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Environmental and Social Impact Assessment of the CBG Mine Extension Project

Chapter 9 – Cumulative Impact Assessment

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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.
ANAİM:	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]
BGÉEÉ:	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:	<i>Chiffre d'affaires</i> [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:** *Commune rurale* [rural commune]
- CRD:** *Commune rurale de développement* [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:** Union internationale pour la conservation de la nature / 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:** *Virus de l'immunodéficience humaine* / human immunodeficiency virus (HIV)
- WB:** World Bank / Banque Mondiale (BM)
- WHO:** World Health Organization / Organisation mondiale de la Santé (OMS)
- ZÉE:** *Zone économique exclusive de la Guinée* [Guinea economic exclusive zone]
- ZICO:** *Zone importante pour la conservation des oiseaux* / important bird area (IBA)

CHAPTER 9 – CUMULATIVE IMPACT ASSESSMENT

9.1 Methodology

The purpose of the Cumulative Impact Assessment (CIA) is to anticipate past, present or future actions or projects that might interact with the Project collectively and generate significant changes. Such projects must be inventoried before the cumulative impacts can be assessed.

For the Cumulative Impact Assessment, the environmental and social study team analyzed the direct and indirect social and environmental impacts of the Extension Project. It then compiled a list of historical, current or planned developments or activities in the ESIA Study Area, in order to assess the cumulative impact caused by interaction between the CBG Extension Project and other activities in the region.

9.1.1 Regulatory framework

The cumulative impact was assessed in accordance with the guidelines of the Canadian Environmental Assessment Agency (CEAA, *Cumulative Effects Assessment Practitioners' Guide*, February 1999), and several other applicable directives and regulations. These guidelines set the following criteria for the study:

- “The study area is large enough to allow the assessment of Valued Ecosystem Components (VECs) that may be affected by the action being assessed. This may result in an area that is considerably larger than the action's "footprint". Each VEC may have a different study area.
- Other actions that have occurred, exist, or may yet occur which may also affect those same VECs are identified. Future actions that are approved within the study area must be considered; officially announced and reasonably foreseeable actions should be considered if they may affect those VECs and there is enough information about them to assess their effects. Some of these actions may be outside the study area if their influence extends for considerable distances and length of time.

- The total effect of the proposed action and other actions on the VECs is assessed.
- These total effects are compared with thresholds or policies, if available, and implications for the VECs are assessed.
- The analysis of these effects uses quantitative techniques, if available, based on best available data. This should be enhanced by qualitative discussion based on best professional judgment.
- Impact mitigation, monitoring and management are recommended (e.g., as part of an Environmental Protection Plan). These measures may be required at a regional scale (possibly requiring the involvement of other stakeholders) to address broader concerns regarding effects on VECs.
- The significance of residual effects is clearly stated and defended.”

IFC standards for cumulative impact assessment (International Financial Corporation, *Good Practice Note – Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets*, 2012) are also observed. According to these standards, cumulative impact assessment must take into account the findings of all impact studies on other projects and all available environmental and social baseline data for the study area. A process similar to the ESIA method must be applied, and must include potential risks and impacts from past projects, as well as any probable or potential project in the region. As in the ESIA, quantitative data must be provided wherever possible, and discrepancies in the data must be understood and justified. Regional mitigation measures must be identified and developed in conjunction with regional stakeholders, government representatives and representatives of other projects located within the CIA study area.

Bauxite extraction is also governed by the 2011 Mining Code, which constitutes the legal cornerstone of the government strategy on foreign mining projects and investments: “The purpose of this Mining Code is (...) to encourage the exploration for and development of mineral resources so as to promote Guinea’s economic and social development. It further seeks to promote a systematic and transparent management of the mining sector which guarantees sustainable economic and social benefits for the Guinean people, within the framework of a mutually beneficial partnership with investors.” (Article 2: Purpose of the Act, Chapter II: Legal Framework of the Mining Sector, Mining Code of the Republic of Guinea, p.15)

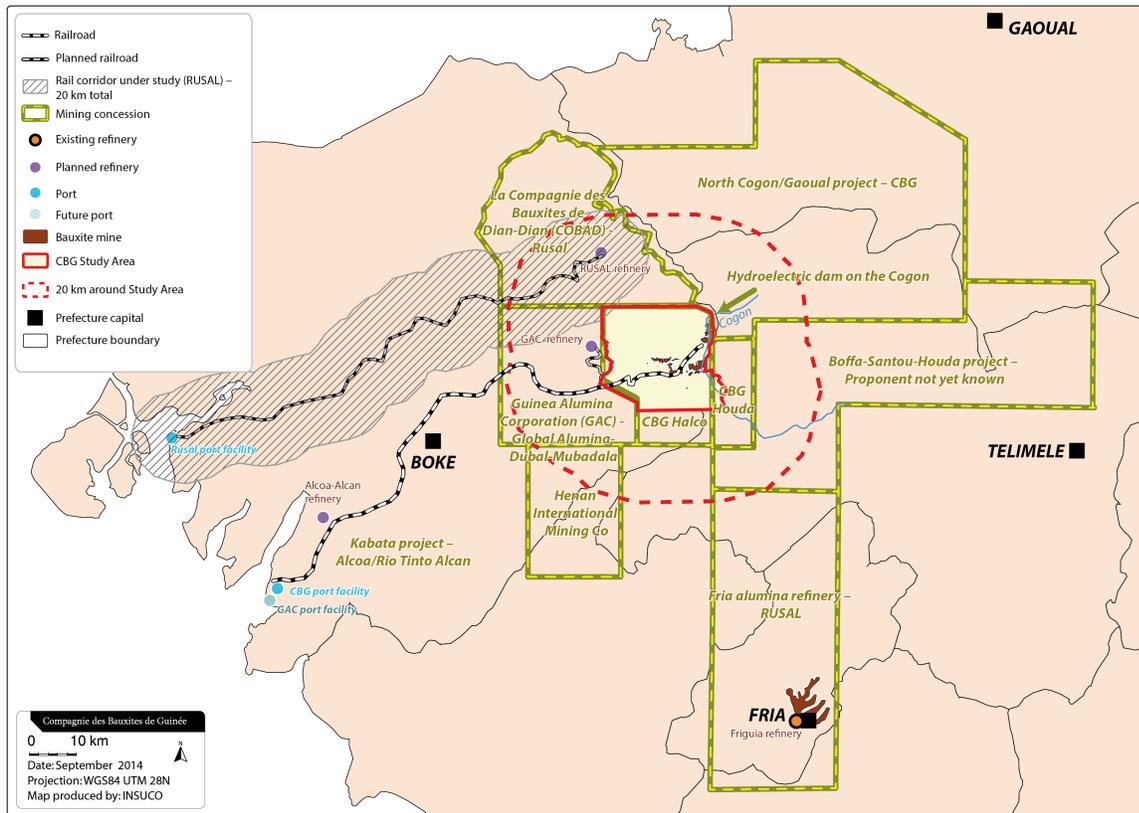
Article 37 states the requirements for the granting of a mining concession, one of which is to produce a feasibility study including [translation] “a plan for developing and exploiting the deposit, including an Environmental and Social Impact Study accompanied by the results from the public inquiry, a plan for mitigating negative impacts and optimizing positive impacts, and a Social and Environmental Management Plan including a hygiene impact study and a basic hygiene development plan approved by the Comité d’Évaluation des Impacts Sanitaires et Environnementaux (C.E.I.S.E.).” (Article 37: Grant, Section III: Mining Concessions, Mining Code of the Republic of Guinea, p. 30)

9.1.2 Study areas

The CIA study areas cover the same three CBG sites as the ESIA: the Sangarédi mining area, the railroad network and the Kamsar plant (including the port).

9.1.2.1 Sangarédi mining area (Zone 1)

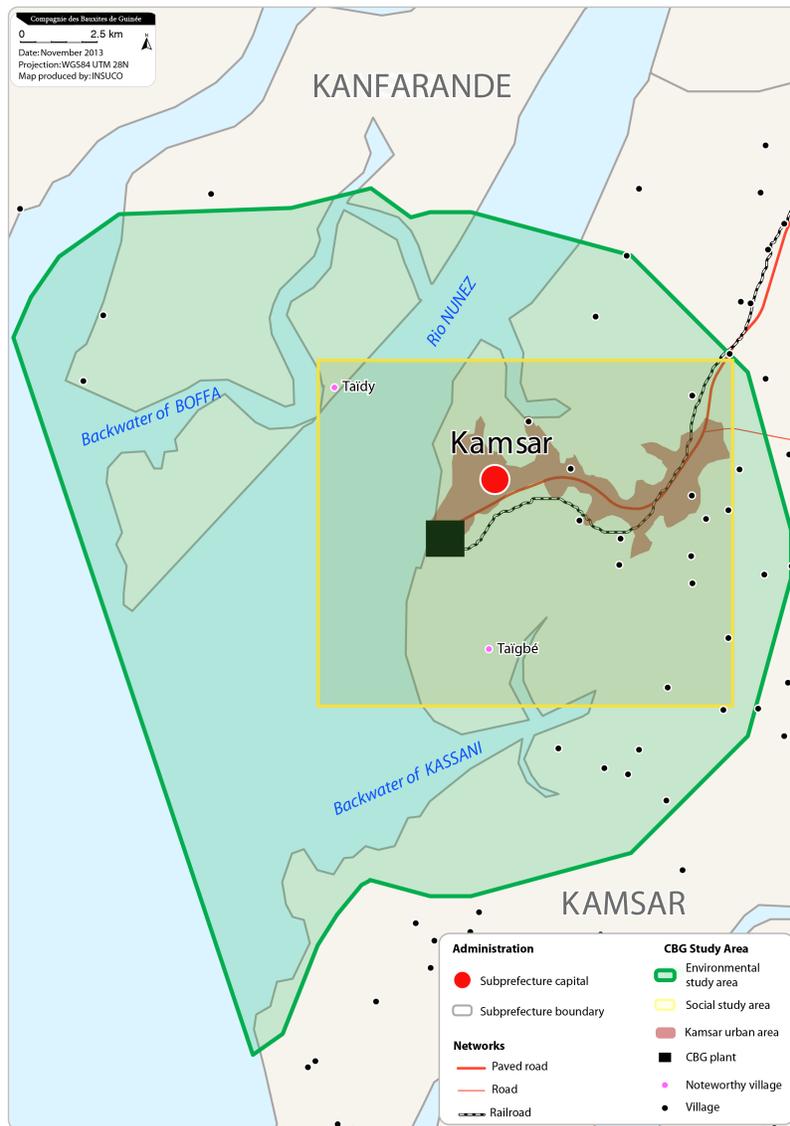
Map 9-1 Location of Zone 1 for Cumulative Impact Assessment



The Environmental Study Area covers nearly 400 km² around Sangarédi and encompasses the CBG/Halco mining concession. For the CIA, this area is augmented by a 20-km peripheral strip in order to include adjacent mining projects and show the cumulative impacts.

9.1.2.2 Kamsar plant area (Zone 2)

Map 9-2 Location of Zone 2 for Cumulative Impact Assessment



Zone 2 (Kamsar plant) is the same as the Zone 2 used in the ESIA, since it is based on a conservative estimate of the scope of the potential impacts. Moreover, potential developments around Kamsar are liable to be concentrated near the CBG plant and the port. The impacts of projects associated with or located near the Kamsar plant could exacerbate those of the CBG Project.

9.1.2.3 Railroad network (Zone 3)

Zone 3, the railroad network, is the same as the Zone 3 used in the ESIA. The impacts of projects associated with or located near the railroad network could exacerbate those of the CBG Project.

9.1.3 Study boundaries

The CIA has two types of significant boundaries, including those stated in the guidelines of the Canadian Environmental Assessment Agency (CEAA, *Cumulative Effects Assessment Practitioners' Guide*, February 1999):

- *spatial boundaries*: "EIAs have traditionally involved defining more or less arbitrary boundaries around action sites that are often local and limited to the effects of the single action. CEA, by definition, expands those spatial horizons."
- *temporal boundaries*: "'How far back in time" and "how far ahead in the future" to consider in an assessment depends on what the assessment is trying to accomplish. Comparison of incremental changes over time requires the use of historical records for establishing an environmental baseline. The possibility of new actions requires the need to look ahead into the future. (...) In practice, temporal boundaries often first reflect the operational life or phases of the action under review (e.g., exploration, construction, operations, abandonment), and then extend to reflect the life of all actions under progressively greater levels of regional development. In either case, the scenarios are often associated with a single year or range of years."

Other boundaries complicate or restrict the assessment of cumulative impacts:

- *dimensional boundaries*: Differences in project size introduce uncertainty into any rigorous assessment of cumulative impacts, since it can be difficult to identify the impacts of small projects;
- *typological boundaries*: The presence of different types of projects in the Study Area poses a problem, since different methodologies and assessment criteria are used for different project types;
- *operational boundaries*: Project uncertainty or abandonment at a given stage of development presents an obstacle to determining that project's importance

in the assessment, since the project is not far enough along to be able to yield a sufficient amount of environmental and engineering data;

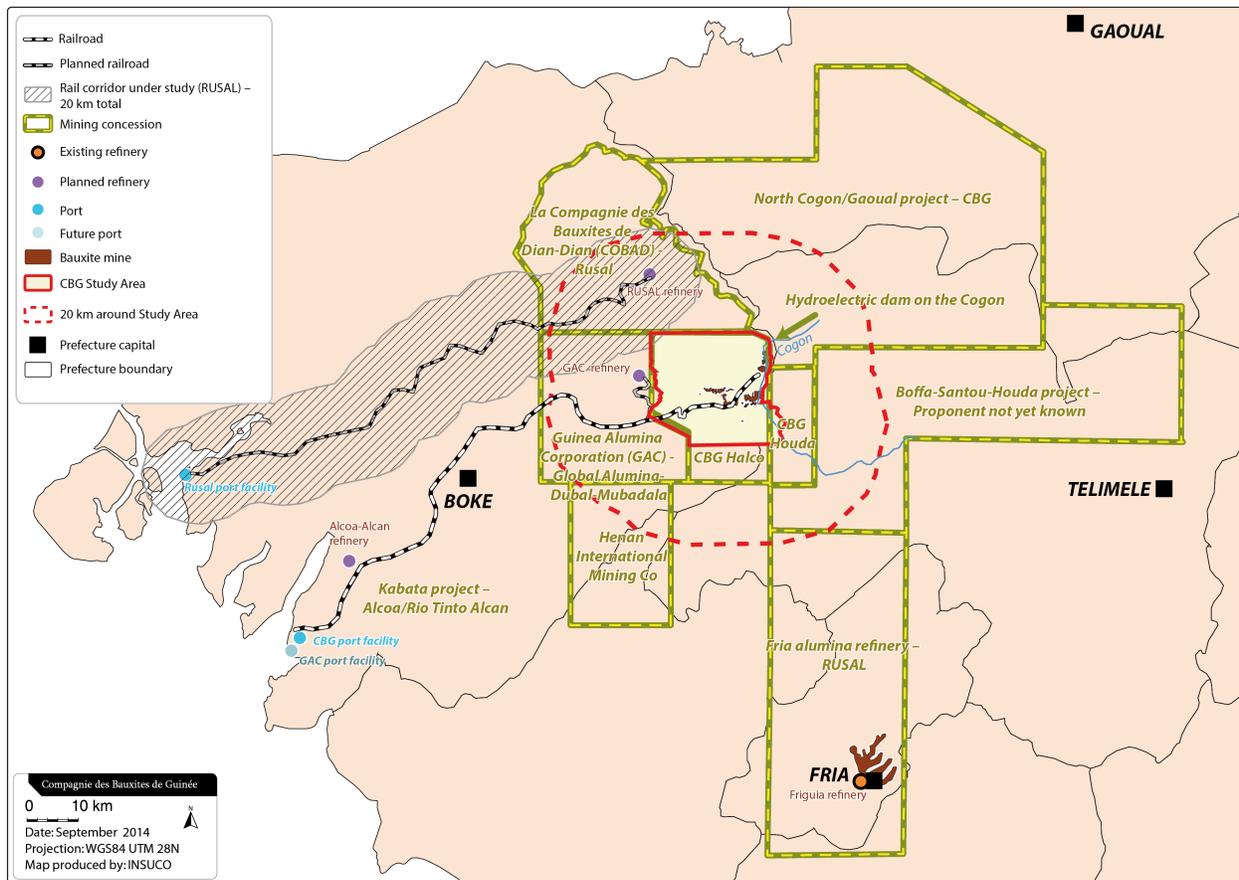
- political boundaries: The lack of cooperation in data sharing is noted when other projects in the Study Area do not make their environmental and social technical data available for a cumulative impact assessment. Some of this information may be sensitive if published and could have negative consequences for the company and/or the stakeholders.

As it turns out, the limited availability of data and information has limited the CIA to a qualitative analysis of the converging impacts and cumulative project effects.

9.2 Projects in the study areas

An important aim of the Cumulative Impact Assessment is to determine which of the many developments taking place in the CIA study areas (Sangarédi, the railroad corridor and Kamsar) (Map 9-3) are relevant to the analysis.

Map 9-3 Other projects in the study areas



The CBG Extension Project is one of many projects planned or operating in the study areas and capable of generating cumulative impacts. They are listed in the following table (Table 9-1):

Table 9-1 Projects taken into account in Cumulative Impact Assessment

Project	Sangarédi CIA Study Area	Railroad corridor	Kamsar Environmental Study Area
Guinea Alumina Corporation (GAC) - Global Alumina-DUBAL-Mubadala	√	√	√
Dian-Dian - RUSAL-COBAD	√	Uncertain	Uncertain
Hydroelectric dam on the Cogon	√	N/A	N/A
North Cogon/Gaoual project - CBG	√	√	√
Boffa-Santou-Houda projects – Proponents not known	√	N/A	N/A
Fria project - RUSAL	√	N/A	N/A
Kabata project - Alcoa/Rio Tinto Alcan		√	Uncertain
Boké alumina refinery - Henan International Mining Company	√	Uncertain	Uncertain

The next sections will provide an overview of the projects mentioned in Table 9-1.

9.2.1 Guinea Alumina Corporation (GAC) – Global Alumina-DUBAL-Mubadala

Project	Proponent	Stage	Location
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Guinea Alumina Corporation (GAC)	Emirates Global Aluminium (Mubadala)	ESIA	Bordering on the west side of the CBG concession
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This project involves mining bauxite west of Sangarédi (on-site conversion into alumina is under study) and shipping it, via the same railroad used by CBG, to a port terminal adjacent to the CBG treatment plant in Kamsar. GAC is now starting exploration on bauxite plateaus in the Wossou and Soucka areas, just south of Zone 1. The port that GAC would build would use the same channel as CBG and could eventually become a service platform for various mining projects in the area. An impact assessment of the project was conducted in 2008, and some parts of it are now being updated.

9.2.2 Dian-Dian project – RUSAL-COBAD

Table 9-2 Dian-Dian project - RUSAL-COBAD

Project	Proponent	Stage	Location
Compagnie de Bauxite et d'Alumine de Dian-Dian (COBAD) - RUSAL	RUSAL	Under study	Dian-Dian

Mining has not begun and the implementation plan is still under study. A railroad and a mine road will cross the current study area to reach the Kamsar area, where an ore terminal will be built for exporting. Construction has already begun on a mine road on the outskirts of the village of Boulléré. Before the end of December 2015, a feasibility study will be undertaken to determine whether the mine can produce 3 MTPA of bauxite for export. By the end of December 2019, the mine’s export capacity will have been expanded to 6 MTPA. There are plans for the

construction of an alumina refinery with a capacity of 1.2 MTPA, to be increased as bauxite production increases. The investor has the option of increasing the plant capacity to 2.4 MTPA.

9.2.3 Kabata project - Alcoa/Rio Tinto Alcan

Table 9-3 Kabata project - Alcoa/Rio Tinto Alcan

Project	Proponent	Stage	Location
Kabata	Alcoa-Alcan/Rio Tinto	Under study	Kabata

The Kabata project (RTA and Alcoa) calls for the construction of a refinery to convert CBG “low grade” bauxite into alumina, with an initial capacity of 1.5 MTPA. Through successive expansions, a maximum capacity of 4.5 MTPA could be reached. The refinery would be built near Kamsar and would be connected to the railroad at PK 14. Construction of a port next to the plant is also planned. A pre-feasibility study was conducted in 2009, then resumed after the 2011–2013 financial crisis.

9.2.4 Boffa-Santou-Houda projects – Proponent not known

Table 9-4 Boffa-Santou-Houda projects

Project	Proponent	Stage	Location
Boffa-Santou-Houda	Uncertain	Uncertain	See map

Several bauxite concessions have been inventoried in the prefectures of Boffa, Boké and Téliélé (former BHP-Billiton concessions). Potential buyers are China Investment Corporation (CIC) and Shandong Xinha Aluminum & Electricity Group.

9.2.5 Hydroelectric dam on the Cogon

Table 9-5 Hydroelectric dam on the Cogon

Project	Proponent	Stage	Location
Hydroelectric dam on the Cogon	Government of Guinea	Concept	50 km north of CBG concession

There are plans to build a hydroelectric dam at Tippo, on the Cogon River, between the prefectures of Boké and Gaoual, financed by mining company SEMAFO Inc. and the IFC. However, the project is not active, and no start date is known.

9.2.6 North Cogon/Gaoual project – CBG

Table 9-6 North Cogon/Gaoual project – CBG

Project	Proponent	Stage	Location
North Cogon	Compagnie de Bauxites de Guinée (CBG)	Concept	North of the Cogon River

In 2027, CBG’s operations are to be extended north of the Cogon River. Expansion of the mining areas—and therefore extension of a railroad or a road suitable for land trains (Map 9-3)—was studied as part of the long-term mining plan 2014–2042 (June 2014) but is not part of this ESIA.

9.2.7 Fria project - RUSAL

Table 9-7 Fria project - RUSAL

Project	Proponent	Stage	Location
Fria	RUSAL	Concept	Fria

The Fria refinery shut down in 2012; for the time being, RUSAL’s plans seem limited to bauxite extraction.

9.2.8 Boké alumina refinery – Henan International Mining Co.

Table 9-8 Boké alumina refinery – Henan International Mining Co.

Project	Proponent	Stage	Location
Boké alumina refinery	Henan International Mining Co.	Concept	Boké

The proponent has undertaken to mine the deposits within the perimeters of the exploration licenses granted to it. It plans to build and operate a 10-MTPA bauxite mine and a 1.2-MTPA alumina refinery. It will also build the necessary infrastructure—port, power stations and railroad. The purpose is to sell bauxite and alumina.

9.3 Cumulative impacts

In assessing the disturbance caused by cumulative impacts, we must take the synergistic and delayed effects into account. Beyond simple cause-and-effect, such effects can amplify the disturbance generated by an action when the environment is particularly sensitive. As much as possible, we must superimpose the principal spatial and temporal effects induced by the construction and operation of several large industrial projects within the same area.

9.3.1 Zone 1 - Mine

9.3.1.1 Sources of impacts

The mining area studied in the ESIA is surrounded by other bauxite mining projects (see Map 9-3 and Table 9-1). We have little information on these other projects; however, for the CIA, we can assume that they will have impacts similar to those of the CBG Extension Project. One exception is the GAC project, which involves building an alumina refinery just west of the CBG Extension Project. The dam on the Cogon at Tiopo is still on the drawing board but would no doubt have a significant impact on the region.

Sources of impacts:

1. development of a transportation network made up of roads mainly for accessing mineable areas and hauling out bauxite; and
2. open-pit bauxite mining, leaving a mark on a significant portion of the region.

9.3.1.2 Physical impacts

Air quality

Based on the distances modeled for air quality impacts (particles and gases), the levels of airborne contaminants will not be compounded by adjacent projects, and the modeled maximum concentrations will therefore not be significantly exceeded. A slight regional increase in annual airborne particle concentration is possible.

Noise and vibrations

Based on the distances modeled for noise and vibration impacts, there is no synergistic/compounding effect (i.e., augmentation of maximum levels) from the presence of adjacent projects; the modeled maximum levels should therefore not be exceeded except in specific cases (e.g., villages in the western part of the Study Area near Boulléré). In these specific cases, it is assumed that mining in the two concessions will begin at the same time in the same area, near the concession boundaries. Noise levels at the mine fall to background levels at 3 km or less. Nonetheless, it is clear that the average noise level will increase, due to the presence of several sources. The area at present is very quiet, but places without major noise will become increasingly rare.

Light pollution

Satellite photos of the Sangarédi region taken at night show only the city of Sangarédi and the mine facilities. With the development of other mines working round-the-clock, the entire region will be more lit-up.

Water quality

Normally, the opening of a new mining area should have only local impacts on surface water, often spread over several different watersheds. Cumulative impacts are nevertheless possible: mainly, increased concentrations of aluminum (from airborne deposits and from soil leaching and erosion) and NO_x and SO₂ (from airborne deposits). The cumulative impacts would of course be greater if there were several projects within the same watershed. But an operation in one watershed can still impact another watershed through airborne contaminants.

The planned dam on the Cogon could obviously impact several aspects of water quality, but there is not enough information about the project to speculate about its contribution to the cumulative impacts on water.

Theoretically, cumulative impacts on groundwater are possible, mainly through leaching of explosive residues. However, the chemical characteristics of the groundwater for the Project indicate that this might not be a major problem.

Soil

The development of several mines could aggravate soil loss through stripping and erosion. Soil contamination from other mining operations would increase as well.

9.3.1.3 Biological impacts

Loss of habitat

Habitat loss could become severe, and regional rather than local. Sangarédi is literally surrounded by bauxite mine projects. Many of the bowal habitats in the region could disappear. The loss of pasturage would put pressure on other areas with potentially greater biological value.

Fragmentation

The development of multiple adjacent road networks would have a severe effect on habitats throughout the region, by cutting the remaining habitats into disconnected fragments. This impact could be at least as severe as the loss of habitat.

Air pollution

Some areas close to the mines could have dust deposition levels severe enough to affect vegetation. However, these impacts will no doubt be local, and certainly there will be no synergistic / compounding effect due to the multiplication of sources.

Noise and vibrations

Even though the noise sources will not be close enough to each other to cause compounded noise levels, the higher overall noise levels in the region could have negative effects on species seeking quiet areas. The main risk is that the sound environment of the entire region will change, resulting in regional losses of species.

Water pollution

With the increased potential for water pollution comes the probability that water-dwelling organisms will be threatened. A severe increase in the concentration of

aluminum in the water, along with potential acidification, could impact fish and other local organisms.

Light pollution

Light pollution in some areas will no doubt have an impact on nocturnal species such as bats and owls. As in the case of other biological impacts, when this impact is extended to a regional level, it can lead to regional losses of species.

Human pressure

Human pressure (for example, the effects of facilitated access to bushmeat) will likely be amplified by the presence of several mining operations. The multiplication of mine roads and possibilities for interconnected access could also attract hunters to the area.

Invasive species

There could be a greater risk of invasive species. Many areas will be cleared or modified, creating entry points for invasive species.

9.3.1.4 Social impacts

Demographics and social dynamics

The opening of several bauxite mines in the region will lead to three types of migration:

1. farm workers from the rural areas, seeking jobs in the city;
2. job-seekers from the subregion or other parts of Guinea;
3. local peasants seeking new arable lands, having been dispossessed of their farmland.

This massive simultaneous arrival of job-seekers will translate into a population explosion in the urban and suburban areas, with particularly high concentrations in towns close to the mines. Most of the migrants will be single men, which could have an impact on the family structure in urban areas, including early marriages and pregnancies and a higher divorce rate.

In the rural areas, the massive simultaneous departure of village men (mostly single) going to look for work in the city means that the villages will be mainly made up of women, children and old people, which could have an impact on food supplies, given the lost food production capacity with the departure of the men.

Access to infrastructure and basic services

The urban migration will place more pressure on the region's infrastructure and basic services, including power generation and distribution, drinking water, schools and health services. This could accelerate development of health and education but also raise the barriers to access to water and electricity, giving rise to greater social inequities in the region.

Land

The presence of other projects in the area means a drastic increase in land occupancy and use (and ultimately overcrowding) at the regional level, which will have impacts on the conditions governing access to land and on the availability of arable land and pasturage, in addition to accelerating change in the traditional ways of managing land. Conflict related to land occupancy could also increase as a result of the migration of farmworkers.

The presence of several mining projects in the area will make it difficult to find substitute lands for populations involuntarily displaced by the mining of bauxite plateaus in the region.

Economic environment and household strategies

Overcrowding will also lead to significant disturbance of ecosystems and increased pressure on the region's food resources.

The arrival of several projects in the region will of course create jobs, but people without the necessary skills will not be able to get those jobs, at least not right away. Moreover, because of migration to the region, there will certainly be more workers than jobs. Population growth in the urban and suburban areas will drive up the cost of living. We can expect increased property speculation, along with inflation of rents and the prices of basic necessities, including food.

Governance and social fabric

A minority of “well-off” and expatriate families (permanent direct employees) will benefit from the expansion of mining. However, most of the people in the mining area could experience a decrease in their quality of life. Consequently, there will be frustration about the expected benefits, increased tension and problems of local governance in terms of inter-village conflicts (land claims, access to salaried jobs, etc.).

There will also be increased pressure on community administrative services and the possible loss of legitimacy of local (district/commune/subprefecture) and traditional authorities.

Movement and circulation

Expansion of mining would increase movements throughout the region. A larger population could also lead to higher transportation prices and, eventually, the creation of new transportation companies.

The construction of new paved and unpaved roads could isolate or de-isolate villages in the concession area, depending on the accessibility and safety conditions of the new roads.

Cultural and archaeological heritage

Economic development of the region will have a modernizing effect on society, resulting in the loss of traditions. The loss of farmland, pastures, water sources and forests will also have an impact on animist practices linked to “sacred sites”. Moreover, the expansion of mined territories could lead to significant losses of cultural heritage sites, especially if there are no coordinated management plans.

Living conditions and landscape

Industrialization of the region will severely degrade the landscape, with visual impacts due to bauxite mine operations. Since many of the pits will be close to villages, the visual impact will be very severe, both during construction and during operation.

9.3.2 Zone 3 – Railroad corridor

9.3.2.1 Sources of impacts

Apart from a few passenger trains, the railroad between Sangarédi and Kamsar is used almost exclusively by CBG to ship bauxite. Some mining developments near Sangarédi will perhaps want to use the railroad as well, to ship bauxite or alumina to a port. This additional increase in traffic will require at least additional sidings and will mean more trains running. If the increase is very great, it may necessitate a second railroad line.

9.3.2.2 Physical impacts

Air quality

Greater use of the railroad line could increase concentrations of atmospheric pollutants such as NO₂, when the trains are idling on the sidings.

Noise and vibration

As long as there is just increased traffic on the existing line, rather than construction of another entire line, train noise will be more frequent but the maximum levels will not change, except near the sidings. There will be some increase in the measured average daily noise level. For example, an increase of two trains per day (one of the estimates used for the GAC project) would mean a noise increase of 1 dBA. Some jurisdictions will set different noise limits depending on how often the noise occurs.

The presence of a second railroad line could compound the noise and vibrations when two trains meet. Protective measures against vibrations may have to be implemented for houses located near the tracks.

9.3.2.3 *Biological impacts*

Fragmentation

More frequent trains will increase the barrier effect of the railroad. And of course the addition of sidings will further aggravate that effect.

Noise and vibration

More frequent noise could extend the impact area around the railroad for certain noise-sensitive species.

Collisions

More frequent train runs will increase the risk of collisions with animals crossing the tracks.

9.3.2.4 *Social impacts*

Health and safety

The development projects in the area (GAC, Kabata, CBG North Cogon, etc.) will use some or all of the existing rail capacity to transport bauxite to the Kamsar port facilities. More frequent train runs will mean a higher risk of pedestrian accidents.

Movement and circulation

More frequent train runs will cause greater disturbance to the flow of merchandise and passengers, as well as disruption of herds moving along the tracks. They will also pose problems for people trying to access basic services (schools, water, health care) and their farmland and pastures.

Living conditions and landscape

Populations living along the tracks will also experience more frequent noise, which is more problematic at nighttime than during the day.

Governance and social fabric

Because of more frequent train runs, the villages located within the railroad corridor will suffer the impacts of mining development, but are poorly positioned to enjoy the advantages (jobs, indirect or induced economic benefits, community projects, etc.). Consequently, there could be an increase in tensions and local governance problems in these villages.

9.3.3 Zone 2 – Kamsar and port

9.3.3.1 Sources of impacts

The CBG port facility and crushing plant are in Kamsar. Other mining companies including GAC are contemplating the possibility of building facilities in Kamsar for exporting bauxite or alumina.

The additional sources of impacts would be as follows:

1. construction and operation of new plants;
2. construction of new port facilities;
3. increased dredging; and
4. increased maritime traffic.

9.3.3.2 Physical impacts

Air quality

The impact of the potential projects on air quality cannot be assessed, since we have no details about their emissions. Nevertheless, the presence of emissions-producing projects nearby (such as the GAC project, just southeast of the CBG plant) would probably cause an increase in local concentrations of atmospheric contaminants.

Noise and vibrations

The impact of the potential projects in this regard cannot be assessed, since we have no details about their noise levels. Nevertheless, the presence of noise-

generating projects nearby (such as the GAC project, just southeast of the CBG plant) would probably cause an increase in local maximum and average noise levels.

Light pollution

With the development of other industrial activities, all of them probably operating round-the-clock, the entire Kamsar region will be more lit-up.

Water quality

The presence of other projects similar to the CBG port and plant (for example, the GAC project, to be built near the CBG site) could cause greater impacts in the Rio Nuñez estuary, such as:

1. increased deposition of airborne particles;
2. increased deposition of airborne NO_x and SO₂;
3. increased spillage of material directly into the water;
4. increased erosion causing greater sediment input into the water;
5. increased dredging along with its impacts on the benthic environment; and
6. increased discharging of wastewater and contaminated water.

The cumulative impacts of several closely situated projects could lead to higher local concentrations of contaminants.

Soil

Soil erosion will no doubt be increased during construction of the industrial and port facilities.

9.3.3.3 Biological impacts

Loss of habitat

Any future development in the Kamsar area is liable to impact the mangroves, which are critical habitats. In addition, increased dredging would have impacts on the aquatic wildlife, both from the operation itself and from sediment deposition.

Fragmentation

Fragmentation would no doubt increase, at least in the aquatic environment simply through more intensive use of the channel.

Air pollution

Some areas could experience dust deposition levels high enough to impact vegetation, and sources could be close enough to each other to cause a compounding effect.

Noise and vibrations

Underwater noise will increase significantly due to increased maritime traffic and port activity (construction and operation). This could have a negative impact on some species such as dolphins.

Water pollution

With potentially greater water pollution comes the probable threat to aquatic organisms. A large increase in aluminum concentrations and potential acidification of the water could have impacts on fish and other local organisms.

Light pollution

There will be some increase in light levels, which could make some parts of the estuary less attractive for nocturnal species.

Collisions

Greater marine traffic will increase the possibility of collisions with aquatic species such as the manatee. The increase may be a compound one, in the sense that twice as many ships afloat could result in more than twice as many collisions, as the possibility of avoidance maneuvers diminishes as traffic density grows.

Invasive species

There is a real possibility that the risk of invasive species will be compounded. Clearing and earthwork in several areas will increase the number of entry points for invasive species.

9.3.3.4 Social impacts

Demographics and social dynamics

The startup of conversion plants and port facilities in the Kamsar area will attract migrants, primarily of two types :

1. farm workers from the area, seeking jobs in the city;
2. people from the subregion or from other parts of Guinea, looking for work.

This massive simultaneous arrival of job-seekers will translate into a rapid and dramatic increase in population density in the urban and suburban areas, with particularly high concentrations in and around Kamsar. Most of the migrants will be single men, which could have an impact on the family structure in urban areas, including early marriages and pregnancies and a higher divorce rate.

Access to infrastructure and basic services

The urban migration will place more pressure on the region's infrastructure and basic services, including power generation and distribution, drinking water, schools and health services. This could accelerate development of health and education but also raise the barriers to access to water and electricity, giving rise to greater social inequities in the region.

Economic environment and household strategies

Increased maritime traffic and dredging in the Rio Nuñez estuary will severely disturb the ecosystems and place increased pressure on fishing resources in the estuary. This will impact traditional fishing and fish processing in the Kamsar area, as well as the mangrove rice fields. Fishermen are usually among the most vulnerable groups, very sensitive to any changes in their means of subsistence.

Consequently, there could be major impacts on the fishing industry in the Kamsar area.

The arrival of several projects at Kamsar would of course create jobs, but people without the necessary skills will not be able to get those jobs, at least not right away. Moreover, because of migration to the region, there will certainly be more workers than jobs. Population growth in the urban and suburban areas will drive up the cost of living. We can expect increased property speculation, along with inflation of rents and the prices of basic necessities, including food.

Governance and social fabric

A minority of “well-off” and expatriate families (permanent direct employees) will benefit from the expansion of mining. However, most of the people in the Kamsar area could experience a decrease in their quality of life. Consequently, there will be frustration about the expected benefits, increased tension and problems of local governance in terms of inter-village conflicts (land claims, access to salaried jobs, etc.).

There will also be increased pressure on community administrative services and the possible loss of legitimacy of local (district/commune/subprefecture) and traditional authorities.

Movement and circulation

Population growth in and around Kamsar would increase movements throughout the region. A larger population could also lead to higher transportation prices and, eventually, the creation of new transportation companies.

9.3.4 Summary of impacts

Table 9-9 provides a summary of the potential cumulative impacts.

Table 9-9 Summary of potential cumulative impacts

Zone	Type of impact	Impact
Zone 1 - Mine	Physical - Air quality	Possible slight regional increase in annual airborne particle concentrations.
	Physical - Noise and vibrations	Average regional noise level will increase because of more numerous sources. The region now enjoys very low noise levels, but quiet areas will become increasingly rare.
	Physical - Light pollution	With the opening of other mines operating round-the-clock, the region will be more lit-up.
	Physical - Water quality	Cumulative impacts are possible, in particular increased aluminum concentrations.
	Physical - Soil	Increased soil losses.
	Biological - Loss of habitat	Habitat losses could become very severe, and regional rather than local. The loss of pasturage will increase pressure on other areas with potentially greater biological value.
	Biological - Fragmentation of habitat	The creation of multiple adjacent road networks will have a major impact on habitats throughout the region, by cutting the remaining habitats into disconnected fragments.
	Biological - Air pollution	Local impacts.
	Biological - Noise and vibrations	The main risk is that the sound environment of the entire region will change, resulting in regional losses of species.
	Biological - Water pollution	A major increase in aluminum concentrations in the water, and potential acidification, could have effects on fish and other local organisms.
	Biological - Light pollution	Greater light pollution in some areas will no doubt have an impact on certain nocturnal species.
	Biological - Induced anthropic pressure	More mine roads and interconnected access will draw more people to the area.
	Biological - Invasive species	Strong possibility of compounded risk of invasive species.
	Social - Demographics and social dynamics	Population explosion in urban and suburban areas. Changes in demographics of villages.
Social - Access to infrastructure & service	Migration to urban areas will put greater pressure on regional infrastructure and basic services.	
Social - Land	Drastic increase and eventually overcrowding in regional land use and occupancy.	

Zone	Type of impact	Impact
	Social – Economic environment	Overcrowding will generate severe disturbance of ecosystems and greater pressure on regional food resources.
	Social – Governance	Most of the people in the mining areas could see a decrease in their quality of life, leading to increased tensions and local governance problems.
	Social – Movement & circulation	Complex changes in village isolation/de-isolation.
	Social – Heritage	Economic development of the region will have a modernizing effect on society, resulting in the loss of traditions. The loss of farmland, pastures, water sources and forests will also have an impact on animist practices linked to “sacred sites”.
	Social – Living conditions	Industrialization will severely degrade the quality of the landscape.
Zone 3 – Railroad corridor	Physical - Air quality	Local increases in concentrations of certain atmospheric pollutants.
	Physical - Noise and vibrations	More frequent train noise.
	Biological - Fragmentation of habitat	Increase in the barrier effect, due to more frequent train runs.
	Biological – Noise and vibrations	More frequent train noise could extend the impact area around the railroad for certain noise-sensitive species.
	Biological – Collisions	More frequent train runs will increase the risk of collisions with animals crossing the tracks.
	Social – Health/Safety	More frequent train runs will increase the risk of pedestrian accidents.
	Social – Governance	Villages along the railroad corridor will suffer the impacts of more frequent train runs but are poorly positioned to enjoy the benefits. Consequently, there could be an increase in tensions and local governance problems in these villages.
	Social – Movement & circulation	More frequent train runs will cause greater disturbance to the flow of merchandise and passengers, as well as disruption of herds moving along the tracks.
	Social – Living conditions	Populations living along the track will also experience more frequent noise, which will be more problematic during the night.

Zone	Type of impact	Impact
Zone 2 – Kamsar and port	Physical - Air quality	Emission-generating projects located close together will probably cause a local increase in atmospheric contaminant emissions.
	Physical - Noise and vibrations	Noise-generating projects located close together will probably cause a local increase in maximum and average noise levels.
	Physical - Light pollution	With the development of other industrial activities, all of them probably operating round-the-clock, the entire Kamsar region will be more lit-up.
	Physical - Water pollution	The presence of other projects could lead to increased impacts in the Rio Nuñez estuary (deposition of airborne particles, dredging, discharging)
	Physical - Soil	The construction of industrial and port facilities would no doubt increase soil erosion during construction.
	Biological - Loss of habitat	All development in the Kamsar area could impact the mangroves, which are a critical habitat. Increased dredging would have impacts on marine wildlife, both from the operation itself and from sediment deposition.
	Biological - Fragmentation of habitat	Fragmentation would certainly increase, if only from more intensive use of the channel.
	Biological – Air pollution	Some areas could experience dust deposition sufficient to affect vegetation.
	Biological – Noise and vibrations	Underwater noise will increase significantly, due to increased maritime traffic and port activities.
	Biological - Water pollution	A severe increase in the concentration of aluminum in the water, along with potential acidification, could impact fish and other local organisms.
	Biological – Light pollution	There will be some increase in light levels, which could make some parts of the estuary less attractive for nocturnal species.
	Biological – Collisions	More maritime traffic will increase the possibility of collisions with aquatic species.
	Biological – Invasive species	The risk of invasive species could be compounded.
Social – Demographics and social dynamics	The massive simultaneous arrival of job-seekers will translate into a population explosion in the urban and suburban areas, with particularly high concentrations in Kamsar and area.	

Zone	Type of impact	Impact
	Social – Access to infrastructure & services	Urban migration will place greater pressure on infrastructure and basic services in the region.
	Social – Land	
	Social – Economy	Increased maritime traffic and dredging in the Rio Nuñez estuary will disturb ecosystems and put greater pressure on fishing resources in the estuary. This will have an impact on the traditional fishing economy.
	Social – Governance	There will be frustration about the expected benefits from the mining projects, and increased tensions and local governance problems.
	Social – Movement & circulation	Population growth in Kamsar and its surrounding districts will increase transportation flow and movement at a regional level.

9.4 Conclusions and recommendations

The Government of Guinea wishes to significantly increase the country's bauxite production. Boké prefecture, which has bauxite resources as well as mining infrastructure and experience, will be the main bauxite-producing area. With numerous projects now in the proposal and development stages, and given that these projects will transform the region significantly and irreversibly, it is strongly recommended that the Government of Guinea undertake a strategic study on the environmental and social impacts of developing the mining industry in the region, and that it work with mining companies, authorities and the local population to draw up a regional development plan.

Such a study could have the following objectives:

- ensure regulation of the mining industry during its expansion;
- maximize positive impacts for the local population and for the nation as a whole (in particular by optimizing the management of public resources and by promoting public-private partnerships and more targeted contributions to development);
- promote inclusive economic growth and, especially, economic diversification; and
- protect the nation's rich cultural and environmental heritage.

Issues addressed in the study could include the following:

- protecting what is left of natural habitats in the plateau region, especially the gallery forests;
- promoting green corridors in the Cogon Valley and other major valleys between plateaus;
- protecting the livelihoods of the farming and herding populations in the bauxite mining areas;
- providing infrastructure and services throughout the area (e.g., water, electricity, health care, sanitation);
- free movement and safety of populations living along the railroad;
- protecting the critical natural habitat of the Rio Nuñez estuary;
- protecting fisheries resources and fishing in the Rio Nuñez estuary;

- coordination between the regional development plan and the PDLs developed by communes, and management of the revenue from mining royalties;
- developing a strategy for economic diversification (both rural and urban) in order to reduce dependence on mining and promote other sources of revenue; and, more basically,
- developing a “growth corridor” similar to the one proposed for southern Guinea (<http://www.riotinto.com/guinea/growth-corridor-12565.aspx>).