinée

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ABBREVIATIONS AND ACRONYMS

(Note: Text in square brackets [] is a translation of a French term for which there is no official English version.)

°C:	Degrees Celsius
AFD	Agence Française de Développement [French development agency]
AIDS:	Acquired immune deficiency syndrome
AIP:	Annual investment plan
AMC:	Alliance Mining Commodities Ltd.
ANAÏM:	Agence Nationale d'Aménagement des Infrastructures Minières [national agency for mining infrastructure development]
APA:	Laboratoire Archéologie et Peuplement de l'Afrique [African archeology and settlement laboratory]
APAÉ:	Association des parents et amis d'élèves [parents and friends of students]
ARV:	Antiretroviral
BAP:	Biodiversity action plan
BEPC:	<i>Brevet d'études du premier cycle du second degré</i> [middle-school leaving certificate]
BGÉÉE:	Bureau Guinéen d'Études et d'Évaluation Environnementale [Guinean bureau of environmental studies and assessment]
BM:	Banque Mondiale / World Bank (WB)
BPII:	<i>Bonnes pratiques industrielles internationales</i> / Industrial international best practices
C/P:	Frontline fishing camps and ports

- CA:** *Chiffre d'affaires* [revenues]
- CBG:** Compagnie des Bauxites de Guinée
- CCME:** Canadian Council of Ministers of the Environment
- CCNUCC:** *Convention-cadre des Nations Unies sur le changement climatique* / World Bank United Nations Framework Convention on Climate Change (UNFCCC)
- CDD:** *Contrat de durée déterminée* [contract of defined length]
- CDI:** *Contrat de durée indéterminée* [contract of indefinite length]
- CÉCI:** *Centre d'études et de coopération internationale* / Centre for international Studies and Cooperation
- CECIDE:** Centre du Commerce International pour le Développement [international trade center for development]
- CEDEAO:** Communauté économique des États de l'Afrique de l'Ouest / United Nations Economic Commission for Africa (UNECA)
- CFB:** Chemin de Fer de Boké [Boké railroad]
- CITES:** Convention on International Trade in Endangered Species
- CMG:** Chambre des Mines de Guinée [Guinean chamber of mines]
- COD:** Chemical oxygen demand
- COPC:** Contaminant of potential concern
- CoPSAM:** Comité Préfectoral de Suivi des Activités des Miniers [prefectoral mining activity monitoring committee]
- CPC:** *Contaminant potentiellement préoccupant* / contaminant of potential concern (COPC)
- CPD:** Comité Préfectoral de Développement [prefectoral development committee]
- CPÉ:** *Consultation et participation éclairées* / informed prior consent (IPC)

CR:	<i>Commune rurale</i> [rural commune]
CRD:	<i>Commune rurale de développement</i> [rural development commune]
CSA:	Centre de santé amélioré [improved health center]
CSO:	Civil society organizations
CSR:	Corporate social responsibility
CU:	<i>Commune urbaine</i> [urban commune]
CVÉ:	<i>Composante valorisée de l'écosystème</i> / valued ecosystem component (VEC)
dB:	Decibel
dB(A):	A-weighted decibel
dBZ:	Decibel relative to Z
DEP	Direction Préfectorale de l'Éducation [prefectoral directorate for education]
DPUHC:	Direction préfectorale de l'urbanisme de l'habitat et de la construction [prefectoral directorate for housing and construction]
DUDH:	<i>Déclaration universelle des droits de l'homme</i> / Universal Declaration of Human Rights (UDHR)
ÉDG:	Électricité de Guinée
EIA:	Environmental impact assessment
ÉIE:	<i>Étude d'impact environnemental</i> / environmental impact assessment
ÉIS:	<i>Étude d'impact social</i> / social impact assessment
EITI:	Extractive Industries Transparency Initiative
EPA:	Environmental Protection Agency (United States)
EPI:	Extended Program on Immunization

EPT:	Ephemeroptera, Plecoptera and Trichoptera (types of aquatic insects)
ESCOMB:	<i>Enquête de surveillance comportementale et biologique sur le VIH/SIDA</i> [HIV/AIDS behavioral and biological surveillance survey]
ESIA:	Environmental and social impact assessment
ESMP:	Environmental and social management plan
ETAE:	<i>Eaux tropicales de l'Atlantique Est</i> [tropical waters of the Eastern Atlantic]
FEL 1:	Front-end loading – preliminary economic assessment
FEL 2:	Front-end loading – prefeasibility study
FEL 3:	Front-end loading – detailed engineering study
FPIC:	Free prior and informed consent
GAC:	Guinea Alumina Corporation
GdG:	<i>Gouvernement de la Guinée</i> / Government of Guinea (GoG)
GDP:	Gross domestic product
GES:	<i>Gaz à effet de serre</i> / greenhouse gas (GHG)
GHG:	Greenhouse gas
GIEC:	Groupe d'experts intergouvernemental sur l'évolution du climat / Intergovernmental Panel on Climate Change (IPCC)
GIS:	Geographic information system
GNF:	Guinean franc
GoG:	Government of Guinea
GPS:	Global positioning system
GRI:	Global Reporting Initiative
GTP:	Ground truth point methodology

Ha:	Hectare
HAP:	<i>Hydrocarbure aromatique polycyclique</i> / polycyclic aromatic hydrocarbon (PAH)
HFO:	Heavy fuel oil
HP:	Horsepower
HSE:	Health, safety and environment
IBA:	Important bird area
ICCPR:	International Covenant on Civil and Political Rights
ICESCR:	International Covenant on Economic, Social and Cultural Rights
ICMM:	International Council on Mining and Metals / Conseil International des Mines et des Métaux
IFC:	International Finance Corporation / <i>Société Financière Internationale</i> (SFI)
IFI:	International finance institutions / <i>institutions financières internationales</i>
ILO:	International Labor Organization
IPCC:	Intergovernmental Panel on Climate Change
ISQG:	CCME Interim Sediment Quality Guideline
IST:	<i>Infections sexuellement transmissibles</i> / sexually transmitted infections (STIs)
ITIE:	Initiative pour la Transparence des Industries Extractives / Extractive Industries Transparency Initiative (EITI)
IUCN:	International Union for Conservation of Nature / Union internationale pour la conservation de la nature (UICN)
km:	Kilometer
km²:	Square kilometer

LA_{eq}:	Equivalent sound level (dBA)
LDIQS:	CCME Interim Sediment Quality Guideline
L_{eq}:	Equivalent sound level (dB)
m:	Meter
m²:	Square meter
m³:	Cubic meter
m³/h:	Cubic meters per hour
MDDEP:	Ministère du Développement durable, de l'Environnement et des Parcs du Québec, now called the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques [Quebec ministry of sustainable development, environment and parks, now called the ministry of sustainable development, environment and the fight against climate change]
MDT:	<i>Matières dissoutes totales</i> / total dissolved solids (TDS)
ml:	Milliliter
mm:	Millimeter
MME:	Ministère des Mines et de l'Énergie / Ministry of Mines and Energy
MTPA:	Million tonnes per annum
MW:	Megawatt
N/A:	Not applicable
NEP:	<i>Niveau d'effet probable du CCME</i> / CCME probable effects level (PEL)
NGO:	Nongovernmental organization
NP:	<i>Norme de performance de la SFI</i> / IFC Performance Standard (PS)
NSP:	<i>Ne s'applique pas</i> / not applicable (N/A)
OAU:	Organization of African Unity

OCDE:	Organisation de Coopération et de Développement Économique / Organization for Economic Cooperation and Development (OECD)
OECD:	Organization for Economic Cooperation and Development
OIT:	Organisation internationale du Travail / International Labor Organization (ILO)
OMS:	Organisation mondiale de la Santé / World Health Organization
ONG:	<i>Organisme non-gouvernemental</i> / nongovernmental organization
ONU:	Organisation des Nations-Unies / United Nations
OSC:	<i>Organisations de la société civile</i> / civil society organizations
OUA:	Organisation de l'unité africaine / Organization of African Unity
OWINFS:	Our World Is Not for Sale
PACV:	<i>Programme d'appui aux organisations villageoises</i> [village support program]
PAH	Polycyclic aromatic hydrocarbon
PAI:	<i>Plan annuel d'investissement</i> / annual investment plan
PARC:	<i>Plan d'action de réinstallation et de compensation</i> / resettlement and compensation action plan (RAP)
PCB:	<i>Plan de conservation de la biodiversité</i> / biodiversity action plan (BAP)
PCS:	<i>Partenaires contre le SIDA</i> [AIDS prevention group]
PDL:	<i>Plan de développement local</i> [local development plan]
PEL:	CCME probable effects level
PEPP:	<i>Plan d'engagement des parties prenantes</i> / stakeholder engagement plan (SEP)
PÉV:	<i>Programme élargi de vaccination</i> / Expanded Programme on Immunization (EPI)

PGES:	<i>Plan de gestion environnementale et sociale</i> / environmental and social management plan (ESMP)
PIB:	<i>Produit intérieur brut</i> / gross domestic product (GDP)
PIDCP:	<i>Pacte international relatif aux droits civils et politiques</i> / International Covenant on Civil and Political Rights (ICCPR)
PIDESC:	<i>Pacte international relatif aux droits économiques, sociaux et culturels</i> / International Covenant on Economic, Social and Cultural Rights (ICESCR)
PK:	Point kilométrique / kilometer point
PM₁₀:	Particulate matter in air up to 10 micrometers in size
PM_{2.5}:	Particulate matter in air up to 2.5 micrometers in size
PMH:	<i>Pompe à motricité humaine</i> / manually operated pump
PNUD:	Programme des Nations-Unies pour le Développement / United Nations Development Program (UNDP)
PP:	<i>Parties prenantes</i> / stakeholders
PPV:	Peak particle velocity
PRCB:	Projet de renforcement des capacités de Boké [Boké rural community development project]
PS:	IFC Performance Standard
QSE:	Quality, safety and environment
RAP:	Resettlement and compensation action plan
RAP:	Rapid assessment program / rapid biological assessment
RSE:	<i>Responsabilité sociale des entreprises</i> / corporate social responsibility (CSR)
RTA:	Rio Tinto Alcan

SAG:	Société Aurifère de Guinée [Guinea gold corporation]
SDT:	<i>Solides dissous totaux</i> / total dissolved solids (TDS)
SEG:	Société des Eaux de Guinée [Guinea water corporation]
SEP:	Stakeholder engagement plan
SFI:	Société Financière Internationale / International Finance Corporation (IFC)
SIA:	Social impact assessment
SIDA:	<i>Syndrome d'immunodéficience acquise</i> / acquired immune deficiency syndrome (AIDS)
SIG:	<i>Système d'information géographique</i> / geographic information system (GIS)
SNAPE:	Service national des points d'eau [national water supply points service]
SO_x:	Sulphur oxides
SP:	<i>Sous-préfecture</i> [subprefecture]
SSC:	Species Survival Commission
SSE:	<i>Santé, sécurité, environnement</i> / health, safety and environment (HSE)
SST:	<i>Solides en suspension totaux</i> / total suspended solids (TSS)
STI:	Sexually transmitted infections
TDR:	<i>Termes de référence</i> / terms of reference (TOR)
TDS:	Total dissolved solids
TOR:	Terms of reference
TPE:	<i>Très petite entreprise</i> / very small business
TPH:	Tonnes per hour
TSP:	Total suspended particulates

TSS:	Total suspended solids
UDHR:	Universal Declaration of Human Rights
UICN:	<u>Union internationale pour la conservation de la nature</u> / International Union for Conservation of Nature (IUCN)
UN:	United Nations
UNDP:	United Nations Development Program
UNECA:	United Nations Economic Commission for Africa
UNESCO:	United Nations Organization for Education, Science and Culture / Organisation des Nations unies pour l'éducation, la science et la culture
UNFCC:	United Nations Framework Convention on Climate Change
UniGE:	Université de Genève / University of Geneva
UTM:	Universal Transverse Mercator
VEC:	Valued ecosystem component
VIH:	<i>Virus de l'immunodéficience humaine</i> / human immunodeficiency virus (HIV)
WB:	World Bank / Banque Mondiale (BM)
WHO:	World Health Organization / Organisation mondiale de la Santé (OMS)
ZÉE:	<i>Zone économique exclusive de la Guinée</i> [Guinea economic exclusive zone]
ZICO:	<i>Zone importante pour la conservation des oiseaux</i> / important bird area (IBA)

CHAPTER 4 – BIOLOGICAL IMPACT ASSESSMENT

4.1 Introduction

4.1.1 Description of Project

The CBG Project is described in Chapter 1.

The efficient management of risks and impacts linked to the implementation of the Project requires a complete Environmental and Social Impact Assessment (ESIA) that covers and assesses the risks and potential impacts of all the actions and phases of the Project.

4.1.2 Goals of the study

The biology impact assessment follows a series of studies in preparation of the implementation of the CBG Expansion Project, notably the biology baseline study, carried out in the impact zone of the Project in 2013/2014 (Chapter 3). This biology impact assessment also takes into account certain of the results of the physical environment study of the Project carried out in the first half of 2014 (Chapter 2).

The Scoping Report for the Environmental and Social Impact Assessment for the CBG Expansion Project produced by ÉEM in November 2013 details the Terms of Reference for the studies. The Terms of Reference were approved by the Ministère de l'Environnement, des Eaux et Forêts on November 8 2013 and the final Scoping Report submitted to the Bureau Guinéen d'Études et d'Évaluation Environnementale (BGÉÉE) December 5 2013.

The main objective of the biology impact assessment is to analyze the potential impacts of an increase in bauxite production and of the support infrastructure on biological components in the zone of influence of the Project. It also describes the mitigation measures to put in place to reduce negative impacts or to optimize Project impacts when they are positive.

More specifically, the objectives of the biology impact study were to:

- to work in close collaboration with the CBG technical teams (Expansion cell) and, to the extent possible, with the subcontractor companies, so as to know the options linked to different phases of the Project and be able to give advice on alternatives rapidly;
- to work in close collaboration with the other disciplines of the ESIA to ensure the quality of the impact assessments and to determine realistic and compatible mitigation measures;
- to ensure that IFC Performance Standards and Guinean laws are fully taken into consideration;
- to evaluate the impacts in a rigorous manner and with the latest data available; and
- to propose mitigation measures likely to protect the natural environment in the Study Area.

The Environmental and Social Impact Assessment (ESIA) includes the production of an Environmental and Social Management Plan (ESMP) so as to allow a coherent implementation of the various mitigation and enhancement measures recommended and favor a sustainable management of the Project to the benefit of the promoter, the natural environments and the host communities.

4.1.3 Study Areas

The Study Areas have been described in a general way in Chapter 1. Some specific aspects related to the biological studies are brought up in Chapter 3.

4.1.4 Participants

The ESIA Project team is described in a general way in Chapter 1.

For the biology impact assessment the key persons were:

4.1.4.1 CBG

Stéphane Dallaire of the *Service Hygiène, Sécurité, Environnement, Relations communautaires* of CBG's Expansion Project and CBG's main contact with the ÉEM biology study team.

4.1.4.2 ÉEM

Eric Muller, Leader of the environmental study.

ÉEM had the overall responsibility of the ESIA studies and of the reports and project management.

4.2 Legal framework

The Scoping Report for the Environmental and Social Impact Assessment for the CBG Expansion Project produced by ÉEM in November 2013 details the legal framework and the standards applicable to the ESIA from the Guinean and international point of view. This information is repeated in Chapter 1 of the ESIA.

The more detailed information below on biological aspects come partly from the *Monographie nationale sur la biodiversité de la Guinée* (Bah et al., 1997) (Chapter 13-1-3) and the *Rapport de la Cour suprême de Guinée sur le droit pénal de l'environnement* (as reported in the *Actes de la Réunion constitutive du comité sur l'environnement de l'AHJUCAF École Régionale Supérieure de la Magistrature de l'OHADA Porto-Novo (Bénin)*, 2008). The biology legal framework is presented in more detail in Annexe 4-1.

4.2.1 Guinean legal framework

4.2.1.1 Introduction

According to the *Rapport de la Cour suprême de Guinée sur le droit pénal de l'environnement* (2008), the Guinean legal authorities have wide powers to protect the environment.

The principal elements of the legal framework applicable to the Project and of importance from the biological perspective are the following:

- *Code de la Protection et de la Mise en Valeur de l'Environnement* (or *Code de l'environnement*) – establishes the national framework for natural resource management and prescribes mechanisms, such as ESIA's, for minimizing negative environmental impacts;
- Loi L/96/010/An du 22 juillet 1996 portant sur la réglementation des taxes à la pollution applicables aux établissements classés ;
- Décret présidentiel N° 199/PRG/SGG/89 codifiant les Études d'Impact sur l'Environnement (November 1989) – establishes that ESIA's must be conducted for certain types of projects, including ports, power stations, mines, etc.;

- Décret 201/PRG/SGG/89 du 8 novembre 1989 portant sur la préservation du milieu marin ;
- Arrêté N° 990/MRNE/SGG/90 – établit les procédures et la méthodologie pour la réalisation d’une ÉIES ;
- Arrêté N° A/2013/474/MEEF/CAB portant sur l’adoption du Guide général d’évaluation environnementale – establishes the procedures and methodology for carrying out an ESIA;
- Loi L/95/036/CTRN du 30 juin 1995, portant sur le *Code minier* de la République de Guinée – governs mining exploration, operations, commerce and processing in the mining industry, with reference to the Code de l’environnement;
- *Code de l’eau*, établi en vertu de la Loi L/94/005/CTRN – governs the management of water resources;
- *Code forestier* (Loi L/99/013/AN, 1999) – governs the management of forest resources;
- *Code de protection de la faune sauvage et réglementation de la chasse* (Loi L/99/038/AN) ;
- *Code minier* (Loi L/2011/006/CNT) ;
- Loi-cadre sur les activités de la pêche en eau douce (L/96/067/AN du 22 juillet 1996) ; and
- *Code pastoral* – establishes the conditions for using lands and resources as pasturage.

The code on the protection of fauna is particularly important for the biological impact assessment. It is therefore described in more detail in the following section.

4.2.1.2 *Code de protection de la faune sauvage*

The Loi L/99/038/AN adopting and enacting the *Code de protection de la faune sauvage et réglementation de la chasse* dates from 1998.

Among the principles of the code it is worth mentioning:

The wild fauna is a heritage of general interest. Thus are recognized its economic, food and social value, as well as its scientific, esthetic, recreational and educational value.

It is the duty of all to contribute to its maintenance and its development.

The preservation of the wild fauna is assured by all appropriate means including the protection of the environment and the plants species that are necessary for it. The education of the whole of the population is also ensured, as much by teaching in schools as by all audio-visual means to elicit a national growing awareness of the need for that preservation.

The fauna is a renewable resource that must be conserved by placing it in favorable habitat and management conditons.

All animal species are an integral part of the national heritage. For this reason, it must be protected.

The preservation, the retention or the re-establishment of a sufficient diversity of habitats necessary for wildlife is also a national obligation. The environment in which evolve the wild fauna is normaly devoted to agricultural, pastoral, forestry aquatic or marine activities.

Speciesl biotope protection measures may be applied on part of the national territory, each time that the state of certain animal species justifies it.

An important part of the law deals with the protection of species:

Article 42: All animal species must be protected. Those whose population conditions allow it may be exploited by hunting according to the management rules that ensure the maintenance or increase of population numbers.

Article 47: All animals that are particularly rare or threatened with extinction, are totally protected on the full extent of the national territory. This list may be modified by decree, taken on joint proposition of the ministerial authorities in charge of hunting and scientific research.

Hunting and capture of totally protected animal species, including young and harvesting of eggs, are formally forbidden. An exception may be accorded to holders of a scienfitic hunting and captures permit.

Article 56: All the animals of species that are partly protected, list for which is fixed by an application decree of the present, have to be the object of an authorization before any hunting act. This authorization is mentioned on the hunting permit.

Some of the species found in the Study Areas of the ESIA are either totally protected (for example the African golden cat and the chimpanzee) or partly protected (for example the serval, the crested porcupine and the hippopotamus) by Guinean legislation.

4.2.2 Action plans of the Guinean government

A number of strategic action plans of the Government of Guinea must also be taken into account in the deployment of the Project. These plans constitute the primary administrative framework for ensuring that environmental priorities are observed throughout the territory. The plans whose strategic directions and objectives are relevant to the ESIA and the Project implementation include the following:

- *Plan d'action national pour l'Environnement (PNAE);*
- *Plan d'action forestier national (PAFN);*
- *Plan directeur d'aménagement forestier des mangroves (SDAM);*
- *Plan d'action national d'adaptation aux changements climatiques (PANA-CC);*
- *Plan d'action national sur la diversité biologique; and*
- *Plan d'action national de lutte contre la désertification (PANL-LCD).*

These plans are described in Annexe 4-1

4.2.3 *Monographie nationale sur la biodiversité de la Guinée*

The *Monographie nationale sur la biodiversité de la Guinée* (Bah et al., 1997) is an important document from several points of view. The *Monographie* follows from the United Nations Conference on the Environment and Development held in Rio de Janeiro in June 1992 and obligations under the United Nations Convention on Biological Diversity. It presents a first approach for a national action plan for biodiversity, taken up later in the 2001-2002 strategy and action plan listed above.

It is also a useful compilation of the information available at the time on the status of species in Guinea. The lists in the *Monographie* need to be brought up to date, as knowledge and statuses evolve quickly in biodiversity matters. Nevertheless, the *Monographie* remains a useful document on the Guinean status of species and the statuses given are considered in this study.

4.2.4 Conventions and international agreements ratified by Guinea

According to the *Rapport de la Cour suprême de Guinée sur le droit pénal de l'environnement* (2008):

The fundamental law of the Republic of Guinea admits the principles of the primacy of international law over internal law.

Article 79 specifies in effect that “treaties or accords regularly approved or noted have as soon as they are published an authority superior to that of laws with reserve of reciprocity.”

For the implementation of these principles by the state actors, notably the legislator and the judge, the Republic of Guinea adopts monism, that is the unity of principle between internal and international law, leading to searching for conformity between internal and international law by proceeding to amendments or modifications to legislative and regulatory texts. That is to say that the international conventions ratified in the field

of the environment and containing penal provisions impose themselves on the Guinean penal legislation and are integrated into our texts.

The international conventions ratified by Guinea and the agreements that have possible implications for the biological aspects of the ESIA of the Expansion Project are the following:

- International Convention for the Prevention of Pollution from Ships (IMO - London, 1954);
- International Convention for the Prevention of Pollution of the Sea by Oil (IMO - London, 1967);
- Convention Concerning the Protection of the World Cultural and Natural Heritage (UNESCO - Paris, 1972);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Washington, 1973 – amended Bonn, 1979);
- Convention on the Conservation of Migratory Species of Wild Animals (CMS) (Bonn, 1979);
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) (The Hague, 1995);
- Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (Abidjan, 1981);
- African Convention on the Conservation of Nature and Natural Resources (Algiers, 1968 revised in 2003);
- United Nations Convention on the Law of the Sea (Montego Bay, 1982);
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971);
- Convention to Combat Desertification (UN - Paris, 1994);
- International Union for the Conservation of Nature and Natural Resources (IUCN) (Fontainebleau, 1948);
- Convention on Biological Diversity (UN - Nairobi, 1991);
- Extractive Industries Transparency Initiative (Candidate status renewed in 2011) (ITIE);

- New Partnership for Africa's Development (NEPAD), African Union strategic framework; and
- The environmental policies of the Economic Community of Western African States (ECOWAS).

These treaties or agreements are described in Annexe 4-1.

4.2.5 Performance standards of the International Finance Corporation (IFC)

Conformity with the International Finance Corporation's (IFC) *Performance Standards on Environmental and Social Sustainability* (IFC, 2012), as well as with the Equator Principles for managing the environmental and social impacts of international investment projects, is a cornerstone of this ESIA report.

The IFC Performance Standards establish essential criteria, in terms of social and environmental sustainability, for accessing international capital. The set of eight operational standards requires that environmental and social management systems be developed, implemented and followed in order to ensure that risks and impacts related to the basic themes of sustainable development are effectively and systematically managed throughout the life of a project. For each theme, particular methodology criteria, essential subjects and support principles are established to guide the process. The themes applicable to the biological impact assessment are as follows:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 3: Resource Efficiency and Pollution Prevention;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;

Performance Standards 1 and 3 deal with general principles that have applications for biology, but Performance Standard 6 deals specifically with biological questions. For this reason, Performance Standard 6 is described in more detail in Annexe 4-2.

The objectives of Performance Standard 6 are:

- protect and conserve biodiversity;

- maintain the benefits from ecosystem services; and
- to promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

4.2.6 Equator Principles

The Project has also been developed in compliance with the Equator Principles III (2011), a financial industry benchmark for taking social responsibility and environmental management into account.

4.3 Initial state of the receiving environment

The initial state of the receiving environment was established on the basis of earlier studies and mainly by field studies undertaken by ÉEM/Sylvatrop in 2013-2014. These are all detailed in the biology baseline for the ESIA (Biology Baseline Study for the CBG Mine Expansion Project, 2014, ÉEM) that includes Chapter 3 of this ESIA and its 12 appendices that are the specialist's reports.

Prior studies are of limited applicability. The most important are the ESIA for Guinea Alumina Corporation (GAC) (2008) and the AECOM ESIA for CBG (2011).

Two specific studies were particularly useful:

- the 2006 inventory *A Rapid Biological Assessment of Boké Préfecture, Northwestern Guinea* is a recent assessment of good quality for sites within Boké prefecture (Wright, McCullough, and Diallo, 2006); and
- the *Critical Habitat Assessment Report, Guinea Alumina Corporation Project* published in 2008, on the habitats of certain mammals (mainly chimpanzees) in the GAC concession (Ecology and Environment Inc. and Kormos, 2008).

The ÉEM/Sylvatrop biology baseline study had as its objectives:

- to identify and characterize the habitats of the Study Area based on aerial photographs and satellite imagery available;
- to assess the faunistic and floristic diversity, in particular in the habitats affected by the Project; and
- to determine the presence of vulnerable or threatened species (according to the lists of the *Monographie Nationale* and the IUCN).

The field studies took place from October to December 2013 and detailed in the reports of the specialists (annexes 3-1 to 3-12 of Chapter 3). The biological studies specifically look at the following main topics:

- vegetation;
- large and medium terrestrial mammals;
- freshwater fauna (Sangarédi only);
- birds;
- reptiles and amphibians; and
- marine mammals, turtles and crocodiles (Kamsar only).

Other important studies not directly related to plant or animal inventories and linked with the social studies (Chapter 5) were also undertaken:

- marine fishing study (Kamsar only);
- firewood and charcoal study; and
- hunting and bushmeat study.

For each of these studies, a specialist of international repute was associated with at least one senior national researcher. Specimens were exported to be studied in laboratories of international repute such as Kew Botanical Gardens in England and the Berlin Museum of Natural History.

4.4 Methodology for the biology impact assessment

The Scoping Report for the Environmental and Social Impact Assessment for the CBG Expansion Project produced by EEM in November 2013 details the impact evaluation applicable to the ESIA. This information is expanded and corrected in Chapter 1 of the ESIA. The description below is a short reminder of the elements of this evaluation within the context of the biological impact assessment and that are the subject of the next sections.

4.4.1 Identification of impacts

The identification of impacts is the first step before their assessment. The technical description of the mine Expansion Project (Chapter 1) allows the identification of sources of impacts. The identification of impact sources attempts to determine all of the Project components (impacting factors) that could have an impact on the biological environment, or the environment in general. These are thus associated with the work and activity needed to increase bauxite production.

These sources of impact can come during the different phases of the Project, either in construction/installation or during operation/maintenance. Work is then carried out to categorize the impacts.

4.4.2 Valued ecosystem components (VECs)

The concept of valued ecosystem components (VECs) refers every part of the environment judged as having a scientific, social, cultural economic, historical, archaeological or esthetic importance.

The list of VECs was determined following the technical studies of the scoping study and the baseline studies in the receiving environment (Chapter 3).

The relative value of ecosystem elements can be determined according to cultural and scientific concerns. Important ecosystem components likely to interact with Project elements are included in the assessment of environmental effects. For biology, three VECs were identified and discussed in more detail in Section 4.6:

- important biological species (based mainly on the IUCN status of the species);
- important biological habitats (based mainly on the IFC Performance Standards); and
- natural resources (fishing, hunting and woodfuel).

4.4.3 Assessment of impacts

The impact assessment methodology and the presentation of mitigation measures and residual impacts are detailed in the general part of the ESIA in Chapter 1.

Potential impacts of the Expansion Project were assessed for each of the subcomponents, using an impact matrix. The matrix allowed the following determination for each impact: the sources of impacts, the phases of the Project involved, its nature (positive or negative), its description, the zone and phase involved, the value of the VEC, the degree of disturbance, the spatial extent and the duration of the impact. The compilation of these data leads to a value that allows an assessment of the “importance of the impact” (negative or positive).

4.4.4 Mitigation measures

For each of the negative impacts, prevention and mitigation measures are proposed to give CBG direction on limiting the impacts caused by the Project. For positive impacts, enhancement measures are suggested.

4.4.5 Residual impacts

The levels of impact after the application of the mitigation and enhancement measures, the “residual impacts”, are assessed.

4.4.6 Cumulative impacts

The cumulative impacts of the Expansion Project and other adjacent projects are described in Chapter 9.

4.4.7 Monitoring measures

Beyond the first phases of implementation of the Expansion Project, it is important that the company undertake continuous impact assessment, recognizing that the risks relative to impacts evolve during the course of operations and following changes in the Guinean mining context and the mitigation measures put into place.

It is also particularly important that indicators be used that allow monitoring of the impacts of the Project. Qualitative and quantitative monitoring indicators are proposed for the main types of impacts.

4.5 Identification of impacts

4.5.1 Introduction

The identification of impacts on the biological environment is always complex because it can be approached in various ways, especially, as in the case of the Extension Project, that cover a large territory and several types of activity. The basic principle is that the assessment deals with the increase in the rate of extraction, transport and treatment of bauxite. The operations already exist and are considered in the baseline case. For some aspects, notably the new mining areas, the difference between the baseline and the state after the increase can be hard to separate.

The first section that follows briefly details the sources of impacts on the biological aspects according to the activities described in the description of Project section of the ESIA (Chapter 1).

The second section that follows assembles the impacts according to their types, defines them and describes acceptable thresholds (when they exist). These are the types of impacts that will be used in the systematic assessment of impacts.

4.5.2 Potential sources of impacts

4.5.2.1 *Increase in bauxite*

Increase in the extraction area

The development of new bauxite mining areas in the Sangarédi region will likely be the major source of Project impacts on the biological environment. The quantification is difficult because the baseline case assumes a continuation of the extraction at the current rate, therefore the use of new mining areas in any case. Only the surface used in the 2014 to 2028 period will change. The situation is made still more complicated by the three extraction rate increase scenarios. Given this complexity, the direct impacts will be calculated within the simplified context of attributing the impacts of mining new areas to the Expansion Project. For some derived aspects (for example noise and dust) this position is reasonable because the increase in rate determines the final impact values.

The most critical direct impacts will obviously be the elimination of individuals during clearing, habitat elimination for a shorter or longer period and the replacement by possibly less productive or useful habits whose legal situation may remain uncertain.

There will also be direct impacts outside the mined areas, including impacts associated with air quality, noise, vibrations, water quality and lighting. Most of these impacts can be estimated after the studies and modeling of the physical environment presented in the ESIA (Sections 2-2 to 2-4).

Changes in the levels of groundwater as a result of the exploitation of new mining areas are another potential impact. In theory, a lowering of groundwater levels could affect springs and stream flow on the slopes of the plateau. Even so, the hydrogeological analysis (Section 2-4) suggests that there might be a slight increase in the flow. Therefore, this impact was not retained.

Finally, the new mining surfaces will have indirect impacts by changing the structure of nearby natural habitats and by increasing fragmentation.

Another complex aspect of the increase in the mining surface is that the construction and operations phases are in fact telescoped and are not easily differentiated.

Development of the road network

The development of new mining areas requires the development of an appropriate road network. Even if in some cases the mining roads will use what remains of old 4x4 trails, wide ones for large trucks will replace them.

The construction of the network will result in the elimination of natural habitats and potential impacts on aquatic habitats at stream crossings. There will also likely be important fragmentation impacts.

CBG's use of the road network for the new mining zones could cause other impacts, such as noise, vibration, dust, use of water, lighting and risks of collisions with animals.

After CBG stops using some of the new roads, the roads could have an impact by changing the ease of access for hunting and firewood harvesting.

Impacts related to the development of road networks have become a major subject of study. In the EU, the subject has been the base for a series of studies (COST) that culminated in a veritable guide of practices to protect the environment (COST 341 2007).

The road network is still at a preliminary planning stage, so it is not possible to determine with precision the associated biological impacts.

4.5.2.2 Increase in the transport of bauxite from Sangarédi to Kamsar

Creation of a new sorting yard and sidings

These modifications will eliminate limited surface areas of partly natural habitat but the impacts will be minor.

Increase in the number of trains

The number of trains will double with the production of 27.5 MTPA. This will reduce the periods of calm between trains.

Increase in the number of locomotives and cars in each train

There will be an additional locomotive and some extra railcars for each train. This will slightly increase the noise, vibrations and aerial emissions at the passage of each train.

4.5.2.3 Increase in the grinding and drying of bauxite at Kamsar

Changes of structures within the plant boundaries

There will be several modifications to the equipment within the boundaries of the plant. They will not cause biological impacts during construction because the work will take place entirely within the plant's boundaries. In the long term, there will be some positive impacts, such as a reduction of dust emissions.

Increase in treated bauxite

The increase in treated bauxite will result in an increase of some gases as a result of increased fuel needs.

4.5.2.4 *Increase in marine transport of bauxite from Kamsar*

(Note: the ESIA only covers impacts within the Rio Nuñez Estuary.)

Construction associated with the quay

There will be certain modifications at the quay (enlargement of the quay, new conveyors and dredging of the basin adjacent to the quay). These could have impacts linked to losses of habitat (marine bottom and mangrove) and the disturbance of animals because of submarine noise during construction.

Increase in marine traffic

The increase in marine traffic will increase the risks of collision between ships and marine mammals. There will also be the potential for increases accidental releases into the waters of the estuary and potential increases in noise and atmospheric emissions.

4.5.3 Definitions and estimates of intensity of impact types for the assessment

4.5.3.1 *Loss of habitat*

The loss of habitat is measured by the surface of natural habitat converted. The main habitat losses from the Project are the use of new mining areas that will eliminate about 3,200 ha of habitat. Other losses will be related to the development of the mining road network, improvements to the railroad line and the new quay in Kamsar.

The loss of habitat is the clearest and most immediate impact on the biological environment. Clearing typically involves the elimination of most of the plants from the site (except for seeds in the soil) and the majority of animals (mainly

invertebrates). Certain animals can avoid the clearing activities but frequently they cannot find adequate unoccupied habitat nearby and die.

The intensity of the impact depends in part on the percentage of the range of species or habitats that are affected.

The importance of the impact of the habitat loss is linked to the species impacted and the nature of the habitats removed. Habitats of species of restricted range or in danger of extinction and critical habitats are obviously the most important.

4.5.3.2 Fragmentation

The elimination of habitat can have much more extensive impacts than those related to the habitat loss itself. This is particularly the case for road networks. New roads can become effective barriers for animals and plants. For example, a large forest cut in two by a road is reduced to two fragments equivalent in size to half the size of the original habitat. Such fragmentation becomes critical for animals requiring a minimum continuous forest range. It also increases the length of edge habitat, which is often less suitable for forest species, and decreases the surface area of deep forest.

The fragmentation is accentuated by secondary effects from vehicles (noise, dust, lighting, collisions) that contribute to the barrier effects due to the loss of habitat.

The question of fragmentation is a subject of more and more intensive studies by biologists, because it is a preoccupying subject for nature conservation: Adam & Geist, 1983 ; Baur A. & Baur B., 1990; Bennett A. F., 1991; Benson R., 1995; Bissonette J. A. & S. A. Rosa, 2009; Bissonette J.A. & C.A. Kassar, 2008; Bouchard, J., A. T. Ford, F. Eigenbrod, & L. Fahrig, 2009; Brody A.J. & Pelton M.R., 1989; Brothers T. S. & Spingarn A., 1992; Brown R. J., Brown M. N. & Pesotto B., 1986; Burnett S. E. 1992; Clevenger, A.P., B. Chruszcz, & K.E. Gunson, 2003; Develey P. F. & Stouffer P. C., 2001; Di Giulio, M., & R. Holderegger, 2009; Donaldson A. & Bennett A., 2004; Eigenbrod, F., S. J. Hecnar, & L. Fahrig, 2009; Foppen R. & Reijnen R., 1994; Forman R. T. T. & Deblinger R. D., 2000; Forman R. T. T., Friedman D. S., Fitzhenry J. D., Martin J. D., Chen A. S. & Alexander L. E., 1997; Forman, R. T. & L. E. Alexander, 1998; Frair, J. L., E. H. Merrill, H. L. Beyer, & J. M. Morales, 2008; Goosem M. W., 1997; Goosem M. W., 2000; etc.

4.5.3.3 *Air pollution*

Air pollution was considered in a preceding section of the ESIA (Section 2.2). In that section, modeling produced predictions of levels of various atmospheric emissions. The levels of dust and certain gases (NO_x , NO_2 , SO_2) were estimated for the new mining areas, the mining roads and the plant and port at Kamsar.

Dust - particulates (PM)

Dust can have direct impacts on animals by inhalation, direct impacts by deposition on plants and indirect impacts through changes to the terrestrial or aquatic environment (deposition on soil or water). In addition, if the dust contains toxic substances such as heavy metals, can have effects on animals and plants.

Dust is recognized as an important element for human health (US EPA, 2009; US EPA, 2012). The main impact is linked to the inhalation of dust during breathing and effects on the respiratory system. In principle terrestrial animals can also be sensitive to inhalation of dust. The respiratory systems of animals can be fairly different from the human system and can be more or less sensitive than the human one, but there are very few studies on this topic. In the absence of more precise information, levels for the protection of human health will be considered.

Deposition of dust on vegetation can have effects on:

- the light arriving to the cells responsible for photosynthesis, thus reducing productivity;
- the stomata that are responsible for the flow of gases by blocking their closure;
- the temperature of the leaves; and
- a series of induced factors (for example susceptibility to diseases and parasites) (Farmer, 1991; Doley, 2013).

Studies on the effects of dust on plants suggest that it is mainly the effects on light levels that are of consequence rather than the effects on the stomata (for example Doley, 2013).

Analyses of the effects of light are fairly complex because the effects depend upon a considerable number of variables, notably:

- the rate of dust deposition;
- the duration of the deposition;
- the size of the particles;
- the weather (rain and wind that “wash” the plant surfaces);
- the lifespan of the leaves;
- the leaf characteristics that can influence holding the dust;
- the physical characteristics of the plants; and
- the presence of other plants (position under cover for example).

Very complex modeling, by species, is needed to arrive at impact estimates (Doley and Rossato, 2010). For example, according to Doley (2013), for a deposition rate of $\text{mg}/\text{m}^2/\text{d}$ for 40 days, there would be a reduction in productivity of 96% to 51% depending on species in Australia. Sharifi et al (1997) determined a reduction in photosynthesis of 21% to 58% in a study in the Mojave Desert. On the other hand, Wijayratne et al’s (2009) study in the field and in the laboratory suggests contradictory results. Armbrust (1986), in a series of experiments on the effect of dust on cotton plants came to interesting conclusions on the duration of the impacts: a return to physiological normalcy three days after dust cover; a loss of weight that can last two weeks with high deposition rates ($28,6 \mu\text{g}/\text{m}^2$); and rapid washing by wind and rain (on the order of a week).

The ESIA for the Rio Tinto Simandou Project (Simandou Project, 2013a) has proposed impact levels for vegetation and these are retained for the impact analysis in the ESIA for the CBG Expansion Project (Table 4-1)

Table 4-1 Vegetation impact levels from dust deposition

Average annual deposition rate	Effect	Importance
< 350 mg/m ² /day	Nuisance and damage to plants unlikely	<i>Not significant</i>
from 350 to 650 mg/ m ² /day	Nuisance and damage to plants possible	<i>Negative - Minor</i>
from 650 to 950 mg/ m ² /day	Nuisance and damage to plants probable	<i>Negative - Moderate</i> -
from 950 to 1190 mg/ m ² /day	Nuisance and damage to plants very probable	<i>Negative - Major</i>
> 1 190 mg/ m ² /day	Serious complaints probable and serious damage to plants	<i>Negative - Critical</i> -

The results of the modeling of dust (Section 2.2) indicate that the impacts would be very limited.

The deposition of particles on the soil or water can have an effect on plants or animals if the dust contains toxic substances and plants and animals assimilate these. The effects of toxic substances are generally considered the most important impacts of dust on the natural environment. Studies on dust carried out in the context of this ESIA did not reveal substances toxic to plants in sufficient quantity to

pose problems apart possibly from aluminum). The results of the analyses of dust samples from Kamsar and Sangarédi show the absence of antimony (Sb), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu) and of nickel (Ni). Only aluminum is present in fairly high quantities.

Aluminum is the third most common element on earth. Aluminum is present in significant quantities in the soils and the waters of the region naturally. For Kamsar modeling for air quality (Section 2.2) indicated a decrease in dust levels during the Expansion Project, so that there might potentially be a slight decrease of aluminum in the water and at the surface of soils near Kamsar, or a stable state. On the other hand, in the Sangarédi region, a slight increase in aluminum deposition might be expected. In the water, the increase could lead to levels slightly above the US EPA recommendations (87 µg/L) (see Section 2.4).

The toxicity of aluminum has been studied for a long time. The toxicity in water is linked to the levels of dissolved organic carbon (see appendix on aluminum toxicity in Annexe 4-10). The conditions in the waters of the region suggest that impacts would be generally minor but that local effects are possible.

Nitrogen oxides (NO_x, NO₂)

Exposure to very high levels of NO and NO₂ and for a long period can have phytotoxic effects (Winner et al 1985, Cape 2003, Greaver et al 2012). In practice, atmospheric levels are rarely high enough to reach the threshold for phytotoxic effects (US EPA, 1993).

The deposition of nitrogen in terrestrial and aquatic environments can have important impacts, notably on environmental acidification (US EPA, 2008). The conclusion of the study of impacts on the aquatic environment is that there should not be effects on the water pH.

The standards recommended for ecologically sensitive areas are often more strict than those for residential zones. For example the Central Pollution Control Board of India recommends levels of 30 µg/m³ for one year and of 80 µg/m³ for 24 hours (CBCB, 2009). The EU (Directive 2008/50/CE) gives recommendations that are then translated into national legislation. For France (2010) the critical average annual level for the protection of vegetation is 30 µg/m³ (NO₂ equivalent). Rio Tinto also used these levels for the Simandou Project. The Simandou ESIA (Simandou, 2013a)

also uses an average annual level for the protection of vegetation of 30 $\mu\text{g}/\text{m}^3$. The levels predicted in the physical environment section (Section 2.2) indicate a small zone above these limits extending out a few hundred meters around the Kamsar plant (without mitigation and for the 27.5 MTPA scenario).

Sulfur dioxide (SO₂)

Exposure to very high levels of SO₂ and for a long period can have phytotoxic effects (Winner et al 1985, Greaver et al 2012). SO₂ has a US EPA three-hour average criterion for the protection of plants of 0,50 ppm (US EPA 2008). Lichens are particularly susceptible to the level of SO₂ and the level of SO₂ seems to be the main cause for the absence of lichens in urban and industrial locations. The levels predicted in the physical environment section (Section 2.2) are below those that can cause direct phytotoxic damage.

The deposition of sulfur in terrestrial and aquatic environments can have important impacts, notably on environmental acidification (US EPA, 2008). The conclusion of the study of impacts on the aquatic environment is that there should not be effects on the water pH.

The standards recommended for ecologically sensitive areas are often more strict than those for residential zones. For example the Central Pollution Control Board of India recommends levels of 20 $\mu\text{g}/\text{m}^3$ for one year and of 80 $\mu\text{g}/\text{m}^3$ for 24 hours (CBCB, 2009). The EU (Directive 2008/50/CE) gives recommendations that are then translated into national legislation. For France (2010) the critical average annual level for the protection of vegetation is 20 $\mu\text{g}/\text{m}^3$ and 20 $\mu\text{g}/\text{m}^3$ on average for the period October 1 to March 31. Rio Tinto also used these levels for the Simandou Project. The Simandou ESIA (Simandou, 2013a) also uses an average annual level for the protection of vegetation of 20 $\mu\text{g}/\text{m}^3$. The levels predicted in the physical environment section (Section 2.2) indicate a zone above these limits extending out up to one to two km around the Kamsar plant (without mitigation and for the 27.5 MTPA scenario).

4.5.3.4 Noise and vibrations

Noise and vibrations were examined in a preceding section of the ESIA. In that section (Section 2.3) predictions of noise levels were produced by complex

modeling. The levels were estimated for the new mining areas, the railroad and the plant and port in Kamsar.

The impact of noise and vibrations on animals is more and more recognized: Barber, J. R., Crooks, K. R. & Fristrup, K. M., 2010; Bee M. A. & Swanson E. M., 2007; Bowles A. E. 1995; Brattstrom, B. H., and M. C. Bondello, 1994; Brumm H., 2004; Brumm, H., 2010; Chan, A. A. Y. H., Giraldo-Perez, P., Smith, S. and Blumstein, D. T., 2010; Francis CD, Ortega CP, and Cruz A. 2009; Francis, C.D., N.J. Kleist, C.P. Ortega, and A. Cruz., 2012; Gordon, S.D., and G.W. Uetz, 2012; Herrera-Montes, M.I., and T.M. Aide, 2011; Holthuijzen, A. M. A., W. G. Eastland, A. R. Ansell, M. N. Kochert, R. D. Williams, and L. S. Young, 1990; Klump GM, 1996; Larkin, R., L. L. Pater, and D. Tazik, 1996; Pater, L.L., T.G. Grubb, and D.K. Delaney, 2009.

Vibrations were evaluated for the mining areas where vibrations associated with the use of explosives during mining may be important. The calculations show that for normal charges, accelerations over 5 mm/s, a conservative value) would be limited to a distance of less than 200 m from the explosion site. This suggests that the vibration impact zone will be limited. The maximum vibrations associated with the increase in transport of bauxite should not increase significantly, however the frequency of the vibration episodes will increase. Vibrations for the new road network were not assessed given the questions still unanswered.

4.5.3.5 *Water pollution*

In the report on water and sediments (Section 2.4), the increase of aluminum in some streams of the Sangarédi area is the most probably form of pollution. It will come indirectly from the deposition of dust on the ground and directly from deposition in watercourses. The impact will be most pronounced on small watercourses near the mining areas. The duration of the impact will be fairly short because the mining activities will change location fairly rapidly. The impact of a higher level of aluminum will be minimized in part because of the pH and levels of dissolved carbon in the water. The questions of aluminum toxicity are discussed in *Appendix A - Overview of aluminum speciation and toxicity* of the complete report on water quality: SENES, 2014. *CBG Extension project environmental impact assessment - Surface water and groundwater impact assessment*. (Annexe 2-10).

There are also possible impacts linked to accidental release and accidents. These could result in the presence of various organic molecules such as fuel oil in the surface waters. This is discussed in Section 2.4 and 2.5.

4.5.3.6 Lighting

The mining of bauxite in the new mining areas will proceed 24 hours a day. It will thus be necessary to light the mine site and the mining roads will be illuminated by a sometimes intense level of traffic.

This lighting in a region currently without many source of lighting will lead to definite impacts, especially for nocturnal animals (Beier P., 2006; Buchanan, B.W., 1993; Buchanan, B.W., 2006; de Molenaar, J.G., M.E. Sanders, & D.A. Jonkers, 2006; Eisenbeis, G., 2006; Frank, K.D., 2006; Gauthreraux Jr., S.A., & C.G. Belser, 2006; Grigione, M.M., & R. Mrykalo, 2004; Longcore, T., & C. Rich, 2006; Montevecchi, W.A., 2006; Wise, S., 2007).

4.5.3.7 Human presence

Certain animal species may be very sensitive to the presence of humans and will avoid places where they are present. During the use of the mining areas there will be a relatively high number of persons on these normally fairly isolated areas. See Freddy, D.J., W.M. Bronaugh, and M.C. Fowler, 1986.

4.5.3.8 Collisions

The increase in the quantity of bauxite to be transported results in an increase in road, railroad and marine traffic. This increases the risks of collisions with animals, particularly with trucks on the mining roads and ships in the du Rio Nuñez Estuary. See: Carsignol J., 1999; Clevenger, A.P., B. Chruszcz, & K.E. Gunson, 2003; Gerow, K., N.C. Kline, D.E. Swann, & M. Pokorny, 2010; Hourdequin, M., editor, 2000; Jaeger, J.A.G., J. Bowman, J. Brennan, L. Fahrig, D. Bert, J. Bouchard, N. Charbonneau, K. Frank, B. Gruber, & K. Tluk von Toschanowitz, 2005; Orłowski, G., and L. Nowak, 2006).

4.5.3.9 Induced anthropic pressure

The induced anthropic pressure includes the increased pressure on natural environments around the mining zones that were used as grazing lands, and the pressure on certain animals and trees due to an increase in ease of access to isolated areas (bushmeat hunting and tree cutting for woodfuel).

4.5.3.10 Invasive species

Clearing of the mining areas and the mining roads will provoke changes in conditions that are often favorable to the invasion of non-native invasive species. These species can compete with local species and prevent the re-establishment of the original vegetation. Frequently also these invasive species are not of great utility of the local fauna.

The impact of invasive species can be mitigated by destroying them when they are present and by avoiding planting non-native species that could become invasive.

4.6 Valued ecosystem components (VECs)

4.6.1 Introduction

Three VECs were retained to evaluate biological impacts:

- important biological species;
- important biological habitats; and
- biological resources.

These three components were divided into several subcomponents. This is particularly the case for the important species, because the sensitivities of the species to various actions of the Extension Project vary enormously.

Other aspects could have been considered (for example, ecosystemic values); however, these aspects were deemed to have been taken into account sufficiently by the three main components or to have been taken into account by components in the other disciplines (physical and social).

The choice of components and subcomponents and the judgment on their importance is based as much as possible on the well-established and justified criteria described in the following sections.

4.6.2 Important biological species

4.6.2.1 Principles

There are numerous documents that try to identify the conservation status of species that are present in Guinea. At the national level one can cite particularly the *Monographie Nationale de la Diversité Biologique* and the level of protection (total or partial) under the *Code de la Chasse*. There are also lists of species to protect under the various conventions to which Guinea is a signatory (par exemple the CITES statuses). In certain cases books or articles in specialized journals may also give indications on the level of rarity of species. All of these sources have been consulted and the information retained in the evaluation of the status of species, however the primary source remains the IUCN statuses.

The IUCN categories are the most complete and up-to-date. They are described in *IUCN Red List Categories and Criteria, Version 3.1, Second edition* (IUCN, 2012).

The applicable IUCN categories (IUCN, 2012) are:

“Critically Endangered (CR)

A taxon is *Critically Endangered* when the best available evidence indicates that it meets any of the criteria A to E for *Critically Endangered* and it is therefore considered to be facing an extremely high risk of extinction in the wild.

Endangered (EN)

A taxon is *Endangered* when the best available evidence indicates that it meets any of the criteria A to E for *Endangered* and it is therefore considered to be facing a very high risk of extinction in the wild..

Vulnerable (VU)

A taxon is *Vulnerable* when the best available evidence indicates that it meets any of the criteria A to E for *Vulnerable* and it is therefore considered to be facing a high risk of extinction in the wild.

Near Threatened (NT)

A taxon is *Near Threatened* when it has been evaluated against the criteria but does not qualify for *Critically Endangered*, *Endangered* or *Vulnerable* now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

Least Concern (LC)

A taxon is *Least Concern* when it has been evaluated against the criteria and does not qualify for *Critically Endangered*, *Endangered*, *Vulnerable* or *Near Threatened*. Widespread and abundant taxa are included in this category.

Data Deficient (DD)

A taxon is *Data Deficient* when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. *Data Deficient* is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

Not Evaluated (NE)

A taxon is *Not Evaluated* when it has not yet been evaluated against the criteria.”

(The abbreviation for each category [in brackets] corresponds in all languages to the English name)

The most recent status reports, as well as available data, are given on species data sheets on the IUCN website (<http://www.iucnredlist.org/search> – The IUCN Red List of Threatened Species. Version 2014.2.). The data sheets were last consulted and validated between June and September 2014.

Although the IUCN information and assessments are critical for the identification of important species for this ESIA, they most nevertheless be used with caution.

First of all it must be recognized that the assessments of the IUCN do not concern all the species present. For certain groups (for example the mammals) the assessments were done on most species but for others the number of assessed species is restricted. For example the botanists from Kew Gardens that at most 5% of the plants of Guinea have been assessed by the IUCN. It is thus important to ensure that non-assessed species but evidently of importance are considered.

Even among the assessed species, an important number remain in the DD category, suggesting potentially important species but for which there is a lack of data to assign a status.

It must also be recognized that the assessments are in constant evolution. For example the three *Endangered* vulture species present (hooded vulture, African white-backed vulture and Rueppell's griffon vulture) were only given the EN status in 2012, following a decline in their populations. The status of the hippopotamus is actually being revised and it is probable that the status, especially for West African populations, will be revised upwards.

With recent advances in taxonomy through the use of DNA studies, statuses need to be revised. For example, it is probable that the Nile crocodile is in fact two species and that the species present in Guinea will be a species with a more important status once the situation is re-assessed. It is the same for the African dwarf crocodile and it is likely that the specimens in the Study Area are likely of a new species.

It is important to remember that distributions in Guinea are still only known in a fragmentary way. The number of significant range extensions reported on the baseline studies for the ESIA illustrates this. Nevertheless it is clear that certain species that are present have very limited distributions and are endemic to very small areas, such as the Sangarédi region. These endemic species are of great importance and must be assessed as such, even in the absence of an IUCN assessment.

The important species have been divided into two groups:

- biological species of first priority; and
- biological species of second priority.

Species of first priority are defined as those identified by the IUCN as *Critically Endangered* (CR) or *Endangered* (EN), plus those species for which the available data strongly suggest that they may have that status in the near future. These species are given a High rating in the VEC value column in the assessment of impacts.

Species of second priority are defined as those defined by the IUCN as *Vulnerable* (VU) or *Near Threatened* (NT), plus those species for which the available data strongly suggest that they may have that status in the near future. These species are given a Medium rating in the VEC value column in the assessment of impacts.

In conclusion, identification and classification of important biological species is a complex topic. There will always be a relative lack of presence data and species status assessments. Nevertheless, the study has shown the presence of a large number of status species that cover a good representation of the types of organism present (plants, terrestrial and marine mammals, birds, terrestrial and marine reptiles, amphibians, and freshwater and marine fish). The broad representation allows for satisfactory identification of the types of impacts and their ranges.

4.6.2.2 Species of first priority

Nineteen species present in the Study Areas have been classified as first priority. These species are described in a summary fashion in Table 4-2 and in more detail in Annexe 4-3. As stated in the table, the presence of all these species was established during ESIA fieldwork in 2013. For most of the species, these are the first confirmations of their presence in the Study Areas.

Table 4-2 Species of first priority

Scientific name	English name	French name	Type	IUCN status	Presence	Notes
<i>Hemidactylus kundaensis</i>			Reptile - lizard	Critically Endangered (B2ab(iii))	Sangarédi (field work EEM ESIA, 2013)	Endemic to Sangarédi subprefecture
<i>Eretmochelys imbricata</i>	Hawksbill turtle	Tortue à écailles	Reptile - marine turtle	Critically Endangered (A2bd)	Kamsar (field work EEM ESIA, 2013)	
<i>Cynisca cf oligopholis</i>			Reptile - amphisbaenian	Endangered (B1ab(iii))	Sangarédi (field work EEM ESIA, 2013)	Endemic to Sangarédi subprefecture - species not yet described?
<i>Phrynobatrachus pintoii</i>			Amphibian - frog	Endangered (B1ab(iii))	Sangarédi (field work EEM ESIA, 2013)	Endemic to the Sangarédi area

Scientific name	English name	French name	Type	IUCN status	Presence	Notes
<i>Pan troglodytes verus</i>	Chimpanzee	Chimpanzé'	Mammal primate	Endangered (A4cd)	Sangarédi (field work EEM ESIA, 2013)	
<i>Procolobus badius</i>	West African red colobus	Colobe Bai D'Afrique Occidentale	Mammal primate	Endangered (A2cd)	Sangarédi (field work EEM ESIA, 2013)	
<i>Epinephelus guaza (=marginatus)</i>	Dusky grouper	Mérou Brun	Marine fish	Endangered (A2d)	Kamsar (field work EEM ESIA, 2013)	
<i>Rhinobatos cemiculus (=Glaucostegus cemiculus)</i>	Blackchin guitarfish	Guitare De Mer Fousseuse	Marine fish	Endangered (A4bd)	Kamsar (field work EEM ESIA, 2013)	
<i>Epiplatys njalaensis</i>			Freshwater fish	Endangered (B1ab(iii)+2ab(iii))	Sangarédi (field work EEM ESIA, 2013)	
<i>Nimbapanchax jeanpoli (= Archiaphyosemion jeanpoli)</i>			Freshwater fish	Endangered (B1ab(iii)+2ab(iii))	Sangarédi (field work EEM ESIA, 2013)	
<i>Necrosyrtes monachus</i>	Hooded vulture	Percnoptère brun	Bird of prey	Endangered (A2acd+3cd+4acd)	Kamsar, Sangarédi (field work EEM ESIA, 2013)	
<i>Gyps africanus</i>	African white-backed vulture	Gyps africain	Bird of prey	Endangered (A2bcd+3bcd+4bcd)	Kamsar, Sangarédi (field work EEM ESIA, 2013)	
<i>Gyps rueppellii</i>	Rueppell's griffon vulture	Vautour de Rüppell	Bird of prey	Endangered (A2abcd+3bcd+4abcd)	Sangarédi (field work EEM ESIA, 2013)	
<i>Chelonia mydas</i>	Green turtle	Tortue verte	Reptile marine turtle	Endangered (A2bd)	Kamsar (field work EEM ESIA, 2013)	
<i>Osteolaemus cf tetraspis</i>	(African dwarf crocodile)	(Crocodile nain Africain)	Reptile crocodile	Vulnerable (A2cd)	Sangarédi (field work EEM ESIA, 2013)	Species not yet described and status to be reviewed by the IUCN

Scientific name	English name	French name	Type	IUCN status	Presence	Notes
<i>Hippopotamus amphibius</i>	Hippopotamus	Hippopotame	Mammal	Vulnerable (A4cd)	Sangarédi (field work EEM ESIA, 2013)	Status being revised and may move up to Endangered
<i>Hemidactylus albivertebralis</i>			Reptile - lizard	Data Deficient (to be revised soon)	Kamsar (field work EEM ESIA, 2013)	Rare species of restricted distribution

4.6.2.3 Species of second priority

Twenty-three species present in the Study Areas have been classified as second priority. These species are described summarily in Table 4-3 in more detail in Annexe 4-3. For 21 species, their presence was established during fieldwork on the ESIA in 2013. The presence of two species of plant comes from the botanical study by BERCA-baara for CBG in 2003. For most of these species these are the first confirmations of their presence in the Study Areas.

Table 4-3 Species of second priority

Scientific name	English name	French name	Type	IUCN status	Presence	Notes
<i>Circaetus beaudouini</i>	Beaudouin's snake eagle	Circaète de Beaudouin	Bird of prey	Vulnerable (A2bcd+3bcd+4bcd;C1+2a(ii))	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Cercocebus atys</i>	Sooty mangabey	Mangabey enfumé	Mammal - primate	Vulnerable (A2cd)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Lepidochelys olivacea</i>	Olive Ridley turtle	Tortue de Ridley	Reptile - marine turtle	Vulnerable (A2bd)	Kamsar (field work ÉEM ESIA, 2013)	
<i>Trichechus senegalensis</i>	West African manatee	Lamantin D'Afrique	Marine mammal	Vulnerable (A3cd)	Kamsar (field work ÉIES ÉEM, 2013, observation CBG 2014)	
<i>Sousa teuszii</i>	Atlantic humpback dolphin	Dauphin à Bosse de L'Atlantique	Marine mammal	Vulnerable (C2a(i))	Kamsar (field work ÉEM ESIA, 2013)	
<i>Khaya senegalensis</i>		Caïllédrat	Plant	Vulnerable (VU A1cd)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Milicia regia</i>			Plant	Vulnerable (VU A1cd)	Sangarédi (field work ÉEM ESIA, 2013)	

Scientific name	English name	French name	Type	IUCN status	Presence	Notes
<i>Azelia africana</i>			Plant	Vulnerable A1d	Sangarédi (field work BERCA-baara 2003)	
<i>Albizia ferruginea</i>			Plant	Vulnerable (VU A1cd)	Sangarédi (field work BERCA-baara 2003)	
<i>Epiplatys hildegardae</i>			Freshwater fish	Vulnerable (D2)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Epiplatys guineensis</i>			Freshwater fish	Vulnerable (D2)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Limosa limosa</i>	Back-tailed godwit	Barge à queue noire	Aquatic bird	Near Threatened (NT)	Kamsar (field work ÉEM ESIA, 2013)	
<i>Numenius arquata</i>	Eurasian curlew	Courlis cendré	Aquatic bird	Near Threatened (NT)	Kamsar (field work ÉIES ÉEM, 2013)	
<i>Caracal aurata</i>	African golden cat	Chat Doré Africain	Mammal - carnivore	Near Threatened (NT)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Rhinoptera marginata</i>	Lusitanian cownose ray	Mourine échançrée	Marine fish	Near Threatened (NT)	Kamsar (field work ÉEM ESIA, 2013)	
<i>Scriptaphyose mion roloffii</i>			Freshwater fish	Near Threatened (NT)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Ichthyborus quadrilineatus</i>			Freshwater fish	Near Threatened (NT)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Malapterurus barbatus</i>			Freshwater fish	Near Threatened (NT)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Malapterurus stiassnyae</i>			Freshwater fish	Near Threatened (NT)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Malapterurus teugelsi</i>			Freshwater fish	Near Threatened (NT)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Paramphilius trichomycteroides</i>			Freshwater fish	Near Threatened (NT)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Petrocephalus levequei</i>			Freshwater fish	Near Threatened (NT)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Epiplatys olbrechtsi ssp. olbrechtsi</i>			Freshwater fish	Near Threatened (NT)	Sangarédi (field work ÉEM ESIA, 2013)	
<i>Philothamnus cf semivariegatus</i>			Reptile - snake	NE	Sangarédi (field work ÉEM ESIA, 2013)	Species not yet described

Scientific name	English name	French name	Type	IUCN status	Presence	Notes
<i>Crocodylus suchus</i>	Nile crocodile	Crocodile du Nil	Reptile – marine and freshwater		Kamsar and Sangarédi (field work ÉEM ESIA, 2013)	DNA analyses indicate that the West African specimens belong to a different species
<i>Terminalia scutifera</i>			Plant	NE	Kamsar (field work ÉEM ESIA, 2013)	Species of restricted distribution
<i>Rungia eriostachya</i>			Plant	NE	Sangarédi (field work ÉEM ESIA, 2013)	Rare but not yet assessed by the IUCN

4.6.3 Important biological habitats

4.6.3.1 Introduction

It was decided to use the habitat categories recognized by the IFC in its Performance Standard 6 (see Annexe 4-2), namely:

- legally protected and internationally recognized areas (similar to critical habitats but with additional restrictions);
- critical habitat;
- natural habitat; and
- modified habitat.

In practice, modified habitats were not retained for this ESIA on the basis of the analysis below.

Legally protected and internationally recognized areas and critical habitat are given a value of High in the VEC value column of the impact assessment, and natural habitat is given a value of Medium.

4.6.3.2 Legally protected and internationally recognized areas

Performance 6 of the IFC defines an area protected by law as:

This Performance Standard recognizes legally protected areas that meet the IUCN definition: "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." For the purposes of this Performance Standard, this includes areas proposed by governments for such designation

Performance 6 of the IFC defines an area recognized by the international community as:

Exclusively defined as UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, and wetlands designated under the Convention on Wetlands of International Importance (the Ramsar Convention).

Before the creation of modern Guinea, there was a plan for the creation of a Parc National de Boké, for the protection of coastal islands and mangrove. This plan might have included part of the Rio Nuñez Estuary. The plan was not retained after independence in 1958.

In 2000, the AGIR project (*Appui à la Gestion Intégrée des Ressources naturelles de l'Union Européenne*) had proposed an *Aire protégée transfrontalière de Guinée-Guinée Bissau*, with some 800,000 ha in Guinea and including at least a part of the Rio Nuñez Estuary. The AGIR project ended in 2005 and there does not yet seem to be any concrete follow-up to the proposal sufficient to satisfy the IFC definition.

The only nearby areas that seem to currently satisfy the definition of Performance Standard 6 are the Ramsar sites of the Tristao Islands to the northwest and of the Rio Kapatchez at the southern border of the Ramsar Study Area.

The site of the Tristao Islands has been a Ramsar site since 1992 and since 2009 a community natural reserve:

The Tristao Islands, declared a Ramsar Site in 1992, are declared "Réserve Naturelle Communautaire Gérée des Îles Tristao" in December 2009

(Arrêté Conjoint A/2009/ 3997/MPA/MEDD/SGG). This island complex includes several villages. This territory shelters an important biodiversity because of the strong relations that link the local populations to their environment. The main human activities remain rice production, artisanal fishing, oil palm production, salt production and small-scale horticulture. Situated between the delta of the Cogon River or Rio Compony and Cacine River, it is bordered on the north, east and south by extensive mangrove forests and sand dunes of more than 20 km in the west. It is a nesting site for more than 200 aquatic bird species that shelters refuges, nurseries and reproduction areas for marine fish. In addition one finds threatened species such as manatees, dolphins (*Sousa teutzi*), marine turtles, crocodiles (*Crocodilus niloticus*) etc.

http://www.lafiba.org/index.php/fr/actualites/archives/fin_decembre_2009_la_guinee_cree_deux_reserves_naturelles

The site of the Rio Kapatchez is to the south and touches the Kamsar Study Area. The following extract (Figure 4-1) that describes the site is from Robertson, P. (2001) Guinea. Pp. 391-402 in L. D. C. Fishpool and M. I. Evans, eds. *Important Bird Areas in Africa and associated islands: Priority sites for conservation*. Newbury and Cambridge, UK: Pisces Publications and BirdLife International (BirdLife Conservation Series No. 11).

Figure 4-1 Description of Rio Kapatchez Ramsar Site

Rio Kapatchez	GN006
Admin region Kindia	A1, A4i, A4iii
Coordinates 10°29'N 14°33'W	Ramsar Site (Unprotected)
Area 20,000 ha Altitude 0–5 m	

Site description

The site is located on the north-west coast, to the south of the town of Kamsar, at the mouth of Rio Kapatchez. It extends between Pointe Gonzalez to the north-west and the Koumba river to the south-east, just to the north of Cap Verga. The site includes a large expanse of mudflats as well as mangroves, sand-dunes, freshwater marsh and rice-fields. Mangroves are well-developed along the Kaliki river and, at its mouth, c.3 km east of Pointe Gonzalez, is a sandy islet known as Khôni Benki.

Birds

See Box for key species. The mudflats are used by both *Phoenicopterus minor* (counts of 5,000–10,000) and *P. ruber*. Several waterbird species nest in the mangroves including *Scopus umbretta*, *Ciconia episcopus* and, perhaps, *Mycteria ibis*. In addition, large numbers of wintering waders use the mudflats, including several hundred *Recurvirostra avosetta*. Khôni Benki is an important high-tide roost for waders. The freshwater marshes and rice-fields are used by numerous nesting *Phalacrocorax africanus*, *Anhinga rufa*, *Casmerodius albus*, *Dendrocygna viduata* and, probably, *Ardeola ralloides*. Although there have been no complete counts, available data suggest that the site is regularly used by more than 20,000 waterbirds and it is likely that further counts would reveal that some species exceed 1% thresholds.

Key species			
A1	<i>Phoenicopterus minor</i>		
A4i		Breeding (pairs)	Non-breeding
	<i>Sterna maxima</i>	1,470 (1998)	—
	<i>Sterna albitrons</i>	1,800 (1998)	—
A4iii	More than 20,000 waterbirds are thought to occur regularly at this site.		

Other threatened/endemic wildlife

The dolphin *Sousa teuszii* (DD) has been recorded near Khôni Benki.

Conservation issues

The area was designated a Ramsar Site in 1992. Disturbance of nest-sites by farmers and fishermen is a problem, as is cutting of the mangroves to supply wood to the nearby urban market of Kamsar. Clearance of mangroves for rice cultivation is a further threat. The site is state owned.

Further reading

Altenburg and van der Kamp (1991a, b), Jones (1993).

The sites along the Guinean coast were examined recently by Veen et al : Veen, J., Keita, N., Dallmeijer, H., Gbansara, M. S. (2009) *Colonies d'oiseaux piscivores nidifiant le long des côtes de Guinée: Étude prospective effectuée du 14 au 30 mai 2009*. VEDA, The Netherlands. They say:

The natural resources of the region of the Tristao Islands, Rio Kapatchez and Rio Pongo are under threat by the destruction of mangroves, the increasing of fishing camps (often temporary) and burning of the vegetation for agricultural uses of the land. Although there exist directions for the protection of Ramsar Sites, there are not very often respected. The surveillance of these sites remains extremely weak.

The report by Veen et al led BirdLife International to re-examine the importance of these coastal sites and to determine in particular if they still fulfilled the criteria for an IBA (important bird area: BirdLife International (2013) *Conservation of Migratory Birds project: scientific review of migratory birds, their key sites and habitats in West Africa*. BirdLife International, Cambridge, UK.

Their conclusions are cited below:

Sites possibly no longer meeting IBA Criteria:

Guinea

îles Tristao

This collection of islands, which is an IBA and Critical Site, is currently designated as a Ramsar Site for waterbirds, and the species present trigger three different IBA criteria for four species as well as for waterbirds as a whole. However, a study by Veen et al. (2009) revealed that its key sandbank colony, Pani Bankhi, that previously supported terns and other ground-nesting seabirds, was no longer present. The sandbank had been permanently submerged and the survey of remaining areas found no signs of nesting seabirds. The other sandbanks documented hosted hundreds of resting terns, but were inundated at high tide and thus unsuitable as breeding colonies. Consensus amongst local people was that there were no breeding seabirds in the area at all although heron and ibis were known to

roost at night in the mangroves. However, more recent, verbally communicated information indicates that the breeding birds have, in fact, simply re-located to a different part of the complex, thus indicating the need for further information and the need to retain the site as an IBA, at least in the short term.

Rio Kapatchez et Mouchon

Like îles Tristao, this site is currently an IBA and Critical Site and is designated under Ramsar Site, with the species present triggering three separate IBA criteria. Unfortunately, like îles Tristao, the site appears to no longer support the bird populations it once did. Veen and colleagues found no sign of any breeding colonies or suitable sand banks that were not inundated at high tide, anywhere within the site. Moreover, Khoni Benki (previously a suspected seabird breeding colony) had disappeared. Again, these observations suggest the site may no longer qualify as an IBA but further survey may be worthwhile, particularly in light of reports experiences reported above from îles Tristao. (p. 41)

The ornithological study for this ESIA suggests prudence. According to the ornithologists who did the study for ÉEM, the estuary of the Rio Nuñez qualifies as an IBA on three different criteria. Therefore for this ESIA, the Ramsar site of Rio Kapatchez is retained in the assessment as an area recognized by the international community.

4.6.3.3 *Critical habitats*

Performance Standard 6 of the IFC defines critical habitats as those with areas that have a high biodiversity value, including:

- 1 - habitat of significant importance to Critically endangered and/or endangered species;
- 2 - habitat of significant importance to endemic and/or restricted-range species;

- 3 - habitat supporting globally significant concentrations of migratory species and/or congregatory species;
- 4 - highly threatened and/or unique ecosystems; and/or
- 5 - areas associated with key evolutionary processes.

According to the Performance Standard 6 definitions for critical habitat, three zones of critical habitat were identified in this ESIA:

- the estuary of the Rio Nuñez at Kamsar;
- the gallery forests around Sangarédi; and
- the Cogon Corridor.

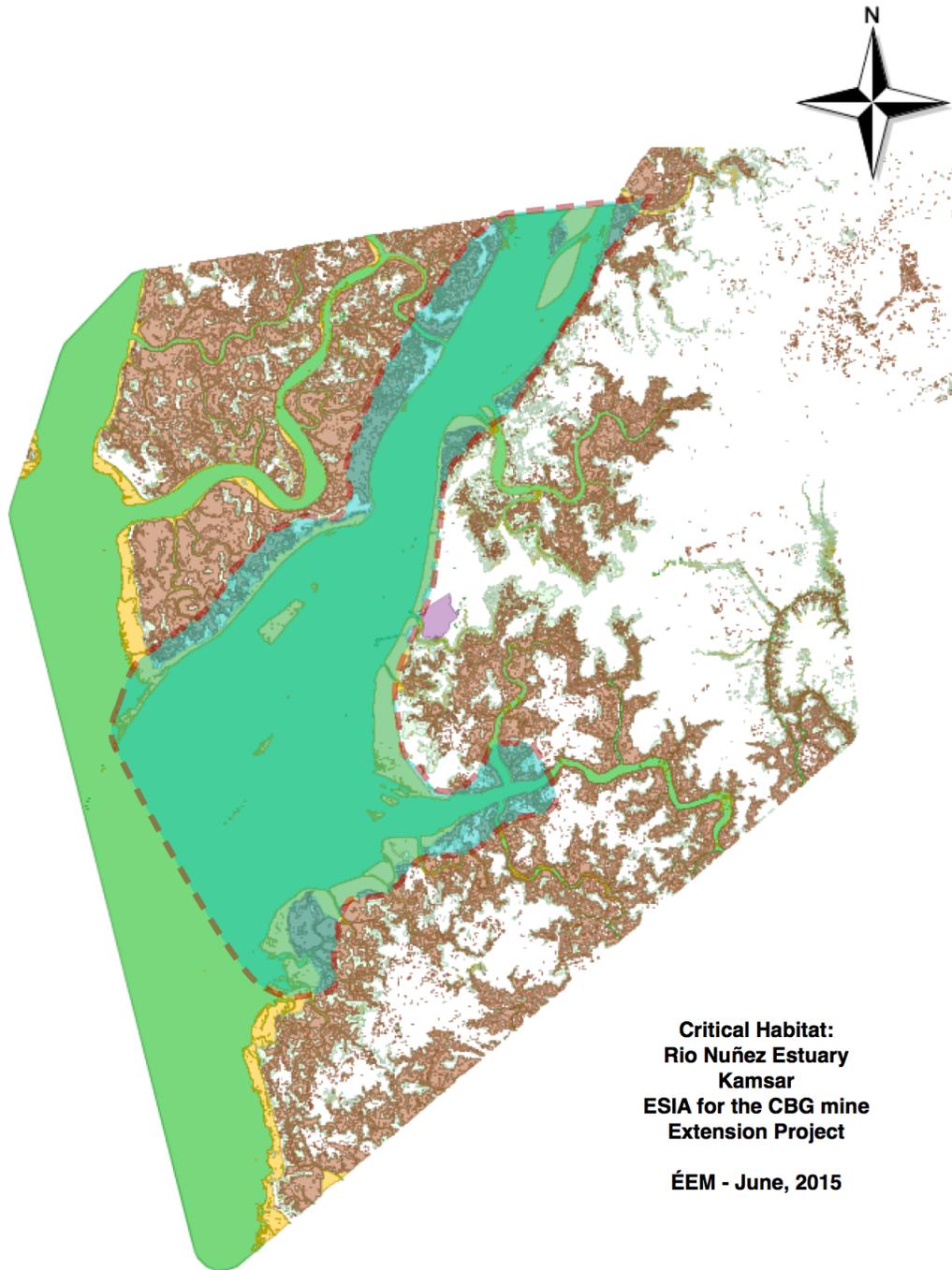
The Rio Nuñez Estuary at Kamsar

The estuary of the Rio Nuñez in the Kamsar Study Area is clearly an important area that fulfills several of the IFC criteria to be a critical habitat. The area includes at least one species considered *Critically Endangered*, five species considered *Endangered* and several *Vulnerable* species (criterion 1). There are at least two restricted-range species (criterion 2). The ornithological studies show migratory bird populations that exceed the threshold for the identification of an important bird area (IBA) (criterion 3). Finally, the area has important mangrove stands, a high-value habitat that is disappearing along the Guinean coast (criterion 4). Criterion is perhaps the least well established. The presence of *Endangered* species is of course not in doubt but these are species with wide ranges and it might be difficult to establish whether the estuary is of “crucial importance” for these species.

The estuary must be considered in its entirety because it is a very integrated ecosystem, tied by the tidal rhythms and the influx of waters and sediments from the rivers. It is also an important habitat for humans because artisanal fishing is critical for many residents.

The area is defined as being the total water surface of the estuary, the mangroves and associated habitats (mud flats and beaches) in the Study Area (Map 4-1). Anthropogenic surfaces are excluded.

Map 4-1 Map of the critical habitat Rio Nuñez Estuary



**Critical Habitat:
Rio Nuñez Estuary
Kamsar
ESIA for the CBG mine
Extension Project
ÉEM - June, 2015**

2 4 6 8 km

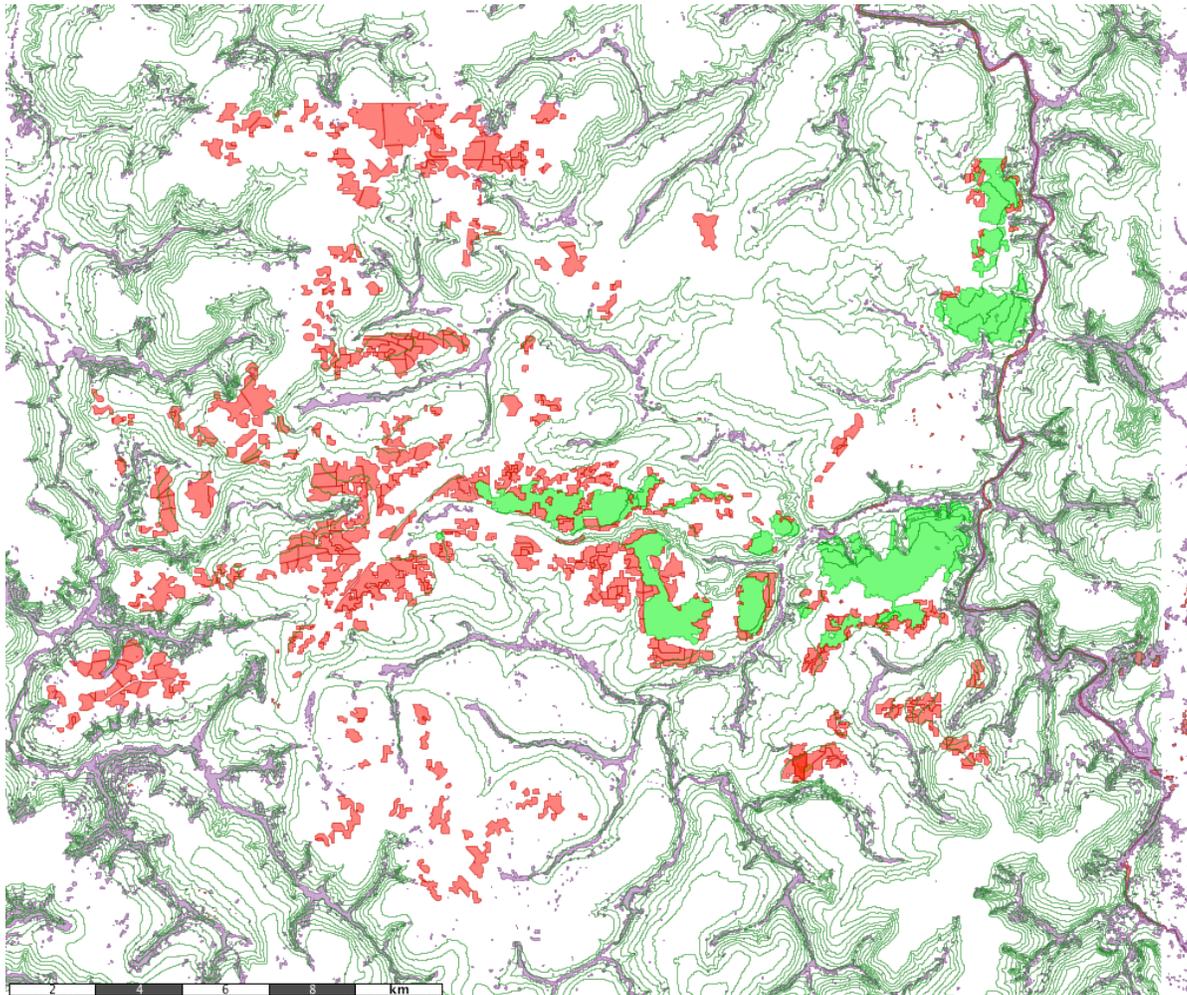
Gallery forests around Sangarédi

The gallery forests in the Sangarédi region represent the last remnants of a forest cover that was once much more extensive. They represent the only habitat for a suite of species, often status species, tied to areas with trees. They also act as protection for the local watercourses. These forest pieces are disappearing at a rapid rate, and with them the associated animal and plant species.

The gallery forests in the Sangarédi region are clearly an important area that fulfills several of the IFC criteria for a critical habitat. The area shelters a *Critically Endangered* species, several *Endangered* species and also *Vulnerable* species (criterion 1). There are at least two range-restricted species (endemics of the Sangarédi area) (criterion 2). Finally, the forest itself represents a habitat in danger that may disappear in the near future (criterion 4).

The gallery forests were defined by identification of habitats classified as dense forests on the vegetation map, because practically all the dense forests are gallery forests. These forests occupy only 8% of the surface of the Sangarédi Study Area (Map 4-2).

Map 4-2 Map of critical habitat – gallery forests Sangarédi region



Critical Habitat:
Gallery Forests (in
purple)
Sangarédi

Old pits in green, new
pits in red

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Extension Project

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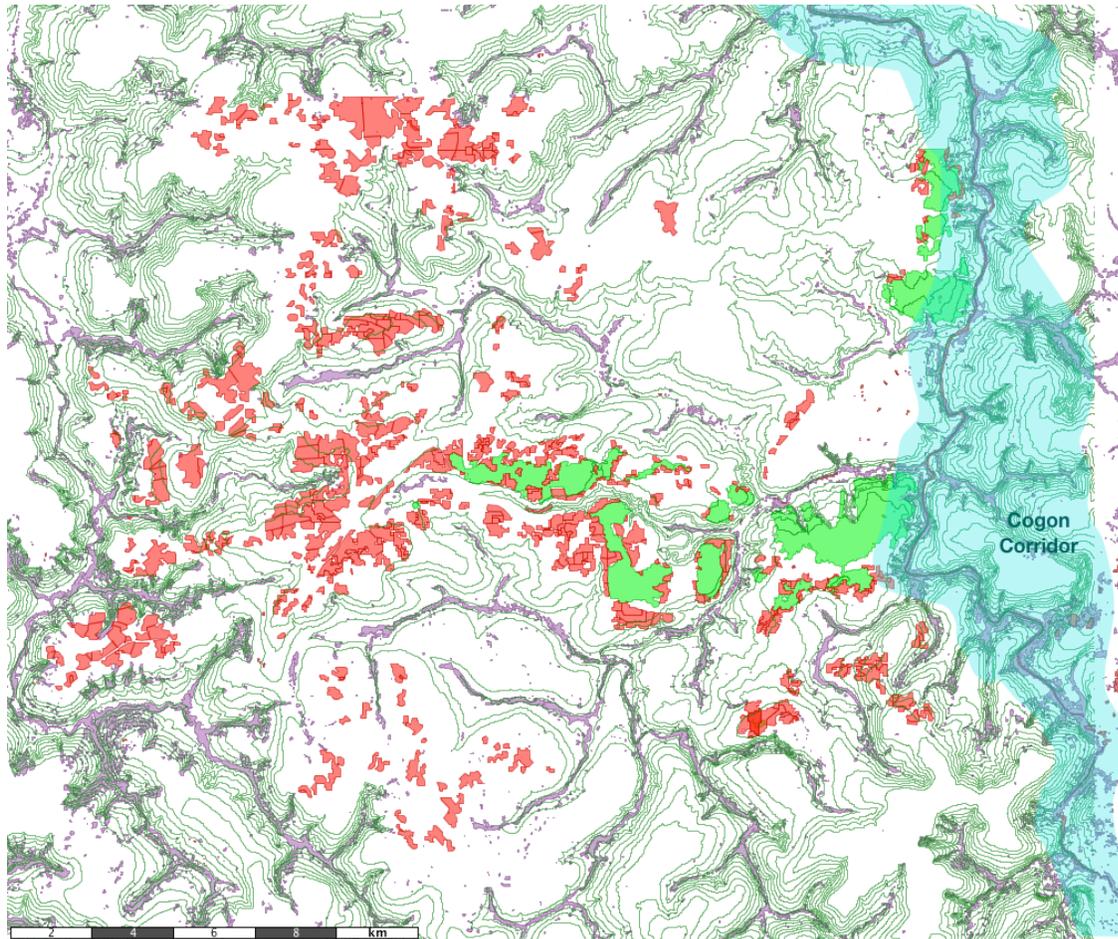
Cogon Corridor

The Cogon Corridor is clearly important from the biological standpoint, with the confirmed presence of two *Endangered* primates (the chimpanzee and the red colobus, with the latter just outside the Study Area boundary). The presence of a hippopotamus population is equally important because this species, currently considered *Vulnerable*, could change categories in the near future. The Cogon is the largest watercourse in the area with substantial wooded habitat left. The Cogon must play an important role as a regional corridor, exemplified by the movement of hippopotami. Finally, the Cogon represents a source of revenue for residents from artisanal fishing.

The Cogon Corridor in the Sangarédi area is clearly an important area that fulfills several of the IFC criteria for critical habitat. The zone includes several *Endangered* species and undoubtedly plays a crucial role for at least one or two (criterion 1). There are at least two range-restricted species (endemic to the Sangarédi area) (criterion 2). Finally, the forest itself represents a habitat in danger that may disappear in the near future (criterion 4).

The representation of the corridor on Map 4-3 is very approximate and will have to be studied in more detail during development of the protection plan.

Map 4-3 Map of critical habitat – Cogon Corridor



Critical Habitat:
Cogon Corridor
Sangarédi
ESIA for the CBG mine
Extension Project
EEM - June, 2015

4.6.3.4 *Natural habitats*

Applying the IFC distinction between natural habitats and modified habitats is complex in a region where the human population has been present for a long time. Indeed, there must be few areas that have not undergone some impact. Even the surviving gallery forests have partly become plantations, with certain trees selectively planted or retained.

The question is particularly complex and important for the bowals. Traditionally, the bowals and their vegetation have been interpreted as results of degradation caused by human intervention:

All of these soils may be covered by a thick ferruginous or bauxitic duricrust. One can find these duricrusts in every topographic position,

indifferent to lithology. They often form vast plateaus denuded of all woody vegetation: the bowal. These are raw mineral soils with no obvious pedological evolution (Maignien, 1958; Leprun, 1979). Their arrival is tied to the disappearance of the forest. There is then an important modification of the bioclimate and the formation of organic complexes follows the rhythm of the seasons. The process of kaolinization slowing with the desiccation of the environment whereas the individualization of iron remains important. The result is a general concreting and hardening of the soils. In dry regions the lack of humidity slows the release of the different oxides and the development of the vegetation. The phenomena of duricrust formation are then less intense (Orange, D., 1990. *Hydroclimatologie du Fouta Djallon et dynamique actuelle d'un vieux paysage latéritique*. Thesis presented to Université Louis Pasteur de Strasbourg).

All these soils of the tropical regions are menaced by laterization under the effect of the alternating humidity and dryness and the bush fires that destroy the protective vegetation cover, favoring the hardening and erosion of the superficial loose soil. Once it is gone, the mineral carapace appears at the surface. In West Africa it goes under the Peul name of "bowal". These crusts and laterite carapaces, totally sterile, cover vast surfaces in the west of the African continent on the plateaus of the south Sudanese zone, between 8° and 15° de latitude north (Mali upper Guinea, Burkina Faso). "The major part of Africa is made up of surfaces that the irreversible processes of pedogenesis have render sterile or not very fertile" (H. Isnard). (Maldague, M., 2006. *Traité de gestion de l'environnement tropical*.)

This opinion is shared by Lisowski (2009), author of the only Guinean flora.

The vegetation of lower Guinea is very degraded; in large part synanthropized... currently vast stretches with more or less deep ferralithic soils are occupied by cultivated fields, fallow lands or by more or less degraded savannas. In the totally degraded areas the ferralithic duricrusts (bowé) appear. (p 3)

... The soil deprived of its primary vegetation cover is subject to more and more accentuated erosion. The bowalization, that is to say the appearance and formation of ferralithic duricrusts, manifests itself everywhere. The denuded sites, called bowé and without economic value for agriculture become a characteristic and constant element of the Guinean landscape (from lower Guinea to upper Guinea). (p 6)

However, the Kew Garden botanists do not share this opinion:

This is a natural, climax vegetation and not "degraded" as claimed e.g. by Lisowski (2009). Impeded drainage and thin or absent soils results in an absence of woody plants, and seasonally inundated grassland with a unique assemblage of species including [some] restricted to bowal. Evidently species groups have evolved in this habitat over many millennia. Fire is a natural part of this ecosystem, though it has now become managed by the local population to aid cattle husbandry. » (ÉEM, 2014. *Biology Baseline Study - Environmental and Social Impact Assessment of the CBG Mine Expansion Project. Annexe 1 : Botanical baseline survey in Guinea for Compagnie des Bauxites de Guinée (CBG)*). (Annexe 3-1).

In the bowals father east in Guinea the vegetation seems more diverse and there are often status species present. It is possible that this increased diversity is due to higher rainfall in these regions or deeper soils. Status species were not found in the bowals during fieldwork in the Sangarédi region in 2013 but their presence is not excluded and additional surveys will be done prior to any clearing. In any case it is evident that the bowal vegetation in the Sangarédi region, even if it relatively poor, includes species specific to this type of habitat. As a precaution measure, it has been decided in this ESIA to consider the bowals as well as fallow land and other forms of extensive agriculture as natural habitats.

4.6.3.5 *Modified habitats*

IFC Performance Standard 6 foresees the consideration of modified habitats if these are of high value in terms of biodiversity: "This Performance Standard applies to those areas of modified habitat that include significant biodiversity value..." Since this ESIA has as a precaution already elevated the potentially modified habitat into

natural habitat, there are no remaining modified habitats of “significant biodiversity value.” What remains is zones of human housing, industrial zones and mines.

4.6.4 Biological resources

4.6.4.1 Introduction

IFC Performance Standard 6 specifies:

Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.

The two preceding sections dealt specifically with aspects concerning the protection and conservation of biodiversity. The management of ecosystem services is partly handled in the preceding section (in the sense that the protection of habitats is considered by ecosystem protection plans), but also in those sections dealing with physical aspects. This section deals with sustainable management of living natural resources to the extent that the Project may have an impact on such resources.

These resources include notably fishing (in the Rio Nuñez Estuary and the Cogon River in particular), hunting for bushmeat, harvesting of firewood and the harvesting of wild plants for food and as medicines. The three most important elements are fishing in the Rio Nuñez estuary, hunting and firewood harvesting. These aspects are treated in the specific studies:

ÉEM, 2014. *Biology Baseline Study - Environmental and Social Impact Assessment of the CBG Mine Expansion Project. Annexe 3 : Results of a Rapid Baseline Survey of the Fishery Resources of the Rio Nuñez Estuary, North-west Guinea.* 36 p. (Annexe 3-3)

ÉEM, 2014. *Biology Baseline Study - Environmental and Social Impact Assessment of the CBG Mine Expansion Project. Annexe 11: Rapid Survey of Hunting and the Bushmeat Trade in and around Sangarédi, North-west Guinea.* 23 p. (Annexe 3-11)

ÉEM, 2014. *Biology Baseline Study - Environmental and Social Impact Assessment of the CBG Mine Expansion Project. Annexe 12 : Results of a*

Rapid Baseline Survey of the Use of Woodfuel Resources in and around Sangarédi, North-west Guinea. 32 p. (Annexe 3-12)

The purely socioeconomic aspects of these activities are included in the Social section of the ESIA (Chapter 5). The discussion here involves only the biological aspects.

4.6.4.2 The fish of the Rio Nuñez

Fishing in the Rio Nuñez Estuary is an important artisanal activity on which a considerable number of residents depend. The fish and other edible animals of the estuary are therefore considered a VEC of Medium value.

4.6.4.3 Bushmeat

The right to hunt is recognized by Guinean legislation, and the consumption of legally obtained animals is a potentially important aspect for residents from the nutritional point of view but also in terms of tradition. The animals likely to be hunted or trapped are therefore considered a VEC of Medium value. An important aspect in a consideration of bushmeat as a VEC is that one of the major impacts assessed will in effect be a potential increase in illegal capture once access to more or less isolated areas improves. It is mainly a VEC for the Sangarédi region because the principal impacts will occur there.

4.6.4.4 Woodfuel

Firewood is important for residents, being for many the only means of cooking or heating. It is therefore considered a VEC of Medium value. As for bushmeat, one of the key aspects of the assessment will be the impact of improved access to more or less isolated regions. It is mainly a VEC for the Sangarédi region because the main impacts will occur there.

4.7 Impact analysis

4.7.1 Introduction

The three following sections present the results of the impact assessment for the important biological species, the habitats and the biological resources. The summary tables for the evaluations are presented in Section 4.7.5.

4.7.2 Important biological species

For the important biological species, the analyses must be done species by species, because each species tends to be affected in a different way (depending on its distribution, habitat, ecological niche, numbers and characteristics). Each important species (that is, each of the 42 species identified as being of first or second priority in Section 4.6 of Chapter 4) was analyzed individually, and the summary results of the analyses by species are given in the data sheets in Annexe 4-3. The impact levels by species are given in Section 4.7.5 and the summary of the impact calculations in Annexe 4-4.

4.7.3 Important biological habitats

4.7.3.1 *Rio Nuñez Estuary – critical habitat*

The estuary of the Rio Nuñez will be affected in two ways:

First, by activities associated with the enlargement of the port of the plant: the additional dredging of the turning basin, the enlargement of the quay and potentially the construction of one or more conveyors toward the quay (local and short-term activities but with a high level of disturbance in a critical habitat with important species). The importance of the impact must be assessed as High – negative.

Second, by long-term changes, such as the increase in marine traffic and additional maintenance dredging (local long-term activities in a critical habitat with important species). The importance of the impact must be assessed as High – negative.

The mitigation measures in Section 4.8 address many potential impacts, notably:

- specific measures (underwater noise, collisions, etc.) ; and
- development of a management and action plan for the protection of the Rio Nuñez Estuary.

The plan specifies that the goals of the plan must be to: protect important species (dolphin, manatee, aquatic birds, marine turtles, crocodiles, marine fish); protect key habitats (mangrove, mud flats); protect artisanal fishing; plan the port installations in a sustainable fashion; determine a realistic schedule; and determine monitoring measures.

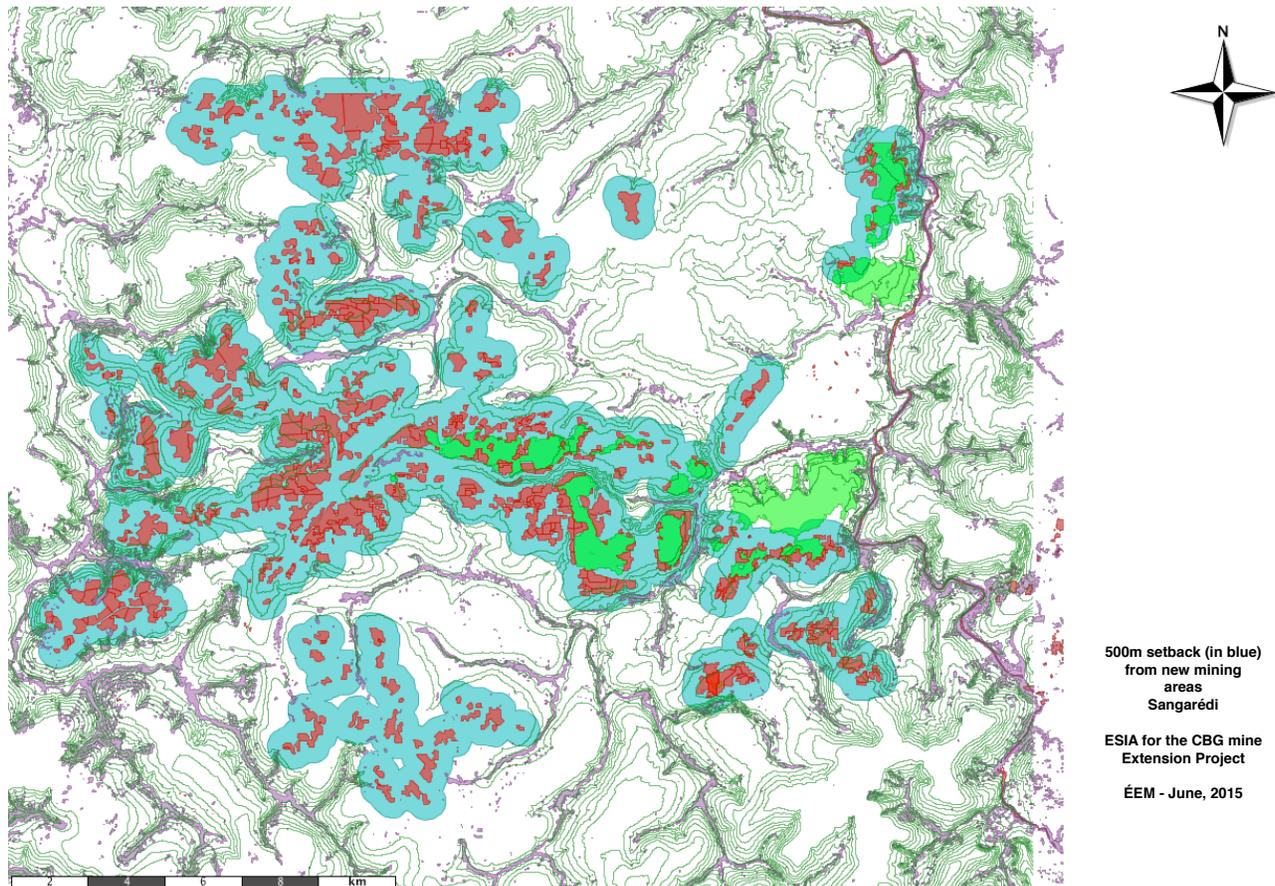
The application of these measures would reduce the impact level. The residual impact level given is the Medium – negative for the construction impacts because even with mitigation measures certain impacts will remain. The impact level during the operation phase is this Medium – positive because protection measures for the estuary should compensate certain other long-term impacts.

4.7.3.2 Gallery forests near Sangarédi – critical habitat

Gallery forests are without doubt the most critical habitat in the Sangarédi region. Fortunately, the gallery forests, by definition, are found in the bottom of valleys, whereas the new mining areas are found on the plateau. Therefore, the development of the new mining areas will occur almost entirely outside the gallery forest zones. In total, only seven ha out of 4,900 ha of gallery forest in the Study Area (0.1%) will be eliminated to make way for mines. The areas of gallery forest that might be eliminated are very small (the average size of the 103 parcels is 640 m²) and they should be confirmed in the field. The estimates presented here are all based on interpretation of satellite imagery.

Nevertheless, the risk of impact, apart from clearing, is real in view of the proximity of the mining areas and the gallery forest in some cases (see Map 4-4) and the likely impacts associated with the development of the mine road network. In view of the value of the of gallery forests the importance of the potential impact must be assessed as High – negative.

Map 4-4 Gallery forests near new mining areas



The mitigation measures in Section 4.8 notably include:

- Additional studies on the mining road network;
- Other specific measures (noise, dust, lighting, etc.); and especially
- Development of a forest protection plan.

The forest protection plan is a key element in the strategy for protection of biodiversity for the Project. The measures described in Section 4.8 specify:

- The goals of this plan must be to protect ecosystems and the important species that inhabit them (chimpanzee, mangabey, African golden cat, rare plants, reptiles, amphibians and fish); protect remnant habitat; promote the restoration of key habitats to ensure or bring back an effective corridor role to the gallery forests; determine a realistic schedule; and determine monitoring measures;

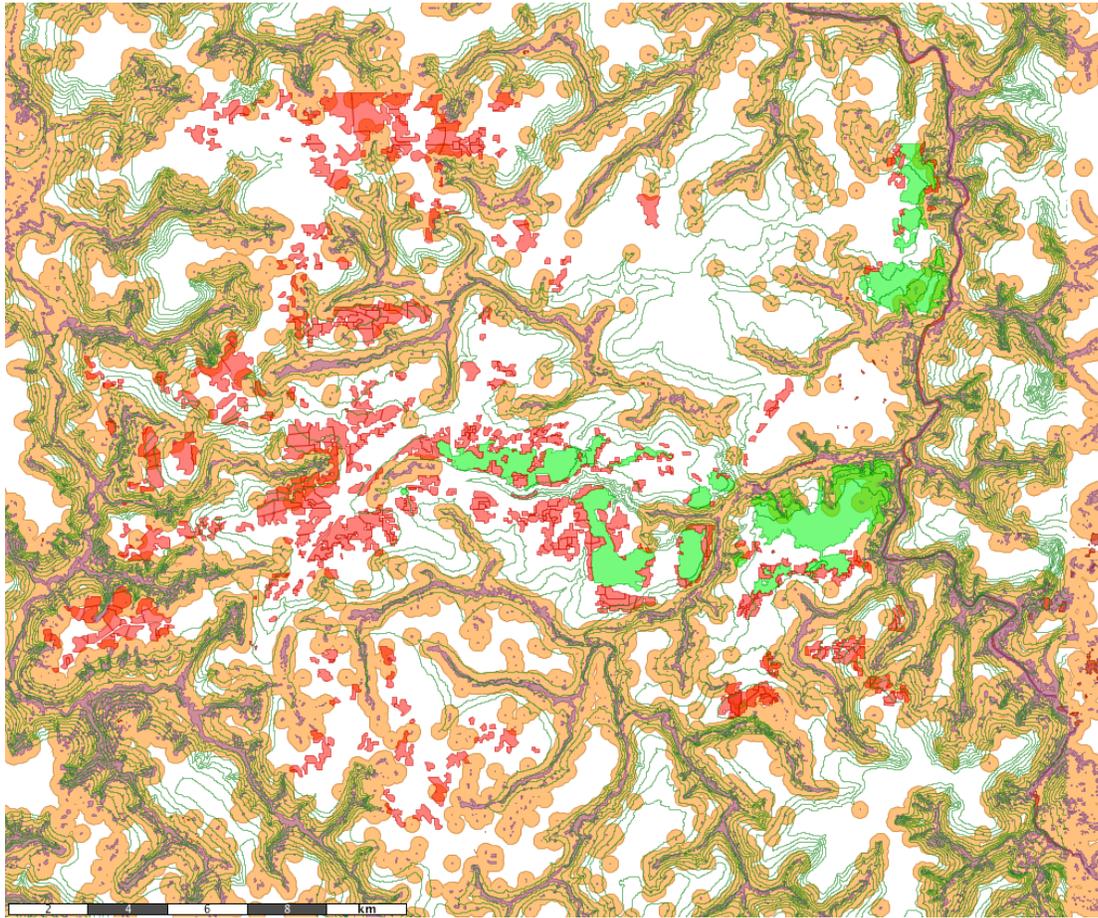
- The determination of a functional corridor is complex and requires knowledge about the animals that are supposed to use the corridors. Corridors that are too narrow may not fulfill their roles; and
- As the plan must in part be considered a compensation measure by CBG for the destruction of natural habitats on future mines, the surface area of the areas to protect and the corridors to create must at least be comparable to the surface area lost: 3,200 ha. This surface area is approximate and may evolve to consider losses linked to the road network (when there will be enough data on this topic) and impacts outside of the area to be cleared (impact from noises, dust, etc.). The plan may also take into account rehabilitated mine areas if these are devoted solely to the restoration of natural habitat. An important part of the to surface area (at least half) must be devoted to the creation of new forest habitat linked to the existing gallery forests to improve their role as corridors.

It will be important during the development of the plan to take well into account the role of corridors. The fragmentation of habitats will become important with the development of the mine road network. Map 4-5 shows the application of a 500 m buffer from the existing gallery forests. It is not intended to recreate such a network of corridors but the map is useful to put into relief potential zones.

Map 4-6 shows zones of concentrations of important species. The Cogon Corridor and the gallery forests to the north of Kourawel come out as zones to prioritize.

The application of these measures would reduce the level of final impact on the gallery forest and the residual impact would be positive. The residual impact would thus be a Medium – positive.

Map 4-5 500m setback from gallery forests - examples of corridors



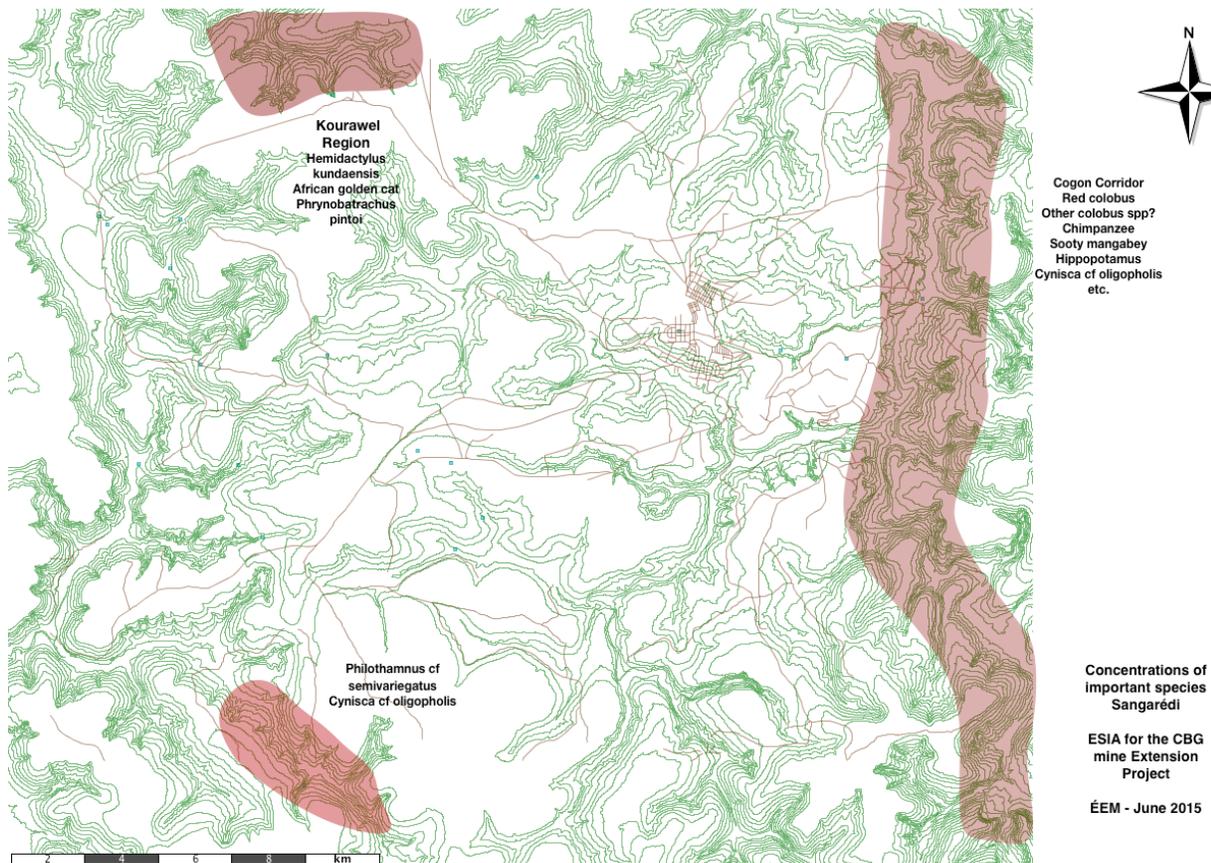
500m setback (in light brown) from gallery forests (in purple) - example of corridor creation Sangarédi

Old pits in green, new pits in red

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Map 4-6 Areas of concentration of important species



4.7.3.3 Cogon Corridor – critical habitat

The Cogon corridor will not be strongly affected by the Expansion Project in that nearly all the new mining areas are relatively far from the corridor. Nevertheless, impacts are possible from small mining areas close to the corridor and from impacts such as increased aluminum in the water.

The importance of the potential impact is assessed as Medium – negative.

The mitigation measures in Section 4.8 include:

- Specific measures (noise, dust, lighting, etc.); and
- The development of a protection plan for the Cogon Corridor

The plan specifies that:

- The goals of the plan must be to: protect important species present (chimpanzee, new population of red colobus, hippopotamus); protect the remaining habitat; promote the restoration of key habitats to ensure or restore the role of regional corridor; protect local resources such as artisanal fishing; determine a realistic schedule; and determine monitoring measures; and
- In this case, the identification of a wide corridor going to the heights of the plateaus is needed.

The application of these measures would reduce the level of impact and should have a positive affect on the corridor. The residual impact is thus Medium - positive

4.7.3.4 *Natural habitats*

At least 3,200 ha of natural habitat, in the broadest sense of the word as defined earlier, will be cleared for the new mining areas. This area represents the mine surface only and could increase if there is a need for additional work areas outside the mine area *per se*. In addition, clearing will probably be needed during the construction of mining roads.

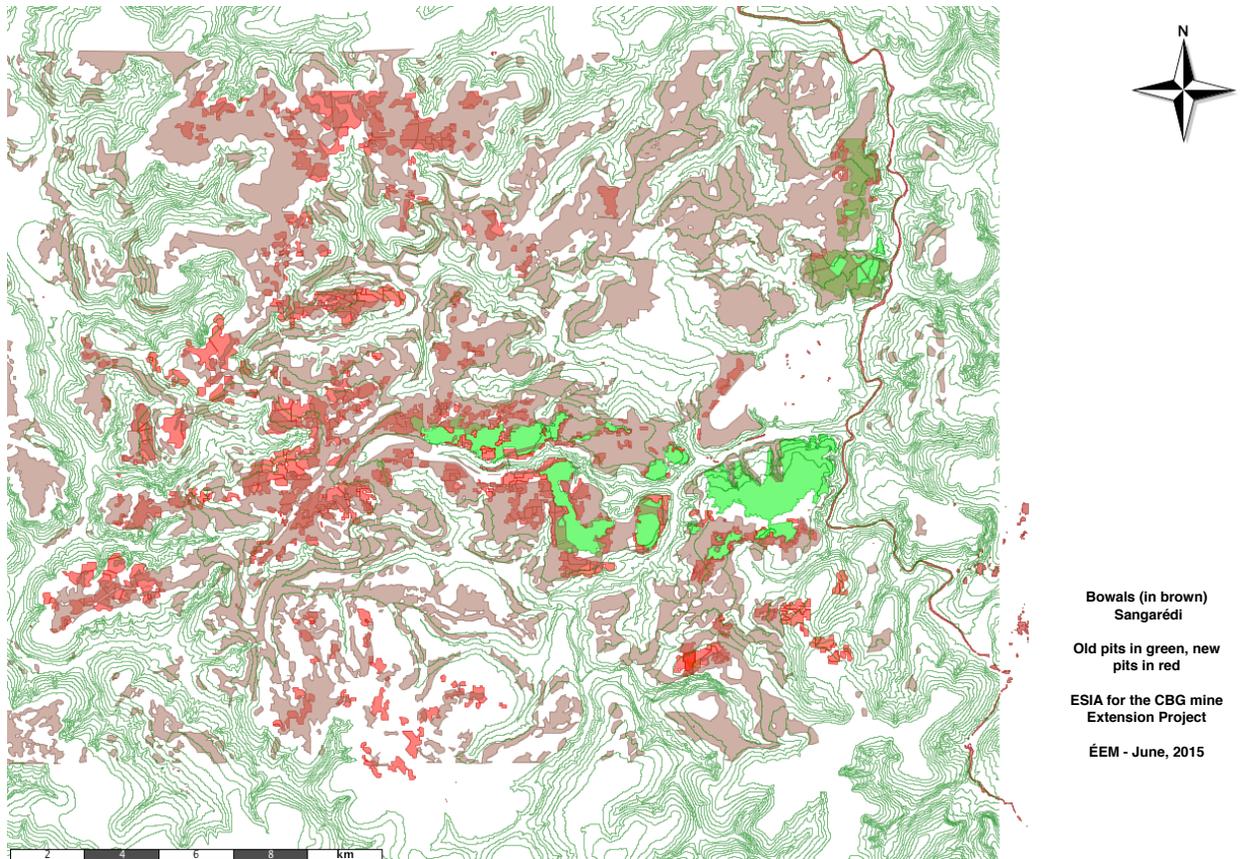
This entire surface is not attributable to the Expansion Project. The baseline for the Project is the continuation of extraction at current levels. Therefore, a good part of this surface would be cleared in any case in the 2014-2027 period. Because the maximum extraction rate (close to twice the current rate) will be reached only toward the end of the Project, it is conservative to estimate that less than 50% of the clearing will be the result of the Expansion Project. A precise estimate is difficult because the mining planning studies are based on volume rather than surface area, and the depth of the deposits can vary.

It is also important to consider that the total surface of new mining areas will not be in continuous use during the duration of the Project. As a result of modifications to the mining plan in 2014, the use of a given area will take place over a shorter time

and if the rehabilitation of the exploited areas is rapid and effective, only a portion of the 3,200 ha will be outside natural habitat at any time.

More than half of the natural habitats that will be eliminated will be bowals (about 1,800 of bowal of the 3,200 ha total) (Map 4-7). This represents about 12% of the bowal area in the Study Area.

Map 4-7 Bowal distribution at Sangarédi



The certain impacts on biological elements through the elimination of an important surface area (whatever the percentage that can be attributed to the Expansion Project) and all of the indirect impacts listed before indicate that the potential impact importance must be assessed as High – negative.

The mitigation measures in Section 4.8 address many of the potential impacts, notably through:

- additional studies prior to clearing;
- specific measures to avoid habitats;

- specific measures during clearing;
- rehabilitation measures
- other specific measures (noise, dust, lighting, etc.)
- development of a mine rehabilitation plan
- development of plan for the protection of bowal vegetation.

The application of these measures would reduce the level of impact, without totally eliminating it. The residual impact is thus Medium - negative

Compensating for the loss of biodiversity would be done by positive measures in the Study Area for gallery forest and the Cogon Corridor.

4.7.4 Biological resources

4.7.4.1 *Fish of the Rio Nuñez Estuary*

The assessment for the estuary fish is similar to that of the estuary as critical habitat however the impacts are scored differently because the value of the fish as a resource is lower and because many of the fish involved are benthic (therefore on average more sensitive to the effects of dredging).

The fish of the Rio Nuñez Estuary will be impacted in two ways.

First, by activities associated with the enlargement of the port of the plant: the additional dredging of the turning basin, the enlargement of the quay and potentially the construction of one or more conveyors toward the quay (local and short-term activities but with a Medium level of disturbance. The importance of the impact must be assessed as Medium – negative.

Second, by long-term changes, such as the increase in marine traffic and additional maintenance dredging (local long-term activities). The importance of the impact must be assessed as Medium – negative.

The mitigation measures in Section 4.8 address many potential impacts, notably:

- specific measures (underwater noise, collisions, etc.); and
- development of a management and action plan for the protection of the Rio Nuñez Estuary.

The plan specifies that the goals of the plan must be to:

- protect important species (dolphin, manatee, aquatic birds, marine turtles, crocodiles, marine fish);
- protect key habitats (mangrove, mud flats);
- protect artisanal fishing;
- plan the port installations in a sustainable fashion;
- determine a realistic schedule; and
- determine monitoring measures.

The application of these measures would reduce the impact level. The residual impact is of Low – negative for construction impacts because even with the mitigation measures certain impacts will remain. The residual impact is of Low – negative for operation impacts because dredging impacts may be difficult to mitigate for benthic fish.

4.7.4.2 *Bushmeat*

The main impact on the bushmeat resources, outside of general impacts on animals, is the greater access to the resource following the development of the mine road network.

The importance of the potential impact must be assessed as Medium – negative.

The mitigation measures in Section 4.8 include:

- specific measures (noise, dust, lighting, etc.); and
- the development of a management plan for bushmeat hunting.

The plan specifies:

- The goals of the plan must be to: identify measures to take to reduce aspects of this hunt that are outside of legality according to the *Code de la chasse*; ensure that the mining roads do not become a means of transport favoring the bushmeat trade; in particular, ensure that the trade in sensitive species (such as the black duiker or colobus monkeys) is stopped; determine a realistic schedule; and determine monitoring measures.

The application of these measures would reduce the level of impacts. The residual impact would be Low – negative.

4.7.4.3 *Woodfuel*

The main impact on the woodfuel resources, outside of general impacts on trees, is the greater access to the resource following the development of the mine road network.

The importance of the potential impact must be assessed as Medium – negative.

The mitigation measures in Section 4.8 include:

- specific measures for the protection of vegetation (dust, etc.); and
- the development of a management plan for woodfuel harvesting.

The plan specifies:

- The goals of the plan must be to: identify measures to take to protect particularly sensitive area such as areas close to springs and areas of forest protection identified in the forest protection plan; ensure that the mining roads do not become a means of transport for woodfuel trade for people not of the area; determine a realistic schedule; and determine monitoring measures.

The application of these measures would reduce the level of impacts. The residual impact would be Low – negative.

4.7.5 Summary presentation of the potential and residual impacts

Table 4-4 gives a summary of the potential and residual impacts by component and subcomponent. The methodology is the one described in Chapter 1. The impacts are described in more detail in preceding sections, Annexe 4-3 and the summary of calculations in Annexe 4-4.

The potential impact levels of the Extension Project are reassessed in this section, assuming the application of all the mitigation measures for each discipline, and they are summarized in the ESMP (Chapter 10) according to an aggressive and sustained

schedule with support from the appropriate resources. The residual impact levels under these conditions are presented below.

For the biological impacts, the mitigation measures are particularly complex and often include, besides specific measures, additional studies and management and protection plans. The residual impacts assume that these studies and plans have been carried out. If the studies are not done or if the plans are not applied, it is evident that the residual impacts will have to be reviewed.

Often there are negative and positive impacts to assess for a subcomponent, and the final assessment takes into consideration these opposite impacts.

Impacts of a positive nature:

High	Medium	Low	Does not apply (n/a)
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Impacts of a negative nature:

High	Medium	Low	Does not apply (n/a)
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Other impacts:

None = no predicted impact

Neutral = positive and negative predicted impacts counterbalance

n/a = does not apply

Table 4-4 Summary of impacts on the biological environment

VEC/impacts by subcomponent	Construction phase			Operation phase		
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
Species of first priority (Critically Endangered and Endangered according to the IUCN or equivalent)						
<i>Hemidactylus kundaensis</i> – Critically Endangered lizard endemic to Sangarédi	High	n/a	n/a	n/a	n/a	n/a
<i>Residual impacts</i>	None	n/a	n/a	n/a	n/a	n/a
<i>Phrynobatrachus pintoii</i> – Endangered and endemic frog	n/a	n/a	n/a	High	n/a	n/a
<i>Residual impacts</i>	n/a	n/a	n/a	Medium	n/a	n/a
Chimpanzee	n/a	n/a	n/a	High	n/a	n/a
<i>Residual impacts</i>	n/a	n/a	n/a	Medium	n/a	n/a
Two species of freshwater fish	n/a	n/a	n/a	High	n/a	n/a

VEC/impacts by subcomponent	Construction phase			Operation phase		
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Undescribed species of African dwarf crocodile	n/a	n/a	n/a	High	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium		n/a
Two species of marine turtle	n/a	High	n/a	n/a	Medium	n/a
Residual impacts	n/a	Medium	n/a	n/a	None	n/a
Undescribed form of <i>Cynisca oligopholis</i> – reptile	n/a	n/a	n/a	Medium	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Red colobus	n/a	n/a	n/a	Medium	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Blackchin guitarfish – marine fish	n/a	n/a	n/a	n/a	Medium	n/a

VEC/impacts by subcomponent	Construction phase			Operation phase		
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
Residual impacts	n/a	n/a	n/a	n/a	Medium	n/a
Species of vulture (2 at Kamsar, 3 at Sangarédi)	n/a	n/a	n/a	Medium	None	n/a
Residual impacts	n/a	n/a	n/a	None	None	n/a
Hippopotamus	n/a	n/a	n/a	Medium	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Hemidactylus albivertebralis – recently described lizard	n/a	n/a	n/a	n/a	None	n/a
Residual impacts					None	
Dusky grouper					None	
Residual impacts	n/a	n/a	n/a	n/a	None	n/a
Species of first priority (Vulnerable or Near Threatened according to the IUCN or equivalent)						
West African manatee	n/a	High	n/a	n/a	High	n/a
Residual impacts	n/a	None	n/a	n/a	Neutral	n/a

VEC/impacts by subcomponent	Construction phase			Operation phase		
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
Atlantic humpback dolphin	n/a	High	n/a	n/a	High	n/a
Residual impacts	n/a	None	n/a	n/a	Neutral	n/a
African golden cat	n/a	n/a	n/a	High	n/a	n/a
Residual impacts	n/a	n/a	n/a	Neutral	n/a	n/a
Smoky mangabey	n/a	n/a	n/a	Medium	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Eleven species of freshwater fish	n/a	n/a	n/a	Medium	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Rhinoptera marginata – marine fish	n/a	n/a	n/a	n/a	Medium	n/a
Residual impacts	n/a	n/a	n/a	n/a	Medium	n/a
Two species of migratory aquatic birds	n/a	n/a	n/a	n/a	Medium	n/a

VEC/impacts by subcomponent	Construction phase			Operation phase		
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
Residual impacts	n/a	n/a	n/a	n/a	Medium	n/a
Nile crocodile (likely a distinct species)	n/a	Medium	n/a	Medium	Medium	n/a
Residual impacts	n/a	Low	n/a	Low	Low	n/a
Three tree species of dry woodlands	n/a	n/a	n/a	Low	n/a	n/a
Residual impacts	n/a	n/a	n/a	Low	n/a	n/a
Three tree species of humid habitats	n/a	n/a	n/a	None	None	n/a
Residual impacts	n/a	n/a	n/a	None	None	n/a
Beudouin's snake eagle	n/a	n/a	n/a	n/a	None	n/a
Residual impacts	n/a	n/a	n/a	n/a	None	n/a
Critical habitats according to IFC standards						
Gallery forests	n/a	n/a	n/a	High	n/a	n/a

VEC/impacts by subcomponent	Construction phase			Operation phase		
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Cogon Corridor	n/a	n/a	n/a	Medium	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Rio Nuñez Estuary	n/a	High	n/a	n/a	High	n/a
Residual impacts	n/a	Medium	n/a	n/a	Medium	n/a
Natural habitats according to IFC standards						
Natural habitats	n/a	n/a	n/a	High	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Biological resources						
Marine fish	n/a	Medium	n/a	n/a	Medium	n/a
Residual impacts	n/a	Low	n/a	n/a	Low	n/a
Bushmeat	n/a	n/a	n/a	Medium	n/a	n/a
Residual impacts	n/a	n/a	n/a	Low	n/a	n/a
Firewood	n/a	n/a	n/a	Medium	n/a	n/a

VEC/impacts by subcomponent	Construction phase			Operation phase		
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
<i>Residual impacts</i>	n/a	n/a	n/a	Low	n/a	n/a

4.8 Mitigation measures

4.8.1 General consideration

Guinean laws including the Mining Code, Environment Code, Land and Domain Code and Local Government Code, along with the international IFC Guidance Notes (SFI, 2012a) and the ICMM standards provide a normative environmental and social framework for mining projects. Many measures set out in national legislation and international standards are designed to prevent and mitigate real or perceived potential impacts of mining projects.

Figure 4-2 National and international legislative framework

National Legislation and International Standards

- **Constitution of Guinea**
- **Mining Agreement between CBG and the State - 1963 (decrees and amendements)**
- **Mining Code**
- **Forestry Code**
- **Hunting Code**
- **Code for the Protection and Enhancement of the Environment**
- **National Action Plan for Biological Diversity**
- **National Plan for the Management of Mangroves**
- **African Convention on the Conservation of Nature and Natural Resources**
- **Convention on the Conservation of Migratory Species of Wild Animals**
- **Agreement on the Conservation of African-Eurasian Migratory Waterbirds**
- **Convention on Wetlands of International Importance**

The mitigation measures proposed in this part of the report include the main measures presented in individual parts. Certain measures common to several

components or subcomponents are consolidated into a single measure. They have as goal to enhance positive impacts of the Project and to prevent, even compensate negative impacts of the Expansion Project. These are also summarized in the Environmental and Social Management Plan (ESMP – Chapter 10).

An unusual aspect is the predominant role played by CBG in the region of Kamsar and Sangarédi. For more than 40 years, CBG has been the main economic strength in the region and it takes on roles often reserved to government agencies. That is why there are certain cases where the measures recommended in this section are beyond the normal framework for a mining company. This is the case for example of the role of CBG in the protection of habitats in the Cogon South concession, but outside the mining areas.

General measures related to the reduction of emissions, dust, noise, of impacts to water, etc. are considered in the physical environment report (Chapter 2) and are not repeated here, although often it has been impacts on biodiversity that have required their application. Nevertheless the total mitigation measures (physical, biological and social) are considered in the assessment of residual impacts for biology.

Measures introduced during the development of the Project and included in the description of the Project (for example the reduction of dredging) are already taken into account during the pre-mitigation assessment of impacts. These measures are detailed in Chapter 1 of the ESIA.

4.8.2 General measures

4.8.2.1 *Recognition of the importance of biodiversity*

The detailed discussion of the place of biodiversity in the legislative and prescriptive framework of Guinea (Section 4.2.1) illustrates clearly the importance placed by Guinea on biodiversity.

It would undoubtedly be useful if CBG talked officially to its employees and subcontractors about this importance accorded by the Republic of Guinea and voiced its adherence to the principles formulated.

- In view of the importance accorded by the Republic of Guinea to biodiversity, as demonstrated in its laws, its action plans and the international conventions it has ratified, CBG reiterates its adherence to the principles and recommendations of these texts and recalls them to its employees and subcontractors.

4.8.2.2 *Recognition of the overall biodiversity situation in the Study Areas*

Efficient management depends on a good understanding of the situation.

The ESIA has, for the first time, given a detailed view of the biodiversity in the Study Area.

The studies confirm a biodiversity impoverished by the disappearance of many of the large mammals, likely following a demographic surge and the loss of habitats associated with it.

It is clear that habitat and species losses continue at a rapid rate.

The studies demonstrate however that there are still important species and habitats to protect.

Among the species present there are at least two species *Critically Endangered*, twelve *Endangered* and numerous others with high conservation or protection statuses.

Among these habitats there are large areas of critical and natural habitat that Performance Standard 6 of the IFC require protection or compensation measures.

- In view of the presence of numerous important species for conservation and critical habitats, discovered during the ESIA, and that could be impacted by the Expansion Project, CBG commits to taking the mitigation measures required by the applicable Guinean and international texts and the IFC standards for their protection. All employees and subcontractors will be advised about the biological importance of the sites, of the specific measures to be taken in the field (for example to avoid bush fires), and of forbidden acts (for example hunting on the sites).

4.8.3 Additional studies

The additional studies described below were not part of the studies undertaken during the ESIA either because of engineering decisions still being considered (dredging and mining roads), or because the studies preferably have to be done just before the opening of new pits. These studies are in addition to the monitoring measures described in Section 4.9.

It is evident that other studies could be recommended during the development of the action plans. For example it is becoming clear that the taxonomic situation of bats in the region is more complex than previously thought (Koubinova et al, 2013) and that a bat study would undoubtedly be useful.

4.8.3.1 *Additional study on dredging (Kamsar)*

As it is possible that dredged sediments will be deposited on the marine bottom in the estuary, analyses of the benthic fauna and others on the deposition site should be done. This, to determine more precisely impacts in an area identified as critical habitat.

4.8.3.2 *Additional study on the mining road network (Sangarédi)*

At the date of finalizing the biology report, there were no details on the development of a road network associated with the mining of new areas. The network itself will have a significant impact, notably by destroying habitats, fragmenting of habitats and reducing animal movements (especially for medium and large mammals). The network would also have impacts on access to isolated areas for persons searching for bushmeat and woodfuel. It will be imperative that competent biologists participate in the development of the network: alignments, avoidance of critical habitats, reduction of fragmentation of habitats, protection of aquatic habitats, use by residents and others, status after the end of mining, etc.

4.8.3.3 *Additional botanical studies (Sangarédi)*

The botanical study for the ESIA recommends that additional studies be done in areas to be mined during the September to October period, the preferred period to

identify bowal species. The botanical studies to date have not identified species of high conservation status on the bowals but this remains a possibility. In addition, a species considered *Vulnerable* by IUCN was found in a wooded grassland (*Khaya senegalensis*).

It is recommended to do these studies in September-October before mining in a new area. The identification of bowal plants can be difficult and requires very competent botanists (such as those of Kew Royal Botanical Gardens). During these studies, the botanists should also verify the limits of critical habitats in proximity and inform CBG if there are corrections to make to their distribution. They could also make recommendations as to the measures to be taken if necessary (identification of species with high status).

Before clearing for the new mining roads, it would be judicious to check for the presence of important species by the botanists already present for the mining area studies.

4.8.3.4 *Additional study for Endangered vultures (Sangarédi)*

Three species of *Endangered* vultures are quasi the only Endangered species to frequent in a regular manner the sites to be mined at Sangarédi. The individuals of the three vulture species cover large territories and would likely not be very sensitive to mining activities in a specific area. The exception is in the case of nesting on tree close to or on the sites to be mined. As the Mining Plan covers a long period, it is not useful to do a survey at the beginning of the Project. However, as the time approaches for the opening of a new mining area, it would be prudent to do a verification for vultures and other birds of prey. They could make recommendation on measures to take if necessary.

4.8.3.5 *Additional study for the Kunda half-toed lizard Hemidactylus kundaensis*

During work close to Kourawel it will be important to verify the presence of this species by a competent herpetologist and to take measures necessary for its protection if there impacts predicted. This species could live in houses and if there changes to the village by CBG actions, this would have to be taken into account.

4.8.3.6 *Collection of ancillary observations on biodiversity*

CBG employees and subcontractors can help to understand the biodiversity in the Study Area by keeping logs of observations or in advising the environmental inspector. Among the specific actions:

- Keeping of logs by certain key people: for example environmental inspectors, site supervisors, drivers, ship captains);
- The logs should contain all observations of large fauna or unusual environmental aspects (death of vegetation, fish kill in a stream, etc.); and
- In particular, finds of all vertebrate carcasses should be notified to the environmental inspector who will be able to identify the carcass (or preserve it or photograph it for identification by a specialist) and determine if tissue samples should be taken (for DNA analysis for certain species or determination of cause of death is poisoning is suspected).

4.8.4 Specific measures

4.8.4.1 *General habitat avoidance measures*

Certain avoidance measures of sensitive habitats were taken during the development of the Expansion Project (for example reduction of the dredging). Other studies depend on additional studies awaiting engineering results (choice of deposition zone for dredging, study of road network) or that should be done just before clearing (botanical and ornithological studies). The mining zones were determined by geological criteria and are relatively predetermined, save avoiding mining altogether. Most of the modifications to the infrastructure at Kamsar and Sangarédi are occurring in areas already affected by the Project or populated areas close to the railroad.

Construction and operation activities have to be done in the context of explicit work areas and not allowing access to neighboring areas (except specific exceptions). That is to say:

- Clear delimitation (signs, barriers, fencing) of work zones for each phase (construction and operation);

- Forbidding access outside of the work area or the roads or trails leading to it, on foot or by vehicle. This with the aim of reducing disturbance to animals, destruction of vegetation (trampling or risk of fire) and compacting of soil. This applies to CBG employees and subcontractors except for special cases to be approved by the environmental inspector;
- Explanations to be given to all regarding the reasons for these measures; and
- In particularly sensitive areas, reinforce the interdiction by signs.

4.8.4.2 *Measures during clearing (everywhere but especially Sangarédi)*

Even though quasi all of the clearing will take place in fairly open environments and without any identified high status species at this date (except the vultures), the precaution principles recommends that certain measures be taken:

- Presence of an environmental inspector during clearing. The inspector will have to make sure the explicit measures are respected. In addition he or she will have to exercise a precautionary judgment in case of unexpected discoveries (for example presence of unexpected animals or archeological specimens);
- Clear delimitation in the field of the area to be cleared and for the passage of machinery;
- Ensure respect of those limits. Work or even passage on foot forbidden outside the limits. The presence of an important number of persons outside the work area could negatively affect the fauna around the site. Hunting or harvesting of natural products outside of the work area to be absolutely forbidden;
- Avoid clearing more than absolutely necessary;
- Keep the access for heavy machinery to the minimum required. Compacting of soil outside the work area is negative for the rehabilitation of the site;
- Avoid passing too close to trees with heavy machinery;
- Take measures against setting vegetation on fire;
- If it is necessary to cut trees, the wood will have to be made available to local residents;

- Clearing will have to take place in such a manner as to aid movement of animals towards habitats that are not going to be cleared. In particular avoid temporary habitat islands;
- During clearing, if it is evident that there are animals present (mammals, birds, reptiles, amphibians), these should be encouraged to leave by making noise for example. For amphibians and lizards capture them if possible to place them outside of the area to be cleared. Not to be done for snakes, given the possibility of the presence of dangerous species;
- Avoiding voluntarily killing animals during clearing;
- Take into consideration the recommendations of specialists that will visit the sites before clearing;
- As specified in the mitigation measures for the physical environment (Chapter 2), the soil will have to be carefully removed and stored so as to be reused during rehabilitation. This soil is important not only as a substrate for plants but also as reservoir of seeds of local plants adapted to the environment; and
- As specified in the mitigation measures for the physical environment and the following section, take all required measures to prevent erosion and the contamination of streams.

4.8.4.3 *Measures associated with work near streams and other surface water elements (Sangarédi)*

General measures to reduce impacts on the surface freshwater system are given in Section 2.4 of Chapter 2 (Physical Environment Study). Most of the work in Sangarédi will be done far from streams, however there are some specific measures that have to be considered, particularly for the development of the road network:

- Avoid all work in the water or the banks unless it is absolutely necessary;
- Avoid the destruction of vegetation on the banks
- An environmental inspector will have to be present during any work in or close to streams; and
- Any stream crossing of a stream to improve or create a new road will have to be the object of a specific environmental plan that will specify measures to take and periods to avoid (spawning periods for example).

4.8.4.4 *Measures for noise (especially Sangarédi)*

The general measures to reduce or control noise are given in Section 2.3 of Chapter 2 (Physical Environment Study). However, there are certain specific measures to consider for the protection of biodiversity:

- Take into consideration the critical habitats close to the new mining areas and ensure that mining takes place in such a way as to limit noise in the critical habitats. For example by starting to dig in the part farthest away. This will allow a progressive increase in noise (perhaps allowing habituation) and will reduce the noise because much of the digging will take place below grade;
- When possible, place noise generating equipment in area far from the critical habitat; and
- Avoid making too much noise (use of explosives) during the night, early in the morning or as sunset. These are key periods for many animals and they will be more impacted.

4.8.4.5 *Measures for dust and air quality (everywhere)*

The general measures to reduce or control noise are given in Section 2.3 of Chapter 2 (Physical Environment Study). However, there are certain specific measures to consider for the protection of biodiversity:

- Avoid burning vegetation (cut or in place) during clearing. It is a source of atmospheric pollution. Consider grinding and composting to improve soil quality during rehabilitation;
- Ensure that soil stockpiles are well protected from the wind by stabilizing them and letting plants grow on them; and
- Ensure the rehabilitation of areas that are no longer required as soon as possible to reduce dust and bring the area back into natural habitat.

4.8.4.6 *Measures for lighting (everywhere)*

The lighting of the mines and installations and by trucks along the mining roads can impact some animals:

- Reduce the use of lighting to what is absolutely required for safety;

- Consider the use of directional lighting to avoid lighting non-essential areas such as the sky or areas outside the work area;
- Consider the use of screens to limit the lighted area;
- Use timers or movement detectors where constant lighting is not required;
- Use fairly low lighting towers to reduce non-essential lighting;
- Vehicles should use low beams except if security conditions require the use of high beams;
- Ensure that interior areas are not over-illuminated. Indoor illumination can have impacts outside via windows and doors; and
- In some cases these light may have an impact on bats. These effects may be linked to the attraction of insects coming to the light or by avoidance of lit areas. In the case of attraction of insects, this can be reduced by using sodium lights.

4.8.4.7 Measures concerning dredging (Kamsar)

At the date the biology report was finished, there were no details on the type and techniques of dredging to be used during the enlargement of the turning basin by the quay. Dredging has the potential to be the cause of significant impacts on at least one *Endangered* species in the Rio Nuñez Estuary. This is biologically important and because according to Performance Standard 6 of the IFC, such impacts in a critical habitat are problematical for the Project.

- Implicate the biologists of the team in discussion on dredging;
- A critical species is the blackchin guitarfish (*Rhinobatos cemiculus* [= *Glaucostegus cemiculus*]). This benthic fish is considered *Endangered* according to the IUCN, it is present in the estuary and fairly close to the quay and is important for artisanal fishing. The reproduction period is September to October and it is likely the most important period for this species. It is therefore recommended that, if possible, dredging be avoided from August to January. The study for marine mammals and reptiles for this ESIA concluded that there was no particularly critical time for the other important species in the estuary;
- Dredging should be done using methods that minimize impacts on marine turtles, notably by avoiding the use of trailing suction dragheads that can

wound turtles by the action of their sucking heads. If there is no alternative, turtle-shields or other means should be used (see Dickerson et al., 2004)

4.8.4.8 Construction of conveyors and extension of the quay (Kamsar)

The construction of the extension to the quay and potentially the construction of new conveyors will occur in an area of critical habitat (the waters and mangroves of the Rio Nuñez Estuary). The critical impact will likely be the underwater noise produced by construction activities (construction of pilings, explosives, drilling).

- Avoid noise levels above the injurious threshold proposed by Southall et al. (2007) for cetaceans. These levels are sound pressure levels of 230 dB re: 1 μ Pa and sound exposure levels of 198 dB re: 1 μ Pa²-s for single- or multi-pulse acoustic sources such as piling, and sound exposure level of 215 dB re: 1 μ Pa²-s for non-pulse sound sources such as drilling);
- These levels can be avoided by using the measures described in the report on marine mammals and reptiles of this ESIA (Annexe 3-2 p. 63-64); and
- Minimize impacts on mangroves during the construction of conveyors; in particular minimize destruction during construction access. See the measures recommended for clearing at Sangarédi.

4.8.4.9 Measures to avoid collisions between animals and ships (Kamsar)

The Project Expansion assumes that the number of ore ships will double. Additionally there will be an increase in other ships (dredges, tugs and launches). The possibility of collisions between ships and large marine animals (dolphins, manatees, crocodiles and marine turtles) will thus increase considerably. The risks of collisions can be reduce through the use of the following measures:

- Impose a speed limit for ships. A maximum speed of 18.5 km/hr protects certain cetaceans (Conn and Silber, 2013) and a maximum speed of 7 to 11 km/hr protects manatees (Laist and Shaw, 2006). Therefore a general limit of 18.5 km/hr associated with a limit of 11 km/hr or less within less than 100 m of the coast should protect many species;

- Collisions between boats and animals are often the result of frequent changes in boat heading that make it difficult for animals to track and avoid the boat. Consequently, vessels should be reminded to maintain a steady heading when possible. When vessels are required to maneuver continuously, a slower vessel speed should be implemented.
- Produce and distribute a brochure that explains the importance of protecting animals in the estuary and the means of reducing the problems;
- Select construction vessels that have ducted or cowled propellers; and
- Any collision with a substantial animal (cetacean, manatee, crocodile, marine turtle) should be reported to the environmental inspector. If possible the animal should be taken and data recorded by the inspector (photos, measurements, samples, etc.).

4.8.4.10 Measures to avoid collisions between animals and vehicles (Sangarédi)

The risks of collisions are particularly real in the case of the mining road network in Sangarédi (see additional study in Section 4.8.3.2). Certain general measures can be considered and applied to other situations:

- Specify and apply severely a speed limit for all Project vehicles. To the extent that CBG allows access to its roads by others, CBG should also apply this limit to others. There are few studies that clearly determine the effects of speed reduction on accidents with animals. One of these studies (Gunther, Biel, and Robison, 1998) suggests a very significant decrease in accidents in going from 88 km/hr to 72 km/hr. One study (Hobday, 2010) shows that a car must travel at less than 60 km/hr at night to avoid collision with a dark animal (like a chimpanzee). For large trucks, the ideal speed at night would of course be less. Clearly a speed limit can only have an impact if it is enforced;
- Have drivers follow courses that will include sensitization to environmental issues in general and risks of collisions in particular; and
- Drivers will have to keep a log of observations of large animals seen (alive or dead) and of collisions with large animals. The inspector will have to be notified in case of a dead animal so as to get information (photos, measurements, samples, etc.).

4.8.4.11 *Measures concerning invasive species*

Clearing and changes in habitats are often favorable for certain invasive species, often not native to the area. These species can compete with local species and reduce the biodiversity value. Among the measures to take:

- *Chromolaena odorata* is an invasive species from the Neotropical zone and was seen in several places around Sangarédi. This plant is considered to be a great danger for tropical forests (Grice and Setter, 2003; Struhsaker, Struhsaker and Siex, 2004), and poses environmental problems in West Africa. It should be destroyed wherever it is found in the Project area; and
- *Anacardium occidentale* (cashew tree) is present in certain plantations and has been planted in some CBG rehabilitated mines. It is not native to Guinea (from South America) and it poses a certain invasive danger. The approach to rehabilitation should be reviewed and local species used.

4.8.4.12 *Measures for rehabilitation (everywhere but especially Sangarédi)*

Ideally the goal of rehabilitation is to re-establish the habitats that were there before the intervention and in certain cases even to create habitats of higher value. Most of the habitats to rehabilitate will be on the exploited mines. This topic is approached in the action plan for mine rehabilitation. However certain general measures also applicable to rehabilitation in other areas, are listed here:

- Avoid using exotic species;
- Use local species that can contribute to the ecosystemic value of the habitat;
- On the bowals, use species that are typical of bowal vegetation;
- Put back the soil that was stripped as it is a veritable seed bank of species that are locally adapted; and
- If necessary consider the possibility of nurseries of local species, some taken during clearing.

4.8.5 Management and actions plans for the protection of biodiversity

4.8.5.1 *Measures required under Performance Standard 6 of the IFC*

Performance Standard 6 of the IFC explains the measures to be taken if the Project impacts natural or critical habitats (as explained in Annexe 4-2, the modified habitats of the IFC are not involved and the protected areas are not directly impacted).

For natural habitats, the IFC specifies the search for an alternative, consultation with stakeholders and the use of mitigation measures. The mitigation measures strive to ensure no net loss of biodiversity. The measures can include:

- Avoiding impacts on biodiversity through the identification and protection of set asides;
- Implementing measures to minimize habitat fragmentation, such as biological corridors;
- Restoring habitats during operations and/or after operations; and
- Implementing biodiversity offsets.

For critical habitat, it must be shown that the activities of the project fulfill the required conditions of Paragraph 17 (see Annexe 4.2). Paragraph 18 says:

In such cases where a client is able to meet the requirements defined in paragraph 17, the project's mitigation strategy will be described in a biodiversity action Plan and will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.

It is this clear that in the two cases (natural habitat and critical habitat), measures beyond classis mitigation measures described in the preceding sections must be applied. These protection measures, set-asides, corridor creation, et al., must be described in one more action plans.

Although the emphasis here is on the requirements of the IFC, such plans may also be required under the laws, action plans and conventions of Guinea.

All action plans must also include monitoring measures. These are described separately in Section 4.9.

The following subsections describe the plans to put into place to arrive at the request of the IFC. These plans will obviously have to be detailed with the progress of the Project (specifically with the data from the additional studies described earlier). Nevertheless the plans described here and the monitoring measures described in Section 4.9 give the essential elements of an action plan on biodiversity.

Fieldwork undertaken in 2013 demonstrated the presence of numerous species considered important from the perspective of biodiversity conservation. The additional studies and monitoring measures will reinforce these data. The presence of these species justifies putting in place a protection and management system in the Study Areas. The following action plans are intended to protect all the elements of the ecological systems of the Study Areas, even those species whose presence is not yet recognized

4.8.5.2 Development of a mine rehabilitation plan (Sangarédi)

A good and rapid rehabilitation of the mines as soon as extraction is complete is an essential point of any biodiversity protection plan. This is particularly true when there is a series of small zones to mine, spread out in the concession. Ideally the rehabilitation should be a return of the land to its initial roles as natural habitat or agricultural land, this as quickly as possible and in a permanent way. The 2014 Mining Plan is a big step forward from the environmental point of view compared to the 2013 Mining Plan because it specifies the use of contiguous mining areas at the same time. This not only reduces the impacts linked to spread-out mines, but also allows planning rehabilitation of an area shortly after its use.

The question of the rehabilitation of the mines is complex and must consider not only biological aspects but also social and economic ones:

- The plan must be seen by CBG as one of the approaches to satisfy Performance Standard 6 of the IFC. The plan will demand efforts and costs from CBG;
- This plan must of course include besides CBG, local stakeholders, notably local residents and villages

- The rehabilitation plan must also include biologists, agricultural experts and sociologists, familiar with the local situation;
- The goals of the plan must be to: specify the rehabilitation measures, clarify the status of the rehabilitated areas (notably vis-à-vis the local populations); determine a schedule for rehabilitation; and determine monitoring measures for rehabilitation;
- It will be important to explain well the reason for the plan and how it will work to residents. Without the support of the local populations, the plan will not be effective;
- A schedule must be established at the beginning of the plan development;
- A list of people responsible and participants will be established as soon as possible;
- An annual report must be published each year that describes what was done and decided and what remains to; and
- The development of the plan will finish upon the production of the final plan that will establish more precise actions.

4.8.5.3 Development of a mining road management plan for bushmeat hunting

It is very probable that without mitigations measures there will be an increase in bushmeat hunting linked to the development of a road network that will allow easier and more rapid access to locations currently fairly isolated. The use of the existing mine road network by private citizens is evident. The development of the new road network may occur over existing roads and any closure of the roads would leave residents of several villages totally isolated. The need for a management plan will follow the additional study on mining roads that was recommended. If a plan is necessary it will have to include the following elements:

- This plan must of course include besides CBG, local stakeholders, notably local (residents, villages and the commune of Sangarédi) and government agencies;
- The plan must also include one or two competent biologists, familiar with the local situation;

- The goal of the plan is not to limit or forbid legal hunting acts but to target illegal acts that put animal species in peril. In fact, all commerce of bushmeat is forbidden in Guinea except with a special ministerial agreement;
- The goals of the plan must be to: ensure that the mining roads do not become an easier means of transport for bushmeat; determine a realistic schedule; and determine monitoring measures;
- It will be important to explain well the reason for the plan and how it will work to residents. Without the support of the local populations, the plan will not be effective;
- A schedule must be established at the beginning of the plan development;
- A list of people responsible and participants will be established as soon as possible;
- An annual report must be published each year that describes what was done and decided and what remains to; and
- The development of the plan will finish upon the production of the final plan that will establish more precise actions.

4.8.5.4 Development of a mining road management plan for woodfuel harvesting

It is very probable that without mitigations measures there will be an increase in woodfuel harvesting linked to the development of a road network that will allow easier and more rapid access to locations currently fairly isolated (as for bushmeat, described above). The need for a management plan will follow the additional study on mining roads that was recommended. If a plan is necessary it will have to include the following elements:

- This plan must of course include besides CBG, local stakeholders, notably local (residents, villages and the commune of Sangarédi) and government agencies;
- The plan must also include one or two competent biologists, familiar with the local situation;
- The goal of the plan is not to limit or forbid woodfuel harvesting but to ensure that the new means of transport do not put the resource or harvesting by residents in danger;

- The goals of the plan must be to: ensure that the mining roads do not become an easier means of transport for woodfuel by persons not living in the area; determine a realistic schedule; and determine monitoring measures;
- It will be important to explain well the reason for the plan and how it will work to residents. Without the support of the local populations, the plan will not be effective;
- A schedule must be established at the beginning of the plan development;
- A list of people responsible and participants will be established as soon as possible;
- An annual report must be published each year that describes what was done and decided and what remains to; and
- The development of the plan will finish upon the production of the final plan that will establish more precise actions.

4.8.5.5 Development of a forest protection plan (Sangarédi)

It is clear that the forests that still exist in the Sangarédi area are the most critical habitats of the area. Nearly all of the dense forests that still exist are along watercourses in the form of gallery forests. The protection of the forests also ensures the protection of the watercourses of the valleys.

- The plan must be seen by CBG as one of the approaches to satisfy Performance Standard 6 of the IFC. The plan will demand efforts and costs from CBG;
- This plan must of course include besides CBG, local stakeholders, notably local (residents, villages and the commune of Sangarédi) and government agencies;
- An effort should be made to also include other mining companies, with neighboring concessions. Their support could help build a regional approach that would extend beyond the limits of the Study Area;
- The plan must also include one or two competent biologists, familiar with the local situation;
- The goals of this plan must be to protect ecosystems and the important species that inhabit them (chimpanzee, mangabey, African golden cat, rare plants, reptiles, amphibians and fish); protect remnant habitat; promote the

restoration of key habitats to ensure or bring back an effective corridor role to the gallery forests; determine a realistic schedule; and determine monitoring measures;

- The determination of a functional corridor is complex and requires knowledge about the animals that are supposed to use the corridors. Corridors that are too narrow may not fulfill their roles;
- As the plan must in part be considered a compensation measure by CBG for the destruction of natural habitats on future mines, the surface area of the areas to protect and the corridors to create must at least be comparable to the surface area lost: 3,200 ha. This surface area is approximate and may evolve to consider losses linked to the road network (when there will be enough data on this topic) and impacts outside of the area to be cleared (impact from noises, dust, etc.). The plan may also take into account rehabilitated mine areas if these are devoted solely to the restoration of natural habitat. An important part of the to surface area (at least half) must be devoted to the creation of new forest habitat linked to the existing gallery forests to improve their role as corridors;
- It will be important to explain well the reason for the plan and how it will work to residents. Without the support of the local populations, the plan will not be effective;
- A schedule must be established at the beginning of the plan development;
- A list of people responsible and participants will be established as soon as possible;
- An annual report must be published each year that describes what was done and decided and what remains to; and
- The development of the plan will finish upon the production of the final plan that will establish more precise actions.

4.8.5.6 Development of a bowal protection plan

It may seem paradoxical to suggest a bowal vegetation protection plan when the bowals of Sangarédi do not seem to have species of high status. Nevertheless the bowals of the Sangarédi region often coincide with the bauxite areas to be mined. It is not impossible that the mining of bauxite by CBG and other nearby mining companies could result in a marked decrease of the area of bowals and their specific vegetation. Thus it is reasonable to ensure that that vegetation of the bowals does

not disappear. It is also necessary to take into account the presence of some animals specific to this type of vegetation.

- The botanists that will do the additional studies will determine for each new area to mine the percentage of the bowal vegetation that will be eliminated; and
- If the percentage is over 50% a study will have to be done to determine approaches for the protection of a minimum population.

4.8.5.7 Development of a Cogon Corridor protection plan

The valley of the Cogon in the Study Area is clearly important from the biological point of view. Even more, the valley of the Cogon viewed in a larger context deserves to be considered at the regional level, as the valley still seems to be acting as an important regional corridor. A plan such as this can only succeed with the participation of mining companies holding concessions along the Cogon.

- The plan must be seen by CBG as one of the approaches to satisfy Performance Standard 6 of the IFC. The plan will demand efforts and costs from CBG;
- This plan must of course include besides CBG, local stakeholders, notably local (residents, villages and the commune of Sangarédi) and government agencies;
- The participation of other mining companies, with neighboring concessions, is of course essential. Their support could help build a regional approach that would extend beyond the limits of the Study Area. The Government of Guinea and the IFC could encourage other companies to participate;
- The plan must also include one or two competent biologists, familiar with the local situation;
- CBG should take the role of initiator of the discussions;
- The goals of the plan must be to: protect important species present (chimpanzee, new population of red colobus, hippopotamus); protect the remaining habitat; promote the restoration of key habitats to ensure or restore the role of regional corridor; protect local resources such as artisanal fishing; determine a realistic schedule; and determine monitoring measures;
- In this case, the identification of a wide corridor going to the heights of the plateaus is needed;

- It will be important to explain well the reason for the plan and how it will work to residents. Without the support of the local populations, the plan will not be effective;
- A schedule must be established at the beginning of the plan development;
- A list of people responsible and participants will be established as soon as possible;
- An annual report must be published each year that describes what was done and decided and what remains to; and
- The development of the plan will finish upon the production of the final plan that will establish more precise actions.

4.8.5.8 Development of a Rio Nuñez Estuary protection plan

The Rio Nuñez Estuary is a critical habitat but the situation is very different from the Sangarédi area where CBG has a mining concession that covers a large surface area and where CBG can exercise a major role in its protection. For the Rio Nuñez Estuary there are several groups having rights, including local and foreign fishermen, and undoubtedly soon other mining companies. More than in Sangarédi, a protection plan here must include large number of actors, including of course the Government of Guinea. Only an integrated approach will allow the management of the estuary for the good of all and of biodiversity.

- The plan must be seen by CBG as one of the approaches to satisfy Performance Standard 6 of the IFC. The plan will demand efforts and costs from CBG;
- This plan must of course include besides CBG, local stakeholders, notably local (residents, villages and the commune of Kamsar), government agencies and mining companies that might locate here;
- CBG should take the role of initiator of the discussions;
- The plan must also include one or two competent biologists, familiar with the local situation;
- The goals of the plan must be to: protect important species (dolphin, manatee, aquatic birds, marine turtles, crocodiles, marine fish); protect key habitats (mangrove, mud flats); protect artisanal fishing; plan the port installations in a sustainable fashion; determine a realistic schedule; and determine monitoring measures;

- It will be important to explain well the reason for the plan and how it will work to residents. Without the support of the local populations, the plan will not be effective;
- A schedule must be established at the beginning of the plan development;
- A list of people responsible and participants will be established as soon as possible;
- An annual report must be published each year that describes what was done and decided and what remains to; and
- The development of the plan will finish upon the production of the final plan that will establish more precise actions.

4.8.6 Communication measures

4.8.6.1 *Annual report of the environmental inspector*

It is essential to regularly communicate the environmental results and observations:

- The environmental inspector is responsible for the annual report;
- The annual report must be addressed to responsible parties at the CBG, to government agencies and to local stakeholders. In some cases it may also be judicious to send copies to the IFC, interested NGOs and other interested parties. Distribution of the report by public download via the Internet is recommended and would be a sign of good faith;
- The environmental inspector should be seconded by competent external biologists for the report writing;
- The report should contain the results of observations of incidents and animal observations (including those of drivers, site supervisors and others);
- The report should also contain the proceedings of all meetings held with the public or government agencies dealing with environmental matters; and
- The report should also include a copy of all of the final or annual reports regarding the varied environmental work underway during the year (additional studies, action plans and monitoring reports).

4.8.6.2 *Communications with the public*

Besides the annual report, the environmental inspector will be responsible for communications with the residents. These communications must include:

- Regular meetings with residents to explain what is happening;
- Special meetings when there are incidents or when a new mining area opens;
- Communications via radio and newspapers;
- Brochures; and
- An Internet site.

4.9 Monitoring measures

4.9.1 Introduction

A monitoring program is a requirement for verifying impact predictions and the efficiency of mitigation measures. Some of the mitigation measures already include monitoring measures and the protection plans will undoubtedly establish other specific monitoring measures. Certain aspects are already recommended by other disciplines (for example water quality monitoring). Monitoring measures described here are those not already included in the preceding section and that merit consideration.

A good monitoring program must be doable. For example it would be theoretically desirable to verify the continued presence of certain rare species such as the endemic frog (*Phrynobatrachus pintoii*) or certain reptiles (*Philothamnus cf semivariiegatus*, *Cynisca cf oligopholis*, and *Hemidactylus kundaensis*). Unfortunately it is not clear that it would be possible to verify fluctuations in numbers of these species, not very visible and present in very low numbers. An approach by habitat would also be useful but very complex.

4.9.2 Reports

Each year the persons responsible for the monitoring will have to submit a report detailing the fieldwork, the results, the conclusions and the recommendations. This report will have to be transmitted to all of the applicable stakeholders and, if possible, put on an Internet site for public download.

4.9.3 Primates at Sangarédi

Monitoring of chimpanzees is very desirable. It is an *Endangered* species, present in critical habitats in the Sangarédi area. Chimpanzee monitoring will also allow verification of measures to preserve these critical habitats. Chimpanzees are relatively numerous and fairly easy to see (individuals and nests in trees). During the monitoring for chimpanzees, it will be important to follow the evolution of other

threatened primates in the area (red colobus, sooty mangabey and others whose presence are not yet confirmed).

The choice of consultant for this monitoring program will have to be based mainly on competence doing this type of work.

The details of the monitoring protocol will have to be established by the consultant in charge of the monitoring program and approved by government agencies but should:

- Have the clearly stated goal of following the fluctuations of primate populations, particularly primates;
- Cover the environmental Study Area for Sangarédi for the ESIA of the Expansion Project but potentially targeting preferentially areas close to the new mining areas;
- Allow for sufficiently frequent field studies (probably annually) to be able to detect changes quickly;
- Follow recommendations from the most recent studies on inventory methods for primates (for example H. Kuhl, F. Maisels, M. Ancrenaz and E.A. Williamson (2008). *Best Practice Guidelines for Surveys and Monitoring of Great Ape Populations*. Gland, Switzerland: IUCN SSC Primate Specialist Group);
- Include recommendations in case of substantial population decreases; and
- Provide competent field biologists

4.9.4 Hippopotamus at Sangarédi

Hippopotamus are one of the species using the Cogon Corridor. The IUCN status of this species is being revised and could change. In addition they are fairly easy to see and therefore easy to monitor. The monitoring could also be helped by information from residents. Monitoring of hippopotamus could also be the opportunity to monitor other species along the river.

The choice of consultant for this monitoring program will have to be based mainly on competence doing this type of work.

The details of the monitoring protocol will have to be established by the consultant in charge of the monitoring program and approved by government agencies but should:

- Have the clearly stated goal of following the fluctuations of hippopotamus populations along the Cogon;
- Cover the environmental Study Area for Sangarédi for the ESIA of the Expansion Project but preferentially targeting the Cogon Corridor;
- Allow for sufficiently frequent field studies (probably annually) to be able to detect changes quickly;
- Include recommendations in case of substantial population decreases; and
- Provide competent field biologists

4.9.5 Atlantic humpback dolphin at Kamsar

The Atlantic humpback dolphin is an IUCN Vulnerable species and there is a good population in the Rio Nuñez Estuary. The species is fairly easy to see and individuals can be recognized by differences in their fins. It is a type of species likely to be sensitive to disturbance.

The choice of consultant for this monitoring program will have to be based mainly on competence doing this type of work.

The details of the monitoring protocol will have to be established by the consultant in charge of the monitoring program and approved by government agencies but should:

- Have the clearly stated goal of following the fluctuations of dolphin populations in the Rio Nuñez Estuary;
- Cover the environmental Study Area for Kamsar for the ESIA of the Expansion Project;
- Allow for sufficiently frequent field studies (probably annually) to be able to detect changes quickly;
- Follow recommendations from the most recent studies on inventory methods for dolphins, particularly methods using the identification of individuals (for example Parsons, K. M. 2010. *Procedural Guideline No. 4–5 Using*

photographic identification techniques for assessing bottlenose dolphin (Tursiops truncatus) abundance and behaviour dans Marine Monitoring Handbook March 2001. Joint Nature Conservation Committee);

- Include recommendations in case of substantial population decreases; and
- Provide competent field biologists.

4.9.6 Revisions

A good monitoring program is not static but is continually modified in view of the monitoring results. It is highly probable that following the initial results, modifications in methodology or target species may be recommended. These modifications should be considered and implemented.

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