

Nyumba Ya Akiba Cement Plant, Bas-Congo Province of Democratic Republic of Congo: Updated Environmental and Social Impact Assessment

Report Prepared for

Nyumba Ya Akiba Sarl

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Nyumba Ya Akiba Cement Plant Project, Bas Congo Province of Democratic Republic of Congo

Updated Environmental and Social Impact Assessment

Nyumba Ya Akiba Sarl

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Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by **Nyumba Ya Akiba Sarl (NYA)**. SRK has exercised due and customary care in revising this Environmental and Social Impact Assessment but has not, save as specifically stated, independently verified information provided by others. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's limited investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

AfDB	African Development Bank
ARPC	DRC Mining Department "Quarry Products Research License"
BAT	Best Available Technologies
BREF	EU BAT Reference Documents
CaCO ₃	Calcium Carbonate
CaO	Calcium Oxide
CEO	Chief Executive Officer
CHMP	Cultural Heritage Monitoring Plan
CNE	DRC - National Energy Commission
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
DFI	Development Financial Institutes
DPEM	DRC Department of the Protection of Mining Environment
DRC	Democratic Republic of Congo
E&S	Environmental and Social
EHS	Environmental, Health and Safety
EIB	European Investment Bank
EIE	Etudes d'Impact Environmental
EIS	Environmental Impact Studies
EMP	Environmental Management Plan
EMS	Environmental Management System
EP	Equator Principles
EPC	Engineering, Procurement and Construction
ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Assessment
ESIS	Environmental and Social Impact Studies
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESP	Electrostatic Precipitator
ESPS	OPIC Environmental and Social Policy Statement
EU	European Union
FLS	FLSmdth
GEEC	DRC Groupe d'Etudes Environnementales du Congo

GEF	Global Environment Facility
GHG	Green House Gases
GIIP	Good International Industry Practice
IFC	International Finance Corporation
ILO	International Labour Organization
IMP	Influx Management Plan
IPPC	EU - "Integrated Pollution Prevention and Control"
ISO	International Organization for Standardization
JV	Joint Venture
LCP	EU Directive - "Large Combustion Plants"
mamsl	Meters Above Mean Sea Level
MENCT	DRC Ministry of Environment, Nature Conservation and Tourism
MOU	Memorandum of Understanding
N ₂	Nitrogen
NERP	EU - National Emission Reduction Plan
NO _x	Nitrogen Oxides (NO + NO ₂)
NYA	Nyumba Ya Akiba
OEMS	Office of Environmental and Mining Studies, SPRL
OHSAS	Occupational Health and Safety Assessment Series ONATRA DRC - Office National du Transports Congo
OPC	Ordinary Portland Cement
OPIC	Overseas Private Investment Corporation (USA)
PAP	Project Affected People
PC	Public Consultations
PM	Particulate Matter
RAP	Resettlement Action Plan
SARL	DRC - "Societe Por Actions a' Responsibilite Limite"
SEP	Stakeholders Engagement Pan
SMP	Social Management Plan
SNCC	DRC - Societe National des Chemins de Fer du Congo
SNEL	DRC - Societe National d' Electricite
SO ₂	Sulphur Dioxide
SO _x	Sulphur Oxides
SPRL	DRC - "Societe Privee a' Responsibilite Limite"
TSP	Total Suspended Particulates

UNDP	UN Development Programme
UNGC	UN Global Compact
WB	The World Bank
WMF	Waste Management Facility
WMP	Waste Management Plan
+ve	Positive (impact rating)
-ve	Negative (impact rating)

1 Introduction

NYUMBA YA AKIBA SARL (NYA), Concession RAFI, 1, Avenue Ngongo Lutete, Kinshasa - Combe, Democratic Republic of Congo (DRC), a joint venture between Lucky Cement Pakistan and Groupe Rawji DRC, proposes to construct a 3,000 tonnes per day clinker and 3,580 tonnes per day cement manufacturing facility, limestone quarry and associated facilities in Bas-Congo Province of DRC.

An Environmental Impact Assessment (EIA) for the project including the limestone quarry and the cement plant was conducted by an accredited local consultant (OEMS) in December 2010 in accordance with the DRC legislation. This EIA was approved by the local authorities in 2011 and the quarry operational permit granted.

Subsequently, an Environmental and Social Impacts Assessment (ESIA) for lender approval was performed in December 2012 by the Pakistani consulting firm ECTECH, including the cement plant, limestone quarry and some associated facilities but not covering the entire area of influence of the Project. These and other gaps relative to the required assessment framework to meet the requirements of international funders were identified via an independent environmental and social due diligence (ESDD) by ERM on behalf of the lenders. In particular, gaps were identified relating to ecosystem services, cultural heritage, hydrology and biodiversity, as well as the project footprint covered under the ECTECH ESIA.

NYA appointed SRK Consulting (SRK) in June 2013 to prepare an updated ESIA, Environmental and Social Management Plan (ESMP) for the Nyumba Project (“the project”), in line with good international industry practice (GIIP) based on the IFC Performance Standards and other requirements, including those of the African Development Bank (AfDB). The purpose of the updated ESIA and ESMP (this report) is to address the outstanding requirements identified in ERM’s due diligence report, as well as comment received from AfDB. In addition to meeting the DRC legal requirements, the ESIA and ESMP must also meet GIIP.

This ESIA is intended to be a revision of the ESIA conducted by ECTECH and as such large portions of this ESIA are derived directly from the ECTECH report, either verbatim or with editing aimed at improving the readability of the document. The authors of this report hereby acknowledge the ECTECH report as a major source.

The following comments regarding the ECTECH report are highlighted:

1. The original report by OEMS ESIA was prepared in 2010 and was done to a standard that satisfied the requirements of the DRC’s environmentally related legislation.
2. The ECTECH ESIA was prepared in order to meet the requirements of major lending institutions such as the IFC. This revision (this report) has been prepared with the same objective in mind.
3. SRK has restructured the ECTECH report to conform to SRK’s standard ESIA reporting template. As far as possible the original text and report sections have been kept intact.
4. Where it has been necessary to update a section, the original information presented has been kept intact as much as possible.
5. The original Tables, Figures, and Appendices have been maintained as much as possible. In some cases these have been supplemented with new information, and where possible Figures

Note on Content from ECTECH ESIA

Where the text of this report is derived from the ECTECH report, this is indicated by means of a blue line in the right hand margin, as is shown in this paragraph

have been replaced to improve the quality of the images. The new information in the report has been obtained from NYA, NYA's consultants, and the specialists appointed for this ESIA. Specialist input varies from site observations to desktop assessments. The decision on what information to include in this ESIA has been made exclusively by SRK.

6. It is recognised that the project design is currently being developed. This ESIA has therefore benefited from information that was not available during the ECTECH ESIA. In some instances detailed information will only become available at a later stage in the project life cycle, and in these instances the ESIA is not as specific as would normally be the case.

1.1 Assumptions and limitations

At the outset it is necessary to outline overarching assumptions and limitations as follows.

1.1.1 Assumptions

The following assumptions have been made by SRK in the preparation of this report:

- At the outset of this update, SRK assumed that all the technical data and information provided by NYA and the previous ESIAs was accurate and up-to-date. It was assumed that all existing specialist reports would be made available to SRK for review and updating and that limited new work, with the exception socio-economic and heritage baseline would be required.
- Baseline data has been collected by various parties over a limited period of time with resultant, spatial, temporal and scope gaps. It is assumed that NYA will address these gaps as part of its management commitments and once addressed will be incorporated into an updated ESIA and ESMP and as part of the monitoring plans.
- The information and designs contained in the ESIA/ ESMP are conceptual at this stage, and detailed design will only occur prior to construction in line with requirements in the ESIA/ ESMP and a revision to the ESIA/ESMP may be undertaken to reflect the final project description and any impacts and management that were not identified.
- SRK's point of departure for this ESIA update was the ERM ESDD and the lender terms of reference. In the course of the study period, SRK has identified further gaps in the ECTECH ESIA (2012) that have not been filled as part of this study. We have noted these as part of the action plan at the end of the ESMP and we assume that these actions and our recommendations will be implemented.
- The ESMP is a dynamic document and should evolve as and when the project description is updated and finalised as well as over the lifetime of the project. The ESMP in this update is based on an incomplete project description and we assume once the project has been finalised, and at later relevant points in the project, that updates will be made to the ESMP and other management plans.
- SRK assumed that the ECTECH ESIA structure was acceptable and we have used this structure in the update.
- SRK has assisted NYA in developing an environmental and social policy however it is assumed that NYA will operationalise and take ownership of this environmental and social policy through the development of an environmental and social management system based on good international industry practice. Similarly it is assumed that NYA will implement and engage with stakeholders on the basis of the stakeholder engagement plan and the associated grievance mechanism developed by SRK.

- It is assumed that NYA accepts and will implement the management commitments contained in the ESIA and ESMP.
- A monitoring and evaluation system, including auditing, will be established to track the implementation of the ESMP to ensure that management measures are effective to avoid, minimize and mitigate impacts; and that corrective action is being undertaken to address shortcomings and/or non-performances.
- NYA and its contractors/consultants will adopt a process of continual improvement when managing and/or mitigating negative environmental impacts arising from the project. The ESMP will be used as the basis of environmental management and will be improved and refined regularly.
- Existing and proposed upgrades to infrastructure outside the project concession area (such as facilities and infrastructure for product export and raw material import, including the Matadi Port and roads and railway lines connecting it to the site) have not been included in this ESIA. It is assumed that the relevant environmental authorisations have been, or will be, obtained by the third parties responsible for this infrastructure via a separate process.
- This update is based on the ECTECH ESIA/ESMP and assumes that all management commitments in the OEMS EIS permitting document were drawn into the ECTECH report.
- This updated ESIA and ESMP is assumed to be for lender approval purposes only and has not been prepared for submission for authorisation under DRC legislation. Any activities and infrastructure described in this document that have not been previously permitted will be the subject of a separate permitting/amendment submission to the DRC authorities...

1.1.2 Limitations

- Very limited time has been available for the ESIA/ ESMP update. As such the collection of comprehensive baseline data has not been possible. Where further baseline monitoring is required, this is highlighted in the ESIA/ESMP as an action that must be pursued.
- Water quality sampling that has been undertaken by SRK has been limited to the end of the rainy season (June 2013) and one round of limited sampling. Previous data collected by OEMS and ECTECH was also limited and does not contribute towards a useful dataset for analysis and prediction. Recommendations in this regard have been submitted as a scope of work for detailed water studies.
- Records of previous stakeholder engagement were limited and were not made available to SRK in time for inclusion and consideration in this update or in the development of the stakeholder engagement plan. It was a specific ERM ESDD requirement that previous stakeholder engagement processes be well documented – this has not been achieved in this update.
- NYA requested SRK's advice on location of certain infrastructure including the overburden spoil site and waste sites. The selection of possible locations for these facilities is provisional and has not taken into a number of factors that would need further investigation to confirm the locations of these facilities on the site prior to implementation. Factors that are relevant to the location of these facilities, and that have not considered, include:
 - Geotechnical considerations, including whether the underlying geology is suitable for the location of the facility, and/ or whether the location of the facility may prevent future access to limestone deposits;
 - Agricultural fields and areas used by communities;

- Floodlines; and
- Topography.
- Detailed hydrological studies (surface and groundwater) including the relative risk of flooding still need to be completed and the project design in relation to floodlines is still to be determined.
- Gaps in information related to the project description still remain. These include but are not limited to:
 - Effluent streams
 - Water management systems
 - Dewatering requirements
 - Water balance
 - Explosives magazine
 - Design of the overburden site
 - Volumes and types of hazardous products used on site
- No consideration has been given to impacts and management associated with upset conditions due to lack project information around these conditions.
- Based on SRK's terms of reference for the ESIA update, Yuku village was assessed in detail in the socio-economic baseline survey by SRK in June 2013. This level of study was not informed by a clear project description or the impact assessment, but rather by the terms of reference provided to SRK. As a consequence it is possible that expectations for resettlement could have been created within the Yuku Camp Village prior to and as a result of the household surveys that may not necessarily be warranted on the basis of the impact assessment. SRK has however based its management recommendations on the assumption that Yuku Camp Village will be resettled. Should this not be the case the impacts and management commitments will need to be revised accordingly.
- The resettlement action plan has been developed specifically focussing on Yuku Camp Village. The impact assessment undertaken in this update raises impacts to the Mbamba village that may warrant resettlement of households in this village but this has not been addressed in the RAP. Further work will be required to address this once the final project description has been confirmed.
- Time limitations have precluded SRK from undertaking a specific scoping phase or documenting this in a scoping report. As part of this study process stakeholder engagement and specialist reviews and updates have taken place in parallel precluding stakeholder engagement from informing the specialist work. SRK's updates have been based on our experience and additional gaps, issues and impacts have been scoped accordingly.
- The specialists have identified specific information gaps and other limitations associated with their work, listed in their respective baseline/ impact assessment sections. As a result of these gaps, the level of detail presented in this report is lower than would ordinarily be expected in an ESIA/ESMP of this nature, and as a consequence the level of confidence with the relevant impact ratings is lower. A conservative approach is taken to rating of the significance of impacts, and where such knowledge gaps exist, the significance ratings are more conservative (following the precautionary approach) than would otherwise be the case.

- Cumulative impacts have been qualitatively assessed due to lack of detailed baseline data to support this.
- Good impact assessment is dependent on integration between specialists to ensure that baseline data, impact prediction and management measures complement rather than contradict. Every effort has been made by SRK to maximise integration, however due to the pace at which this update of the ESIA has taken place, there may be areas within the ESIA where integration has not been optimised.

1.2 Geographical setting

The project site is located approximately 250 km south west of Kinshasa and 100 km east of Matadi in the vicinity of the N-1 road to the north. The project will be developed on a greenfield site in the surrounding area of the Kinsua Village, Songololo territory, Bas Congo province of DRC, located approximately 30 km west from Kimpese city, as illustrated on Figure 1-1.

The cement plant will be supplemented by limestone and clay mining through mining concessions located approximately 1.5 km north from the cement plant site.

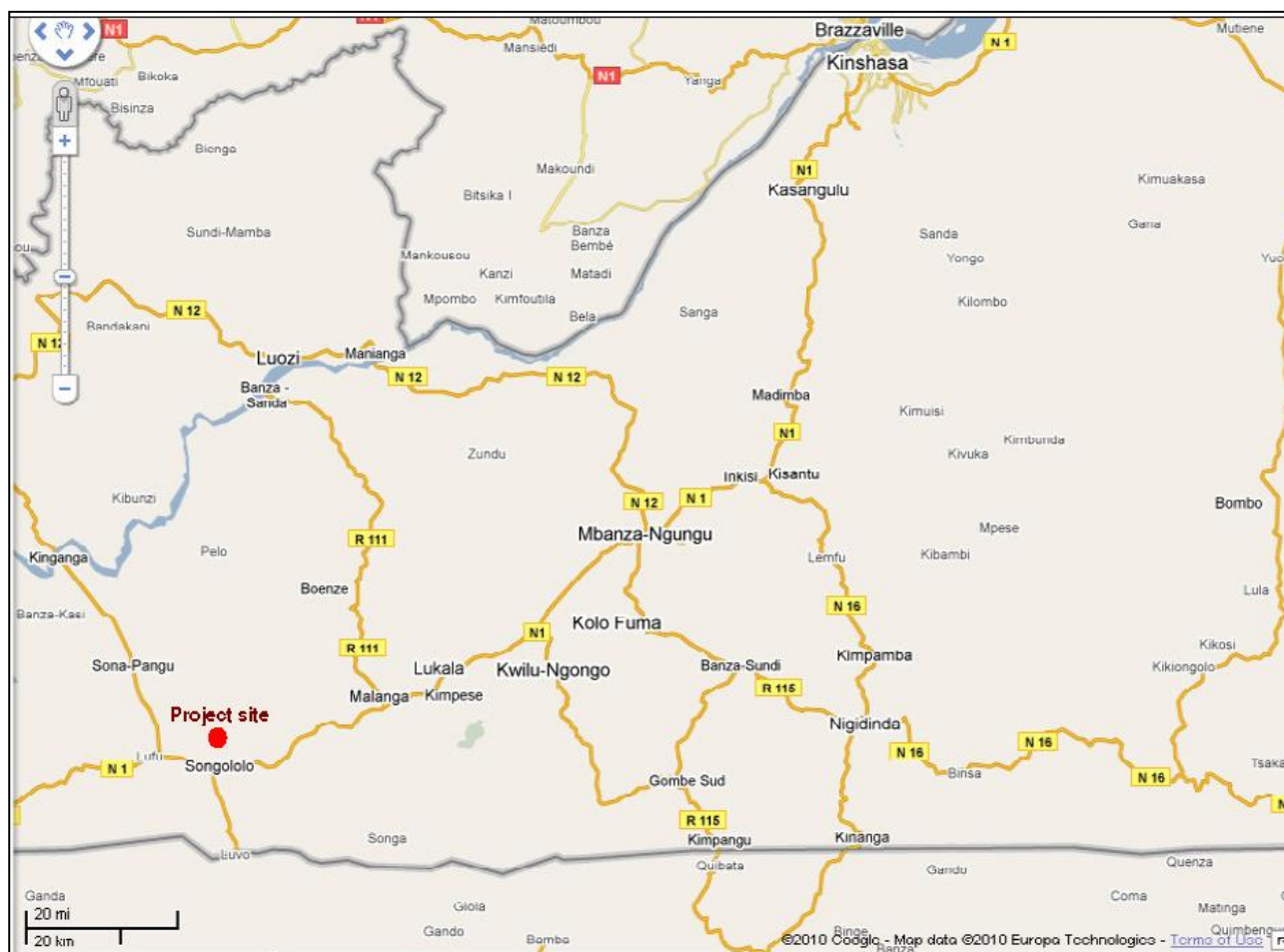


Figure 1-1: Project Location

1.3 Purpose of this report

The purpose of this ESIA report is to identify the key environmental and social impacts which are likely to result from the construction, operation and closure / decommissioning phases of the proposed cement plant, quarry and associated facilities. These impacts will be assessed and mitigation measures to be adopted for their minimisation proposed.

The ultimate goal of this ESIA report is to produce an Environmental and Social Management Plan (ESMP) to address impacts that may occur during the various phases of the proposed project. Compliance with the ESMP and the associated mitigation measures for the identified significant negative impacts will ensure the implementation of this project in an environmentally sustainable manner both at Construction as well as Operation stages of the Project.

1.4 Scope of ESIA Study

This ESIA report update covers the development of a cement plant with an annual cement production capacity of up to 1.18 million tonnes, as well as an associated limestone quarry and related facilities (including roads, powerlines, accommodation, etc.), as described in Section 4 and shown on Figure 4-5. An increase in production capacity (up to double) may form part of a subsequent phase of the project, however this has not been included in the scope of this ESIA and any additional approvals that might be required would have to be dealt with via a revised ESIA. SRK is, however, of the understanding that the project layout and footprint area would not require significant amendments to accommodate this potential increase in production capacity.

Existing and proposed upgrades to infrastructure outside the project concession area (such as facilities and infrastructure for product export and raw material import, including the Matadi Port and roads and railway lines connecting it to the site) also have not been included in this ESIA. It is assumed that the relevant environmental authorisations have been or will be obtained by the third parties responsible for this infrastructure via a separate process.

The original report by OEMS, prepared in 2010, was done to a standard that met the requirements of the DRC's environmentally related legislation. The revised ESIA, conducted by ECTECH in 2012, was aimed at addressing the requirements of international institutions such as the IFC and other major lending institutions. As noted in the ECTECH ESIA, these included the following:

- OPIC-Environmental and Social Policy Statement (ESPS), October 15, 2010;
- OPIC- Environmental Handbook (February 2004);
- International Finance Corporation's Performance Standards on Environmental and Social Sustainability (January 1, 2012);
- International Finance Corporation, Access to Information Policy January 1, 2012;
- International Finance Corporation's Environmental, Health, and Safety, General Guidelines, April 30, 2007;
- IFC Environmental, Health, and Safety Guidelines, General EHS Guidelines: Environmental Air Emissions And Ambient Air Quality (April 30, 2007);
- IFC Environmental, Health, and Safety Guidelines for Cement and Lime Manufacturing (April 30, 2007);
- IFC Environmental, Health, and Safety Guidelines for Mining (December 10, 2007);
- IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission And Distribution, (April 30, 2007);
- BREF Notes for Cement, Lime and Magnesium Oxide Manufacturing Industries BREF (05. 2010) (recently updated as 2013/163/EU, The BAT conclusions for the production of cement, lime and magnesium oxide);
- FD (06. 2012);

- European / (EU) Emission Standards, EU Laws including EU Directives (November 16, 2012), and Directive 2008/50/EC on ambient air quality and cleaner air for Europe;
- International Organization for Standardization (ISO) 14000 Standards;
- ILO Labour Standards (Core Labour Standards and Basic Terms and Conditions of Employment for all Workers, including subcontractors) and
- OHSAS 18001 for Occupational Health and Safety.

The scope of SRK's revision of the ECTECH ESIA report has been extended to address:

- The European Investment Bank Environmental and Social Practices Handbook (2010);
- African Development Bank Integrated Environmental and Social Impact Assessment Guidelines, October 2003;
- African Development Bank Group's Policy on the Environment ('Environmental Safeguards Policy'), February 2004;
- African Development Bank Involuntary Resettlement Policy, November 2003; and
- Environmental Review Procedures for Private Sector Operations of the African Development Bank May 2000.

1.4.1 Due diligence of previous ESIA

A due diligence assessment of the previous ESIA report for the project compiled by ECTECH was undertaken by ERM, the findings of which are reported in their May 2013 Draft Due Diligence report. The Action Plan below (Table 1-1) summarises the findings of the due diligence and actions required to rectify the identified gaps. This Action Plan formed the basis for SRK's terms of reference for the ESIA update. The sections in this report where SRK has addressed the gaps identified are listed in the final column of the Action Plan.

Table 1-1: Action Plan from ERM Due Diligence report, listing how gaps are covered in this ESIA update

Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
ESIA update						
General <i>Study Area / Project definition</i>	The ESIA needs to be updated based on the final project design (for the quarry and cement plant). Based on the presentation of the Study Area, all potential impacts will be identified properly including hydrology, noise, air emission and biodiversity. Based on this information, the impacts need to be reassessed as well as the associated mitigation measures.	Refer to the PS1 line 7 8 and 15 for references and guidelines	Company and appointed environmental and social consultant together with the engineering team in charge of the Project design. ERM recommends that French speakers are part of the team as well as local experts with strong biodiversity and social experience.	Prior to commencement of construction	Updated ESIA that integrates a clear project description, Study Area as well as an assessment of the potential impacts and proposed mitigation measures	See updated project description in Section 4. Where relevant, information gaps are highlighted and the effect of these on impact ratings is clearly stated (e.g. additional hydrological and hydrogeological studies and design detail required).
General <i>Impact assessment methodology</i>	The impacts assessment methodology should be reviewed and clarified to make it reproducible and auditable for all readers and applied for the different impact that have been assessed	Refer to the PS1 line 7 for references and guidelines	Company's environmental and social consultant	Prior to commencement of construction	Updated ESIA that present a clear impact assessment methodology	A systematic impact rating methodology as described in Section 7.1 has been applied to all impacts.
General <i>Overburden / Topsoil storage impact assessment</i>	The ESIA should integrate information about the overburden / topsoil storage area and process (final location, storage characteristics and volumes) as well as an assessment of the potential impacts and proposed mitigation measures.	Refer to the PS3 line 4 for references and guidelines	Project and Company's environmental and social consultant	Prior to commencement of construction	Updated ESIA that integrates a description of the overburden storage area as well as potential impacts and proposed mitigation measures	Included in Project description (Section 4.2.1). The overburden storage facility has been taken into account in all relevant impacts (Section 7) and mitigation measures (Section 8).
General <i>Project Associated facilities assessment</i>	The potential impacts the Project's associated facilities should be clearly identified and assessed, including:	Refer to the PS1 line 8 for references and guidelines	Project and Company's environmental and social consultant	Prior to commencement of construction	Updated ESIA that integrates description and impact assessment of the associated facilities	Associated project facilities are included in the Project description as follows: access road and haul road – Section 4.1.3;

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
	Access road to the quarry from the N1 Road between the quarry and cement plant Worker camps Electrical line between the Kwilu sub-station and the site					accommodation – Section 4.1.2; powerlines – Section 4.10.2; waste management – Section 4.11; wastewater treatment – Section 4.10.4. These facilities are also included in the impact assessment (Section 7).
General <i>Cumulative impacts</i>	The ESIA should integrate information on the existing or future industrial projects (including other cement plants) in the Bas-Congo area and the existence of a development strategy for the cement industry in the Region. The cumulative impacts of the 400 kV power line installed through the Project area should be assessed as well.	Refer to the PS1 line 11 for references and guidelines	Project and Company's environmental and social consultant	Prior to commencement of construction	Updated ESIA that integrates a description and assessment of potential cumulative impacts	Cumulative impacts are addressed in Section 7.7
Environment <i>Biodiversity assessment</i>	The ESIA report should integrate a detailed description of the Flora and fauna observed on the site, including a focus on the gallery forests, the two ponds/lakes located in the cement plant area as well as the wetlands area. Information on the habitat classification for the site should also be presented in the ESIA.	Refer to the PS6 lines 6, 9, 13 and 16 for references and guidelines	Project and Company's environmental consultant	Prior to commencement of construction	Updated ESIA that integrates an assessment of the biodiversity of the entire study area, including the gallery forests, ponds and wetlands	Baseline conditions for biodiversity, including these components, are described in Section 6.3. Impact ratings and mitigation measures are provided in Sections 7.2.7, 7.3.4, 7.4.1 and 7.5.1. Appendices 7.1 and 7.2 provide additional information.
Environment <i>Hydrological assessment</i>	The ESIA should integrate and assess the results of the hydrological study on the Sanzikua /Yuku rivers including data collected during the dry	Refer to the PS3 lines 4 and 9 for references and guidelines	Project and Company's environmental consultant	Prior to commencement of construction	Updated ESIA that integrates an assessment of the hydrology of the study area, including the data collected during the dry	Due to time limitations, dry season sampling was not possible, however, recommendations for further studies in this regard are

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
	season, based on the Project's water consumption estimation. Information about the potential communities that use the rivers should also be integrated in the assessment. The report should also present the process water effluent (estimated volumes and characteristics) more clearly and provide information on the discharge points and water treatment solution proposed.				season	provided in Section 7.3.6. Water resources in the area are described in Section 6.2.4 and Appendix 7.3. Alternatives for process water and effluent treatment (Sections 5.6 and 5.10.3). Impacts, mitigation, management and monitoring measures are provided in Sections 7.2.4, 7.3.6, 7.4.1, 7.5.1, Sections 8 and 9.
Environment <i>Hydrogeological assessment</i>	A hydrogeological study of the quarry area should be integrated as part of the ESIA to provide information on the volumes, characteristics and behaviour of the ground water that will be pumped to lower the ground water table during the limestone extraction process.	Refer to the PS3 lines 4 and 9 for references and guidelines	Project and Company's environmental consultant	Prior to commencement of construction	Updated ESIA that integrates an assessment of the hydrogeology of the site (mainly for the quarry area) including information on the potential volumes and quality of the water that will be pumped and discharged in the rivers	Due to time limitations, detailed hydrogeological assessment was not possible, however, recommendations for further studies in this regard are provided in Section 7.3.6. Where possible, these aspects have been included in project description (Sections 4.5.10, 4.10.3, 4.10.4), Baseline conditions (Section 6.2.4), Impacts, mitigation, management and monitoring measures (Sections 7.2.4, 7.3.6, 7.4.1, 7.5.1, Sections 8 and 9).
Environment <i>Hazardous product storage</i>	The ESIA should clearly present the potential hazardous products stored on site, location, estimated volumes and potential associated impacts.	Refer to the PS3 line 13 for references and guidelines	Project and Company's environmental consultant	Prior to commencement of construction	Updated ESIA that integrates an identification of potential hazardous products stored on site and associated potential impacts and proposed mitigation measures.	Project description (Section 4.7 and 4.8). Impacts resulting from contamination of soil or water resources due to storage and handling of hazardous materials are

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
						included under those respective subsections in Section 7, as well as Section 7.3.12 (safety risks) and management and monitoring measures in Sections 8 and 9.
Environment <i>Ecosystem services assessment</i>	The ESIA should be updated to integrate an assessment of the ecosystem services (identification, prioritization, assessment and propose mitigation measures).	Refer to the PS6 line 24 for references and guidelines	Project and Company's environmental consultant	Prior to commencement of construction	Updated ESIA that integrates an assessment of the ecosystem services associated to the Project's Study Area	Ecosystem services are discussed in: Baseline conditions (Section 6.5.5 and 6.3.2); Impacts (Section 7.2.11, 7.3.11, 7.4.1 and 7.5.1); Management and monitoring (Sections 8 and 9).
Environment <i>Monitoring program</i>	The ESIA should review some section of the monitoring program for the noise and air emission to ensure it complies with the most recent practice available (not sufficiently developed to provide an accurate tool that could be used by the Project to evaluate their environmental performance and compliance during the Project life cycle)	Refer to the PS3 lines 5 and 10 for references and guidelines	Project and Company's environmental consultant	Prior to commencement of construction	Updated ESIA that integrates a more detailed monitoring program for the construction and operation phases	Updated monitoring plans for the relevant environmental components, including air and noise, are provided in Section 9).
Environment <i>Dust emissions</i>	The ESIA should provide a detailed description of the mitigation measures proposed to reduce the dust emissions, in accordance with IFC guidelines and National regulations as applicable.	Refer to the PS3 lines 5 and 10 for references and guidelines	Project and Company's environmental consultant	Prior to commencement of construction	Updated ESIA that integrates more information on the dust emission management	Management and mitigation measures for dust emission control are provided in Section 8, and monitoring measures in Section 9.
Social <i>Socio-economic</i>	The socio-economic baseline should be updated to provide a	Refer to the PS1 line 7 8 and 15	Project and Company's social consultant	Prior to commencement	Updated ESIA that integrates a detailed socio-	A detailed socio-economic baseline, based on

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
<i>baseline</i>	better understanding of the affected communities present in the Project area and propose a good working base for the development of the RAP. An assessment of the impacts due to potential influx of workers and families should be developed.	and PS5 lines 8 to 9 and 12 to 32 for references and guidelines		of construction	economic baseline	extensive site surveys, is presented in (Section 6.5). Impacts relating to population influx are included in Section 7.2.9 and 7.3.11.
Social <i>H&S baseline</i>	The ESIA should integrate information on the risks and potential impacts of the project to the health and safety of the affected communities as well as appropriate mitigation measures based on a description of the situation in the area of concern.	Refer to the PS4 lines 5 to 7 and 9 and 10 for references and guidelines	Project and Company's social consultant	Prior to commencement of construction	Updated ESIA that integrates a detailed health and Safety baseline of the potentially affected communities	Baseline conditions with regard to health and safety are included in Section 6.5. Impacts and mitigation measures are included in Sections 7.2.9, 7.3.11, and 7.7), monitoring in Section 13.3.5 and 13.5. and management plans in Appendix 12 and 13).
Social <i>Security</i>	The Project should present an assessment of the risks related to the use of security companies on site and integrate an assessment of the presence of the police being used as a subcontractor of the security company.	Refer to the PS4 lines 12 to 14 for references and guidelines	Project and Company's social consultant	Prior to commencement of construction	Updated ESIA that integrates an assessment on the security company that will be subcontracted as well as the presence of the DRC police as part of the security process on site	Security measures are included in the Project description (Section 4.9.2), impact assessment and mitigation measures (Section 7.2.9 (Impact HS4), 7.3.11 (Impact HS8)), and Management and monitoring (Section 13).
Social <i>Cultural heritage assessment</i>	The ESIA should include an assessment to identify whether any cultural heritage is present on the site and provide information on the religious practices in the area	Refer to the PS8 lines 6 to 8 and 11 to 15 for references and guidelines	Project and Company's social consultant	Prior to commencement of construction	Updated ESIA that integrates a detailed description of the cultural heritage present in the Project's Study Area as well as the associated impact and mitigation measures proposed	A cultural heritage site survey was conducted. Baseline conditions are reported in Section 6.5.6). Impacts and mitigation measures (Section 7.2.10). Management and Monitoring, including Chance Find Procedure (Section 9.10).

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
ESMS implementation (Environmental and Social Management System)						
ESMS <i>Implement an ESMS and hire of an Experienced EHS manager</i>	The Company should implement an appropriate EHS management structure and develop an Environmental and Social Management System that will integrate the aspects presented in the lines below. The Company will need to develop a specific action plan to capture all actions required from the environmental and social due diligence report and from the updated ESIA. The ESMS should ensure that all processes are in place to capture all these actions. To do so, the Company should hire an experienced EHS manager that has strong local knowledge of the regulatory standards and applicable requirements and also the skills to implement the specific international standards recommendations and actions required under the ESMS. This EHS manager should be assisted by different employees in charge of the operational EHS management, including a community liaison officer, responsible of the communication with the affected communities.	Refer to the PS1 line 18 for references and guidelines	Company's management	Prior to commencement of construction for the sections related to the construction phase	EHS manager hired by the Company Updated ESMS in place	NYA has prepared draft policies and plans as part of its ESMS (refer to Appendix 10-19) which align with international standards. NYA has hired an EHS Manager with suitable skills and experience, based on SRK's recommendations (see NYA organisational structure in Section 9.2). The organisational structure outlines the responsibilities of key staff and makes provision for community liaison officer/s. Updated ESMS is included in Sections 9 and 13 An action plan is included in Appendix 20.

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
ESMS <i>EHS Policy</i>	Develop a Project specific Environmental and Social policy that will be used as an overarching framework for the EHS topic management. The existing document presented by the company (5th of April) can be used as a working base but should be updated to reflect more the Project's specificities, the different phases (construction, operation and decommissioning) and provide a clear distinction between the overarching EHS policies and operational procedures.	Refer to the line 6 references and guidelines	PS1 Company's EHS manager for supported by the top and management	Prior to commencement of construction	Updated EHS policy, adapted to the Project's specificities and considering the comments from the ESIA and gap assessment report	See Health and Safety Policy in Appendix 10, and Section 9 for additional information on the EHS/SD structure. A suite of plans are presented in Appendices 11-19, and include broad procedures/guidelines for the development and implementation of standard operating procedures (SOPs). SOPs need to be developed after detailed design.
ESMS <i>HR policy</i>	The Project should develop a human resources policies and procedures for the Project to include policies on right of association and collective bargaining but also information on equal opportunities, discrimination and fair treatment in recruitment, hiring and working conditions, information on retrenchment, etc., presented in the gap analysis report, based on the ILO conventions	Refer to the line 12 references and guidelines	PS2 Company's HR manager for together with Top and Management	Prior to commencement of construction	HR policy that considers the output from the ESIA report and gap assessment	A Human Resources Policy and Labour and Human Resources Plan have been drafted (see Appendix 10 and 11 respectively). These documents are aligned with the good international requirements and practices. NYA has also drafted a Human Rights Policy.
ESMS <i>Occupational health and safety</i>	The company should develop an Occupational Health and Safety System and apply it to the entire company and subcontractors working for the project. The H&S system should include a policy/plan and operational	Refer to the line 23 references and guidelines	PS Company's EHS manager for supported by the top and management	Prior to commencement of construction	Occupational health and safety plan and procedures for implementation to the company and subcontractors (trainings, communication framework, organisational structure,	NYA has drafted a Health and Safety Policy and Occupational Health and Safety Plan (see Appendix 10 and 12 respectively). The EHS/SD structure is set out in Section 9. Operational

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
	procedures, but also develop the appropriate tools to implement the policy to all employees and subcontractors working on the Project (communication/organisational framework, training programs, auditing and reporting). This H&S system should be developed for each phase of the project, starting with the construction work.				auditing and reporting).	procedures will be prepared in response after detailed design has been finalised.
ESMS <i>Monitoring program</i>	The company should develop a detailed monitoring plan (air, noise, ground and surface water) for the different phases of the Project as part of the ESMS, based on the recommendation of the updated ESIA. The monitoring plan will have to be clearly articulated with meaningful timeframes, responsibilities and defined indicators against which progress can be measured. A clear reporting procedure will also be defined. The Project will also integrate a strong GHG emission assessment as part of its management practice. This assessment should be used proactively and updated frequently to identify the main source of emission in order to propose reduction and	Refer to the PS1 line 22 to 24 and PS3 lines 7, 8, 10 and 12 for references and guidelines	Company's EHS manager supported by the Project's engineers and top management	Prior to commencement of construction for the monitoring related to the construction phase	Monitoring plan and GHG emission assessment and management plan	The monitoring plans for environmental and social issues are presented in Sections 9 and 13 respectively. Measures relating to monitoring are also included in management plans (see Appendices 11-19). Appendix 14 presents the GHG assessment and management plan.

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
	improvement measures.					
ESMS <i>Sub-contractors and Supply chain</i>	The Project should apply these EHS standards and policies as part of the subcontractor selection process. NYA will need to formalise a supply chain protocol which governs selection of suppliers and incorporates the requirements of NYA's Human Rights Policy.	Refer to the PS2 lines 24 to 29 for references and guidelines	Company's management	Prior to commencement of construction for the section related to the construction phase	EHS policy and implementation tools (organisational structure and audit program and reporting) that allows to control that it is implemented to the subcontractors as well	NYA is committed to selecting and monitoring sub-contractors against EHS policies and standards. Refer to draft policies in Appendix 10. A Human Rights Policy is also contained in Appendix 10, and will guide the preparation of a supply chain protocol for sub-contractors.
ESMS <i>Waste management plan</i>	The Project should develop a waste management plan covering the waste production during the construction phase and operation of the Project.	Refer to the PS3 lines 7, 8, 10 and 12 for references and guidelines	Company's EHS manager supported by the top management	Prior to commencement of construction for the section related to the construction phase	Waste management plan and implementation/disclosure tools	A Waste Management Plan is contained in Appendix 15 of the updated ESIA. This plan also covers the management of waste at the proposed landfill site Section 5.9 outlines the alternative locations of this facility.
ESMS <i>Emergency Preparedness and Response</i>	An emergency response plans specific to each phase of the Project and activity need to be prepared by the Company and disclosed to all employees, subcontractors and affected stakeholders. The existing EHS document presented by the company (5 th of April), that includes some emergency response aspects, can be used as a working base but should be updated to reflect the Project's specificities and internal responsibilities, the	Refer to the PS4 lines 12 to 14 for references and guidelines	Company's EHS manager supported by the top management	Prior to commencement of construction for the section related to the construction phase	Emergency preparedness and response plan for each phase together with the disclosure tools (responsibility within the company, disclosure, training, auditing and reporting programs)	An emergency is presented Appendix 16. This plan will once finalised be disclosed to all employees, sub-contractors and affected communities. This plan should be implemented in conjunction with the community health and safety plan contained in Appendix 13. These plans should be implemented through the EHS/SD structure presented in Section 9.2

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
	different phases (construction, operation and decommissioning) and the tools and procedures for the plan's implementation.					
Social considerations (RAP – SEP – Grievance mechanism – Workers camps)						
Resettlement Action Plan (RAP)	A RAP need to be developed prior to the construction phase, including a study to determine if specific people need to be considered as vulnerable. The RAP should include a compensation matrix and compensation packages. The Livelihood Restoration Plan (LRP) and RAP should reflect the understanding and objectives of the resettlement and include a strong socio-economic baseline of the potentially affected communities. The Stakeholder Engagement Plan should take into consideration the specific case of resettlement and host communities. A specific grievance mechanism regarding land acquisition/ RAP process needs be developed as part of the general grievance mechanism.	Refer to the PS5 lines 8 to 9 to 12 to for references and guidelines	Company's appointed consultant, EHS manager supported by the community liaison officer and top management	Prior to commencement of construction	Documented RAP including the identification and compensation matrix + LRP and agreement between the company and the different people concerned by the resettlement	The socioeconomic baseline data for Yuku Camp village was updated (see Section 6.5) and used to update the RAP prepared by ECTECH. In addition to presenting information for Yuku Camp village, the Framework RAP presented in Appendix 18 sets out the methodology and findings of economic displacement. A Stakeholder Engagement Plan is presented in Appendix 17, and refers to consultation with communities affected by resettlement. As the land has not been identification for resettled households, the consultation with host communities is presented in the Framework RAP in Appendix 18.
Stakeholder Engagement Plan (SEP)	The Company should develop a detailed Stakeholder Engagement Plan (SEP) prior to the construction work commencing including :	Refer to the PS1 line 25 to 34 and PS8 lines 9 and 10 for references and guidelines	Company's appointed consultant, EHS manager supported by the community liaison officer and top management	Prior to commencement of construction	Documented SEP including a clear description/mapping of the stakeholders involved in the Project, planning of the engagement process,	A detailed Stakeholder Engagement Plan is presented in Appendix 17, and is informed by stakeholder input. In June

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
	A stakeholder analysis and mapping; A SEP implementation plan; A disclosure of the final version of the ESIA and a summary in local language; A record of each question potentially asked during the disclosure process; Specific measures to allow the effective participation of potential people identified as disadvantaged or vulnerable. NYA must ensure that this process is transparent, objective, meaningful and uses easily accessible information which is in a culturally appropriate local language and format and is understandable for affected communities. This process could be undertaken at the level of the “<i>cadre de concertation permanente</i>” but needs to be extended to all the affected people, to ensure that all stakeholders are appropriately consulted. This process will be on-going and iterative. NYA will have to disclose the ESIA conclusions and a summary in local language will have to be made available to Affected Communities. The Project should also consult the population and the authorities regarding the way they will handle the presence of				records of all meeting, information disclosed and feedback from the stakeholders and answers provided by the company	2013 focus group meetings were held with vulnerable groupings (refer to Section 10). The final draft of the updated ESIA will be disclosed in the last two weeks of July (16-31 July) and the comments incorporated in the final updated ESIA. A non-technical summary has been produced to present the ESIA conclusions to local stakeholders. The summary has been translated into French, Lingala and Kikongo, and copies of the document will be circulated to all affected parties in the project area. Notification letters in local languages will be widely distributed to all recorded stakeholders.

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Gap/Issue	Recommendation	Citation Reference	/ Responsible parties	Timeframe for completion	Deliverable	Addressed in SRK ESIA update
	the graves in the Yuku village					
Grievance mechanism	A grievance mechanism needs to be formalized by NYA and implemented independently from the “ <i>cadre de concertation permanente</i> ” and the local authorities.	Refer to the line 35 and line 20 references and guidelines	PS1 EHS manager supported by the community liaison officer and top management	Prior to commencement of construction	Documented grievance mechanism procedure, process disclosure to the affected communities and records of grievances with historic and timeline of identified actions implementation.	A grievances mechanism is presented in section 12 of the report as well as in the Stakeholder Engagement Plan contained in Appendix 17. This mechanism will be implemented by NYA independently of the “ <i>cadre de concertation permanente</i> ”
Workers' accommodation	The Company should clearly identify the requirements in term of accommodation for the different phases of the Project. Based on this information, NYA needs to provide detailed and formalized plans and maps for housing and associated facilities that correspond to the demand of the construction and operation phase. These infrastructures should be designed and operated by the Project/contractors in accordance with the provisions of the IFC PS2 and the relevant guidelines within the guidance document Workers' Accommodation: Processes and Standards: A Guidance Note by IFC. An audit procedure should be implemented as part of the ESMS to guarantee that the international standards are applied and respected during the construction and operation phases.	Refer to the line 12 20 for references and guidelines	PS2 Company's appointed consultant, EHS manager supported by the top management	Prior to commencement of construction	Documentation on the Project's needs in terms of workers accommodation and design of the future workers accommodation + assessment compared to international standards	An updated project description and location maps are presented in Section 4 of the ESIA. Section 4.12 presents information pertaining to employee accommodation and facilities, which is aligned to the requirements of IFC-Performance Standard 2 relating to Labour and Working Conditions.

1.5 Need and Desirability of the Project

According to HOLTEC Feasibility Study (2011), historical cement demand in the DRC has risen by average 12.3% per year during the period 2000 to 2010, from 0.3 million tonnes to 0.9 million tonnes. Past supply and consumption situation of cement in DRC is presented below.

Table 1-2: Historical Supply and Consumption of cement (thousand tonnes)

Year	Domestic Production	Imports	Exports	Domestic Consumption
2006	519	-	88	431
2007	530	200	56	674
2008	411	400	30	685
2009	433	400	62	811
2010(E)	495	462	49	908

[Source: HOLTEC Feasibility Study]

Out of the total present cement supply, 52% is provided by local production and remaining 48% is covered by imports. According to HOLTEC Feasibility Study the domestic cement demand is forecasted to grow to 1.8 million tonnes by 2015 (when the proposed project is likely to come on-stream), at the rate of 14% to 15% per annum caused by growing economy and rise in construction activities. Considering a potential growth at the annual average rate of 9% beyond 2015, the estimated demand by year 2020 will be about 2.8 million tonnes. This cement requirement does not include any increase in future export market. In fact the proposed project will also substitute cement imports

Domestic installed annual cement manufacturing capacity (in Million Tonnes per annum) is as below:

1. Cimenterie de Lukala (CILU) = 0.42
2. Cimenterie Nationale (CINAT) = 0.30
3. CIMENKAT = 0.20
4. Forrest Group, 2 plants = 0.08

The plants, listed as item (1) and (2) above, have old process and machinery and due to frequent breakdowns have not been able to operate at installed capacity. Whereas, the plants listed at item (3) and (4) have been totally shutdown due to civil disturbances in the eastern part of DRC.

Heidelberg Cement AG reached an agreement with Forrest Group and CILU to invest in their plants for modernization and revamping.

NYA cement plant is expected to produce annually 1.18 million tonnes of cement, at 100% capacity utilization. Estimated domestic distribution of cement from NYA plant is as below:

- West DRC = 44%
- South DRC = 26%
- North DRC = 18%
- East DRC = 12%

Cement distribution in western and southern parts of DRC (expected area of influence of NYA) will be about 70% of total distribution pattern. In addition, exports to Angola and Republic of Congo are likely to increase.

1.6 Structure of the Report

This report is divided into fifteen chapters:

Section 1 Introduction

Introduces the project and the scope of this report.

Section 2 Governance Framework

Provides the legislative and regulatory context for the project based on the relevant national and international requirements and guidelines

Section 3 Identification of the Project

Describes the methodology and process followed for the ESIA

Section 4 Project Description

Describes the various elements of NYA's proposed project, including the cement processing plant, quarry and associated facilities

Section 5 Analysis of alternatives

Describes the various alternatives considered during project design

Section 6 Baseline Conditions in the Area Potentially Affected by the Project

Gives an overview of the affected biophysical and socio-economic environment in the area of the project.

Section 7 Potential Environmental, Social, Health and Safety Impacts

Describes and rates the significance of the potential impacts identified, both before and after the successful implementation of the recommended mitigation measures.

Section 8 Proposed Environmental Management Measures

Lists the recommended mitigation and management measures recommended by the specialists and Environmental Impact Practitioner to mitigate negative impacts and enhance positive ones, for each phase of the project.

Section 9 Environmental Management and Monitoring Plan

Provides a plan for on-going monitoring and management of environmental impacts, specifying timeframes, reporting requirements and responsibility for each measure

Section 10 Public consultations / disclosure

Describes the process of public consultation and disclosure adopted for the project and summarises the issues raised during such consultations

Section 11 Project compliance with IFC Performance Standards

Describes how the project and ESIA meet the requirements of the IFC Performance Standards 1-8

Section 12 Grievance Redress Mechanism

Describes the mechanism for recording and addressing grievances raised by the public and stakeholders

Section 13 Social Management Plan

Describes the management measures recommended for the mitigation of negative social impacts and the enhancement of positive impacts resulting from the project

Section 14 Summary and Conclusions

Summarises the key findings of the ESIA

Section 15 References

Lists the literature sources referenced in this report.

2 Governance Framework

This section is largely based on the original text from ECTECH's ESIA report, with minor amendments or updates by SRK, primarily to include the relevant guidelines and standards of the applicable lenders for completeness.

2.1 DRC Regulatory Framework

This section gives a brief account of Applicable Host Country Laws and Regulations.

DRC law draws its substance from at least seven sources, namely the Constitution, international treaties, legislation, administrative regulations, custom, case law, and doctrinal writings.

At the apex of the legal system, the DRC Constitution is the first source of law. It is the fundamental and organic law of DRC, with three components. It sets up the institutions and the apparatus of government, defines the contents and limits of government powers, and protects fundamental human rights and freedoms.

2.1.1 Constitution De La Republique Democratique du Congo [The 18th February, 2006 Constitution of Democratic Republic of Congo]

The preamble of the Constitution reaffirms Congo's adherence to human rights and the equal representation of women and men in state institutions. It reaffirms adherence to the Universal Declaration of Human Rights, the African Charter on Human and Peoples' Rights (African Charter), and the UN conventions on the rights of children and women. The DRC has ratified all the main international human rights and humanitarian legal instruments, including the UN Convention on Civil and Political Rights and the UN Convention on Social, Economic and Cultural Rights.

The Constitution also protects fundamental freedoms, including opinion, conscience and religion (Article 22); expression (Article 23); information, press and communication (Article 24); privacy (Articles 29 and 31); movement (Article 30); assembly, demonstration and petition (Articles 25, 26 and 27, respectively); asylum (Article 33) and protection of foreign nationals and their property (Article 32).

DRC Constitution proclaims that private property is sacred (Article 34). It lay down the right to work (Article 36) and freedom of association (Article 37), the right to form trade unions (Article 38) and the right to strike (Article 39).

The Constitution fundamentally applies the right of cultural association and protection of it citizens' thereto in Article 45, implying the right to practice cultural beliefs and customs during cultural ceremonies and events, including funerals and the protection of cultural objects.

Article 53 of the DRC Constitution states that:

- Every person has a right to a healthy environment and which is favourable to his/her full development.
- The environment must be protected.
- The State must look after the protection of the environment and the health of the people.

Article 123 of the DRC Constitution makes provision for laws to be made concerning, inter alia, "the protection of the environment and tourism".

Article 203 allows for co-operative governance by central government and the Provincial administrations "to protect the environment, natural sites and landscapes, and the conservation of such sites."

The Constitution of the Democratic Republic of the Congo of 18 February 2006 makes the following provisions:

- a) All Congolese are equal before the law and have the right to equal protection by the law (article 12);
- b) In education, access to public services or any other area, no Congolese shall be subject to discrimination, whether on the basis of law or executive action, on the grounds of religion, family origin, social status, residence, political opinions or convictions or of belonging to a race, ethnic group, tribe or cultural or linguistic minority (**article 13**);
- c) The State has the duty to ensure and promote the peaceful and harmonious coexistence of all of the country's ethnic groups.

It also ensures the protection and promotion of vulnerable groups and of all minorities. It ensures their development (**Article 51**).

2.1.2 Environmental Management Governance Structure

Environmental management is dealt with between several ministries and at different levels of government.

Parliamentary Commission for the Environment

The Parliamentary Commission for the Environment has between 50-60 members who are organized into four committees: general environment, mining environment, flora and fauna and environmental control. One of the aims of the Commission is to approve sector laws and policies from an environmental perspective.

Ministry of Environment, Nature Conservation and Tourism and Ministry of Mines

The ministry responsible for the environment in the DRC has experienced several changes in name and associated responsibilities: directorates of nature conservation, land affairs, tourism, water and forests have all been included and excluded at various times since the ministry was created under Ordinance No 75-231 of 22 July 1975. This piece of legislation gave the ministry responsibility for environmental impact studies [Etudes d'Impact Environnemental (EIE)]. This was reinforced in Ordinance No 07/018 of 16 May 2007, which specifies the responsibilities of the Ministries, where the President of the DRC gave authority for the management of EIA to the then named Ministry of the Environment, Nature Conservation, Water and Forests (now known as the Ministry of Environment, Nature Conservation and Tourism (MENCT)).

However, in the same Ordinance, the president gave responsibility for all matters relating to mines, including environmental issues, to the Ministry of Mines, specifically to the Director of the Department for the Protection of the Mining Environment (DPEM).

There are some 20 Directorates within the MENCT, but an overall organogram was not available. A Canadian Consulting company undertook an institutional review of the MoE in January 2008, with the objective to make recommendations regarding the re-structuring of the Ministry to reduce the number of departments and directorates to allow for more efficient management.

The main Directorate in MENCT with responsibility for EIA is described below.

Environment – Groupe d'Etudes Environnementales du Congo (GEEC)

In ministerial Order No 044/CAB/MIN/ECN-EF/2006 of the 8th December 2006, the MENCT created an agency for EIA administration and approval called Groupe d'Etudes Environnementales du

Congo (GEEC). A further ministerial order No 008/CAB/MIN-EF/2007 of 3rd April 2007 amended and completed the institution of GEEC.

GEEC is a technical structure within the MENCT responsible for the administration of EIA in the country. Its main objectives are:

- To conduct and coordinate the activities relating to environmental and social impact studies (ESIS);
- To define the procedure of ESIS in the DRC;
- To ensure that the execution of all projects or development programmes is undertaken according to strict environmental and social standards;
- To promote capacity building within Congolese administrative structures and within public and private investors in matters relating to ESIS;
- To promote consultation and information sharing with the public concerning the management of the environment; and
- To present an annual State of Environment report for the country.

The creation of GEEC demonstrates the political will of the DRC government to make sure that all development projects will safeguard the biophysical and social environment. The scope of GEEC extends over all projects which may have impact on the environment, across all sectors, with the current exception of mining.

GEEC is composed of five sections, with a total of 9 technical-cum-management personnel and eight administration/support staff.

The infrastructure portfolio includes: Component A - projects relating to roads, water and sanitation, generation and transmission of electricity, anti-erosion works and involuntary resettlement of people.

The Social-Agriculture portfolio includes Component B - projects such as: distribution and production of genetically modified seed, artisanal fisheries, rehabilitation of rural tracks and roads, community development such as health, education, water and sanitation and social protection of vulnerable people such as the aged, women and AIDS orphans.

2.1.3 Laws, Rules and Regulations Relating to Environmental Quality Standards:

Environmental Quality Standards relating to quarries, mining and cement manufacturing are covered under Article 46 of the:

“OFFICIAL NEWSPAPER OF THE DEMOCRATIC REPUBLIC OF CONGO, Office of the president de la République, DECREE N°038 / 2003 OF CARRYING MARCH 26TH, 2003, MINING REGULATIONS”

However, for all other industrial sectors and ambient environment, World Bank/International Finance Corporation (WB/IFC) are followed. Accordingly, the project under reference has to follow the following standards as operational in the country.

Noise

Article 46 of Mining Regulations March 26, 2003 of Democratic Republic of Congo presents the limiting values for noise levels from Mining exploitation activities or Quarry are given in Table 2-1. **Table 2-1: Sound Level**

Ground site	Night dB(A)	Day dB(A)

(a)	40	45
(b)	45	55
(c)	70	70

Article 47: Ground (sites) Category

The grounds are classified in the three following categories:

- The ground where there are many residential houses making a community or a village, a school or a hospital or any kind of education services, health;
- The ground where there is a permanent commercial activity, hunting or fishing or any recreational activities.

However, the noise level expected at night is applicable at the boundary of residential houses. Somewhere else, the maximum level of noise expected at day time is also applicable at night.

- The ground where there is mainly industrial activities or farms. However, the location of one residential house in this kind of ground, the limits lines are 50 dB (A) at night and 55 dB (A) during day time.

The day and night times are from 7:00 am to 7:00 pm, and from 7:00 pm to 7:00 am respectively.

Air quality

For Air Emissions and Ambient Air, the limiting values given are presented as under:

Article 49: From the content attenuation of emissions in the atmosphere.

The attenuation measures of emissions in the atmosphere are presented in three pages maximum that specify:

- For each nature of contaminant, the quantity issued (tonnes per year), the rate of discharge (m^3/h), the gases temperature ($^{\circ}\text{C}$) and the concentration of the contaminant (mg/Nm^3);
- The purification systems or measure to prevent, eliminate or reduce the clearing of the contaminants and indicate the (%) percentage of efficacy; and
- In case where the dry dust removers are used, methods and warehousing, store or of clearance of this dusts.

The applicant must respect the following limit of pollution inside his perimeter (Table 2-2) and outside his perimeter (Table 2-3):

Table 2-2: Limits of air pollution inside the perimeter (DRC Mining Regulations, 2003)

Nature of Contaminant	Limits of Pollution
Arsenic (As)	0.5mg/m ³
Carbon Monoxide (CO)	29 mg/m ³
Copper (Cu)	1 mg/m ³
Free Silica	5.0 mg/m ³
Hydrogen Cyanide (HCN)	11 mg/m ³
Hydrogen Sulphide (H ₂ S)	14 mg/m ³
Lead (Pb): Emissions and smokes	0.15mg/m ³
Nitrogen Dioxide (NO ₂)	6 mg/m ³
Solids particles	10 mg/m ³
Sulphur Dioxide (SO ₂)	5 mg/m ³

Table 2-3: Limits of pollution outside the perimeter¹ (DRC Mining Regulations, 2003)

Nature of Contaminants	Limits of Pollutions
Particulate Matter (PM) (< 10 µm): Annual Arithmetic mean Maximal average on 24 hours	 100 g/m ³ 500 g/m ³
Nitrogen oxide like NO ₂ : Annual Arithmetic mean Maximal average on 24 hours	 100g/m ³ 200 g/m ³
Sulphur dioxide: Annual Arithmetic mean Maximal average on 24 hours	 100g/m ³ 500g/m ³

Article 50: The accepted air pollutions limit:

The limits of air pollution inside and outside the perimeter are classified according to the nature of contaminants describe to the above tables:

Article 51: From the installation of air pollution control device

The applicant for Mining Exploitation (permit) or Permanent Quarry permit must install air pollution control device at the plant (processing and transformation).

Article 52: Pollution tests

During the works of Mining exploitation or quarry and the works of ore process, the applicant realize at the months of January, March, July, October, a series of tests inside his perimeter and outside his perimeter , analysing the level of contaminants listed in the table above. He must record the used test method and eventually, the corrective measures to take to a register.

¹ The units as stated in the Mining Regulations are incorrect and should be stated as µg/m³ as is the case for most international guidelines and standards for these parameters. A value in g/m³ exceeds all known international guidelines encountered.

The Mining permit applicant or permanent quarry license must realize air pollution test outside the perimeter at 5 meter of the perimeter border at the North, South, East and West of the perimeter.

Waste Water

Article 66 of Mining Regulations of Democratic Republic of Congo, March 26, 2003 presents the limiting values for waste water.

Article 66: at the maximal concentration of contaminant in water

For each category of water affected of the project as described at the previous title, the operator must propose some measure attenuation and rehabilitation that reduces the pollution level of water less than the limits presented at the tables below:

Table 2-4: Properties of released effluent

pH	6 to 9
BOD ₅	50 mg/l
Oil and grease	20mg/l
Temperature at the limit of mixing zone	5°C at the maximum level of ambient temperature of water in the recipient water body and 3°maximum if the water of recipient body >28 °C
Acute Toxicity	>at the equality level from the tests (fish from river).
Concentration of contaminants	>to the limits presented in the table 5 below.

Table 2-5: Requirement at the pouring level of the last tributary

Parameter	Maximal acceptable concentration (snap sample)
Arsenic	0.40 mg/L
Copper	1.5 mg/L
Iron	6,00 mg/L
Nickel	1,00 mg/L
Lead	0.5 mg/L
Zinc	10 mg/L
Cyanide	2.00 mg/L
TOTAL **Hydrocarbons	10.00 mg/L
Mercury	0.002 mg/L
Matter in suspension	100 mg/L

Table 2-6: Minimum monitoring frequency and duration for surface and groundwater quality at waste management locations

Location	Minimum sampling frequency	Minimum post-closure monitoring duration
Waste management facilities:	2 times per year	5 years
1. Mining and hole used for the control of trash and mining lixiviation and cyanide		
2. Mining and hole used for the control of acidogenic trash mining	3 times per year	10 years
1. The area of lixiviation waste and acidogenic accumulation	2 times per year	5 years
2. The area of acid generating mining waste	3 times per year	10 years
3. The area of waste accumulation of high risk	4 times per year	20 years
The affected location or infected by the mining activity:		
Presence of sulphide	3 times per year	10 years
Any other contaminant	2 times per year	5 years

Physico-chemical properties to measure:

1. at minimum, the physico-chemical to measure for the control water at the plane area are same as during the exploitation basing to the table 5 of this annex.
2. for the groundwater is adding to this parameter, those listed to the section on the requirement of groundwater protection.
3. however, basing to the nature of contamination found on the site after attenuation and rehabilitation work after closing of the site, others parameter can be added to the control programs.

Table 2-7: Annual parameter group of control

	Group 1			Group 2	Group 3
	Conventional parameter	Nutrients	Mineral and metallic elements		
Parameters	Alkalinity Chlorides Conductivity DBO ₅ DCO Hardness Fluoride Dissolved solid Total solid Substances Phenolics Sulphates	Nitrogen Ammoniac Total nitrogen Kjeldahl Nitrates + Nitrites Phosphorous	Aluminium Arsenic Cadmium Chromium Cobalt Iron Magnesium Manganese Mercury Molybdenum Potassium (radium 226) Silica sodium	Cyanates Thiocynates	Sulphide thiosulfate

2.1.4 DRC Civil Law and Penal Codes

DRC criminal law, which is mainly set out in the 1940 Penal Codes, can be divided in two parts: The ordinary Penal Code for civilians and the Penal Code for the military. The corresponding Code of Penal Procedure and the Code for the Military Penal Procedure, respectively, regulate the implementation of the ordinary and the military penal codes.

In April 2010, the Penal Codes had been updated so as to incorporate the latest amendments and complementary provisions. Over and above the Penal Codes, specific legislation covers additional acts in branches of DRC law other than criminal law. On 20 July 2006, the Congolese parliament adopted new legislation that modifies the Penal Code and the Code of Civil Procedure by providing for more progressive definitions of sexual offenses.

DRC Civil Code comprise of three parts: The first part is the law of persons (*droit civil des personnes*), the second part is property law (*droit civil des biens*) and the third part is the law of obligations (*droit civil des obligations*).

DRC law traditionally distinguishes between four types of business organizations, of which the most significant are the “*société privée à responsabilité limitée*” (SPRL) and the “*société par actions à responsabilité limitée*” (SARL), a limited liability company. While SPRLs are private limited liability companies owned by members, SARLs are comparable to holding companies, which require presidential authorization before they can be registered, and in whose shares are from time to time open to public subscription. Most joint ventures between international mining companies and state-owned enterprise, called “*sociétés mixtes*”, are treated as SARLs

2.1.5 DRC Mining/Quarrying Laws and Regulations – Mining Code

The legal system of the DRC is civil law-based and the mining industry is regulated through national legislation, regulations issued by the DRC parliament and the DRC executive branch.

The main legislation, that the mining industry comes under the control of, is the Mining Code (adopted in 2002) and the ancillary Mining Regulation, adopted in 2003. This legislature is in general applicable throughout the entire country.

The Mining Code was enacted by Law No. 007/2002 on the 11th of July 2002 (the Mining Code). The implementing measures of the Mining Code are provided by the Mining Regulation, enacted by Decree No. 038/2003 on the 26th of March 2003 (the Mining Regulation). This core legislation includes environmental standards applicable to mining activities (also including quarry rights).

The main administrative entities in charge of regulating mining activities in the DRC as provided by the Mining Code are:

- The President of the Republic, who can enact mining regulations to implement the Mining Code and exercises his powers by Decree made on his own initiative or on the proposal of the Minister of Mines, after having obtained the opinion of the Directorate of Geology or of the Mining Registry.
- The Minister of Mines, who has, amongst other powers, jurisdiction over the granting, refusal and cancellation of mining rights, and exercises his powers by way of Decree.
- The Mining Registry, which is a public entity, under the supervision of the Minister of Mines and the Minister of Finance, whose assignment is to conduct administrative proceedings concerning the application for, and registration of, mining rights, as well as the withdrawal, cancellation and expiry of those rights.

- The Directorate of Mines, which is responsible for inspecting and supervising mining activities with regard to health and safety, work practices, production, transport, sale and social matters.
- The Department in Charge of the Protection of the Mining Environment, which has powers regarding the definition and implementation of the mining regulations concerning environmental protection and the technical evaluation of the mitigation and rehabilitation plan, the environmental impact study and the environmental management plan.

According to the Constitution and the Mining Code, the state is the owner of all mineral resources in the soil or subsoil. The state may grant to private parties (local or foreign) the rights to explore and exploit mineral resources by awarding mining titles. The mining legislation also, does not impose a specific classification system for reporting mineral resources and reserves.

The mining rights are protected by the DRC judicial system which adheres to the rule of law enforced pursuant to established procedures by courts that are independent from the executive and legislative branches of the state. Moreover, the Mining Code provides for a specific recourse system for mining right holders and organizes three ways to resolve mining disputes or threats over mining rights. Such disputes can be resolved by administrative recourse, judicial recourse and national or international arbitral recourse, depending on the nature of such threat or dispute.

Exploration and Exploitation Permits for the DRC

Exploration operations are subject to the prior approval of a mitigation and rehabilitation plan (MRP) subsequent to the delivery of the exploration permit. However, prospecting and small-scale exploitation permits are only subject to codes of conduct.

Exploitation permits are subject to the prior approval of an environmental impact study (EIS) and an environmental management plan (EMP).

As part of its environmental management plan, the holder of an exploration or exploitation right must provide for the measures of remediation and environmental rehabilitation after closure, the costs of which need to be entirely backed by a financial guarantee. However, the funding of the guarantee depends on the type of operation and its duration, and can take place over time. The amount is revised mid-term.

The rights of aboriginal, indigenous, lawful occupants and currently or previously disadvantaged peoples are protected by the mining rights.

Any private party can engage in non-artisanal exploration or exploitation of mineral substances in the DRC provided he or she is the holder of a valid mining right (exploration or exploitation), which is obtained upon completion of the corresponding administrative procedure. The granting of mining titles is based on a 'first-come, first-served' principle: the applications for mining rights for a given 'perimeter' (demarcated surface area with indefinite depth) composed of quadrangles or 'squares' are registered in the chronological order of their filing.

In exceptional cases, the Minister of Mines may submit to tender, open or by invitation, mining rights relating to a specific deposit. To maintain the validity of his or her mining rights, the holder must commence exploration within six months (exploration permit) or commence development and construction works within three years (exploitation permit) as of the date the title evidencing his or her right is issued, and pay the surface duty per square relating to his or her title at the counter of the Mining Registry. If he or she fails to fulfil any of these obligations, the holder may be deprived of his or her right. A title-holder must also comply with specific rules relating to, among others, protection of the environment, cultural heritage, health and safety or construction and planning of infrastructure.

The surface rights are acquired by private parties according to the Land Law No. 73-021 of the 20th of July 1973, the state has the exclusive, inalienable and imprescriptible property of the land. The

state can grant surface rights to private or public parties that have to be distinguished from mining rights since surface rights do not entail the right to exploit the mineral substances of the soil or subsoil and, inversely, a mining right does not entail any surface occupation right over the surface.

However, subject to any rights of third parties over the surface concerned, the holder of an exploitation mining right has, with the authorization of the governor of the province concerned, and on the advice of the administration of mines, the right to occupy within his or her mining perimeter the land necessary for his or her activities and associated industrial activities, including the construction of industrial plants and dwellings, to use the water, dig canals and channels, and establish means of communication and transport of any type. [Moreover, for use of water resources, above-ground or below-ground, permission of Ministry of Energy is also required].

Nevertheless, any occupation of land preventing the rightful surface right holders from using the surface, or any modification rendering the land unfit for cultivation, will entail the obligation for the holder of the mining rights to pay fair compensation. The mining rights holder is also liable for the damage caused to the occupants of the land in connection with his or her mining activities, even if they are authorized. The Mining Code provides for judicial and arbitral recourses in the event of disputes.

The Mining Code and the Mining Regulation provide for mainly self-contained environmental measures, and health and safety rules. The principal regulatory bodies that administer those laws are the department in charge of the protection of the mining environment (for environmental matters) and the directorate of mines (for health and safety matters).

The Titleholder of mining concession shall only be liable for damage to the environment caused by his activities insofar that he has not observed the terms of his Environmental Plan subject to prior approval, including the changes in the course of the project, or violated one of the environmental obligations provided for under this Title.

Mining Code - Article 279: Restrictions on the occupation of the land

Except with the consent of the competent authorities, no person may occupy land:

- a) Reserved for cemeteries;
- b) Containing archaeological remains or a national monument;
- c) Situated on or less than ninety meters from a dam or a building belonging to the State;
- d) Close to National Defense installations;
- e) Within an airport;
- f) Reserved for railway projects;
- g) Reserved for the planting of young trees or forest plantations;
- h) Situated less than ninety meters from the boundary of a village, a town, a municipality or a city;
- i) On a street, a road, a motorway;
- j) Within a national park.

Unless there is consent from the owner or legal occupant, no person may occupy land situated less than:

- a) one hundred and eighty meters from occupied, unoccupied or temporarily unoccupied houses or buildings;
- b) forty five meters from land hoed and ploughed for farm cultivation;

- c) ninety meters from a farm breeding cattle, having a reservoir, a dam or a private water reserve.

Mining Code - Article 280: Actual liability for the occupation of the land

- The holder or lessee must compensate for the damages caused by the works he carries out in connection with his mining activities, even if they are authorized.
- All damages caused to the assets of third parties shall be settled at their actual replacement value, plus 50%, unless the assets are returned to the condition they were in prior to the occurrence of said damage.

Mining Code - Article 281: Compensation for the occupants of the land

Any occupation of land depriving the rightful holders of enjoyment of the surface rights, any modification rendering the land unfit for cultivation, shall cause the holder or lessee of the mining and/or quarry rights, at the request of the rightful owners of surface rights, and at their convenience, to pay fair compensation, corresponding either to the rent or the value of the land at the time of its occupation, **plus 50%**.

Land, as referred to in the above paragraph, means the ground on which the individuals have always carried out or are effectively carrying out any activity.

Amicable settlement of the dispute may be made by any legitimate method other than resorting to the courts, especially by compromise, settlement, arbitration or before an Officer of the Judiciary Police or an Officer of the Public Prosecutor's office.

In the absence of an amicable settlement between the parties within 3 months from the date on which the dispute arises, the compensation shall be determined by the competent court pursuant to the rules on judicial organisation and jurisdiction in force in the DRC.

However, the usual occupant of the land may, in agreement with the holder, continue to exercise his right to cultivate the land provided that the work in the fields does not hinder the mining activities. The owner of the surface rights shall then no longer continue to construct buildings on it.

Lastly, the simply passing through the land does not entitle to any compensation if no damage results therefrom. The act of passing must take place with a view to best conserving the environment.

Mining Code - Article 282: Restricted access areas

At the request of the holder of an exploitation right or a permanent quarry exploitation authorization and after making the necessary investigation, the Minister may demarcate a zone around the holder's sites, as a restricted access area, in whole or in part, prohibiting any activities and/or the circulation of third parties.

Damages caused in that area by the mining or quarry exploitation works to third parties who might violate that prohibition, shall not entitle them to any compensation.

The Mining Regulations set forth the conditions to set up these areas, as well as the duration thereof.

Mining Code - Article 283: Authorized activities

Without prejudice to the State's ownership rights over its sub-soil, and subject to any rights of third parties over the surface concerned, the holder of an exploitation right or a permanent quarry exploitation permit has, in addition to the rights relating to his permit, with the authorisation of the Governor of the province concerned, and on the advice of the competent department of the Mines Authority:

- a) Within his surveyed Perimeter, the right:
- To occupy the land necessary for his activities and associated industrial activities, including the construction of industrial plants, dwellings and others of a social nature;
 - To use the underground water, the water in non-navigable water courses, and water courses conducive, in particular in connection with a concession relating to a waterfall, to build a hydro-electric station intended to meet the power requirements of the mine;
 - To dig canals and channels;
 - To establish means of communication and transport of any type.
- b) Outside his demarcated Perimeter, the right to establish means of communication and transport of any type.

The rights of occupation set forth in the present article constitute legal encumbrances in the public interest. They cannot be infringed, directly or indirectly, by the granting of subsequent mining and/or quarry rights.

Law no. 007/2002 of July 11, 2002 relating to the Mining Code Section II: Protection of the Cultural Heritage

Article 205: Declaration of archaeological elements:

The Holder of a mining or quarry right must inform the local administrative authority and the authority in charge of Culture, Arts and Museums, of the discovery of archaeological elements if the exploration or exploitation activities reveal the existence thereof.

Article 206: Discovery of elements of the national cultural heritage

The Holder is prohibited from moving the objects, which are contained in the updated national cultural heritage list, be they movables or other items. In this case, he must inform the local administrative authority and the authority in charge of Culture, Arts and Museums of this fact in writing, and without delay.

The Holder must remove, secure and keep these elements of national cultural heritage safe, as applicable, at the cost and on behalf of the State if the local administrative authority and the authority in charge of Culture, Arts and Museums concerned do not remove them within a period of sixty days following notification of the discovery.

Law No. 038/2003 of March 26, 2003 Relating to the Mining Code 11 Chapter IV: Protection of the Cultural Heritage

Article 489: On the protection and conservation of the national cultural heritage law

- a) The conservation of archaeological remains discovered during mining or quarry operations is subject to compensation to the Holder, in accordance with the dispositions of article 275 of the Mining Code;
- b) Elements of national cultural heritage discovered during mining or quarry operations must be taken in charge by the competent authority, which will also establish the modalities for compensation in favour of the Holder, who removes, secures and conserves the discovered cultural heritage elements in account of the State in accordance with article 206 of the Mining Code.

The protection of cultural resources is further legislated by Ordinance-Law No. 77-016 of March 15, 1971 - for the Protection of Cultural Property.

Law No. 77-016 of March 15, 1971 Relating to the Protection of Cultural Heritage Chapter III – Archaeological Excavations and Discoveries

- *Article 36* – Indicates that any archaeological excavations need to be sanctioned/permited by the *Director General of the Institute of National Museums*.
- *Article 38* - The State itself can execute archaeological excavations on any territory, with the exception of land adjacent to erected and closed buildings.
- *Article 40* – Furthermore, make provision for the management of accidental and chance finds of “*remains of movable property or of interest to art, history or archaeology*” and immediately reporting such discoveries to the Territorial Administrator.
- *Article 42* – Further, makes provision for the Minister of Culture to commission classification of cultural property.

2.1.6 Code du Travail [The Labour Code]

The country's labour legislation is called “Code du Travail” and was modified by the October 2002 Labour Code, which is in compliance with the conventions and recommendations of the International Labour Organization. The code provides for a control of labour practices and regulates recruitment, contracts, the employment of women and children, and general working conditions. The code also provides for equal pay for equal work without regard to origin, sex, or age.

Most importantly, according to Article 216 of the Labour Code, any physical or legal person planning any activity that requires the hiring of workers must notify the Labour Inspection Department and the National Bureau of Employment within 15 days of the start of business. The declaration is filed in a single form, with one specimen sent to the Inspectorate of Labour and another two to the Office of Employment. After the Ministry of Labour receives the declaration of commencement of activities, the Ministry can send inspectors to check if the company is in conformity with employment legislation.

Employers must cover medical and accident expenses. Larger firms are required to have medical staff and facilities on site, with the obligations increasing with the number of employees. Employers must provide family allowances based on the number of children, and paid holidays and annual vacations, based on the years of service. Employers must also provide daily transportation for their workers or pay an allowance in areas served by public transportation. The Ministry of Labour must grant permission for staff reductions. Generous pensions and severance packages are required by the Labour Code.

Every foreign employee must apply for a work permit from the National Committee of Employment of Foreigners within the Ministry of Labour. The right to strike is recognized and the law provides for reconciliation procedures in cases where the government is not involved.

The Ministry of Labour controls expatriate residence and work permits. There is no requirement that investors purchase from local sources or export a certain percentage of output.

[Translation of Articles from Droit du Travail]

Article.1 - This Code is applicable to all workers and all employers, including those of public enterprises carrying out their occupation on the extent of the Democratic Republic of the Congo, regardless of race, sex, marital status, religion, political opinion, national extraction, social origin and the nationality of the parties, the nature of the services, the amount of the remuneration or the place of conclusion of the contract as long as it is running in the Democratic Republic of the Congo. It also applies to workers of public services of the State contract of work. It does apply to the sailors and boatmen engaged in inland navigation in the silence specific regulations that concern them or where

these regulations expressly refer. Excluded from the scope of this Code are: 1) the judiciary; (2) the career of public service of the State agents governed by general status; (3) the officers and career public servants of the public services of the State governed by particular statutes; (4) the elements of the Congolese Armed Forces, the Congolese national police and the national Service.

Article.2 - The work is for everyone a right and a duty. It is a moral obligation for those who are in are not prevented by age or the unfit to work certified by a doctor. Forced or compulsory labour is prohibited. Falls also within the scope of the ban, any work or service exacted from any person under the menace of any penalty and for which the said individual is not provided voluntarily.

Article.3 - All the worst forms of child labour were abolished. The term "the worst forms of child labour" includes especially:

- a) all forms of slavery or similar practices, such as the sale and trafficking of children, debt bondage and serfdom as well as the forced or compulsory labour, including forced recruitment of children for use in armed conflict;
- b) the use, procuring or offering of a child for purposes of prostitution, production of pornography, pornographic performances or obscene dances;
- c) the use, procuring or offering of a child for the purpose of illicit activities, including the production and drug trafficking);
- d) work which, by its nature or the conditions in which they are exercised, are likely to harm the health, safety, dignity or the morality of the child.

Article.4 - There is hereby established a national Committee to combat the worst forms of child labour. This Committee has the mission: to develop the national strategy for the eradication of the worst forms of child labour; to monitor the implementation of the strategy and to evaluate the level of implementation of the recommended measures.

Article 5 - An interdepartmental order issued by the Ministers in their duties respectively labour and social welfare and Social Affairs and family, determines the organization and the functioning of the national Committee to combat against the worst forms of child labour.

Article 160 - The Enterprise or any kind of Establishment must ensure the health service (hospital) at the work place.

Article 161 - The Health service at work is ensured by a Doctor at work. They have a job especially to prevent and to ensure: the medical inspection of worker and sanitary inspection of the place of work; immediate aid and emergency relief to the victim of accident or upset.

Article 163 - Any company or institution has an obligation to hold a special service of safety, hygiene and beautification of the workplace.

Article 167 - Any establishment or any business of any nature whatsoever of the workers has the obligation to set up a Committee of safety, hygiene and beautification of the workplace.

Article 168 - The security, hygiene and beautification of the workplace Committee mission is to: design, correct and execute the policy of prevention of occupational diseases and work accidents; to stimulate and control the functioning of the security and occupational health services.

Article 169 - An order of the labour and Social Welfare Minister in charge after notice of the national labour Council determines the composition, jurisdiction and the rules of operation of safety committees, hygiene and beautification of the workplace.

May 17, 1968. -68/13 Ministerial order - Working Conditions of women and children. (Ministry of labour and social welfare)- [this ministerial order is not the subject of a publication in the official journal].F. DROIT DE LA SÉCURITÉ SOCIALE [Right to Social Security]

Article 1- It is forbidden to any employer of women and children in work exceeding their forces, exposure to occupational hazards high or which, by their nature or by the circumstances in which they are carried out, are likely to hurt their morals.

Article 2 - For the purposes of this order, 'manual transport of loads' means any transport where the weight of the load is fully supported by the worker; It includes also the uprising and the laying of the charge.

Article 3 - For the purposes of this order, the term "regular load manual transport" means any activity devoted way continuous or essential to the manual load or transport normally, even discontinuously, the manual load transport.

Article 4 - Subject to the derogations provided for in Section 2 of this chapter, the duration of the actual work of women cannot exceed eight hours per day or 48 hours per week. When the actual working time exceeds 4 hours a day, it must be cut to one or several rest periods of which the total can be less than an hour.

Title III – Child labour

Article 24 - The children of 14 and 16 years old can work for light work and sub-lubrious as define at the article 9 of the of the decree 19/67 of 30 October 1967 revised, and saying that:

- Not more than 4 hours per day also the day for classes and holiday;
- Not illegal and not very different for the school program.

Article 25 - Children of 16 years old and 18 years cannot work for 8 hours per day. When the working hours is not more than 4 hours per day; this must be cut with one or more break times so the total break cannot be less than one hour.

Article 26 - None of children of less than 18 years old can work on Sunday.

Article 27 - The work at night is forbidden for all children of less than 18 years old.

Work Forbidden For Children (Work that can be more than the strength of children)

Article 28 - The work for children aged less than 18 years old to the regular manual work of load is forbidden. However this forbidden is not applicable for the crop of seeds leafs and fruits except bananas and fruits of palm tree as the crop work in made on the ground.

[Translation of Articles from Droit de la Securite Sociale]

Article.1 –

(1) There is hereby established a plan to set up a social security system covering the service: benefits of labour and occupational disease (the occupational hazards branch) accident; invalidity, retirement and death pensions (pensions Branch); family benefits (family allowances branch); of all other employees to introduce later in favour of workers social security benefits.

(2) Pension funds can be established within one or several undertakings for the benefit of employees, with the permission of the Minister of Labour, to provide benefits in addition to those resulting from the social security scheme established by this decree-law. Orders by the Minister of Labour will determine the conditions which shall be subject to the granting of the authorization depending on whether the institution is calling for a contribution from the beneficiaries, as well as the rules of operation and the conditions for liquidation of the institution.

2.1.7 The Land Tenure System

The land tenure system in the DRC is governed by Law No. 73/21 of 20 July 1973 as amended and supplemented by Law No. 80/8 of 18 July 1980 which makes the State the sole owner of the soil and subsoil. This law, which is inspired by the customary land system, provides for the prior consent of the Leader of the Clan owner of the land before endorsement by the Administrative Authority of the allocation of lands. In practice, access to land has first to be authorized by the customary leaders who grant land plots as life estate or “freehold” to the applicants. Such allocation will be used as proof when seeking officialisation by Territorial Administration of ownership of the land plots obtained. Land is made available to farmers after drawing up leasing contracts of a long duration of up to 99 years for big farms. Development and payment of an annual land tax are the conditions that the beneficiary of land must meet in order to maintain his right to the said land. In the eyes of the land law, women have the same rights and obligations as men. However, such rights are not always granted automatically. There is a need for sensitization programmes to foster the application of this law in rural areas.

Agricultural land, though abundant, is unequally distributed because of a land law which is still strongly marked by customs that confer on traditional chief's ownership of vast estates which are randomly developed by third parties in the form of share farming. Moreover, large areas granted to enterprises and/or to private individuals are under exploited because they are above their capacity to manage. This type of tenure sometimes limits agricultural investments and the rational utilization of factors of production and, consequently, land productivity. The Government which is aware of this problem has initiated a national consultation with all the stakeholders with a view to amending the land law to render it more equitable and more attractive to private investors.

2.1.8 The Forest Code

With the assistance of The World Bank, the DRC government drafted a new Forest Code, which was adopted in August 2002. The DRC Government is engaged in an extensive program of sector reforms which led to the adoption of the Law No. 011/2002 of 29 August 2002 on the Forest Code.

The code includes all of the provisions governing the status, development, conservation, exploitation, monitoring and police the forests and forest land (Article 3 of the Forest Code).

On the institutional level, the main innovations of the Forestry Code are:

1. The State has an obligation to develop a national forest policy materialized by a national forest plan revised periodically based on the dynamics of forest industrialization;
2. Three categories of forests are now under this Act (classified forests, protected forests and permanent production forests);
3. The creation of a forest “cadaster” (registry) at the headquarters of the provincial government.
4. The creation of a National Advisory Council and Provincial Advisory Boards of the forests.

The Forest Code, in its Article 7, States that the forests in the DRC are the property of the State. Their operation and their use by persons or legal entities of public or private law are governed by the provisions of this Act and its implementing measures. The forest domain of State (Affairs FDEA) now splits into three categories: the classified, protected forests and permanent production forests. The three categories are defined as follows (Forest Code, Art. 10):

- **Classified Forests**, often referred to as patronage areas, but should not be confused with the protected forests, are those submitted pursuant to an act of classification to a restrictive legal regime regarding the rights of use and exploitation; they are assigned to a particular, including ecological vocation. Classified forests must be at least 15% of the total area of the national

territory. The classification is made by order of the Minister after assent of the Provincial Advisory Council of the forests concerned, based on prior consultation of the riparian population. However, the integral natural reserves, national parks and conservation areas, are the responsibility of the President of the Republic. The order of classification determine location and concerned forest boundaries, its category, its name, the mode of management of its resources, restrictions have been applied, to practice usage rights and responsible for its management.

- **Protected Forests** are those that were not the subject of an act of classification and are subject to a less restrictive legal regime with respect to the rights of use and exploitation rights. Protected forest is subject to grant by means of a contract of which the duration may not exceed 25 years. This term is renewable under the conditions set out in the contract. A local community can also, at the request, obtain logging concessions as a part or all of the protected forests owned under customary. The award is thus by Decree of the President of the Republic.
- **Permanent Production Forests** are forests that are subtracted from the forests protected by a public inquiry to grant them. These are subject to the rules laid down in the forest Code and its implementing measures. (Examples: forest concession, local community forest).

2.1.9 Loi Cadre sur l'Environnement RDC [The DRC Environment Framework Law]

The Environment Framework Law has been enacted, July 9, 2011, on the basic principles for the protection of the environment. The Democratic Republic of the Congo has for more than a decade, the most important period of expansion in the exploitation of its resources natural, including forestry, mining, oil, etc. However, the increase in these activities reveals important gaps with regard to respect for the environment. This was justified among other things by the absence of a unifying legal text of all environmental values.

It is to fill the gap that the Congolese State has, since July 09, 2011, notified the Law No. 11/009 with fundamental principles relating to the Protection of the Environment. The objective of this law is to set the fundamental principles relative to the management and protection of the environment against all forms of degradation in order to allow for the rational exploitation of natural resources, to fight against all forms of pollution and to improve the quality of life of the population, both present and future.

The Law deals with Environmental and Social Assessments. It requires all development projects which may have an impact on the environment to submit an Environmental and Social Impact Study (ESIS). This applies equally to all public works carried out by the State, Provinces or other public enterprises which could have a significant impact on the environment.

Importantly, the Law requires all multi-sectoral or sectoral plans, programmes and projects to be subjected to a Strategic Environmental Assessment (SEA). Number of the domains included in the law, the mining, which in Year 2002 set up a certain number of principles and mechanisms of protection of the environment. Since then, mining companies are subject to the Act of 11 July of the Mining Code.

2.1.10 The Environmental Protection Act (2012)

The DRC has specific legislation pertaining to the protection of cultural resources as specified in the newly legislated Environmental Protection Act. This act specifies general principles which serve as a basis for specific laws for governing the different sectors of the environment.

Act No. 11/009 of 09 July 2011 Regarding Fundamental Principles Relating to the Protection of the Environment, Chapter 5: Management and Conservation of Natural Resources, Article 35 specifies that the State, the provinces and the decentralized territorial entity, within their respective

jurisdictions, shall identify and ensure the protection, conservation and development of cultural and natural heritage.

The DRC Environmental Protection Act came into effect in 2012. Article 203 of this act allows for cooperative governance by central government and the provincial administrations: “to protect the environment, natural sites and landscapes, and the conservation of such sites.”

2.1.11 The Société National d'Electricité [SNEL]

The Société National d'Electricité (SNEL) is the state-owned organization responsible for electricity generation and supply.

SNEL is a vertically-integrated monopoly electricity production and distribution utility, and reports to the Ministry of Energy. In 2001, the government invited international tenders for the privatisation of SNEL, but privatisation is still seen as unlikely, primarily due to the extensive damage inflicted on the SNEL's infrastructure during the war.

2.1.12 The National Energy Commission

The National Energy Commission (CNE) is responsible for monitoring the energy sector in the country. The Commission consists of an advisory committee, chaired by the Minister for Energy, and a permanent secretariat of approximately 75 members. The CNE is directly responsible for the renewable energy sector of the country, as part of its remit, and has previously conducted studies into the potential use of wind power and micro-hydro power for rural electrification.

2.2 NYA Policies

NYA's company policies consist of the following, and are included in Appendix 10:

- Sustainable Development Policy;
- Health and Safety Policy;
- Human Resources Policy;
- Human Rights Policy.

2.3 Applicable International Environmental and Social, Health and Safety Laws and Regulations

2.3.1 International Framework

In the context of Applicable International Environmental and Occupational Safety and Health Laws and Regulations, this report has also taken into consideration the IFC “Environmental, Health, and Safety Guidelines, Cement and Lime Manufacturing (April 30, 2007), IFC “Environmental, Health, and Safety Guidelines, Mining (December 10, 2007), IFC “Environmental, Health, and Safety Guidelines, General EHS Guidelines (April 30, 2007), OPIC-Environmental and Social Policy Statement (ESPS), October 15, 2010; OPIC- Environmental Handbook (February 2004), International Finance Corporation's Performance Standards on Environmental and Social Sustainability (January 1, 2012); International Finance Corporation, Access to Information Policy, January 1, 2012; IFC Environmental, Health, and Safety Guidelines, General EHS Guidelines: Environmental Air Emissions And Ambient Air Quality (April 30, 2007); IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission And Distribution, (April 30, 2007); BREF Notes for Cement, Lime and Magnesium Oxide Manufacturing Industries BREF (05. 2010); FD (06. 2012) and European / (EU) Emission Standards, EU Laws and EU Directives (November 16, 2012); International Organization for Standardization (ISO) 14000 Standards; ILO Labour Standards (Core Labour Standards and Basic Terms and Conditions of Employment for all Workers, including

subcontractors) and OHSAS 18001 for Occupational Health and Safety and the "Pollution Prevention and Abatement Handbook" by the World Bank Group- effective July 1998.

Within this handbook, different guidelines are mentioned for the purpose of assessing industrial facilities with respect to their environmental compliance. In the present case, the guidelines for new cement plants are applicable for the Social and Environmental Impact Assessment.

2.3.2 The Equator Principles

Development financiers play a major role in the development and enforcement of international sustainable development standards through the conditioning of their loans. This is often through the Equator Principles (EP), the first version of which was launched in June 2003. The Equator Principles provide a framework for financial institutions seeking to manage environmental and social risks, and to promote best practice in this context. The signatories are predominantly private banks which provide project financing in developing countries. The signatories require borrowers to demonstrate that they have substantially met these principles or will do so in the development and management process. These undertakings are aligned with the IFC/World Bank policies, safeguards, performance standards and guidelines.

The third version, Equator Principles III, was launched on and became effective from 4 June 2013. They apply to all transactions from 1 January 2014, may be applied to transactions signed between 4 June and 31 December 2013, however mandates signed before 4 June 2013 are not required to use EP III.

EP III reflects new requirements related to managing impacts on climate, human rights considerations in due diligences and strengthening of reporting and transparency. Presently NYA does not have an inventory of its greenhouse gas emissions or a plan to reduce the consumption of fossil fuels for energy purposes. Integrated reporting is required to strengthen the company's system for mitigating and managing environmental and social impacts arising from mining operations.

The EPs have now been adopted by 79 financial institutions (Equator Principles website, 7 June 2013). The Principles require observance of the International Finance Corporation (IFC) Performance Standards and the World Bank Group Environmental, Health and Safety (EHS) Guidelines when developing projects in non-high income OECD^[1] countries.

Application of Equator Principles

The EP III, through their incorporation of World Bank Group Guidelines and policies, set forth a process to be used by international lending institutions to categorise, assess, mitigate and monitor the social and environmental risk of projects. The steps to be followed by international lending institutions include:

- Review of the project sponsors social and environmental assessment;
- Categorization of the potential impact of a project, from minimal impact to potentially significant adverse impact;
- Evaluation of the project sponsors action plan to determine likely compliance with host country laws and relevant International Finance Corporation (IFC) standards;
- Consultation with local populations affected by the project;
- Public disclosure of the project's Social and Environmental Assessment and action plan; and

^[1] Organization for Economic Cooperation and Development

- Insertion of covenants in the loan agreement to ensure that the project sponsor provides regular reports and complies with relevant laws and standards and the project sponsor's Social Environmental and Assessment and action plan.

The specific international guidelines and standards that apply to the project are the Performance Standards on Environmental and Social Sustainability, (IFC 200b). Other international guidelines relating to air quality, water quality, noise and other issues also may apply to the project. These guidelines provide required boundaries for the project design and operations to meet and maintain certain environmental and human standards.

2.3.3 IFC EHS Guidelines

The Environmental Health and Safety (EHS) General Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) as defined in IFC's PS3, also relevant to PS4. Applied by agencies including the World Bank and the IFC, they are PS and measures generally considered to be achievable in new facilities at reasonable costs by existing technology. Industry sector EHS guidelines are designed to be used together with the General EHS Guidelines document. Of relevance here are the Mining, as well as the Cement and Lime industry EHS Guidelines.

2.3.4 IFC Policy on Environmental and Social Sustainability

International Finance Corporation (IFC) is the private sector arm of the World Bank Group. Summarily, it aims at fighting poverty with passion and professionalism for lasting results and to help people help themselves and their environment by providing resources, sharing knowledge, building capacity, and forging partnerships in the public and private sectors.

International Finance Corporation's (IFC) Policy on Environmental and Social Sustainability, Effective January 1, 2012 supersedes the IFC Disclosure of Information Policy (April 2006) in its entirety. This Policy is not an express or implied waiver of IFC's privileges and immunities under its Articles of Agreement, international conventions, or any applicable law, nor does it provide any contractual or other rights to any party.

At IFC while transparency and accountability are fundamental to fulfilling its development mandate, IFC encourages its clients to be more transparent about their businesses and believes that when clients are committed to transparency and accountability they help promote the long-term profitability of their investments.

IFC strives for positive development outcomes in the activities it supports in developing countries including: (i) investments financed directly by IFC; (ii) investments implemented through financial intermediaries (FIs) or managed by IFC's Asset Management Company or any other IFC subsidiary, as well as investments funded in part or in whole by donors; and (iii) advisory services.

IFC believes that an important component of achieving positive development outcomes is the environmental and social sustainability of these activities, which IFC pursues and expects to achieve through the application of this Policy on Environmental and Social Sustainability (the Sustainability Policy or the Policy), and a comprehensive set of environmental and social Performance Standards. Through this Policy, IFC puts into practice its commitments to environmental and social sustainability. Activities supported and financed by IFC include a wide range of investment and advisory products including technical, financial and/or regulatory advice, project structuring as well as training to companies, industries, and governments.

Within the scope of an agreed advisory activity, all advice and training will be consistent with the Performance Standards. The Performance Standards on Environmental and Social Sustainability consist of the followings:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
- Performance Standard 2: Labour and Working Conditions
- Performance Standard 3: Resource Efficiency and Pollution Prevention
- Performance Standard 4: Community Health, Safety, and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

These Performance Standards help IFC investment and advisory clients manage and improve their environmental and social performance through a risk and outcomes based approach. While managing environmental and social risks and impacts in a manner consistent with the Performance Standards is the responsibility of the client, IFC seeks to ensure, through its due diligence, monitoring, and supervision efforts, that the business activities it finances are implemented in accordance with the requirements of the Performance Standards. As a result, the outcome of IFC's environmental and social due diligence of a proposed business activity is an important factor in its approval process, and will determine the scope of the environmental and social conditions of IFC financing.

IFC's development mission are its efforts to carry out investment and advisory activities with the intent to "do no harm" to people and the environment, to enhance the sustainability of private sector operations and the markets they work in, and to achieve positive development outcomes. IFC is committed to ensuring that the costs of economic development do not fall disproportionately on those who are poor or vulnerable, that the environment is not degraded in the process, and that renewable natural resources are managed sustainably.

IFC recognizes that climate change is a serious global challenge and that climate-related impacts may impede economic and social well-being and development efforts. Working with the private sector and other parties to address climate change is therefore a strategic priority for IFC. IFC will engage in innovative investments and advisory services to support climate-friendly solutions and opportunities for business.

IFC support for low-carbon economic development is one dimension of a balanced approach to development, including supporting access to modern, clean, and reliable energy services. IFC pursues this objective through the use and development of relevant products, instruments, markets, and advisory services as well as through the adoption of appropriate technologies, processes, and practices in the activities it supports.

The desired outcomes are very briefly described in the objectives of each Performance Standard as below:

Performance Standard 1 - Assessment and Management of Environmental and Social Risks and Impacts

Performance Standard 1 underscores the importance of managing environmental and social performance throughout the life of a project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the clients, its workers, local communities directly affected by the

project (the Affected Communities) and, where appropriate, other stakeholders. Drawing on the elements of the established business management process of “plan, do, check, and act,” the ESMS entails a methodological approach to managing environmental and social risks and impacts³ in a structured way on an on-going basis.

Business should respect human rights, which means to avoid infringing on the human rights of others and address adverse human rights impacts business may cause or contribute to. This Performance Standard applies to business activities with environmental and/or social risks and/or impacts.

Performance Standard 2 - Labour and Working Conditions Introduction

Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers through a constructive worker-management relationship, and by treating the workers fairly and providing them with safe and healthy working conditions, clients may create tangible benefits, such as enhancement of the efficiency and productivity of their operations.

Performance Standard 3 - Resource Efficiency and Pollution Prevention Introduction

Where on the one hand increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels; there on the other hand the current and projected atmospheric concentration of Green House Gases (GHG) threatens the public health and welfare of current and future generations.

This Performance Standard outlines a project-level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices.

Performance Standard 4 - Community Health, Safety, and Security Introduction

Performance Standard 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts due to project activities. While acknowledging the public authorities' role in promoting the health, safety, and security of the public, this Performance Standard addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups.

This Performance Standard addresses potential risks and impacts to the Affected Communities from project activities.

Performance Standard 5 - Land Acquisition and Involuntary Resettlement Introduction

Performance Standard 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use.

Unless properly managed, involuntary resettlement may result in long-term hardship and impoverishment for the Affected Communities and persons, as well as environmental damage and

adverse socio-economic impacts in areas to which they have been displaced. For these reasons, involuntary resettlement should be avoided and where unavoidable, it should be minimized and appropriate measures to mitigate adverse impacts should be carefully planned and implemented.

Performance Standard 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources

Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this Performance Standard have been guided by the Convention on Biological Diversity, which defines biodiversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems.”

This Performance Standard addresses how clients can sustainably manage and mitigate impacts on biodiversity and ecosystem services throughout the project’s lifecycle.

Performance Standard 7 - Indigenous Peoples

Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. As a consequence, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities. This vulnerability may include loss of identity, culture, and natural resource-based livelihoods, as well as exposure to impoverishment and diseases.

Private sector projects can create opportunities for Indigenous Peoples to participate in, and benefit from project-related activities that may help them fulfil their aspiration for economic and social development. Furthermore, Indigenous Peoples may play a role in sustainable development by promoting and managing activities and enterprises as partners in development. Government often plays a central role in the management of Indigenous Peoples’ issues, and clients should collaborate with the responsible authorities in managing the risks and impacts of their activities.

Performance Standard 8 - Cultural Heritage

Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project’s use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.

2.3.5 The World Bank Environmental, Health and Safety Guidelines

Guidelines published by the International Finance Corporation/World Bank Group (IFC/WB) in the Environmental, Health and Safety (EHS) General Guidelines document in 2007 is presented in this section for ambient air quality guidelines and guidelines for the cement and lime manufacturing

industry. The EHS guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP) (WB/IFC, 2007b).

Table 2-8: World Bank/IFC ambient air quality guidelines (Source: WB/IFC 2007)

Pollutant	Maximum 1-hour Concentration ($\mu\text{g}/\text{m}^3$)	Maximum 8-hour Concentration ($\mu\text{g}/\text{m}^3$)	Maximum 24-hour Concentration ($\mu\text{g}/\text{m}^3$)	Annual Average Concentration ($\mu\text{g}/\text{m}^3$)
PM ₁₀	-	-	150 ¹	70 ¹
	-	-	100 ²	50 ²
	-	-	75 ³	30 ³
	-	-	50 ⁴	20 ⁴
PM _{2.5}	-	-	75 ¹	35 ¹
	-	-	50 ²	25 ²
	-	-	37.5 ³	15 ³
	-	-	20 ⁴	10 ⁴
SO ₂	-	-	125 ¹	-
	-	-	50 ²	-
	-	-	20 ⁴	-
NO ₂	200 ⁴	-	-	40 ⁴
Ozone	-	160 ¹	-	-
	-	100 ⁴	-	-

- Interim target-1 (IT-1) – These levels are associated with about a 15 % higher long term mortality risk relative to the AQG level.
- Interim target-2 (IT-2) – In addition to the other health benefits these levels lower the risk of premature mortality by approximately 6% [2-11%] relative to the IT-2 level
- Interim target-3 (IT-3) – In addition to the other health benefits these levels reduce the mortality risk by approximately 6% [2-11 %] relative to the IT-2 level
- Guideline (AQG) – In addition to the lowest levels at which total cardiopulmonary and lung cancer mortality have been shown to increase with more than 95 %confidence in response to long term exposure to PM_{2.5}

Table 2-9: World Bank/IFC ambient emissions guidelines for cement and lime manufacturing (Source: WB/IFC 2007).

Pollutant	Units	Guideline Value for Cement Manufacturing*	Guideline Value for Lime Manufacturing
PM (New Kiln)	mg/Nm ³	30 ¹	-
PM (Existing Kiln)	mg/Nm ³	100	-
Dust	mg/Nm ³	50	50
SO ₂	mg/Nm ³	400	400
NO _x	mg/Nm ³	600	500
HCl	mg/Nm ³	10 ²	10
Hydrogen Fluoride	mg/Nm ³	1 ²	-
Total Organic Carbon	mg/Nm ³	10	-
Dioxins and Furans	Mg TEQ/Nm ³	0.1 ²	-
Cadmium and Thallium (Cd+Tl)	mg/Nm ³	0.05 ²	-
Mercury (Hg)	mg/Nm ³	0.05 ²	-
Total Metals ³	mg/Nm ³	0.5	-
*Daily average values corrected to 273K, 101.3kPa, 10% O₂ and dry gas, unless otherwise noted 10mg/Nm³ if more than 40% of the resulting heat release comes from hazardous waste - If more than 40% of the resulting heat release comes from hazardous waste, average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours - Total Metals = Arsenic (As), Lead (Pb), Cobalt (Co), Chromium (Cr), Copper (Cu), Manganese (Mn), Nickel (Ni) Vanadium (V), and Antimony (Sb).			

Table 2-10: EU emissions guidelines for cement and lime manufacturing (Source: EU 2013/163/EU)

Pollutant	Process	Units	Guideline Value for Cement Manufacturing	Guideline Value for Lime Manufacturing
Dust	Dusty Operations	mg/Nm ³	< 10	< 10
	Kiln Firing Process		< 10-20	< 10
	Cooling and Milling		< 10-20	-
SO ₂	Preheater Kiln	mg/Nm ³	< 50-400	< 50-200
NO _x	Preheater Kiln	mg/Nm ³	< 200-450	100-350
CO	Preheater Kiln	mg/Nm ³	-	< 500

2.3.6 EU - Reference Document on Best Available Techniques [BAT] in the Cement, Lime and Magnesium Oxide Manufacturing Industries

The BAT (Best Available Techniques) Reference Document (BREF) titled 'Cement, Lime and Magnesium Oxide Manufacturing Industries' reflects an information exchange carried out under Article 17(2) of Directive 2008/1/EC of the European Parliament and of the Council (IPPC Directive).

Unless otherwise stated, references to 'the Directive' in this document means the Directive 2008/1/EC of the European Parliament and the Council concerning integrated pollution prevention and control (IPPC). As the IPPC Directive applies without prejudice to Community provisions on health and safety at the workplace, so does this document.

This document forms part of a series presenting the results of an exchange of information between EU Member States and industries concerned on best available technique (BAT), associated monitoring, and developments in them. It is published by the European Commission pursuant to Article 17(2) of the Directive, and must therefore be taken into account in accordance with Annex IV of the Directive when determining "best available techniques".

The purpose of the IPPC Directive is to achieve integrated prevention and control of pollution arising from the activities listed in its Annex I, leading to a high level of protection of the environment as a whole. The legal basis of the Directive relates to environmental protection. Its implementation should also take account of other European Community objectives such as the competitiveness of the Community's industry thereby contributing to sustainable development.

More specifically, the Directive provides for a permitting system for certain categories of industrial installations requiring both operators and regulators to take an integrated, overall view of the potential of the installation to consume and pollute. The overall aim of such an integrated approach must be to improve the design, construction, management and control as well as decommissioning of industrial processes so as to ensure a high level of protection for the environment as a whole.

Central to this approach is the general principle given in Article 3 of the Directive which states that operators should take all appropriate preventative measures against pollution, in particular through the application of the best available techniques enabling them to improve their environmental performance.

The term "best available techniques" is defined in Article 2(12) of the Directive as "the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole."

Article 2(12) goes on to clarify further this definition as follows:

- 'techniques' shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned
- 'available techniques' means those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator;
- 'best' means those most effective in achieving a high general level of protection of the environment as a whole.

Furthermore, Annex IV to the Directive contains a list of 'considerations to be taken into account generally or in specific cases when determining best available techniques, bearing in mind the likely

costs and benefits of a measure and the principles of precaution and prevention'. These considerations include the information published by the Commission pursuant to Article 17(2) of the Directive.

This document has subsequently been updated and recently published as 2013/163/EU, The BAT conclusions for the production of cement, lime and magnesium oxide. The content however remains in accordance with the former BREF document.

2.3.7 African Development Bank Environmental, Health and Safety Guidelines

The following relevant African Development Bank guidelines and policies are relevant to the project:

- Integrated Environmental and Social Impact Assessment Guidelines, October 2003.
- African Development Bank Group's Policy on the Environment ('Environmental Safeguards Policy'), February 2004.
- Involuntary Resettlement Policy, November 2003.
- Environmental Review Procedures for Private Sector Operations of the African Development Bank, May 2000.
- Environmental and Social Assessment Procedures for African Development Bank's Public Sector Operations, June 2001

2.4 Other benchmarks, guidelines and reference materials

2.4.1 EU Reference Documents and Directives

Integrated Pollution Prevention and Control (IPPC) Reference Document on the General Principles of Monitoring (July 2003)

This reference document on "The General Principles of Monitoring" reflects an information exchange carried out under Article 16(2) of Council Directive 96/61/EC. This document provides information to guide IPPC permit writers and operators of IPPC installations in meeting their obligations under the Directive with regard to monitoring requirements of industrial emissions at source.

Environmental Noise Directive (2002/49/EC)

Following a proposal by the Commission adopted in Year 2000 (1), the European Parliament and Council adopted Directive 2002/49/EC relating to the assessment and management of environmental noise on 25 June 2002, also known as the "END".

The END aims to "define a common approach intended to avoid, prevent or reduce on a prioritized basis the harmful effects, including annoyance, due to the exposure to environmental noise". For that purpose several actions are to be progressively implemented. It furthermore aims at providing a basis for developing EU measures to reduce noise emitted by major sources, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery.

Directive 2001/80/EC (Large Combustion Plants Directive)

The overall aim of the LCP Directive is to reduce emissions of acidifying pollutants, particles, and ozone precursors. Control of emissions from large combustion plants - those whose rated thermal input is equal to or greater than 50 MW - plays an important role in the Union's efforts to combat acidification, eutrophication and ground-level ozone as part of the overall strategy to reduce air pollution.

The LCP Directive contains the following provisions:

- Plants licensed after 26 November 2002 have to comply with the (stricter) emission limit values for SO₂, NO_x and dust fixed in Part B of the Annexes III to VII.
- Plants licensed on or after 1st July 1987 and before 27 November 2002 have to comply with the (less strict) emission limit values fixed in Part A of the Annexes III to VII.
- Significant emission reductions from "existing plants" (licensed before 1st July 1987) are required to be achieved by 1st January 2008:
 - a) by individual compliance with the same emission limit values as established for the plants referred to in point 2 above, or
 - b) through a national emission reduction plan (NERP) that achieves overall reductions calculated on the basis of those emission limit values.

Note that this directive has been superseded by the recently published cement directive of 2013/163/EU (The BAT conclusions for the production of cement, lime and magnesium oxide), the content of which is summarised (as the BREF document it replaces) in Section 2.3.6, as well as EU directive: 2010/75/EU on industrial emissions for the production of cement, lime and magnesium oxide.

EU – Ambient Air Quality and Cleaner Air Directive (2008/50/EC)

The ambient air quality directive revises European legislation relating to ambient air quality with the aim of reducing pollution to levels which minimise the harmful effects on human health and on the environment.

The directive aims for the following (website: <http://europa.eu>):

- Defining and establishing objectives for ambient air quality designed to reduce harmful effects on health and the environment;
- Assessing the ambient air quality in Member States on the basis of common methods and criteria;
- Collating information on ambient air quality in order to monitor long-term trends, in particular;
- Ensuring that such information on ambient air quality is made available to the public;
- Maintaining air quality where it is good and improving it in other cases;
- Promoting increased cooperation between the Member States in reducing air pollution.

Member States shall designate the competent authorities and bodies responsible for evaluating the quality of ambient air, approving measurement systems, ensuring the accuracy of measurements, analysing assessment methods and cooperating with other Member States and the Commission.

The directive also establishes a system for assessing ambient air quality with respect to particulate matter (PM₁₀ and PM_{2.5}), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), oxides of nitrogen (NO_x), lead (Pb), benzene (C₆H₆), carbon monoxide (CO) and ozone (O₃). Through the directive thresholds for the pollutants have been identified (Section 4.5.10) and how the pollutants should be measured. These are undertaken through setting up air quality management plans and action plans in each of the Member States.

Environmental Policy Handbook (2005)

The Handbook provides a short outline of EU environmental policy history, analyses and presents some 60 pieces of EU environment and nature protection legislation, most of which have been adopted in the last 15 years, establishing links between the different pieces of legislation. Against the

current decline in environmental policy and the trend towards its subordination to jobs and economic growth, the handbook encourages an informed and intelligent use of existing legislative networks and calls for resistance to attempts to water it down.

Handbook for Implementation of EU Environmental Legislation

The objective of the Handbook for Implementation of EU Environmental Legislation (December 2008) is to provide a planning framework and step-by-step guidance on the approaches and specific activities required to ensure the effective and legally compliant implementation of EC environmental legislation. It targets candidate countries, potential candidate countries, as well as existing Member States. The Handbook provides:

- An introduction to each environmental sector setting out a framework for planning the implementation of the legislation contained within that particular environmental sector;
- Separate fiches containing information and guidance about each legal act presented in the EC's acquis guidance document;
- Ample examples of implementation efforts in existing Member States, highlighting institutional, policy and legislative frameworks.

2.4.2 ILO Guidelines on Occupational Safety and Health Management Systems

In 2001, the International Labour Organization (ILO) published ILO-OSH 2001, also titled "Guidelines on Occupational Safety and Health Management Systems" to assist organizations with introducing OSH management systems. These guidelines encourage continual improvement in employee health and safety, achieved via a constant process of policy, organization, planning and implementation, evaluation, and action for improvement, all supported by constant auditing to determine the success of OSH actions.

The ILO management system was created to assist employers to keep pace with rapidly shifting and competitive industrial environments. The ILO recognizes that national legislation is essential, but sometimes insufficient on its own to address the challenges faced by industry, and therefore elected to ensure free and open distribution of administrative tools in the form of occupational health and safety management system guidance for everyone. This open access forum is intended to provide the tools for industry to create safe and healthy working environments and foster positive safety cultures within the organizations.

2.4.3 OHSAS 18000

OHSAS 18000 is an international occupational health and safety management system specification. OHSAS 18000 comprises two parts, OHSAS 18001 and 18002 and embraces a number of other publications. OHSAS 18000 is the internationally recognized assessment specification for occupational health and safety management systems. This internationally recognized specification for occupational health and safety management system operates on the basis of policy, planning, implementation and operation, checking and corrective action, management review, and continual improvement.

2.4.4 ISO 14001

ISO 14001 sets out the criteria for an environmental management system. It does not state requirements for environmental performance, but maps out a framework that a company or organization can follow to set up an effective environmental management system. It can be used by any organization that wants to improve resource efficiency, reduce waste and drive down costs. Using ISO 14001 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved. ISO 14001 can

also be integrated with other management functions and assists companies in meeting their environmental and economic goals.

ISO 14001, as with other ISO 14000 standards, is voluntary, with its main aim to assist companies in continually improving their environmental performance, whilst complying with any applicable legislation. Organizations are responsible for setting their own targets and performance measures, with the standard serving to assist them in meeting objectives and goals and the subsequent monitoring and measurement of these.

ISO 9001 Quality Management Systems and ISO 14001 Environmental Management System can work in tandem with OHSAS 18001/18002 to complement each other and form a better overall system. Each component of the system is specific, auditable, and accreditable by a third party after review.

2.4.5 ISO 26000

In 2005, ISO launched the development of an International Standard providing guidelines for Social Responsibility. It was adopted in November 2010. ISO 26000 in contrast with most ISO standards does not aim at certification.

The objective of ISO 26000 is to “provide harmonized, globally relevant guidance based on international consensus among expert representatives of the main stakeholder groups and so encourage the implementation of social responsibility worldwide. The guidance in ISO 26000 draws on best practice developed by existing public and private sector initiatives and is intended to be useful to organizations large and small in both these sectors”.

ISO 26000 defines social responsibility as the “responsibility of an organization for the impacts of its decisions and activities on society and the environment, through transparent and ethical behaviour that contributes to sustainable development, including health and the welfare of society; takes into account the expectations of stakeholders, is in compliance with applicable law and consistent with international norms of behaviour and is integrated throughout the organization and practised in its relationships”

ISO 26000 deals with a wide range of issues and has identified seven “core subjects”: organizational governance; human rights; labour practices; the environment; fair operating practices; consumer issues; and community involvement and development.

Although it is not meant to become a certification standard nor to be used as a standard-setting document, nothing in the text prevents countries from adopting national standards based on ISO 26000 that could become certifiable.

2.4.6 IFC Good Practice Note Addressing Grievances from Project-Affected Communities

Companies across sectors and through all stages of project development can benefit from understanding community concerns and complaints and addressing them. This Good Practice Note provides guidance on basic principles and process steps that organizations should take into account when creating and implementing grievance mechanisms. Together, these principles and steps constitute a baseline set of considerations and good strategies for designing and implementing procedures appropriate to the project scale and impact.

2.4.7 International Treaties and Agreements

The DRC has ratified all the main international human rights and humanitarian legal instruments, including the UN Convention on Civil and Political Rights and the UN Convention on Social, Economic and Cultural Rights.

DRC Government has ratified three International Labour Organization (ILO) conventions: The Abolition of Forced Labour Convention, the Discrimination (Employment and Occupation) Convention, and the Minimum Age Convention.

The Democratic Republic of Congo has ratified Convention No. 138, the Minimum Age Convention and Convention No. 182, the Worst Forms of Child Labour Convention, both in 2001. Child labour is regulated by the law under which children are not allowed to perform hazardous work.

DRC has signed the “Convention on International Trade in Endangered Species of Wild Fauna and Flora.”

DRC has signed international agreements on: Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Marine Dumping, Ozone Layer Protection, and Wetlands.

DRC has approved the following international conventions and protocols pertaining to the environment and which are of relevance to the Proposed Project:

- United Nations Framework Convention on Climate Change, 1992;
- Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal adopted on 22 March 1989;
- Bamako Convention on the Ban of the Import into Africa and the Control of Trans-boundary Movement and Management of Hazardous Wastes within Africa, adopted 30 January 1991;
- Convention on Biological Diversity, 5 June 1992;
- United Nations Convention to Combat Desertification (UNCCD), adopted 1997;
- Convention on the Protection of World Cultural and Natural Heritage ratified 1975;
- Convention on the Means of Prohibiting and Preventing the Elicit, Import, Export and Transfer of Ownership of Cultural Property, ratified 2003;
- Montreal Protocol, 1985;
- Ramsar (wetlands) Convention; and
- The Kyoto Protocol.

The ratified treaties become part of the national laws and their provisions prevail in case of contradictions with the provisions of the national laws.

2.4.8 The UN Global Compact

Officially launched on 6 July 2000 by the United Nations, the Global Compact (UNGC or GC) is a voluntary initiative which “seeks to align business operations and strategies everywhere with ten universally accepted principles in the areas of human rights, labour, environment and anti-corruption”. With over 6066 corporate participants and other stakeholders from over 132 countries, the UN Global Compact has become the largest corporate responsibility initiative.

The ten principles of the Global Compact are:

- Human Rights
 - Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights.
 - Principle 2: Make sure that they are not complicit in human rights abuses.

- Labour Standards
 - Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining.
 - Principle 4: The elimination of all forms of forced and compulsory labour.
 - Principle 5: The effective abolition of child labour.
 - Principle 6: The elimination of discrimination with regard to employment and occupation.
- Environment
 - Principle 7: Businesses should support a precautionary approach to environmental challenges.
 - Principle 8: Undertake initiatives to promote greater environmental responsibility.
 - Principle 9: Encourage the development and diffusion of environmentally friendly technologies.
- Anti-Corruption
 - Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.

The participants in the Global Compact can include the following:

- Companies from any industry sector, except those companies involved in the manufacture, sale etc. of anti-personnel land mines or cluster bombs, companies that are the subject of a UN sanction or that have been blacklisted by UN Procurement for ethical reasons. Private military companies and tobacco companies, often excluded by other initiatives or ethical funds, are allowed to become participants. To participate, a company simply sends a letter signed by their CEO to the UN Secretary General in which it expresses its commitment to:
 - the UN Global Compact and its ten principles;
 - engagement in partnerships to advance broad UN goals; and
 - the annual submission of a Communication on Progress (COP).
- Companies joining the United Nations Global Compact commit to implement the ten principles within their “sphere of influence”. They are expected to make continuous and comprehensive efforts to advance the principles wherever they operate, and integrate the principles into their business strategy, day-to-day operations and organizational culture.
- Other stakeholders can also participate in the Global Compact, including civil society organizations, labour, etc.

2.4.9 European Investment Bank Environmental and Social Practices Handbook

The EU’s Sustainable Development Strategy, adopted by the European Council in June 2006, proposes high quality impact assessment for all major decisions and deals with an integrated way with economic, environmental and social issues (the “triple bottom line”).

The environmental and social policies, principles and standards as well as the operational practices of the European Investment Bank (EIB) derive from and reflect the evolving EU approach and that of other international institutions towards the promotion of environmental sustainability and social well-being, in the broader context of the goal of sustainable development.

The Handbook provides advice on planning and managing the environmental and social appraisal and monitoring. It describes the steps for determining the scope of the environmental and social review process throughout the project cycle that the EIB shall carry out for all projects in all regions. It also explains the role of highly specialized units or individuals who collectively ensure that the Bank’s activities respond to the highest possible standards.

3 Project background and approach to the ESIA

3.1 Identification of the project

3.1.1 Project's Sponsors

NYA, is 100% owned by LUCKY RAWJI HOLDINGS LIMITED (JV Company incorporated in British Virgin Islands), which has equity partnership from Groupe Rawji (50%), DRC and Lucky Cement, Pakistan (50%). Detailed ownership structure and sponsoring companies profile is presented as Appendix -1.1.

Groupe Rawji

Groupe Rawji is the entity behind a group of companies operational primarily in the DRC with interests in the fields of distribution, Banking and Financial Activities (RAWBANK sarl), Manufacturing, Industrial products trading, Logistics, Electrical contracting and consultancy, Real-estate and Port operations. The group also has operations in Angola, Belgium, China, Dubai, Germany, India, Nigeria, and South Africa.

Lucky Cement Limited, Pakistan

Lucky Cement Limited is a Pakistan-based company engaged in the manufacturing and marketing of cement. The Company offers two types of cement: Ordinary Portland Cement (OPC) and sulphate resistant cement (SRC). Its OPC is used in general constructions, as well as concrete mortars and grouts.

Lucky Cement is an ISO 9001:2008 and 14001:2004 certified company. Consultant responsible for compiling the ESIA, EIS and ESMP

3.1.2 ECTECH's Study Team

NYA hired services of ECTECH Environment Consultants, Lahore, Pakistan to undertake preparation of "Social and Environmental Impact Assessment (SEIA)", alternatively known as an "Environmental and Social Impact Assessment" (ESIA), the term which is used in this report, of the proposed project.

A brief introduction of the ECTECH team is given in the Appendix 1.2.

3.1.3 SRK Project team

The SRK ESIA team is largely made up of staff from SRK's South African offices, as well as specialists from various other consultancies. The key team members and their roles are outlined in Table 3-1. SRK is the overall Project manager for the ESIA process and has: provided reporting expertise; given insight on interpretation of the relevant guidelines and standards; and co-ordinated liaison with the Project's client team. Where possible, in-country expertise (both from SRK's DRC office and local sub-contractors) has been used for logistical support, heritage assessment, assistance with species identification for ecological studies, interviewing communities during the socio-economic surveys, and assistance with stakeholder consultations.

Table 3-1: SRK ESIA update Team Members

Company	Name	Role in ESIA Process	Qualifications/Experience
SRK SA Project management team	Darryll Killian	Project manager and reviewer	Partner; Principal Environmental Scientist MSc (Environmental)
	Lyn Brown	Project co-ordinator (ESMP update)	Principal Environmental Scientist MSc (Environmental Science); Pr.Sci.Nat.
	Robin Gardiner	Project co-ordinator (ESIA update); traffic impact assessment	Partner, Principal Environmental Scientist; Pr. Sci Nat.
	Nicola Rump	Project co-ordinator (ESIA update)	Environmental Scientist; MSc (Environmental)
	Donald Gibson	ESMP and policies	Partner; Principal Environmental Scientist MSc Pr.Sci.Nat.M. Inst.D.
	Jeanne-Claire Trickett	Project co-ordinator (scheduling)	MSc (Eng.) Environmental; BSc Hons (Geophysics); GSSA
	Helen Jansen	Non-technical summary	Environmental Scientist
SRK SA specialist team	Manda Hinsch	Water resources study update	Associate Partner / Principal Scientist BSc (Hons), Pr.Sci Nat, FWISA.
	Johannes van der Walt	Water resources study update	Principal Hydrogeologist MSc Hydrogeology (Pr Sci Nat)
	James Lake	Soils study update and closure planning (desktop)	Associate Partner, Principal Scientist; MSc (Geochemistry) Pr Sci Nat
	Vassie Maharaj	Stakeholder Engagement specialist	Associate Partner; Principal Consultant: Stakeholder Engagement
	Adele Malebane	Social impact assessment	MSc, Development Planning; Social scientist
	Vuyo Matshikiza	Socio-economic study co-ordinator	BCom (Hons) Economics; Socio-economist
	Andrew Hart	Relocation Action Plan update	Social Development Consultant
	Lysette Rothman-Guest	Stakeholder Engagement Plan update	Senior Stakeholder Engagement specialist BL (Landscape Architecture)
	Susan Reuther	Economics and ecosystem services update (desktop)	Principal Environmental Consultant; BSc (Hons) Econ, MPhil (Env Mgmt) CEAPSA

Company	Name	Role in ESIA Process	Qualifications/Experience
	Vis Reddy	Air quality study update (desktop)	Partner, Principal Consultant MSc (Environmental Geochemistry), Pr.Sci.Nat.,
	Dhiren Naidoo	Air quality specialist input and impact rating	Principal Climate Change Consultant; MPhil (Env Science)
	Robert Short	Greenhouse Gas and Energy impact assessment and planning update	MSc; Principal Environmental Scientist; Pr. Sci.Nat.
	Warrick Stewart	Biodiversity study update	MSc; Principle Environmental Scientist; Pr. Sci.Nat.
SRK DRC	Aime Bertrand Nkouemou	Stakeholder engagement / social baseline field study	MSc, Environmental Science
	Huguette Besa Nyemba	Stakeholder engagement / social baseline field study	Undergraduate: Sciences and Technics of development
	Phillippe Katuta	Logistical assistance; Stakeholder engagement / social baseline field study	BSc, Chemistry; Environmental Scientist
DRC support team - University of Lubumbashi	John Mukabila	Cultural Heritage field assessment	Archaeologist
	Professor Muya	Cultural Heritage – overseeing field assessment	Archaeologist - University of Lubumbashi
	Edouard Ilunga wa Ilunga	Ecological field assessment	MSc (Botany); PhD student (Botany)
	Alain Tsungu	Ecological field assessment - assistant	Student at the Institut Supérieur d'Etudes Agronomiques (ISEA) of Tshela in Bas-Congo
Heritage Contracts and Archaeological Consulting CC	Jaco van der Walt	Cultural heritage assessment reporting (desktop)	MA (Archaeology); SAHRA accreditation; ASAPA member
Acusolv	Ben van Zyl	Noise study update (desktop)	Acoustical Engineer PhD Eng FSAAI

3.1.4 Statement of SRK Independence

Neither SRK nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of SRK.

SRK has no prior association with NYA in regard to the mineral and industrial assets that are the subject of this Report. SRK has no beneficial interest in the outcome of the technical assessment being capable of affecting its independence.

SRK's fee for completing this Report is based on its normal professional daily rates plus reimbursement of incidental expenses. The payment of that professional fee is not contingent upon the outcome of the Report.

3.2 ESIA objectives

The overall objectives of the ESIA process are to:

- identify issues and concerns regarding the proposed Project that need to be addressed;
- identify national, international and corporate management requirements which the Project must satisfy;
- gather and evaluate baseline information to characterise the affected environment and communities;
- undertake consultation with stakeholders and promote full disclosure of information and transparency in regard to the Project;
- identify, define and evaluate environmental and social impacts so that the potentially significant impacts can be adequately addressed during Project design;
- develop a framework management system that sets out key management and monitoring objectives for the life of the project that can be further developed and implemented by NYA and any contractors involved;
- assess and provide feedback on selected Project alternatives; and
- promote environmentally and socially sustainable development.

This ESIA has been planned and undertaken with due consideration of the legal, regulatory and policy requirements outlined in Section 2.

3.3 Overview of this study

This ESIA report has been compiled following site reconnaissance by ECTECH (followed up by a subsequent site visit by SRK in June 2013 for verification and additional data collection purposes) to identify the following Environmental and Social areas of concern:

- To achieve the desired environmental compliance standards under the IFC/World Bank Guidelines (discussed in detail in Section-2 of this ESIA Report) as applicable to the project.
- Plans and activities to remedy/mitigate any potential adverse impacts and the gaps that could probably remain after implementation.
- Any other points/steps to be taken which could be beneficial to mitigate environmental adverse impacts that may accrue both during construction and regular operation of the proposed plant and quarry.

In addition to the evaluation and review of the available records, data and the facts for the project feasibility study, detailed discussions were held with the concerned members of the project management as well as other project stakeholders during visit to DRC and on the project site study.

Recommendations regarding measures to be taken to mitigate and compensate for any determined/detrimental environmental impacts are contained in the ESMP, including all parameters that need to be measured, and the frequency of monitoring actions.

A qualitative and semi-quantitative methodology was adopted to conduct this study inter-alia in due compliance with the ESIA requirements. The study included collection of both primary and secondary data regarding environmental status and other relevant factors.

3.4 Assessment process and methods

The first step in the ESIA process was environmental and social screening of the project, following which it was categorised (in terms of the IFC / World Bank / African Development Bank categories)

3.4.1 Categorization of the NYA Project

Categorization of the project is based on environmental and social screening criteria of the IFC/World Bank:

- **Category A:** Projects with potential significant adverse social or environmental impacts those are diverse, irreversible, or unprecedented;
- **Category B:** Projects with potential limited adverse social or environmental impacts that are few in number, generally site specific, largely reversible and readily addressed through mitigation measures, and;
- **Category C:** Projects with minimal or no social or environmental impacts.

The Equator Principles defines Category A and B projects as follows:

The **Category A** principle classification criteria refer to significant adverse environmental impacts affecting sensitive sites, or diverse impacts, or they are unprecedented.

A **Category B** project is defined as those where the potential adverse environmental impacts on human populations, or environmentally important areas, are less adverse than those of Category A projects.

Other systems for project categorisation exist, but do not differ materially from the IFC / EP project categorisations. Examples of these are the European Investment Bank (EIB) project categorisation system, which rates projects on a scale of A (low risk) to D (unacceptable risk), and the AfDB system, which rates projects on a scale of 1 (projects that are likely to have the most severe environmental and social impacts and require a full ESIA) to 3 (projects that shall not induce any adverse environmental and social impacts and do not need further ESA action).

Based on the project screening, the NYA proposed project is categorised as a Category A (IFC / EP) / C (EIB) / 1 (AfDB) project in terms of the definitions above due to the number of potentially significant environmental and social impacts, some of which will not be reversible through mitigation.

In their Due Diligence report on the project, ERM listed the justification for their characterisation of the project as Category A in terms of the IFC guidelines as follows:

Inherent Risks and Sensitivity of Receiving Environment

The local context of the NYA project is understood to be sensitive. Site community relations representatives report that people living within the area of the NYA concession and in the project area of influence are dependent on agriculture and water resources. Some sensitivities relating to biodiversity due to the presence of gallery forests, wetlands and lakes were also observed in the Project Area during the site visit.

Diversity and Significance of Potential Impacts

Potential impacts from the plant and quarry development are considered to be significant due to the raw materials and waste generated during the process. The key impacts and risks considered relevant to the project assessment include for example:

- Potential contamination of soil and groundwater and surface waters (and induced impacts on the biodiversity) from dust emissions, hazardous product storage tanks, improper disposal of waste and discharge of untreated process water to the surface water;
- Potential impacts to hydrology and hydrogeology (and induced impact on the biodiversity) from process water pumping in surface water (rivers), underground water (dewatering of the quarry) and storage of removed topsoil and non-marketable layers of raw quarried material;
- Traffic increase (transport to the port, workers transportation, final product delivery) impacting the local population's health and safety;
- Large workers influx to the area and associated secondary impacts (including pressure on local social infrastructure and transmittable diseases); and
- Future economic and physical displacement to accommodate the footprint of the Project.

The ESIA has therefore been prepared to meet the IFC's assessment and reporting requirements of a Category A project.

In accordance with Category A requirements, there are recommendations, in the ESIA Report, to prevent, minimize, mitigate or compensate for adverse impacts identified. The following requirements will be incorporated within the ESIA process through the full assessment of potential impacts as follows:

- Identification of opportunities to improve environmental performance;
- Preparation of a full social and environmental assessment i.e. a full ESIA;
- Preparation of an Environmental Management Plan (EMP);
- Provided an EMP with mitigation, and monitoring; and
- Carried out consultations in a structured and culturally sensitive way.

Taking into account the above criteria of the "Equator Principles", IFC/World Bank & EIB for categorization of the project, The NYA Project can be categorized as a **Category A**.

3.4.2 Site surveys and specialist studies

As part of the initial ESIA by ECTECH, a site survey for baseline data collection, environmental monitoring for data collection was carried out by the experts of ECTECH Environment Consultants. The monitoring was carried out on November 12 to 17, 2012. The monitoring was carried out at different locations on the plant site and quarry area. Results of the monitoring are reported in the relevant sections of this report.

The subsequent ESIA update by SRK included an additional site survey undertaken from 9 to 21 June 2013 by key specialists from SRK's project team to fill critical gaps and update the baseline information where possible. The project timeframes did not however allow for detailed data collection and analysis, and where relevant, limitations in this regard are noted. The following specialist studies were included in SRK's ESIA update:

- Air quality – desktop update of previous study by ECTECH;
- Greenhouse gases - desktop update of previous study by ECTECH;
- Noise - desktop update (including noise impact modelling) of previous study by ECTECH;

- Water resources – site assessment² and update of previous study by ECTECH;
- Ecology and biodiversity (terrestrial and aquatic) – field investigation and update of previous study by ECTECH;
- Ecosystem services – desktop study based on information gathered during ecological and social surveys. Not included in ECTECH ESIA;
- Economics - desktop study based on information gathered during social surveys. Not included in ECTECH ESIA;
- Soils and land capability – desktop study based on available information and experience. Not included in ECTECH ESIA;
- Traffic – site assessment. Not included in ECTECH ESIA;
- Social impact assessment – household surveys and update of previous study by ECTECH.

Due to time limitations for the ESIA update, separate specialist study reports were not produced, and specialists provided input directly into the ESIA report.

3.4.3 Environmental site screening input to project design

During the site visit by SRK's project team, high level input and recommendations based on environmental and social sensitivities identified on the site was provided to the NYA team to inform outstanding components of the project design. Components addressed in this manner include the following:

- Haul road connection around the Yuku river crossing;
- Siting of the overburden stockpile area
- Siting of the waste management facility

A preliminary high level map indicating areas of potential ecological and social sensitivity over the project area, relative to the proposed project infrastructure is shown on Figure 3-1. Note however that this map does not take into account geotechnical, groundwater, floodlines, topographic or land use considerations, all of which would need to be taken into account prior to the final siting of infrastructure. Only very coarse-scale imagery was available for the northern part of the study area (i.e. north of the existing staff village), so the sensitivity map for the northern part of the study area should be treated as very preliminary and requiring refinement in the future. The spatial extent of the sensitive features was depicted in a precautionary manner by including a 500 m buffer around all villages, which could be potentially impacted through dust, noise and health impacts (from the waste facility), and a 100 m buffer around important ecological features identified during the field work and then mapped in GIS (e.g. wetlands, swamps, rivers, streams, Gallery Forest, Swamp Forest etc.). Due to the limited time-frames for the fieldwork and its timing during the dry season, additional sensitive features may be present on the site that could be identified during further fieldwork and mapping. No differentiation was made between the relative sensitivity of individual ecological and social features (e.g. moderate sensitivity vs. high sensitivity swamp) due to time constraints.

It was recommended that all infrastructure be located outside of these sensitive areas to the greatest extent possible. Further detailed investigation may determine however that certain infrastructure could potentially be located within the outer limits of these sensitive areas with little or no significant impacts, subject to appropriate mitigation measures being implemented. Further discussion on the above is provided in Section 5 (analysis of alternatives).

² Note – due to time limitations for the ESIA update, only limited data collection (primarily qualitative) could be undertaken during the site visit. Recommendations regarding additional study requirements are included in this report

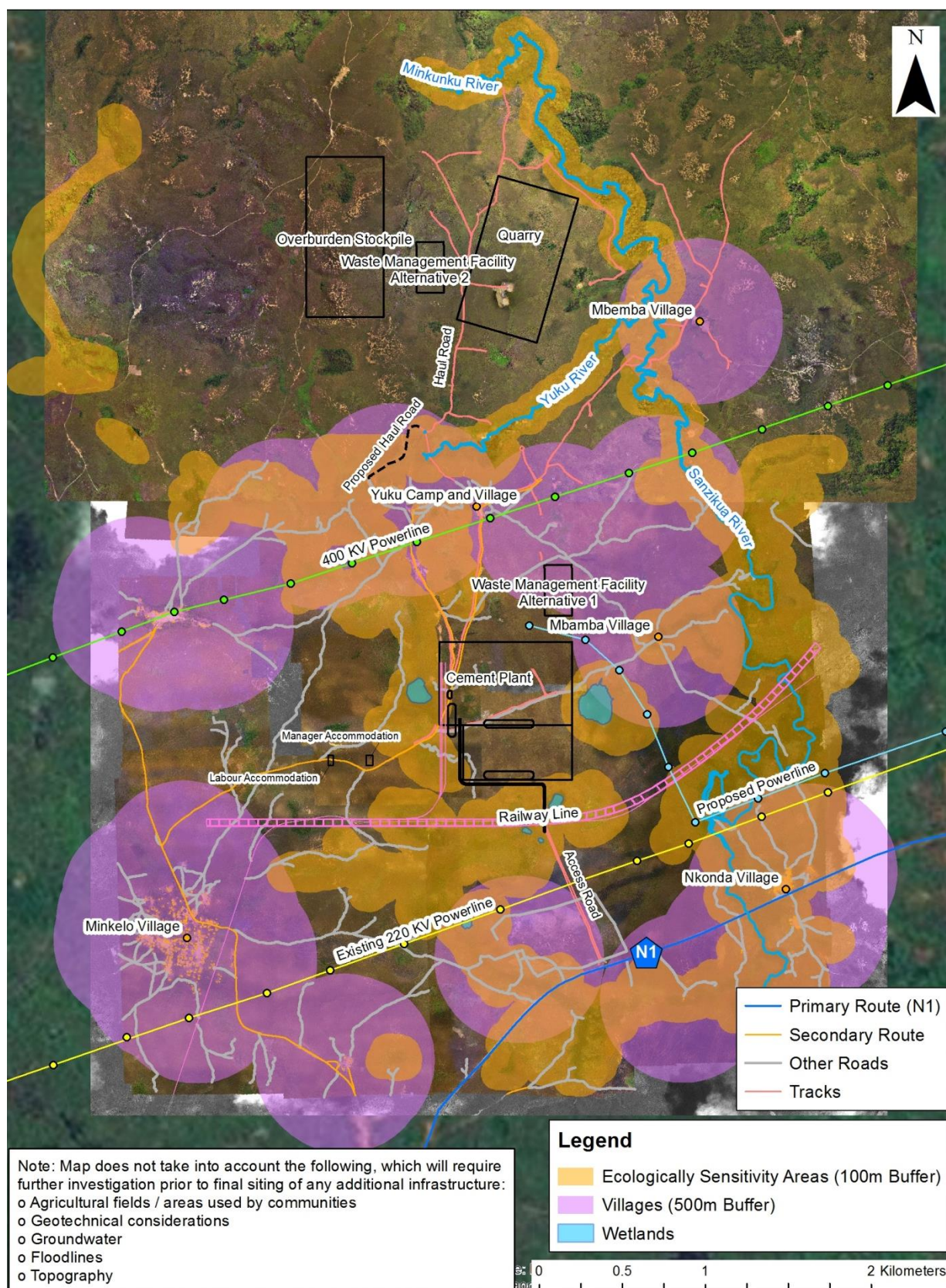


Figure 3-1: High level sensitivity map showing areas of potential ecological and social sensitivity relative to proposed and existing infrastructure

3.4.4 Review

For the purposes of the ESIA update, SRK reviewed the project related documentation listed in Table 3-2 and where relevant incorporated extracts and findings of these into this updated ESIA report.

Table 3-2: Documents reviewed by SRK

Document	Author	Date of Publication
Environmental and Social Due Diligence Draft Report	ERM	May 2013
ESIA report and annexes	ECTECH	February 2013
EIA report and annexes	OEMS SPRL	December 2012
FLS contract and technical information	FLSMIDTH	February 2013
Land and mining concession information and permits	NYA	June 2013
Draft resettlement agreement	NYA	March 2013
Surface water assessment report	CREN	Feb 2013
Soil Investigation and Topographical map	NYA	Oct-Dec 2012
Applicable regulation (mining and investment code)	DRC	-
Grievance letters	Communities	March 2013
Holtech Feasibility Report	Holtech	May 2011
Maps of site (from Holtech report)	Holtech	May 2011

4 Description of the Project

4.1 Introduction

NYA proposes to install and operate a new cement plant in Bas-Congo Province of DRC, using local limestone and clay as raw materials and imported coal as fuel. The Project is estimated to cost about 240 million USD. The proposed Project comprises of a quarry and adjacent cement manufacturing plant.

The new plant will be built according to the Best Available Technologies (BAT) defined for the cement industry (as provided by FLS), which include the adoption of preheating and pre-calcining technology in the clinker production and de-dusting bag filters for gases. The new plant will use coal as fuel.

4.1.1 Proposed Project Location

The proposed Project will be located in Songololo Territory, Cataractes District of Bas Congo Province of DRC (Figure 4-1 and Figure 4-2).

Bas-Congo is the only province with a coastline (Atlantic Ocean). It borders the provinces of Kinshasa to the north-east, Kwango to the east, and the Republic of Angola to the south as well as the Republic of the Congo and Cabinda to the west. The provincial capital is Matadi. The only other major city is Boma. The province is divided into the districts of Cataractes, Bas-Fleuve, and Lukaya.

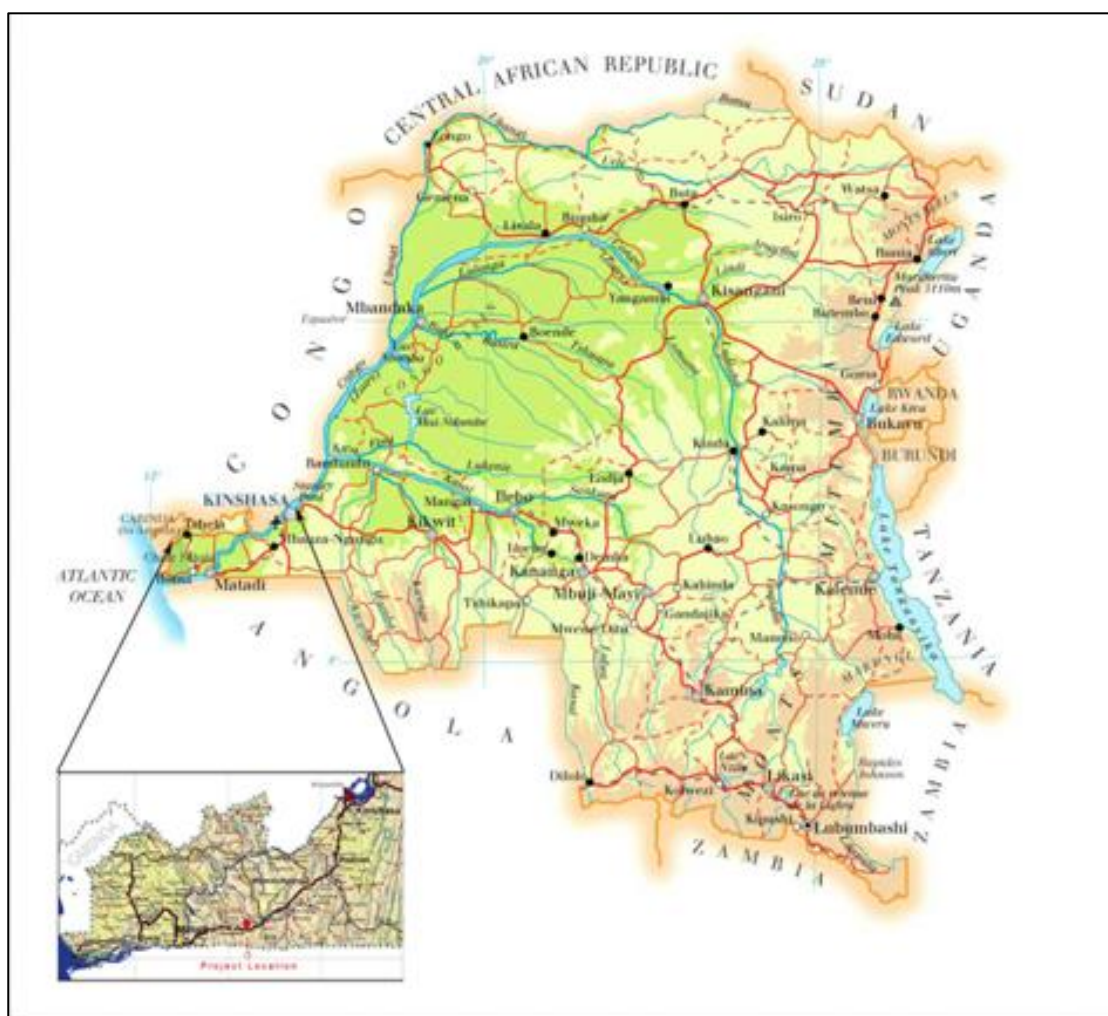


Figure 4-1: DRC Map Showing Bas Congo Province



Figure 4-2: Bas Congo Map indicating the Project Location

Bas Congo Province towns with their 2010 populations are indicated in Table 4-1.

Table 4-1: Towns in Bas Congo province, listing 2010 population and distance to the project

Name	District	Territory	Pop. 2010	Coordinates	Distance to project (km)
Boma	-	-	167,326	5°51'S 13°03'E	1456.875
Inga	Bas-Fleuve District	Tshela	10,417	5°39'S 13°39'E	61.11
Inkisi	Lukaya District	Kasangulu	77,797	5°08'S 15°04'E	108.781
Kasangulu	Lukaya District	Kasangulu	30,724	4°35'S 15°11'E	156.511
Kimpese	Cataractes District	Songololo	53,660	5°33'S 14°26'E	26.056
Kimvula	Lukaya District	Kimvula		5°43'03"S 15°57'44"E	195.606
Kinzau-Mvute	Bas-Fleuve District	Tshela	17,870	5°29'S 13°17'E	102.876
Lukula	Bas-Fleuve District	Lukula	31,394	5°23'S 12°57'E	141.372
Luozi	Cataractes District	Luozi	13,258	4°57'S 14°08'E	72.603
Madimba	Lukaya District	Madimba		4°58'48"S 15°08'46"E	125.079
Matadi	-	-	291,338	5°49'S 13°29'E	82.308
Mbanza-Ngungu	Cataractes District	Mbanza-Ngungu	97,037	5°15'S 14°52'E	83.142
Muanda	-	Muanda	86,896	5°56'S 12°21'E	207.728
Seke-Banza	Bas-Fleuve District	Seke-Banza	6,015	5°20'S 13°16'E	108.072
Songololo	Cataractes District	Songololo	12,382	5°42'S 14°02'E	20
Tshela	Bas-Fleuve District	Tshela	45,588	4°58'0"S 12°56'0"E	157.448

The proposed cement plant is located about 35 km south-west of Kimpese city (population about 54,000) which is second largest city in Cataractes District. Plant and quarry are to be located in Kimpese and Luima Sectors of Songololo Territory.

The map shows the study area in the Kibale Forest region. The map includes a scale bar (0 to 10 Km) and a north arrow. The study area is highlighted by a red rectangle. The map shows various geographical features including villages, roads, railways, rivers, lakes, plant areas, a mine, and NYA blocks. The map is oriented with North at the top.

The quarry and cement plant location, as well as that of the associated infrastructure are indicated on Figure 4-5. The figure also shows the two nearby rivers, surrounding villages, including Yuku Camp Village, the N-1 Highway, National Railway and powerlines in the vicinity of the project area.

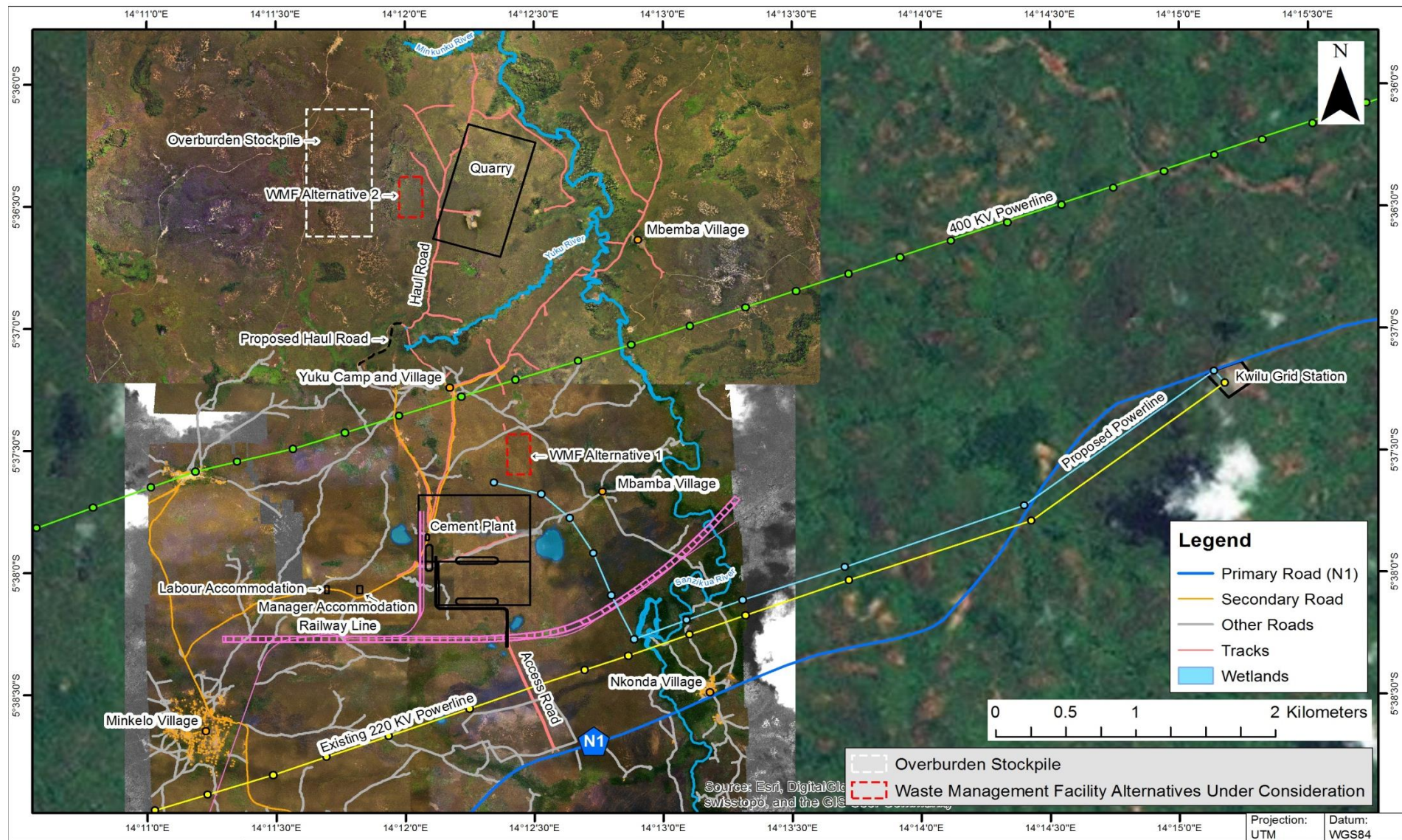


Figure 4-5: Site locality map showing quarry, plant and associated infrastructure (including existing infrastructure)

4.2 Quarry

The Quarry Products Research Licenses (ARPC) numbered as 11737, 11942, 11946 and 11947 were obtained following the decisions of the Provincial Division Chief of Bas-Congo No. 142 dated December 23rd, 2009 and No. 024, 026, 027 dated March 9th, 2010 and evidenced by the Research Certificates of CAMI/CRPC/5833/2010 dated April 12th, 2010, CAMI/CRPC/5868/2010, CAMI/CRPC/5870/2010 and CAMI/CRPC/5871/2010 dated April 27th, 2010. NYA has obtained permanent quarry exploitation Certificates dated July 01, 2011, Nos. CAMI/CECP/6349-11, 6350-11, 6351-11, 6352-11, 6353-11, 6354-11 and 6355-11 (attached as Appendix -3.1) from the Directeur General, Cadastre Minier (Survey of Mining), Ministry of Mining and owns the above-mentioned quarry rights.

NYA holds a lease of 28.56 Sq. Km area under exploration permit and has explored an area of about 480 hectares for limestone/clay/laterite (if required as corrective for the cement mix). The locations of the various mining license areas are shown on Figure 4-7.

Land concession/lease rights have been issued as per “Certificates Registration of Emphyteutic Lease” dated January, 09, 2012 by the Conservateur Des Titres Immobiliers (Curator of Real Estate Securities), Ministry of Land Affairs. Certificates are numbered: 22032/22033/22034/22035/22036/22037/22038 for occupation of land located in the ‘Localites’ of Yuku, Vemba, Minkelo, Luima, Konda and Kisua (attached as Appendix-3.1).

The area around the limestone deposit exhibits undulated topography with small knoll and gullies. The topography is rugged representing flat plateau on top with gentle cliffs dissected by gullies. The deposit's area mainly consists of red clay and laterite soil with few outcrop of limestone in low lying area. The elevation of the deposit rises gently from southwest to northwest with an elevation difference of nearly 50 m.

The geological structure of the deposit is as below:

- Overburden Soil thickness = few cm to 5 meter
- Laterite and Clay = few meters – 45 meters
- High Grade Limestone = > 50 m

A typical geological cross-section of the deposit is given in Figure 4-6, and a description is provided below.

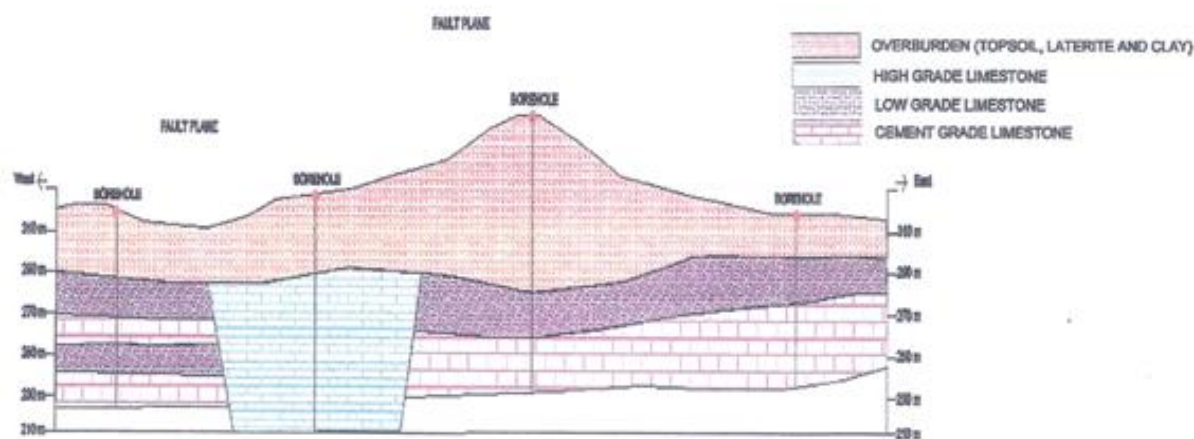


Figure 4-6: Geological Cross-section of Deposit

[Source: HOLTEC Feasibility Report]

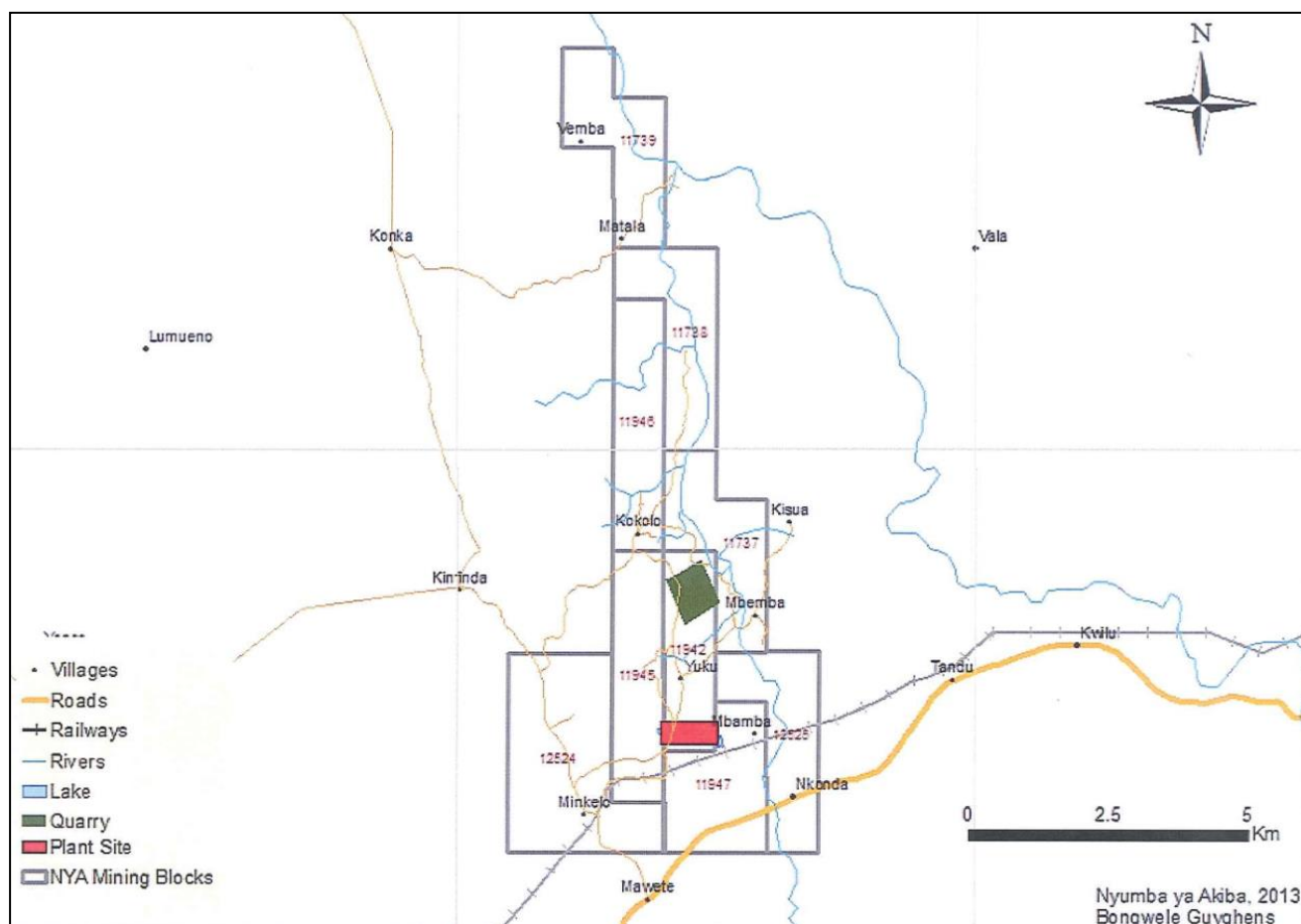


Figure 4-7: NYA mining concession license areas

- **High Grade Limestone:** High grade limestone is hard and compact, well bedded, fine grained light grey in colour (devoid of any shaley band). This limestone is confined in Central – Northern part of the concession area.
- **Low Grade Limestone:** This grade limestone is underlying to high grade limestone. It is well bedded, fine grained, medium hard greenish to pinkish in colour, with frequent shale partings and irregular fragments of pinkish limestone embedded with argillaceous matrix.
- **Cement Grade Limestone:** Cement grade limestone underlying to low grade limestone is well bedded, fine grained, medium hard greenish grey to pinkish in colour, with irregular fragments of pinkish limestone embedded with argillaceous matrix mainly few shale partings.
- **Shale:** Shale underlying to limestone is fined grained, grey to greenish in colour, soft and friable. This formation is mainly confined in the Western part of the concession area.

Elevation within the area ranges from 330 meters above mean sea level (mamsl) at the North end to 285 mamsl in the southwest corner of the concession area. The drainage of the quarry area is served by Minkuku and Yuku streams flowing by within the area and ultimately merging into Sanzikua River, and passing through eastern boundary of concession area

NYA, in November 2010, appointed RODIO GEOTECH of South Africa, to carry out survey and core drilling research work for raw materials. A total of 26 drill holes were made: 9 in license area 11737, 12 in license area 11942, 3 within license area 11946 and 2 in license area 11947. The deposits have been identified within license areas 11737 and 11942. Total meterage drilled during research work were 1715.18 meters with 287 samples collected and analysed.

Details of concession/lease areas / tenements, with coordinates are provided in Table 4-2.

Table 4-2: Details of concession/lease areas, with coordinates

Tenement	Map No.	Summits	Longitude			Latitude		
			Degree	Minute	Second	Degree	Minute	Second
11946	S6/14	1	14	11	30	-05	36	00
		2	14	11	30	-05	33	00
		3	14	12	00	-05	33	00
		4	14	12	00	-05	36	00
Tenement	Map No.	Summits	Longitude			Latitude		
			Degree	Minute	Second	Degree	Minute	Second
11947	S6/14	1	14	12	00	-05	39	00
		2	14	12	00	-05	38	00
		3	14	12	30	-05	38	00
		4	14	12	30	-05	37	30
		5	14	13	00	-05	37	30
		6	14	13	00	-05	39	00
Tenement	Map No.	Summits	Longitude			Latitude		
			Degree	Minute	Second	Degree	Minute	Second
11737	S6/14	1	14	12	30	-05	36	00
		2	14	12	30	-05	36	00
		3	14	12	00	-05	35	00
		4	14	12	00	-05	35	00
		5	14	12	30	-05	35	00
		6	14	12	30	-05	35	30
		7	14	13	00	-05	35	30
		8	14	13	00	-05	37	00
Tenement	Map No.	Summits	Longitude			Latitude		
			Degree	Minute	Second	Degree	Minute	Second
11942	S6/14	1	14	12	30	-05	37	00
		2	14	12	30	05	38	00
		3	14	12	00.01	05	38	00
		4	14	12	00.01	05	36	00
		5	14	12	30	05	36	00
		6	14	12	30	05	37	00

[Source: OEM EIA Study]

The deposit consists of massive limestone of light gray colour alternating with thin green stripes with a lot of cavities. This is a seasonal limestone characterized by lagoonal deposit. Limestone is found continuously in all four perimeters and in four (4) blocks separated by argillaceous limestone, marl and clay. According to the HOLTEC Feasibility Report the estimated mineable limestone reserve is about 70 million tonnes. The deposit comprises of sedimentary rock characterized by limestone bands which alternate with clays and marls.

The deposits mainly consist of calcite, silica, clay minerals (silica alumina), and some hematite with thin strips of manganese. However, minerals are predominantly calcite and clay minerals (silicates alumina). The life of the deposits to be mined is estimated at more or less 40 years per deposit.

The mineral deposits are below ground, but not very deep. Accessing them will involve the removal of overburden which covers them, the content of which depends on the nature of the soil covering each deposit, given the geological formation of each of the perimeters. The deposits are in four (4) blocks but initially one (1) block will be exploited. The volume of overburden stripping is estimated at more or less 34 million tonnes for this block which will accommodate the need for 12 years.

NYA has not planned to establish a stockpile facility for mined material at the quarry. All quarried products will be directly transported by trucks to the cement manufacturing facility.

The four blocks of quarry fall within the southern and eastern areas of license area (tenement) 11737 and in tenement 11942. Mined limestone and clay/laterite will be transport by trucks to the cement manufacturing plant, which will be located in tenements 11942 and 11947.

Quarry development work will involve:

- Removal of overburden comprising of laterite and clay from area of about 400 x 400 meters.
- Providing of 12 m high benches in overburden and limestone for regular production.
- Laying of level-wise minimum 12 m wide entry road to mining benches.
- Providing water sump at bottom of the lower most bench.
- It is expected that about 1.10 million cubic meters (2.2 million tonnes) of overburden and about 9,000 m³ (22,500 t) of limestone shall be removed during mine development.
- A suitably sized sump shall be created at the corner of the limestone benches for collection of ground/rain water and its subsequent dewatering.

Quarry development work is expected to take about 24 months prior to cement plant commissioning. The initial quarrying area will fall in tenement 11942.

The proposed quarry falls within parameters of Drill Holes: DH-9, DH-11, DH-12 and DH-17. NYA plans, initially, to undertake exploitation work of quarry starting from deposit in drill hole DH-9 and extend it southward to DH-11 (see Figure 4-8). The exploitation of deposits will be through open pit mining as follows:

- **Stripping of Overburden:** This operation consists of the exposure of deposits to be operated by removal of the overburden (and topsoil) covering them by excavators. Composed mainly of silica and clay, this overburden will be used for other construction work provided in the framework of this Project. An overburden dump will be located in a suitable area close to the quarry. A preliminary area for the overburden dump has been recommended by SRK on the basis of the sensitivity analysis (see Figure 4-5). Figure 4-8 indicates a proposed open pit mining procedure.
- **Excavation Work:** For the limestone deposit, mechanical drills will be used to loosen the limestone, following which blasting will be done.
- **Ore (Raw Meal) Requirement:** the estimated requirement of raw meal, i.e. limestone, clay and laterite, is about 1.6 million tonnes per annum at 100% capacity utilization of cement plant (3,000 tonnes per day clinker). Daily requirement works out at 5,300 tonnes based on 300 days operation of the quarry.
- **Quarry Tailings:** The Project will not have a tailings storage facility since even substandard limestone will be used, notably for the construction of roads and houses and the stabilization of Sanzikua and Yuku River banks.
- **Transportation:** The raw materials from the quarry will be transported by dump trucks over a distance of about 1.5 kms, after being loaded by hydraulic excavators, up to the processing plant. Inside the plant, ore transportation will be via conveyor belts from the mill to raw meal storage. NYA plans to utilize an existing clay track/road, which will be widened, to and from the quarry and plant.

Analytical results of samples collected during survey and core drilling are listed in Appendix-3.2.

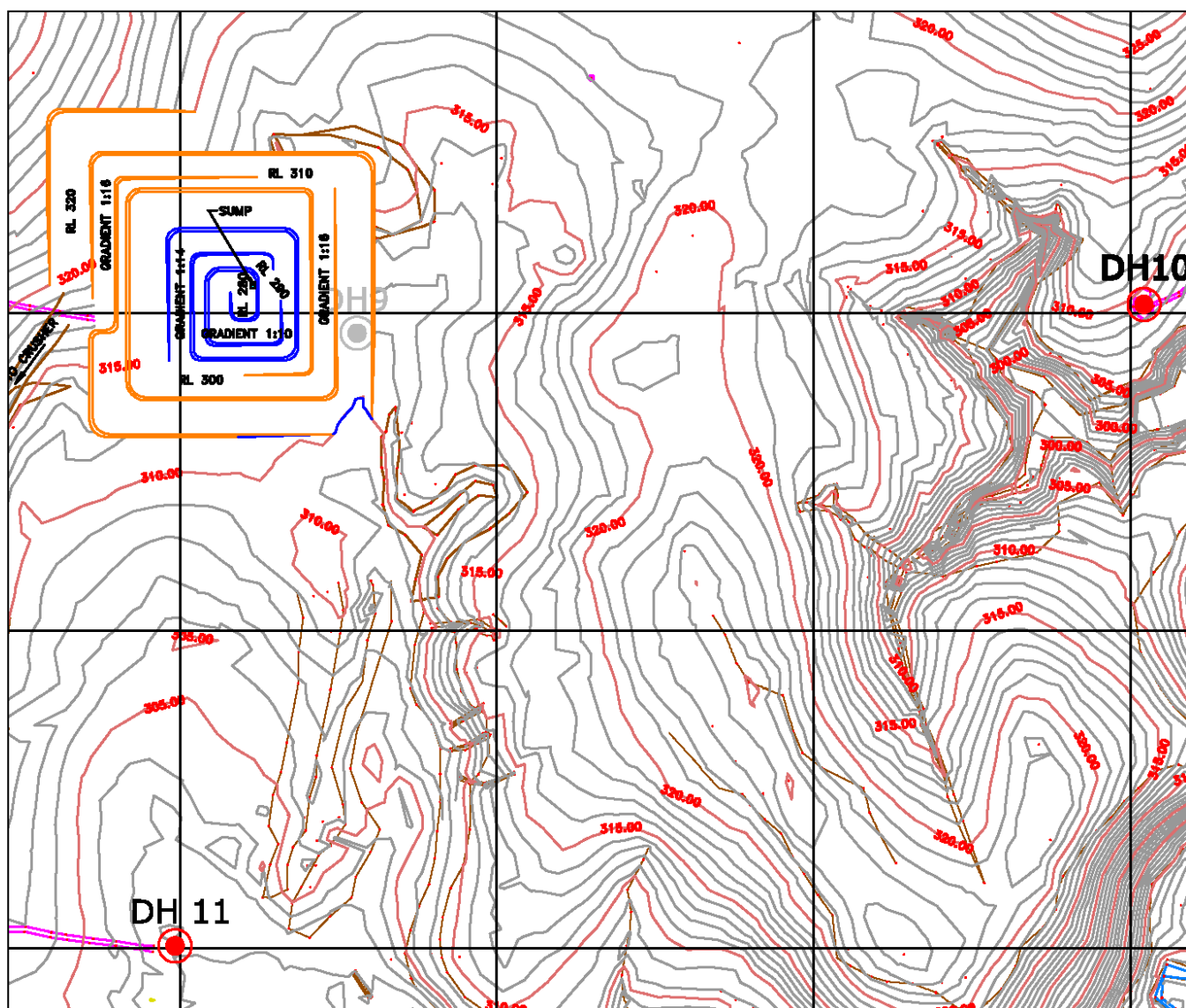


Figure 4-8: Open Pit Mining Procedure

[Source: HOLTEC Feasibility Report]

4.2.1 Overburden spoil facility

Overburden that is not used for other construction will be stockpiled close to the quarry, provisionally in a suitable non environmentally sensitive area identified to the west of the quarry access road and east of the wetland area (see Figure 4-5). Based on a predicted overburden volume of approximately 19 million m³ (30 million tonnes) over the life of the quarry, the footprint area of the facility is estimated to extend over 40 - 45 ha, assuming an maximum stockpile height of 20 m. Detail of the design of the facility has not yet been determined, but will be in accordance with the relevant national and international guidelines, and will include measures for stormwater management and dust suppression.

Waste rock may be used for the construction of the overburden facility, roads and terraces or for the manufacture of concrete, as per the details provided in Table 4-3. Therefore, the overburden spoil site will not host much material during the construction phase of the project (prior to production).

Table 4-3: Detail of overburden removed and its destination

Volume to be Dumped Before Production and In Total				
Description		Unit of Measurement	Pre-Production Requirement	Requirement In Total
1	Lime Stone to be Extracted	Million Tons	0.50	18.25
2	Over Burden to be Removed	Million Tons	7.6360	34.12
3	Over Burden used in Making Roads	Cubic Meters	15,256	
4	Over Burden used for Filling and Plant's Roads	Cubic Meters	13,007	
5	Consumption of Clay part of Over Burden for Production	Million Tons	0.0802	2.93
6	Consumption of Lateritic Clay part of Over Burden for Production	Million Tons	0.0370	1.35
7	Over Burden used in Making Roads and Filling Jobs of FIS Production Line	Cubic Meters	17,664	
8	Total quantity to be Dumped	Million Tons	7.5188	29.8390
9	Volume of Over Burden to be Dumped before Production	Cubic Meters	4,716,914	
10	Volume of Over Burden to be Dumped In Total	Cubic Meters		18,649,375

4.3 Cement Plant

4.3.1 Capacity

The proposed cement plant will have installed daily clinker production capacity of 3,000 tonnes, amounting to 3,580 tonnes per day of cement of quality CEM-I and CEM-II (1,181,400 tonnes per annum of cement at 330 days operation).

According to HOLTEC's Feasibility Report the expected product mix will be 25% CEM-I and 75% CEM-II. The requirement of materials for the product mix will be:

Materials Required	Proportions, % by Wt.	
	CEM I	CEM II
Clinker	92	85
Gypsum	5	5
Limestone	3	10

Daily operating hours and operating days per year, as reported in the HOLTEC feasibility study, are presented below.

	Operating Hours per day	Days per year
Mine	10	300
Limestone/Clay crusher	10	330
Additive Crusher	10	330
Raw Mill	21	330
Coal Mill	16	330
Cement Mill	20	330
Packer	13	330

4.4 Layout

FLS's proposed layout of the plant is presented in Appendix– 3.7. The plant layout is shown in Figure 4-10, and includes provision for a future second production line (although the operation of this is not included in this ESIA).

Large water ponds / wetlands are situated both on the east and west of the proposed plant site. These ponds are used by local communities from the nearby Mbamba and other nearby villages for water and other activities such as fishing. The view looking north from the proposed site towards Yuku Camp Village is shown in Figure 4-9.



Figure 4-9: View looking north towards Yuku Camp

The clay track presently passing through the proposed plant site will have to be re-routed, to allow access of local people to Bembo Village on North West and villages located in extreme north.

The cement plant will require approximately 61 hectares of land, and the quarry and overburden storage site 45 ha each. The total footprint area of the project and associated facilities is approximately 157 ha (as detailed below), which is state land owned by DRC Government.

Table 4-4: Footprint area of project facilities

Facility	Area ha
Overburden Stockpile	45
Waste Management Facility	5
Quarry	45
Cement Plant	61.36
Labour Hostel	0.18
Officer Hostel	0.24
Total	156.78

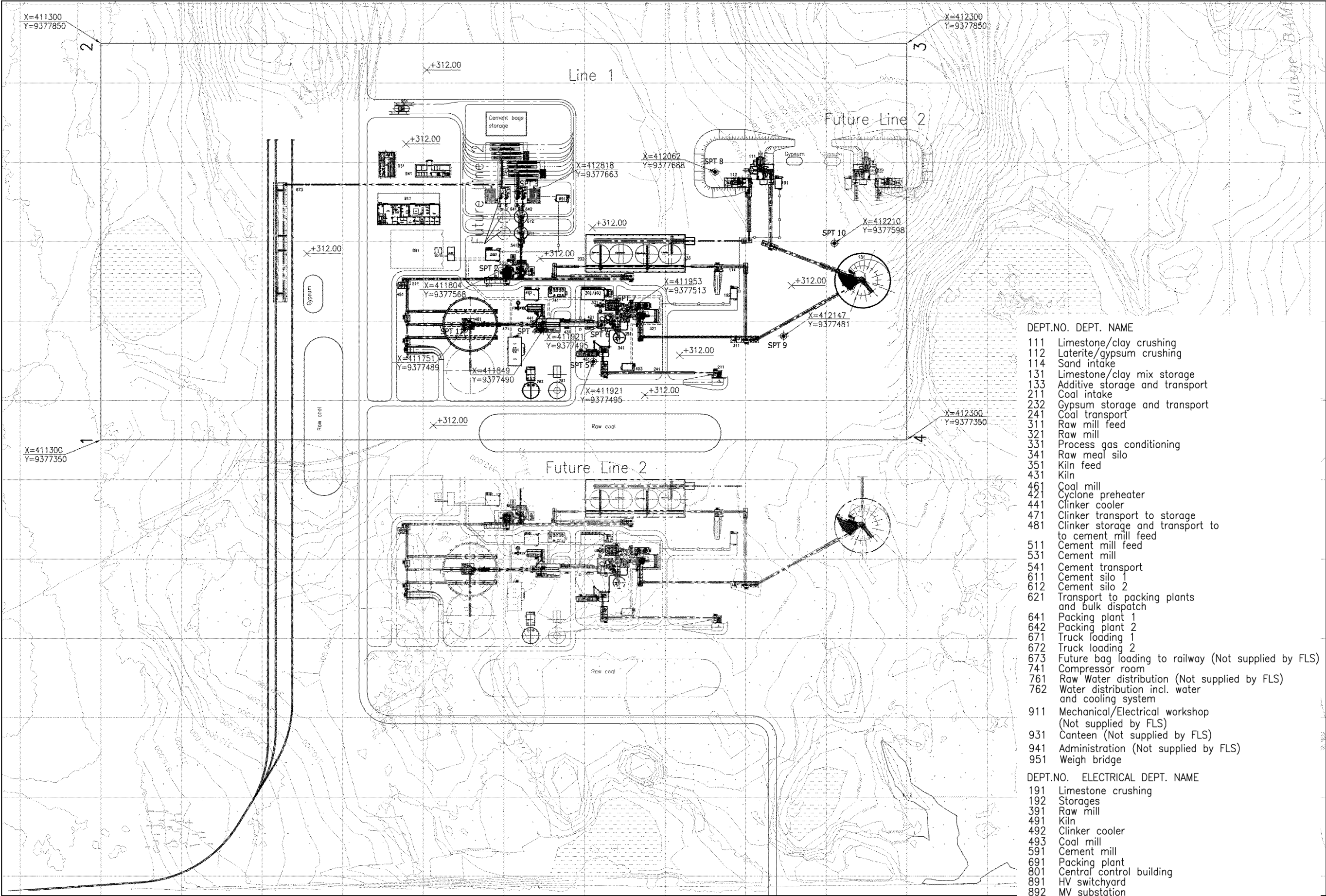


Figure 4-10: Cement Plant Layout (including provision for future line 2)

4.5 Cement Process Description

FLS proposed clinker/cement manufacture process flow diagrams are presented in Appendix-3.3.

4.5.1 Raw Material Extraction

The main raw materials to be extracted from the quarry are limestone, clay, and laterite. After transportation by truck from the quarry, raw materials will be crushed within the boundary of the cement plant. In order to prevent dust emissions during the transport of extracted materials, the trucks speed will be limited to 20 km/hr.

4.5.2 Raw Material Preparation

The raw materials are fed to the crusher by two separate apron feeders in order to proportion the two raw materials to a mix with a predetermined chemical composition.

Crushing will be done in an FLS EV type crusher. The power consumption of the crusher rotor motor controls the apron drives; if the load increases/decreases the speed of the feeders decrease/increase in order to maintain constant power consumption. The FLS BMA (cross belt analyser) controls the relative speed of the two apron feeders and thereby the chemistry of the mix. The additive crusher is a MHC type crusher.

The Circular bridge scraper (CBS) store is designed for continuous chevron stacking in a ring shaped pile. The material enters the store on a rubber belt conveyor and is discharged into a centrally positioned inlet hopper on the stacker jib, as is shown on Figure 4-11.

The slewing/luffing boom stacker is mounted on the centre column allowing rotation in both directions and simultaneously with the vertical movement of the jib. Its height above the crest of the pile is kept at a minimum to reduce dust emissions.

The continuous chevron stacking mode and the speed of the stacker will theoretically result in about 330 layers in the pile. This will provide mixing when using the bridge reclaimer, which scrapes off the pile in a plane corresponding to the angle of repose of the material, i.e. a plane nearly perpendicular to the longitudinal direction of the layers.

A raking harrow is mounted on the bridge reclaimer which rotates anticlockwise around the central column. The sweeping movements of the harrow system cause the material to slide to the base where the chain system conveys it to the centrally placed outlet hopper.

The homogenized material leaves the store via an underground rubber belt conveyor leading either to a hopper or directly to the raw mill.

For storage of additive materials, FLS has proposed a SS (Side Scraper) store.

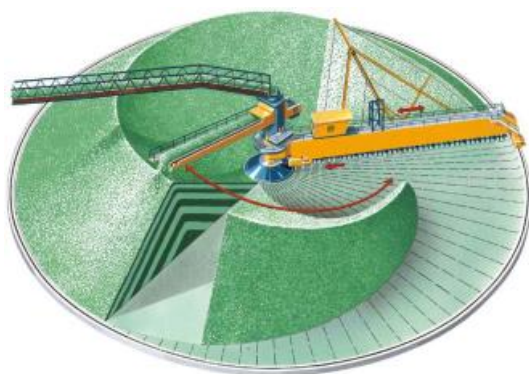


Figure 4-11: CBS Storage, Stacker and Reclaimer

[Source: FLS]

4.5.3 Raw Milling

For raw meal grinding, a vertical roller mill is proposed. Before entering the raw mill, each material is weighed and adjusted according to the chemistry of the raw mix. The finely ground raw material (raw meal) is transported to the homogenisation silo, where it is blended (homogenised), by following a gravity-based extraction sequence as the material leaves the silo.

4.5.4 Raw Mill and Kiln Dedusting

At all stages of raw material preparation, appropriate methods will be used to prevent the escape of air-born dust emissions. These include the use of enclosed conveyors and storage, minimization of material drop distances, use of numerous nuisance dust collectors, and the use of a primary bag filter for the kiln/raw mill exhaust gases which are used for drying of the raw materials. All bag filters will be designed and operated to ensure particulate emissions below 30 mg/Nm³ including all other point sources, such as the clinker cooling, cement grinding, and coal grinding, in accordance with industry standards.

The raw mill kiln exhaust gases main filter is a fabric type with maximum emission rate of 20 mg/Nm³. Provision will be made for inline water spraying for gas conditioning between the preheater outlet and kiln ID fan.

The gas conditioning and the main filter will handle all exhaust gas from the kiln and raw mill circuit. The main filter is designed to fulfil the above mentioned emission requirements for all normal operating conditions with or without the mill in operation. The main filter and main filter fan are designed to withstand the abnormal situation when the conditioning tower is down and the mill is not operational. In this case use of the cold air damper will protect the filter.

The temperature of the gases in the outlet of the conditioning tower automatically controls the flow of water to the conditioning tower (when in operation).

4.5.5 Kiln and Clinker Cooler

Preheater and Pre-Calcliner

The proposed FLS one string five stage preheater with inline pre-calcliner offers an optimal solution with respect to heat economy and power consumption taking into account the moisture content of the raw materials as well as the height of the preheater tower. The cyclones of the proven FLS LP-type ensure a low pressure loss for a given size of preheater. The characteristic feature of the pre-calcliner is the homogeneous mixing of raw meal, fuel and combustion air.

The combustion air is drawn from the (extended) kiln hood as tertiary air. The pre-heated raw meal is fed from the second-lowest cyclone to the pre-calcliner via a riser pipe, partly to the bottom of the calcliner vessel. The temperature in the riser duct and the reduction zone below the calcliner vessel, where all the fuel is fired, can thereby be controlled for optimum control of NO_x reduction and for minimizing/preventing the formation of coatings in the riser pipe area.

The heat generated in the pre-calcliner is used partly to increase the raw meal temperature to calcining level and mainly to implement the actual calcining process. From the calcliner the raw meal is carried to the bottom cyclone stage and from there-on to the kiln.

Automatic regulation of the rate of fuel to the pre-calcliner ensures constant temperature in the collecting cyclone (bottom cyclone stage) and thereby stable operation of the kiln system.

Kiln

In comparison with conventional kiln systems (without pre-calciner) the selected installation offers a considerable reduction in kiln dimension and a high degree of pre-calcination.

The kiln burner is a DUOFLEX two-channel burner with low primary air consumption, normally in the region of 6-8%. The primary air is supplied by a high pressure fan (up to 250 mbar).

Clinker Cooler

The proposed cooler is an FLS Cross Bar Cooler. The clinker leaves the kiln with a typical temperature around 1450°C, and falls onto the cooler inlet zone, after which the clinker is transported slowly down through the cooler. During this transport the clinker is constantly exposed to a cooling air stream from below. The purpose is clinker cooling as well as heat recuperation. The clinker outlet temperature is designed for 65°C above ambient air temperature.

The cooling air passing up through the clinker bed is heated by the clinker, and for the first, i.e. warmest, part of the cooler, the air is sucked back into the kiln system and used as preheated combustion air. Approximately 45% of the total cooling air is returned to the kiln system, corresponding to approximately 75% recuperation of the clinker heat. The remaining air is extracted as excess air from the cooler. The cooler is equipped with a hammer crusher in the outlet.

The cooler excess air is de-dusted in an electrostatic precipitator (ESP) with maximum emission rate of 30 mg/Nm³. In order to protect the ESP against excessive temperatures during upset conditions the cooler is provided with a water injection system. Cooler filter emission rate will be designed for maximum 30 mg/Nm³.

Clinker Storage

Clinker storage will have a capacity of 50,000 tonnes (production of 16.6 days) with an extraction capacity of 200 tonnes per hour.

4.5.6 Coal System

The production of cement requires the use of a significant amount of energy. In order to provide this energy, conventional solid fuels, such as coal, are burned in the pyro-processing system. Co-processing of suitable waste streams generated during operation of the plant may also be investigated for feasibility at a future stage. The fuel (coal) will be transported to the cement plant preferably by train, if possible. A railway siding has been included in the plant design on the western side, to allow for offloading of coal at the plant. Alternatively road trucks will be used from Matadi Port.

Before firing in the pyro-processing system, the fuels, just like the raw materials, have to be pulverized into a fine powder prior to feeding into the cement manufacturing process. For the grinding of coal and FLS ATOX vertical roller mill will be installed.

Raw coal is transported from storage to a feed bin. The desired amount of raw coal is extracted from the feed bin and enters the mill through a double screw conveyor which is working as an air sluice, thus minimizing the amount of false air.

The coal meal product is collected in a bag filter and transported to a silo. A fan placed after the filter provides the gas flow through the mill system. The mill fan is thus operating with dust free gas. After the fan, the gas can be partly recycled, in order to keep the appropriate gas flow and temperature in the mill. The excess gas is conveyed to the stack.

The coal mill system is designed for inert operation, thus minimizing the risk of fire and explosions. This is achieved by using the necessary amount of hot pre-heater gas with a low content of oxygen.

Covered coal storage of 40,000 tonnes capacity will be provided, in three separate stockpile areas, with a water spray arrangement.

On the clean side of the filter an oxygen analyser will be installed to monitor the oxygen content in the mill system at any time. CO analysis equipment is installed to detect whether any fire or smouldering of coal is taking place in the mill, filter or coal meal bin during stoppage. A CO₂/N₂ inertising system is installed for fire-fighting in the mill, filter and bin.

FLS coal mill installations are designed to meet EU approved directives including the ATEX directive 94/9/EC, which must be followed for factory installations, where the risk of explosion is possible. The design of the coal plant is also made in accordance with the explosion protection standard EN 14491 (which is similar to VDI 3673, Germany and NFPA 68, USA).

According to the HOLTEC Report the expected South African coal analysis is as below:

Sulphur	=	0.5 – 1.5%
Calorific Value	=	5,800 - 6,200 Kcal/kg

4.5.7 Cement Mill System

For the grinding of cement an FLS OK vertical roller mill will be installed. Separate weigh-feeders are extracting the feed components from the feed bins in the set proportions. The feed is transported to the inlet of the mill by the means of the feed conveying system. The raw materials enter the mill by the inlet chute. The chute enters the mill on one side of the mill housing, placing the materials on the centre of the grinding table.

The finished product leaves the separator at the top, transported by the separator air to the bag filter, where air and material is separated. The fineness of the product is a function of the gas flow through the mill and the separator rotor speed. The finished product collected in the cyclone is transported to the silos.

The gas taken through the mill and the separator is circulated by a fan. The mill fan is placed after the cyclone. A duct placed after the fan allows re-cycling of gas back to the mill inlet. Excess air from the mill circuit is de-dusted in a bag filter. The amount of gases not re-cycled is taken in as fresh air of ambient temperature through the fresh air damper.

4.5.8 Cement Storage and Packing

Cement will be stored in two (2) concrete silos of capacity 10,000 tonnes each. Two (2) packing lines will be provided, each operating on automatic mode at an indicated capacity of 120 tonnes per hour. Furthermore, 2 x shouts for the bulk loading will also be fixed and each will have loading capacity of 300 tons per hour.

The packing machine is a rotary type with 8 spouts with manual or automatic bag application. Capacities are based on OPC cement in 50 kg glued type valve bags, with 2-4 plies and suitably provided with de-aeration pin-holes. Each filling spout is equipped with its own vertical shaft impeller and an individual electronic weighing system including automatic weighing control.

The packing machine is equipped with dust collecting hoppers, screens and a discharge belt conveyor, and a bag filter for de-dusting the packing line. Each packing machine is connected to 2 truck loaders for manual loading, working in parallel.

4.5.9 Process Controls

The cement plant will be controlled by a Distributed Control System (DCS) from the Central Control Room. Process variables in all manufacturing departments will be continuously monitored in order to regulate and optimize cement production, i.e. from raw material storage to cement storage, packing and loading. However, manual intervention will be warranted during process upsets, equipment malfunction or emergency conditions. Process temperatures and pressures will be continuously monitored for any abnormal conditions to ensure that abnormalities can be detected and rectified.

Operation of the pyro-processing system will be monitored since product quality will be largely determined in the kiln. At every stage of the cement manufacturing, the raw and intermediate materials as well as the end products will be analysed at the plant's laboratory to ensure that they conform to set quality standards on a consistent basis. The laboratory will be equipped for testing of major process related materials, sample preparation, chemical analysis and physical testing.

4.5.10 Environmental controls and applicable regulations / guidelines

The proposed project will operate under strict environmental controls to ensure that pollution is minimised. Implementation of the proposed ESMP will further minimise emissions and contamination resulting from the project as far as possible. All emissions and wastes generated by the project will be managed in line with the following national and international environmental best practice guidelines and regulations:

- Official Journal of The Democratic Republic of Congo, Cabinet of the President of the Republic, Mining Regulation, N°038/2003 Decree of the Bearing March 26th, 2003;
- The “Pollution Prevention and Abatement Handbook” by the World Bank Group- effective July 1998;
- IFC Environmental, Health, and Safety Guidelines, General EHS Guidelines:
- Environmental Air Emissions And Ambient Air Quality (April 30, 2007); IFC Environmental, Health, and Safety Guidelines for Cement and Lime Manufacturing (April 30, 2007); and
- IFC Environmental, Health, and Safety Guidelines for Mining (December 10, 2007).

Air Pollution Controls

Air pollutants generated during the operation of the Project consist primarily of particulates from quarrying, raw, and finished materials as well as fuel combustion by-products.

Dust

FLS has guaranteed that the content of solid particles in clean gases shall not exceed the following:

- Fabric Filters for Kiln and Raw Mill – 20 mg/Nm³ (dry)
- Electrostatic Precipitators for Clinker Cooler Excess Air – 30 mg/Nm³ (dry)
- Fabric Filter for Cement Mill – 20 mg/Nm³ (dry)
- Fabric Filter for Cement Mill Separator - 20 mg/Nm³ (dry)

When compared to the World Bank/IFC guidelines and EU standards, the above applications will meet the requirements for the World Bank/IFC. However, when compared to the EU standards, dust emissions from the cooling process may exceed the standards stipulated whereas the other processes will comply with the respective EU standard.

Dust control measures will be implemented within the perimeters of the quarry, on access roads and at the plant. It is planned that the water removed from the quarry through dewatering will be used for dust suppression of the quarry, overburden site and haul roads. The Project will install a sprinkler system in the quarry and on internal paths of the quarry perimeters. The sprinkler truck will use mine water to moisten the soil. Watering will be conducted to reduce the dust concentrations to below the threshold of 50 mg per litre within the mine and 10 mg per litre outside the perimeters.

For other emissions, a sufficient number of standardized bag filters will be installed at all transfer points at hopper, bins or silos as well as dust producing machinery (crushers, loading equipment, conveyors etc.) for de-dusting purposes. Detail of the total quantity of bag filters and ESP to be installed at the plant are listed in Table 4-5 below:

Table 4-5: Total quantity of installed Bag filters at the plant

S#	Bag filter Type	Specification	Installed Qty
1	Jet Pulse Filter CE 2	8-20	04Nos
2	Jet Pulse Filter CE 1	4-10 SHHRL-B	29Nos
3	Jet Pulse Filter RC	RC 1300/30	03Nos
4	Jet Pulse Filter IN	V-36	04Nos
5	Electrostatic precipitator at clinker cooler	Area :2162 m ²	01No
6	Bag House at VRM	Area :854 m ²	01No
7	Bag House at Coal Mill	Area :376 m ²	01No
8	Bag House at Cement Mill	Area :476 m ²	01No

Other emissions

Low NOx Burners, dosing systems for fuel and kiln feed, and kiln control systems are used for the plant processes to control emissions (NOx, SOx and CO). Cyclones will also be installed to capture materials entrained in airflows, which are routed through principal process units (e.g. milling and pyro-processing stages). They are considered as pre-treatment recovery and recycling device, and assists in enhancing the efficiency of both bag house and bag filter systems.

FLS has yet to confirm the level of NOx, SOx and CO in the exhaust gas as they are in the process of carrying out a detailed evaluation of the system with the raw material samples provided by NYA. These levels are however expected to comply with the EU standards and World Bank/IFC guidelines for emissions as described in Section 2.3.5 and 2.4.1.

Emission monitoring and kiln control systems will be considered to minimize gaseous emissions from combustion processes (NOx, CO, SOx). A microprocessor based monitoring device will be installed.

DRC and international regulatory requirements

The DRC requirements of attenuation measures of emissions in the atmosphere are identified in Articles 49 to 52 of the National Standards of DRC for the Mining Environment. English translation of these standards indicates the following:

Chapter III: Attenuation Measure of Emissions in the Atmosphere

Article 49: From the content attenuation of emissions in the atmosphere.

The attenuation measures of emissions in the atmosphere specify:

- For each nature of contaminant, the quantity issued (t, m, year), the debit (m³/h), the gases temperature (°C) and the concentration of the contaminant (mg/Nm³);*
- (The purification systems or measures to prevent, eliminate or reduce the clearing of the contaminants and indicate the (%) percentage of efficacy; and*
- In case where the dry dust removers are used, methods and warehousing, store or of clearance of this dusts.*

Article 50: The accepted air pollution limits

The applicant must comply with the pollution limits listed in Table 4-6 inside his property perimeter, and those listed in Table 4-7 outside his property perimeter.

Table 4-6: Limits of air pollution inside the perimeter

Nature if Contaminant	Limit of Pollution
Arsenic	0.5mg/ m ³
Carbon Monoxide (CO)	29 mg/ m ³
Copper	1 mg/ m ³
Free Silica	5.0 mg/ m ³
Hydrogen Cyanide	11 mg/ m ³
Hydrogen Sulphide (H ₂ S)	14 mg/ m ³
Lead: Emissions and smokes	0.15mg/ m ³
Nitrogen Dioxide	6 mg/ m ³
Solids Particles	10 mg/ m ³
Sulphur Dioxide	5 mg/ m ³

Table 4-7: Limits of pollution outside the perimeter

Nature of Contaminants	Limits of Pollution
Particulate Matter (< 10 µm):	
Annual Arithmetic mean	100 g/ m ³
Maximal average on 24 hours	500 g/ m ³
Nitrogen oxide like NO₂ :	
Annual Arithmetic mean	100 g/ m ³
Maximal average on 24 hours	200 g/ m ³
Sulphur dioxide:	
Annual Arithmetic mean	100 mg/m ³
Maximal average on 24 hours	500 mg /m ³

Article 51: From the installation of air pollution control device

The applicant for Mining Exploitation (permit) or Permanent Quarry Permit must install an air pollution control device at the plant (processing and transformation).

Article 52: Pollution tests

During the works of Mining exploitation or quarry and the works of ore processing, the applicant must perform during the months of January, March, July, October, a series of tests inside his perimeter and outside his perimeter, analysing the level of contaminants listed in the table above. He must record the test method used and eventually, the correctors' measures to take to a register.

The Mining permit or permanent quarry license applicant must perform air pollution test outside the perimeter of the property, at a distance of 5 meters of the perimeter border at the North, South, East and West of the perimeter."

A comparison of the applicable international and DRC air quality standard and guideline levels is provided in Table 4-8.

Table 4-8: Comparison of IFC/WB, HWO, EU and DRC Air Quality Standards and guidelines

Parameter	IFC/WB ⁽¹⁾	WHO ⁽²⁾	EU ⁽³⁾	DRC ⁽⁴⁾
Particulate Matter (PM ₁₀)	50 µg/Nm ³	50 µg/ m ³ (5)	50 µg/ m ³ (8)	500 g/N m ³ (11)
Nitrogen Oxide (NO ₂)	200 µg/N m ³	200 µg/ m ³ (6)	200 µg/ m ³ (9)	200 g/N m ³ (12)
Sulphur Dioxide (SO ₂)	20 µg/N m ³	20 µg/ m ³ (7)	125 µg/ m ³ (10)	500g/N m ³ (13)

Notes:

1. IFC EHS Guidelines for Ambient Air Quality, (April 30, 2007)
2. World Health Organisation – Ambient Air Quality Guidelines Global Update 2005
3. EU Directive 2008/50/EC – ANNEX XI - Limit Values for Protection of Human Health (2008)
4. DRC - "OFFICIAL NEWSPAPER OF THE DEMOCRATIC REPUBLIC OF CONGO, Office of the president de la République, DECREE N°038 / 2003 OF CARRYING MARCH 26TH, 2003, MINING REGULATIONS".
5. WHO Guideline – PM10, 24 hour average period
6. WHO Guideline – NO2, One hour average period
7. WHO Guideline – SO2, 24 hour average period
8. EU Limit Value - PM10, 24 hour average period
9. EU Limit Value - NO2, One hour average period
10. EU Limit Value - SO2, 24 hour average period
11. DRC – Maximal average 24 hours
12. DRC – Maximal average 24 hours
13. DRC – Maximal average 24 hours

Noise Controls

Most cement projects generate significant, intermittent noise levels during blasting of the limestone within the quarry. Other principal noise emission sources will be associated with motors, fans, blowers, crushers, air compressor, and grinders.

In quarry development or operation activities, the noise sources will include: excavation, blasting, drilling, road vehicles engine and movement, stockpiling, loading and unloading of rock into dumper trucks and power generators. NYA will adopt “good practice” methods in the prevention and control of noise to be established based on the prevailing land use. The Project’s quarry area is not close to any noise receptors such as communities or community use areas, except Yuku Camp Village, which will be relocated. All quarry operation activities will be carried out during day-light only.

In-plant shielding of noise emissions will be adopted to ensure that noise levels at the boundaries are within the regulatory limits, which demonstrates that the cement plant will be fully compliant with both IFC Standards for noise emissions. All equipment to be employed for the plant will be designed to operate with low noise levels, and will not exceed the maximum allowable noise level for the surrounding receiving land use. The blasting will occur approximately 35 meters from the ground level and in accordance with all regular precautionary measures.

FLS Report on “Noise Engineering Method” is attached as Appendix- 3.4. Assessment of noise emission from FLS equipment is based on statistical data collected on multiple cement plants. These noise levels are measured under normal operation of the equipment as a part of the process, and not as a separate measurement of a single machine. The estimated noise level for each machine is therefore derived from a large database of noise measurements (in compliance with EN ISO 11202 and EN ISO 11204).

FLS shall comply with the requirements of the “EU machinery directive 2006/42” and directive 2003/10/EC (“Noise directive”), which requires the applicant to:

- Provide information on all equipment with noise level above 70 dB (A).
- Reduce risks from noise to the lowest level taking account of the technical possibilities.
- Eliminate unnecessary noise.
- Inform / warn nearby receptors of noise levels at or above lower and higher exposure action values (80/85 dBA) (Ref. directive 2003/10/EC).

FLS will produce a Noise Assessment for supply within the EU and on special request. FLS will supply safety signs for areas with noise levels above 85 dBA (as a part of the safety sign package), and a list of expected noise levels of the equipment.

All rotary blowers as well as compressors are equipped with noise reduction hoods. All flows opening to the outside and exhausts will be equipped with silencers (baffle type). Axial blowers, if any, for kiln shell cooling and heating exchanges are however without silencers.

The EU legislation requires for example that the manufacturer provides information on noise emission values from machinery, enabling the owner to deal with the exposure action values (that trigger obligations to provide employees with individual hearing protectors / make it mandatory to use them).

The IFC “Environmental, Health, and Safety (EHS) Guidelines – General EHS Guidelines: Environmental Noise Management (April 30, 2007)”, provides the following Noise Level Guidelines:

“Noise impacts should not exceed the levels presented in Table 4-9, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 4-9: IFC Noise level guidelines

Receptor	One hour L_{Aeq} (dBA)	
	Daytime (07:00 – 22:00)	Nighttime (22:00 – 07:00)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Translation of Articles 46 to 48 of the National Standards of DRC for Mining Environment indicates that:

“The attenuation and rehabilitation measures must reduce the level of noises and vibrations from the project:

Article 46: Continuous Noise

The maximum sound level of the mining exploitation activities or quarry must be less, at any times and at any evaluation point of noise (e.g. residential houses, hospital or school, land where there is a permanent farm activity, industrial or hunting or fishing, from a recreation place) than the higher sound level as follows:

- The maximum sound levels allowed for each land / site category, are shown in the Table 4-10
- The sound level for the surrounding area is taken from the evaluation point at the complete end of the exploitation activity of the project.

Table 4-10: Maximum allowed sound levels for different site categories

Sound Level		
Ground (site) category	Night dB(A)	Day dB(A)
(a)	40	45
(b)	45	55
(c)	70	70

Article 47: Ground (sites) category

The sites are classified in the three following categories:

- Residential areas such as a community or a village, a school or a hospital or any kind of education services, health;
- Areas used for permanent commercial activity, hunting or fishing or any recreation activities. The night-time sound level is applicable at the boundary of residential houses, however, for other adjacent land uses, the maximum daytime level of noise is also applicable at night;
- Areas used mainly for industrial activities or farms. However, if any residential houses are present in this area, the limits are 50 dB (A) at night and 55 dB (A) at day.

Article 48: The vibrations and explosion-related noise

The Mining exploitation or quarry operations must not emit vibrations of which the speed at the ground, evaluated at residential houses, schools or hospitals, or artesian wells is greater than 1,25 cm/second and the air pressure greater than 120 linear decibels.

In the case where the extraction is made at less than 600 m from a construction or building sighted in the previous paragraph (except the house of a mining worker), the applicant must make, at the time for each explosion, self-inspections and the data thereof must be saved in a register and accessible for 2 years minimum.

The applicant of a Mining Exploitation Permit or quarry must explain how attenuation and rehabilitation to bring the noise and vibration levels from the project to within the limits specified based on the Annex XIII of Evaluation Measure of Noise of the Mining Law.”

A comparison of IFC/WB, EU, WHO and DRC Guidelines/Standards for Noise in industrial / commercial areas is presented in Table 4-11

Table 4-11: Comparison of IFC/WB, EU and DRC noise Guidelines / Standards

Parameter	IFC/WB ⁽¹⁾	EU ⁽²⁾	DRC ⁽³⁾
Daytime	70 dB(A) ⁽⁴⁾	70 dB(A)	70 dB(A)
Nighttime	70 dB(A) ⁽⁴⁾	70 dB(A)	70 dB(A)

Notes:

1. IFC EHS Guidelines – General EHS Guidelines : Environmental – Noise Management
2. EU Directive 2003/10/EC
3. DRC - “OFFICIAL NEWSPAPER OF THE DEMOCRATIC REPUBLIC OF CONGO, Office of the president de la République, DECREE N°038 / 2003 OF CARRYING MARCH 26TH, 2003, MINING REGULATIONS”.
4. Guidelines values for noise levels measured outdoors. Source: Guidelines for Community Noise, WHO, 1999.

Water Pollution Controls

The proposed Project has adopted modern, dry process technology for manufacturing cement. The principal effluent released from the clinker production and cement manufacturing process is equipment cooling water, which is innocuous. Moreover, apart from the cooling water used during the raw mill down condition to protect the bag filter, the process water will be completely reused via recirculation through water treatment systems.

Domestic wastewater generated from the employee accommodation toilets and the canteen is estimated to amount to about 120 m³/day. All wastewater will be routed to the wastewater treatment plant prior to disposal. The treated effluent will comply with “IFC Environmental, Health, and Safety (EHS) Guidelines, General EHS Guidelines Environmental Wastewater and Ambient Water Quality (April 30, 2007)”.

Overflow cooling waters, tanker washing and floor washing water will be collected and conveyed by open drains. These process wastewaters will be channelled into a solids 'gravity' separator then to the wastewater treatment plant prior to discharge.

During the peak of construction activities (i.e. the maximum demand), the fresh water requirement will be approximately 500 persons x 100 L water/person/day = 50 m³ of fresh water per day. The

wastewater generated during construction activities will be disposed-off through a package plant treatment system as per requirement of the “IFC Environmental, Health, and Safety (EHS) Guidelines, General EHS Guidelines Environmental Wastewater and Ambient Water Quality (April 30, 2007)”. The sewage treatment systems will be designed to meet the following criteria:

- Properly designed and installed in accordance with local regulations and guidance to prevent any hazards to public health or contamination of land, surface or groundwater.
- Well maintained to allow effective operation.
- Installed in areas with sufficient soil percolation, for the design wastewater loading rate.
- Installed in an area of stable soils that are nearly level, well drained, and permeable with enough separation between the drain field and the groundwater table or other receiving waters.

Quarry Water

The ground water table of the quarry area is between 20 to 25 meters deep. This water will disrupt the open pit mining operation, which will extend below the depth of the water table. Continuous dewatering operation will therefore be required.

Water sumps will be provided at the lowest level of the quarry. This operation will be realized through pumping waters, at the rate calculated on the basis of the underground recharge and the stormwater inflow / runoff during the rainy season. Submersible pumps will be required to pump water to the main sump installed at a higher ground level.

A larger pump will be installed at this main sump for water discharge after settling out of solids in water settlement ponds at the quarry. The locations and footprint areas of these ponds has not yet been finalised and will depend on the volume of water they are required to hold. The amount of water which will be generated is estimated at more or less 10,000 cbm per day. It may vary with the season and depends on the size of the quarries. The flow rate of the water is not yet known but will be variable depending on the season and volume of the cavities.

At present the characteristics of this water are unknown, and will be subject to detailed analysis. If found to be of suitable quality, NYA plans to use some of this water for supply to the workers camp and agricultural activities in the area. The water will also be used for the reduction of fugitive dust generated at the quarry and by transportation trucks, for cleaning purposes and the maintenance of immobilized equipment. This activity will mostly take place during the dry season and daily consumption is estimated at 100m³.

ECTECH reported that based on the geology of the soil of the area it appears likely that the water will not pose a significant impact to the environment or human health, however this will need to be verified. The mineralogy of the rock shows calcite, pyrite, thin strips of manganese, silica and clays. The most abundant are calcite and clays.

The IFC “Environmental, Health, and Safety Guidelines – Mining (December 10, 2007)” effluent guideline values for this sector are presented in Table 4-12. These guidelines should be achievable under normal operating conditions in appropriately designed and operated facilities through the application of pollution prevention and control techniques discussed in the preceding sections of this document.

Table 4-12: IFC Effluent water quality guidelines

Pollutants	Units	Guideline value
Total Suspended Solids	mg/L	50
pH	S.U.	6-9
COD	mg/L	150
BOD5	mg/L	50
Oil and Grease	mg/L	10
Arsenic	mg/L	0.1
Cadmium	mg/L	0.05
Chromium (VI)	mg/L	0.1
Copper	mg/L	0.3
Cyanide	mg/L	1
Cyanide Free	mg/L	0.1
Cyanide WAD	mg/L	0.5
Iron (Total)	mg/L	2.0
Lead	mg/L	0.2
Mercury	mg/L	0.002
Nickel	mg/L	0.5
Phenols	mg/L	0.5
Zinc	mg/L	0.5
Temperature	°C	<3 degree differential
Note: metals concentrations represent total metals		

Drainage will be provided to direct storm water into nearby river courses to avert flooding arising from changes to the topography of areas being quarried.

A pollution control pond and berms will be placed near the quarry for clean and dirty water control. This pond is designed as a balancing pond for the underground water pumped from the quarry and will intercept dirty water from the quarry area prior to treatment.

There will also be a pollution control dam in the plant area for the plant workings. Water from the pollution control dam will be reused in the process. The dam has been designed for a 1:50 year rainfall event.

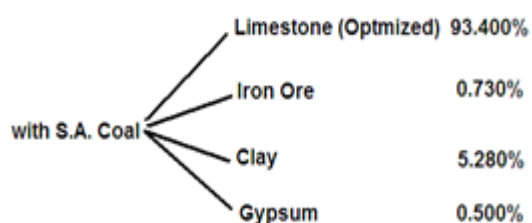
4.6 Material Requirements

FLS's proposed "Mass Flow" data sheet is attached as Appendix-3.5. The mass flow conditions are based on following raw mix and cement mix of CEM-I and CEM-II:

Table 4-13: Raw and cement mix component breakdown

Raw mix (% w/w dry)	Operating	
Limestone	90.0	
Clay	5.0	
Laterite	5.0	
Raw mill feed:		
Mix	90.0	
Sweetner limestone	5.0	
Laterite	5.0	
Cement mix (% w/w dry)	OPC	CEM II
Clinker	95.0	66.0
Gypsum	5.0	4.0
Limestone	0.0	30.0
Blaine	3200.0	4000.0

HOLTEC Feasibility Report indicates the following percentage of materials requirement with South African Coal:



FLS has proposed that the plant will be designed to handle the quantities of materials listed in Table 4-14.

Table 4-14: FLS Designed Material Requirements

Material	Designed Quantity, Tonnes/Day
Raw Meal	4,872 – 5,856
Coal to Preheater/Pre-Calciner	336
Coal to Kiln	240
Gypsum	480

[Source: FLS Mass Flow Diagrams]

Estimated annual requirement of raw materials at 100% capacity utilisation will be:

- Limestone = 1.51 million tonnes per annum
- Clay/Laterite = 0.09 million tonnes per annum

In addition the plant will require following materials:

- Gypsum (imported) = 188 tonnes per day
- Iron Ore (imported) = 40 tonnes per day
- Coal Fuel (imported) = 400 tonnes per day

Design of the plant will be based on the raw material requirements listed in Table 4-15.

Table 4-15: Design Raw Material Required for NYA Project

Task	Amount	Unit	
Clinker Production	1.00	Million Tons	
Conversion Factor	1.56	(with by pass 1.6)	
Raw Meal Requirement	1.60	Million Tons	
Mine Working Days			
Mine Working Days	300		
Working Days per Week	6		
Number of Operating Shifts per Day	2	Shift of 8 Hours duration	
Effective Working Hours	5	Hours	
Raw Material Requirement (Limestone)			
With Limestone 93.49 % of Raw Meal Yearly Limestone required (dry basis)	1.50	Million Tons per Year	
With maximum 10% (assumed) losses due to moisture and handling , Limestone ROM limestone to be fed to crusher	1.65	Million Tons per Year	
Limestone to be fed to crusher per day	5,550	Tons per Day say 5600 tpd	
Limestone to be raised per shift considering 2 shift operation	2,800	Tons per Shift	
With estimated average 5 hours actual mining operation per shift hourly limestone production	560	Tons per Hour	
Total Material Handling			
Limestone	560	Tons per Hour	
Overburden/Reject	856	Tons per Hour at Recovery Ratio of 1:1.53	
Total Material Handling	1,416	Tons per Hour	

Task	Amount	Unit	
Total Requirement of Limestone and Other Raw Materials Proposed from Year 0-5	Schedule for 5 Years		Per Year
Limestone	8.25	Million Tons	1.65
Clay	0.46	Million Tons	0.09
Iron Ore	0.07	Million Tons	0.01
Total	8.78	Million Tons	1.76
Quality			
LSF	98~100		
SR	2.3~2.35		
AR	1.45~1.25		
Average Corrective Percentage			
Clay	10	%	
Iron Ore	1	%	
Pre-Production Activities			
Removal of Soil	65,000	Tons	
Removal of Laterite	545,000	Tons	
Removal of Clay	296,000	Tons	
Handling of Limestone	23,000	Tons	
First Year of Operation			
Removal of Soil	0.317	Million Tons	
Removal of Laterite	3.081	Million Tons	
Removal of Clay	6.369	Million Tons	
Removal of Reject (Limestone)	-	Million Tons	
Handling of Limestone	1.671	Million Tons	
Recovery Ratio	1:5.85		

4.7 Hazardous materials and explosives

Hazardous chemicals store to be located within the plant area to be designed in accordance with GIIP.

Explosives will be used for blasting of the quarry to remove limestone, and will need to be stored on site for this purpose. An explosive storage magazine will be located in a suitable non-sensitive area (see Figure 3-1) so as to ensure a 500m radius safety zone which is clear of infrastructure around the magazine. The exact location of this facility has not yet been determined but is likely to be close to the quarry. The explosive storage magazine will comprise of a concrete and brick structure raised above the ground. The facility will be surrounded by high earth berms, and will be contained within a security fence with an airlock security entrance.

Blasting will be undertaken at the end of the relevant shift and most likely only once a day. All blasting and storage and handling of explosives will be undertaken in accordance with the relevant international guidelines and DRC regulations (Order No 43/266 of 08 August 1955 on the Manufacture, transportation, storage, use, sale and importation of explosives).

4.8 Lubricants

For efficient operation of the plant equipment and machinery, various lubricants (both oils and greases) will be required. The provisions of the FLS Key to Lubricants (Description of Lubricants and Safety Instructions) will be followed and includes information regarding the types of lubricants that will be used, their usage under different climatic conditions, and storage and safety recommendations. Preliminary indications by FLS indicated that approximately 27,000 L and 3,000 kg of oils and greases respectively (of various types) will be required on an annual basis for operation of the plant. These will be stored in enclosed containers at the plant site, as per the manufacturer's instructions, and disposed of in accordance with the Waste Management Plan (Appendix 15).

4.9 Safety and security

4.9.1 Fire prevention

Buildings and locations of flammable materials will be fitted with fire extinguishers. A fire water system will be installed consisting of fire hydrants, hose reels, a sectional pressed steel tank, electric fire pumps (one operating, one on standby), an electric jockey pump and a diesel engine driven emergency pump with auto start and control system. The pumps will start automatically in the event of a pressure drop in the pipeline, indicating a hose reel or hydrant valve has been opened. Fire water will be distributed to the plant and to the accommodation hostels.

4.9.2 Security

NYA will provide security for the site. The accommodation areas, waste management facility, explosives storage area and cement plant will be fenced and access controlled through security booms or gates.

4.10 Fuel, Energy and Water Requirement

4.10.1 Fuel

The designed specific fuel (heat) consumption of the plant is 730 kcal/kg Clinker.

In order to meet its fuel requirement NYA, presently, plans to import coal from South Africa. In addition, provision has been made to use HFO for startup and in emergency. Typical analysis of South African coal and HFO is given below:

	Coal	HFO
Moisture, %	8.50	-
Fixed Carbon, %	52.60	-
Volatile Matter, %	23.50	-
Ash, %	15.40	-
Total Sulphur, %	0.74	-
GCV, Kcal/kg	6,074	9,500

- Coal Requirement at 5,300 Kcal/kg = 396 tonnes/day
- Coal Requirement at 6,074 Kcal/kg = 346 tonnes/day

The installation of two (2) diesel oil storage facilities, each with capacity of 50 m³, is planned at the plant site. A small amount of aviation fuel will be stored in the fuel storage area at the plant site, for use by helicopters during emergency evacuations if necessary. All stored fuel will be placed in underground storage facilities, designed in accordance with SANS 10089-3:2010 which includes recommendations for double skinned tank design, with anti corrosion fibreglassed outer shelter, and fuel leaks observation wells.

4.10.2 Power supply

Power supply for the project will be obtained from the DRC national energy grid. To affect this, on October 24, 2012, NYA has signed a “Memorandum of Understanding” (English translation attached as Appendix–3.6) with Société Nationale d'Electricité, sarl (SNEL), the National Electricity Company, for supply of electricity for the proposed Project. Under the MOU, SNEL agrees to supply electricity to NYA Project as follows:

- Installation of 1 bay (span) at Kwilu grid station (located 6 km east of the cement plant site, alongside the N1 highway) for a 220 kV line;
- Construction of a 220 kV transmission line from Kwilu grid station to the plant site. This transmission line is 6.6 km long;
- Installation of a 220 / 11 kV - 40 MVA transformer at the plant site;
- Installation of one bay for the 220 kV line, one bay for the 220 kV transformer and one bay for the 11 kV output line.

Three powerlines will run through the concession area, as shown on Figure 4-5:

- A proposed 400 kv line (unrelated to the project), running from Kinshasa to Inga Dam, and in the process of construction, will cross the project area between the quarry and cement plant;

- An existing 220 kV double line (unrelated to the project) running from Inga Dam to Kwilu sub-station, following the N1 eastwards from Minkelo. This powerline also is not used by the project and is shown on Figure 4-12;
- A new proposed 220 KV powerline to supply for the project. It will run from Kwilu substation alongside the existing 220 kV line to Minkelo, supplying the cement plant. This line will cross over the N1 close to Kwilu grid station and cross the railway line (at a height of 12 m) in the area of the NYA access road to the N1 and run around the eastern side of the cement plant to the grid station located north of the plant.

The Kwilu grid station is fed electricity from a 220 KV power line from Inga Dam (located on the Congo River) in Central DRC. This line passes close to the proposed plant site. The location of Kwilu Grid Station with respect to the plant site is shown in Figure 4-12.

An 800 kVA 400 Volts 50 Hz diesel generator will be installed for emergency power supply in the event of a power failure from SNEL's Power System. However this will only support essential plant equipment and emergency lighting and will not maintain the operation of the plant as a whole (including the kiln). The Kiln will be restarted and kept rotating to save it from thermal damage during these occasions. The typical frequency of power outages is uncertain, but the environmental and technological implications of frequent shut-downs may require further investigation.

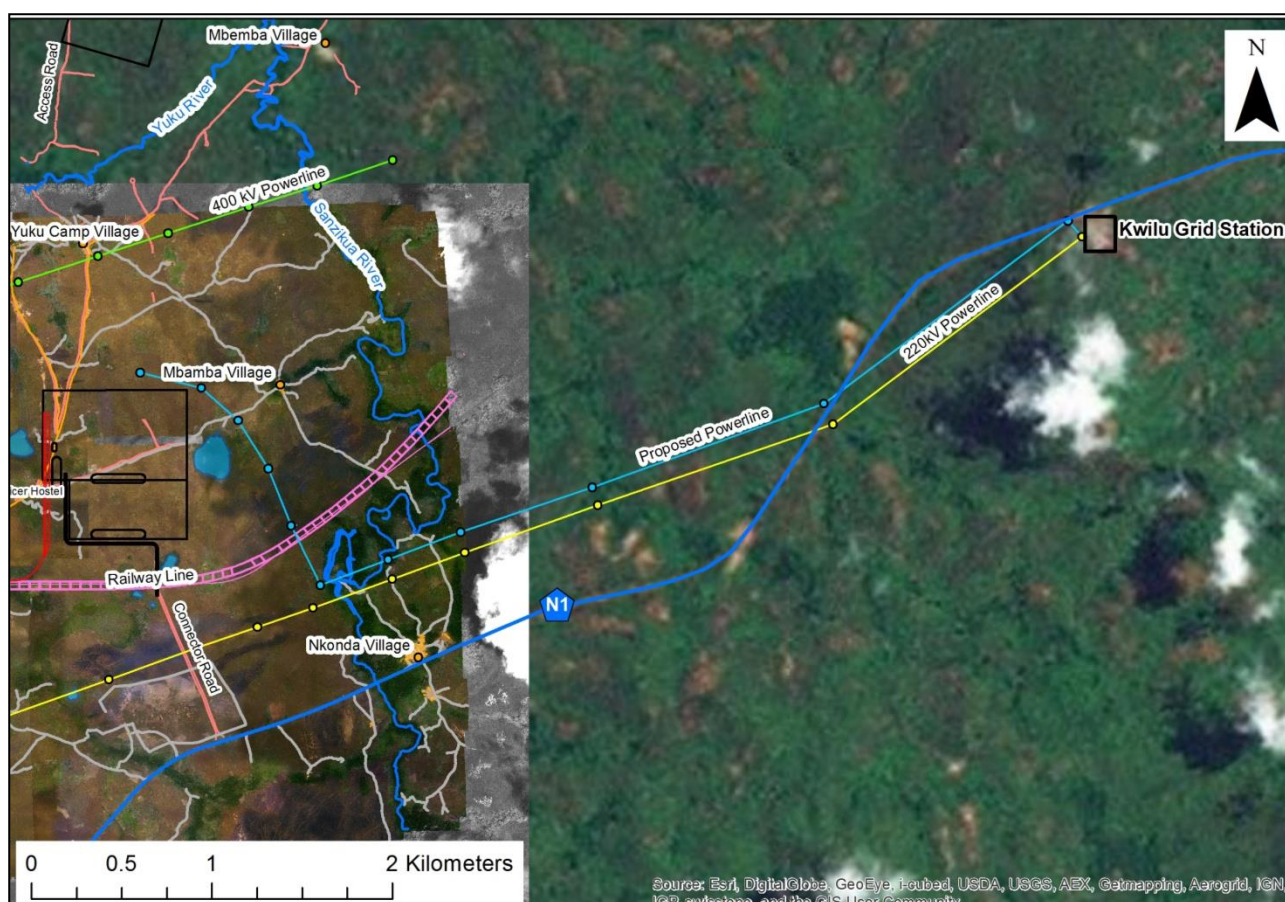


Figure 4-12: Location of Kwilu Grid Station and proposed and existing powerlines

Expected specific electricity requirements of the plant are as below:

• Clinker Production	=	57.0 kWh/t Clinker
• Packing, dispatch	=	1.5 kWh/t CEM II
• Misc. Services	=	1.5 kWh/t cement
• Cement Grinding	=	30.0 kWh/t cement
• Cement Production Plant	=	90 kWh/t CEM I
	=	86 kWh/t CEM II
• Installed Load	=	17.6 MW
• Connected Load	=	32.58 MW

Since it is planned to operate the quarry during daylight hours only, there is no provision for electricity supply to the quarry area. Dewatering of the quarry will be by diesel operated generator/pumps as and when required.

4.10.3 Raw Water

Estimated water requirement is 35 m³/h which equals to 840 m³/day for process cooling water and 120 m³ for domestic use, based on 200l per person per day. All the wastewater will be treated and recycled for process needs, dust suppression and, horticulture, etc.

Raw water supply will be sourced from mine dewatering, surface runoff and extraction from the Yuku and Sansikwa Rivers. Groundwater supply (linked to pit dewatering) will also be investigated.

Water removed from the pit will be treated (if required) and used for dust control in the quarry area, irrigation, and to feed the plant raw water supply and excess water will be channelled back into the river catchment system from which it was dewatered. There is also the opportunity to re-use passive dewatered and treated fissure water from the underground workings to the plant area. There will be no underground water storage.

NYA is planning to use water from Yuku and Sansikwa River. A detailed hydraulic flow study will be carried out to determine the seasonal flow of water in both the Yuku and Sansikwa Rivers. If sufficient quantity of water is not available from the Yuku River then water will be pumped from the Sansikwa River. Estimated flows of water in the Sansikwa River is 0.3m³/s

ECTECH reported that permission of the Energy Ministry is required for both surface and ground water utilisation, and has already been obtained by NYA.

Limited water quality parameters were measured *in situ* by SRK whilst on site (10 – 14 June 2013), the results of which are indicated in Table 4-16. These include pH, conductivity temperature and dissolved oxygen.

Dissolved Oxygen (DO) levels normally fluctuate seasonally and over a 24-hour period. They vary with water temperature and altitude. The measurements taken in Mbamba were taken at a depth of less than 250mm. Photographs and descriptions of each sampling point are included in Appendix 7.3.

Table 4-16: In situ water quality measurements during SRK site visit (June 2013)

Sampling point	pH	Conductivity μS/cm	Dissolved Oxygen mg/l	Temperature °Centigrade*	100% Oxygen Saturation at the measured temperature mg/l
Upstream in Sanzikua River (Bridge at N1)	7.65	184	6.06	23.1	8.56
Mbamba Lake (Lake on eastern side of proposed plant)	6.18	148	4.9	25.5	8.24
Yuku Confluence with Sanzikua	7.71	178	6.03	24.9	8.24
Origin of the Yuku	7.21	338	3.98	27.7	7.81
Minkunku River	8.04	326	6.38	26.0	8.09
Kinsamu River (Tributary of the Sanzikua)	7.34	202	7.25	24.6	8.24

*Maximum dissolved oxygen concentrates vary with temperature

[Source: SRK, June 2013]

The measurements taken indicate that the water quality is good and has not been affected by industrial or agricultural activities. The conductivity which is a measure of the concentration of dissolved salts in the water, and normally increases with industrial and mining activities, is low. The full chemical analysis will however indicate if there are naturally high levels of any compound which may be potentially harmful for ingestion and/or process use. Previous sampling results provided in OEM Report have indicated that Chrome concentrations may be high. It is not clear what the origin of this may be and the result should be confirmed with another sampling run.

Utilisation of these waters for drinking purposes will require use of an adequate treatment technology for removal of nitrates and other impurities. Analysis of samples from the Sanzikua River, located at a distance of over 1.5 kms from the site, collected by Lucky Cement, are reported in Table 4-17 below.

Table 4-17: Analysis of Water from Sanzikua River

Analysis of Water		
1	pH	7.82
2	Conductivity, μohms/cm	350
3	Total Dissolved Solids, ppm	220
4	Total Hardness as CaCO ₃ ppm	40
5	Calcium Hardness as CaCO ₃ ppm	20
6	Total Alkalinity, ppm	38
7	Chloride as Cl ⁻ ppm	60
8	Total Iron as Fe ⁺ ppm	0.13
9	Silica, ppm	4.0
11	Suspended Solids, NTU	Not traces
12	Total Bacteria Count, cfu/ml (48Hrs incubation test)	10 ¹

[Source: OEM EIA Study Report]

Domestic Water Use

The World Health Organisation has guidelines for water use for domestic purposes (World Health Organisation, 2006) and these are shown in Table 4-18. The water provided on the plant and mine for domestic use will be treated to comply with these guidelines.

With the available data and provided that the Chrome be re-assessed it is recommended that minimal treatment will be required. It is not clear what the origin of the chrome is at this time and stage. Slow sand filtration will remove any suspended solids and pathogens will be sterilised with disinfection, possibly by chlorination.

Table 4-18: WHO Guideline values for inorganic chemicals for acceptable Drinking-water Quality

Chemical	Guideline value (mg/l)	Comments
Antimony	0.02	
Arsenic	0.01	
Barium	0.7	
Boron	0.5	
Bromate	0.01	
Cadium	0.003	
Carbon tetrachloride	0.004	
Chloride	250	Detected by taste
Chlorine	5	
Chlorite and chlorate	0.7	
Chlorotoluron	0.03	
Chromium	0.05	
Copper	2	
Cyanide	0.07	
Cyanogen chloride	0.07	
Floride	1.5	
Hydrogen sulphide	0.008	Detected by smell
Inorganic tin		Not guideline deemed necessary
Iodine		No guideline established
Iron		No guideline established
Lead	0.01	
Manganese	0.4	
Mercury	0.006	

Chemical	Guideline value (mg/l)	Comments
Molybdenum	0.07	
Nickel	0.07	
Nitrate and Nitrite	50	
pH		No guideline established
Selenium	0.01	
Silver		No adequate data
Sodium	200	
Sulphate	500	
Total dissolved solids		No adequate data
Uranium	0.015	
Vinyl chloride	0.0003	
Zinc	3	

The Sanzikua River has a much higher flow rate than the other streams/rivers flowing in the concession area. There is a natural spring near Yuku Camp Village, which at present is being used by villagers for drinking purposes.

Once the plant is operational and water is being supplied for domestic use, bacteriological monitoring will be required.

Industrial Water use

Water treatment for process water will be required to prevent corrosion of pumps and equipment. Scale, in addition to causing physical blockage of piping, equipment, and the cooling tower, also increases the energy use of the chillers used in comfort cooling. The thermal conductivity of copper is 2674 btu/[hr(ft²)(F/in)], while the common cooling water scale calcium carbonate has a thermal conductivity of just 6.4 btu/[hr(ft²)(F/in)]. The energy cost penalty for even a small amount of scale can be significant.

A calcium carbonate scale of just 1.5 mil thickness is estimated to decrease thermal efficiency by 12.5 %, which on a 1000 ton chiller would increase annual power costs (Keister, 2008). Described as the "universal solvent," water corrodes all materials of construction at different rates. Steel, being the lowest cost construction material for cooling systems, is very common and is readily corroded by most cooling waters. Other materials, such as copper, brass, and galvanized steel, are also corroded, though at generally lower rates. To obtain a useful life from a cooling system, corrosion inhibitors are generally used to control the corrosion rates to an acceptable level.

The cooling water environment (warm with high dissolved solids and debris loading) is an excellent medium for growth of microorganisms that may cause many severe problems. Not only is there an increased risk of Legionnaires' Disease, but biofilms also plug water passages and piping, help to accelerate corrosion, and reduce heat exchanger efficiency. The effect of biofilms on the power cost of chiller operation is often not appreciated. Looking at the thermal conductivity of biofilm, typically 0.2 btu/[hr(ft²)(F/in)], it is substantially less conductive than the common calcium carbonate scale. Therefore, while a system may be scale free, any biofilm present will still cause excessive energy

use. To prevent these problems, toxic chemicals referred to as "biocides" are added to cooling towers to control the growth of unwanted microorganisms in the cooling water.

Treatment will entail softening to prevent scaling. Water softening is the removal of calcium, magnesium, and certain other metal cations in hard water. The resulting soft water is more compatible with soap and extends the lifetime of plumbing. Water softening is usually achieved using ion-exchange resins. Table 4-19 and Table 4-20 reflect the required water quality for process and cooling water (FLSmith Report 70006383-4.1, 2013).

Table 4-19: Process Water Requirements

Req.	Line	Compound		Minimum	Maximum	Recommended	Unit
2	1	Clarity	(Text)	Clear, colourless	NA	Clear, colourless	
2	2	Foamability	(Text)	None	0.1% of fluid level in glass	None	
2	3	Odour	(Text)	-	None	None	
2	4	Turbidity	(Text)	0	5	0	NTU
2	5	Total Suspended Solids	TSS	0	NA	0	mg/l
1	6	pH		7.5	9	8.0-8.8	
2	7	Conductivity	At 25°C	0	2000	<1500	uS/cm
1	8	Total Dissolved Solids	TDS	0	1000	<750	mg/l
2	9	Alkalinity	CaCO ₃	-	-	-	mg/l
1	10	Calcium	Ca ²⁺	20	100	20-100	mg/l
1	11	Magnesium	Mg ²⁺	0	<Ca ²⁺	<Ca ²⁺	mg/l
1	12	Total hardness	CaO	0	130	0-130	mg/l
2	13	Sodium	Na	-	-	-	mg/l
1	14	Chloride	Cl ⁻	0	250	<250	mg/l
1	15	Sulphate	SO ₄ ²⁻	0	400	<200	mg/l
1	16	Nitrate	NO ₃ ⁻	0	50	<50	mg/l
2	17	Phosphate	PO ₄ ⁻	0	5	<3	mg/l
1	18	Ammonium	NH ₄ ⁺	0	0.1	<0.1	mg/l
2	19	Fluoride	F ⁻	0	1.5	<1.5	mg/l
1	20	Iron	Fe	0	0.3	<0.1	mg/l
1	21	Manganese	Mn	0	0.2	<0.1	mg/l
2	22	Copper	Cu	0	0.3	<0.2	mg/l
1	23	Organic matter, COD	O ₂	0			mg/l

[Source: (FLSmith Report 70006383-4.1, 2013)]

Table 4-20: Cooling water requirements, standard

Req.	Line	Compound		Minimum	Maximum	Recommended	Unit
2	1	Clarity	(Text)	Clear, colourless	NA	Clear, colourless	
2	2	Foamability	(Text)	None	0.1% of fluid level in glass	None	
2	3	Odour	(Text)	-	None	None	
2	4	Turbidity	(Text)	0	5	0	NTU
2	5	Total Suspended Solids	TSS	0	NA	0	mg/l
1	6	pH		7.5	9	8.0-8.8	
2	7	Conductivity	At 25°C	0	2000	<1500	uS/cm
1	8	Total Dissolved Solids	TDS	0	1000	<750	mg/l
2	9	Alkalinity	CaCO ₃	-	-	-	mg/l
1	10	Calcium	Ca ²⁺	20	100	20-100	mg/l
1	11	Magnesium	Mg ²⁺	0	<Ca ²⁺	<Ca ²⁺	mg/l
1	12	Total hardness	CaO	0	130	0-130	mg/l
2	13	Sodium	Na	-	-	-	mg/l
1	14	Chloride	Cl ⁻	0	250	<250	mg/l
1	15	Sulphate	SO ₄ ²⁻	0	400	<200	mg/l
1	16	Nitrate	NO ₃ ⁻	0	50	<50	mg/l
2	17	Phosphate	PO ₄ ⁻	0	5	<3	mg/l
1	18	Ammonium	NH ₄ ⁺	0	0.1	<0.1	mg/l
2	19	Fluoride	F ⁻	0	1.5	<1.5	mg/l
1	20	Iron	Fe	0	0.3	<0.1	mg/l
1	21	Manganese	Mn	0	0.2	<0.1	mg/l
2	22	Copper	Cu	0	0.3	<0.2	mg/l
1	23	Organic matter, COD	O ₂	0			mg/l

[Source: (FLSmith Report 70006383-4.1, 2013)]

4.10.4 Wastewater Treatment

There will be two sources of wastewater during operation:

- Industrial wastewater: From workshops, laboratory, cement processing, etc.
- Domestic (human) Wastewater: From accommodation facilities, departments, offices, central control room, workshops, canteen and clinic (dispensary).

Industrial wastewater

Details of the nature and amounts of process / industrial wastewater from the cement plant and quarry have not yet been confirmed, and will be addressed via the additional water studies recommended (see Section 7.3.6). This will inform the design of the necessary industrial wastewater management infrastructure.

Domestic wastewater

Sewage treatment

Portable toilets will be used for workers in remote locations during the Construction Phase, and prior to the establishment of the permanent waste water treatment system. A package plant wastewater treatment system will be used for the treatment of sewage from the site camps during construction phase and all toilet facilities during the Operational Phase. Possible impacts on the groundwater regime caused by the disposal of human waste will therefore be of a short duration.

A package sewage treatment plant system facilitates the growth of bacteria that break down sewage into non-polluting end products, in a closed system. While the specific product and design that will be used for the project have not yet been determined, a typical design consists of the following:

Mechanical solids removal - The effluent wastewater enters the package plant through a screen, which filters out gross solids prior to aeration.

Aeration - Once the filtered wastewater has entered the aeration chamber, the untreated flow is mixed with active biomass in a rolling action through air diffusers. The diffused air passing through the wastewater coupled with the rolling action provides sufficient oxygen supply allowing microorganisms to oxidize treatable wastes into carbon dioxide, water, and stable sludge.

Clarification and settling - After aeration, the wastewater flows to the clarifier that typically has a hopper bottom configuration and is sized to provide the required retention time based on an average twenty-four hour design flow. During the settling period, solids settle on the bottom of the clarifier.

Sludge treatment - Airlift pumps with adjustable pumping capabilities are used to return these solids in the clarifier, as activated sludge, to the aeration chamber to maintain the maximum efficiency of the biological process. When necessary, excess sludge is wasted to an aerated sludge digestion tank for additional treatment and reduction. A skimmer airlift pump is used to return floatable solids and scum to the aeration chamber for further processing.

Disinfection and discharge - The treated water flows from the clarifier to a disinfection chamber for treatment via chlorination or ultra-violet (UV) disinfection prior to discharge to complete the treatment process. Tertiary filters may also be used where a higher quality of effluent is required.

A detail site evaluation will be done in order to locate the area to be used for the package plant, and to verify the soil characteristics and to size the system.

Other domestic wastewater

Wastewater containing high concentrations of fats, oils and greases from the kitchen will be handled separately by installing a grease trap prior to disposal to the package plant.

4.11 Waste management

Wastes will be disposed of in accordance with DRC and lender requirements including the IFC EHS Guidelines. Consideration will be given to reused / recycling of dust, off-specification quicklime, and hydrated lime into selected commercial products e.g. lime for construction uses, lime for soil

stabilization, hydrated lime, and palletized products. In summary, waste streams produced by the project will be handled as follows:

- Domestic waste will be disposed of in a dedicated domestic waste management facility. If possible, the domestic waste will be recycled. The location of this facility has not yet been confirmed but is provisionally indicated on Figure 4-5.
- Recyclable waste will be decontaminated and once declared safe, made available to local communities.
- Industrial waste will be decontaminated and recycled if possible; otherwise it will be disposed of in the waste management facility.
- Hazardous waste will be stored in appropriate containers which in turn will be stored in a designated hazardous waste area / container. Disposal options will be investigated with suppliers and local government.
- Sewage waste will be treated in a suitable treatment plant and the resultant sludge disposed of at landfill
- Medical waste will be incinerated.

The feasibility of co-processing of suitable waste will be investigated outside the scope of this study.

4.11.1 Facilities

A new waste management facility (WMF) will be developed to accommodate non-mining waste from the cement plant as well as domestic waste from the accommodation areas and offices. Two alternative positions for the proposed location for the WMF is shown on Figure 4-5 (based on high level ecological and social sensitivity only, and subject to further detailed onsite investigation prior to confirmation of the position). The WMF with a low permeability engineered lined cell for hazardous materials, will be in place from the outset of construction and capacity will be reviewed as construction progresses. Provisional arrangements for non-hazardous waste will also need to be made during construction. To accommodate the operational phase, the WMF will consist of the following separate cells / compartments (for management of different waste types with differing cell design requirements), including:

- An unlined non-hazardous waste landfill
- The salvageable material yard on an engineered terrace
- A low permeability engineered lined hazardous waste landfill
- A bunded oil storage facility

The WMF will require an area of approximately 5 ha and will be contained within a security fence with a guard post.

Outside the scope of the current study, it is anticipated that once the NYA cement plant is operational, co-processing (in the cement plant kiln) of suitable categories of waste from the NYA site could be undertaken. This would most likely require a separate feasibility study. Should this proceed, co-processing will be undertaken in line with best available technology (BAT) and Good International Industry Practice (GIIP) including implementation of the waste hierarchy. It is further expected to reduce greenhouse gas (GHG) emissions from the project, and will be in accordance with multilateral agreements including the Basel Convention.

This would not completely replace the requirement for a WMF however, but could considerably reduce the amount of waste going to landfill, as well as the coal fuel requirement of the kiln.

4.12 Employee accommodation and facilities

4.12.1 Construction phase

A maximum of 500 personnel will be required during peak construction (lasting for 5 – 6 months), of which 200 – 300 will be unskilled labourers sourced from local villages. These workers will not be accommodated at the site but will be transported to and from the site daily. More highly skilled construction personnel will make up a smaller component of the construction workforce and will be sourced from locally and regionally as per the Labour and Human Resources Plan (Appendix 11)) and will be temporarily accommodated at the existing exploration camp (consisting of buildings associated with the former farming activities on the site) situated near Yuku Camp Village. These facilities include ablutions and kitchen facilities, and are serviced with water from the local spring and power from an on-site generation plant. Once the permanent labour accommodation facilities (close to the plant site) have been constructed, it is envisaged that these personnel will be accommodated there. Facilities that are no longer required at the Yuku camp site will be removed but the buildings will remain.

4.12.2 Operational phase

Two accommodation camps are proposed – one for more senior level employees (the “manager accommodation” and another for the general workforce (the “labour accommodation”). Both accommodation camps will be located close to each other, to the south west of the cement plant, as shown on Figure 4-5. Transportation to and from the cement plant and quarry will be provided for employees as required.

The labour accommodation camp (0.18 ha) will consist of bachelor accommodation for approximately 250 personnel. The proposed layout of the accommodation is shown on Figure 4-13, and includes 16 bachelor dormitories sleeping 16 persons each (totalling 256), toilet and shower facilities, lounges, four pantries and four laundries. Accommodation for an additional 50 management level personnel will be provided in an adjacent separate management accommodation camp (0.24 ha). The accommodation camp will be connected to services infrastructure designed to accommodate at least the maximum number of inhabitants, including potable water and electricity supply, sewage and waste disposal services. Provision for canteen and kitchen facilities is made at the cement plant. National and international requirements for workers accommodation will be adhered to in the final design and construction of the accommodation facility, which is also designed in accordance with the minimum requirements of the IFC Guidance Note on Workers' Accommodation (IFC and EBRD, 2009).

No provision for female workers or family units has been made in the design of the labour accommodation hostel, and it is assumed that they will be accommodated elsewhere. If additional accommodation is required this will be located at Kimpese Town, approximately 35 km from site.

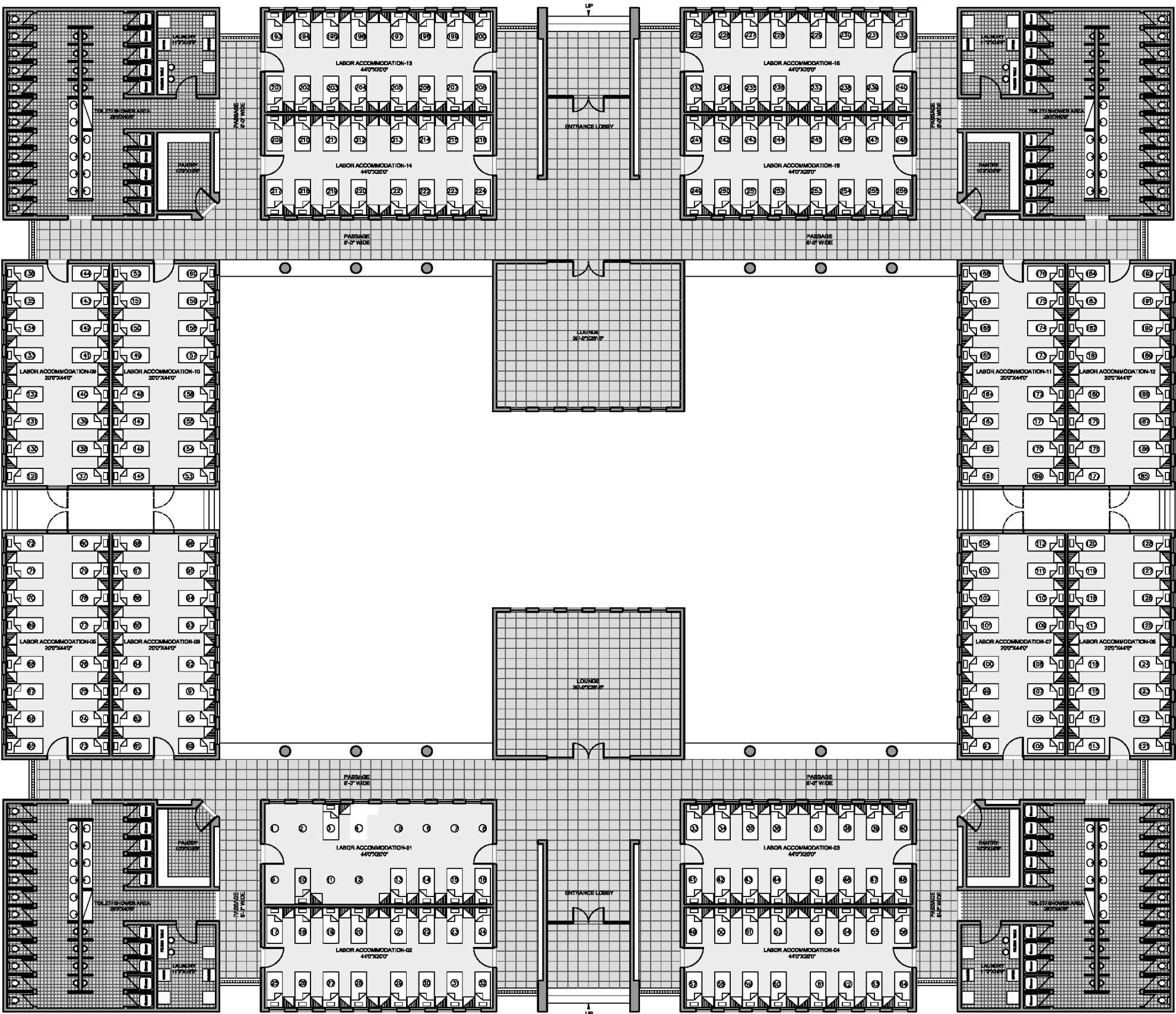


Figure 4-13: Proposed layout for labour hostel accommodation

4.12.3 Medical facilities

NYA will provide health services for their employees and dependents. A clinic facility to deal with medical emergencies and general health issues of employees (during both construction and operation) will be sited close to the accommodation and plant facilities. The exact location of this facility has not yet been determined. There will be sufficient paramedic/medical capacity to treat minor injuries and stabilize patients prior to transfer to the hospital in Kimpese. Emergency evacuation to Kinshasa via helicopter will be undertaken when required.

4.13 Transportation and Logistics

Transport of personnel will be via road. Bussed transportation will be provided from the accommodation facilities to the quarry. Transport of materials and explosives will be via road. Fuel will be transported to site in tankers. Chemicals, parts and spares will be transported in containers for sea, rail and road transport.

NYA plans to enter into a contract with the relevant authority for use of the railways for transport of imported coal from Matadi. For despatch of product, buyers will arrange their own transportation.

4.13.1 Internal Road Network

It is planned to construct a 12 metre width gravel access road to plant site from the N-1 (national road), as shown on Figure 4-5. The coordinates for the take-off point from the N1 are: Latitude S 05°38' 42.2" Longitude E 14 ° 12' 48.8", and the access road will be approximately 2.6 km long, crossing the railway line between the N1 and the plant site. The railway crossing will consist of a level crossing. Currently this railway line is used only infrequently. The access road take-off point from the N-1 is shown in Figure 4-14 to Figure 4-16. The road is planned to cross the railway line between two wetlands that occur to the south of the rail way line. The area immediately north of this crossing is also characterised a series of apparently connected wetlands (for a distance of approximately 50 m from the railway line). Comment on the ecology of these wetlands it provided in Section 6.3.2). Provision should be made in the road design for culverts that enable flow between these wetland areas. The plant road alignment to the north of these wetlands is shown in (Figure 4-5, and provides access to both the employee accommodation hostels and the plant.

The alignment of the haul road between the cement plant and the quarry will mostly follow the existing clay track. This track would require widening to accommodate mining vehicles, and it is envisaged that minor realignment of some sections of the existing track may occur. NYA's proposed haul road alignment is to cross the river in a more direct line than the existing track. This would have the advantage of a shorter haul distance, but would mean establishing a crossing in the flowing portion of the Yuku River, and associated impacts on riverine vegetation, impacts on agricultural lands, and dust impacts on water quality (see Figure 4-17), and impacts on Yuku village.

The environmentally and socially preferred alternative is to follow the existing track, avoiding crossing the Yuku River by passing approximately 100 m to the west of the source of the river. The Yuku River valley extends a considerable distance above the source of the flowing portion of the river, and culverts would need to be provided for in the haul road crossing of the river to accommodate surface flow during the rainy season.



Figure 4-14: Plant take-off point from Highway



Figure 4-15: View of N-1 at take-off point (toward Matadi)



Figure 4-16: View of N-1 at take-off point (toward Kinshasa)



Figure 4-17: View of Yuku River at alternative haul road alignment crossing (facing South)

Source (Figures 4-14 – 4-17): ECTECH ESIA

4.13.2 Wider Road Network

The N1 Highway, from Kinshasa to Matadi, is the principal logistic arterial route between the main port of Matadi and rest of the country, and is in good condition. Most import and export traffic makes use of this highway. The project will make use of this route (see Figure 4-18) for transportation of raw materials and product to and from the port.

Inbound traffic of 25 ton capacity trucks, from Matadi Port to the Project Site, carrying imported materials, is shown below:

Table 4-21: Inbound Material Shipment

S.No	Item	Quantity Tonnes per day	Distance to Plant, Km	Round Trip Total Time (Hrs)	Trips per Day	Actual No. of Trucks	Vehicle movements /day
1	Gypsum	188	110	6	2	4	8
2	Iron Ore	40	110	6	2	1	2
3	Coal	400	110	6	2	8	16
	Total					13	26
[2 shifts/8 hrs; Ave. Speed 40 Km/hr; Loading/unloading – 1 hr; Capacity 25 tonnes]							

The above truck traffic does not include vehicles transporting imported cement packing material (empty bags), personnel travelling to site, and other supplies and equipment.

Outbound traffic, shipping cement to Kinshasa Area (North) and Matadi Area (South), has been estimated as shown in Table 4-22 below:

Table 4-22: Outbound material shipment - Cement

S.No	Market	100% Average Sales per Day	Distance Km	Round Trip (Hrs)	Actual No. of Trucks	Vehicle movements /day
1	Kinshasa	2,760	250	15.5	111	111
2	Matidi	860	110	8	18	32
	Total	3,580			129	144
[2 shifts/8 hrs; 40 Km/hr; Loading/unloading – 3 hrs; Truck size 25 tonnes]						

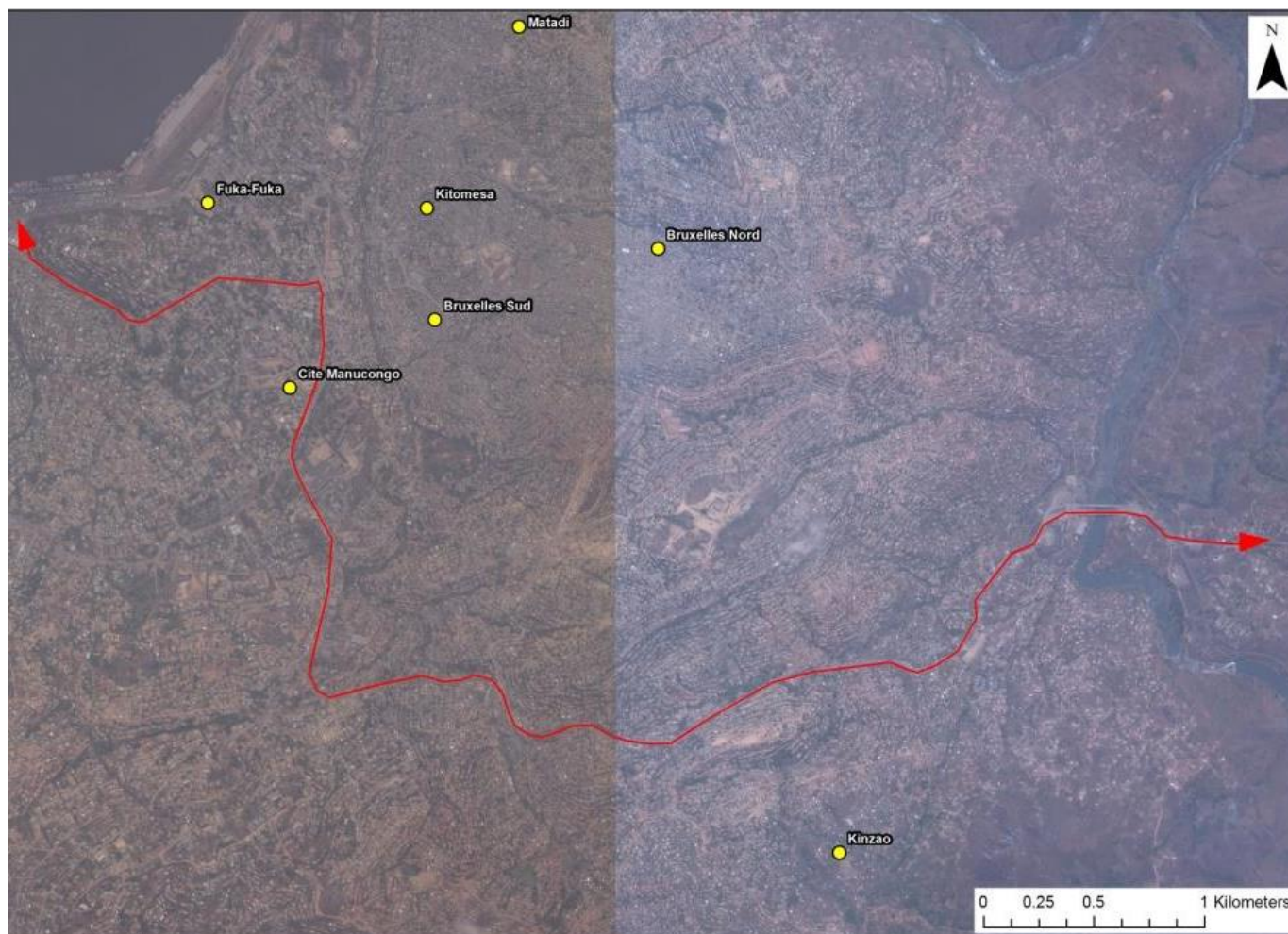


Figure 4-18: Truck route from Matadi to site

Average total number of inbound and outbound trucks amount to approximately 170 truck movement per day. The number of trucks required for inbound materials has been worked out on an average daily basis. In fact, a coal shipload of say 10,000 tonnes has to be unloaded in maximum of 10 days, i.e. 1,000 tonnes per day. In actual practice, for this tonnage of coal 20 trucks will be moving, from port to and from the project site, for 10 days continuously.

If possible, NYA will preferably use railways for transportation of coal and gypsum, but as an alternative plans to utilize trucking companies on contract for transportation of its materials, except for company owned trucks or vehicles. A parking and rest area will be provided for trucks near the cement plant site.

The truck traffic from Matadi Port has to pass through a congested part of Matadi City, which could create traffic hazard and has the potential to limit the ability of NYA to offload coal, gypsum and iron ore within reasonable timelines.

Gypsum & iron ore will be imported in bulk bags which will not be hazardous, whereas coal will be imported in open bulk ships. In order to reduce fugitive dust and fire hazard it is desirable to cover the transportation truck with properly secured tarpaulin and import coal in larger size without fines.

Construction activities that may have a significant impact on traffic volumes are scheduled to take place over a 14 to 18 month period. Previous studies indicate that during the construction phase, the peak traffic volumes entering & leaving the site would be maximum of 50 heavy vehicles per day.

will enter and leave the site during construction. This estimate compares reasonably with similar construction projects for the delivery of cement, steel, and other building supplies. Vehicles for the transportation of construction personnel can typically increase total vehicle movements considerably (to between 300 and 350 vehicles per day). However, establishing accommodation on-site for the construction phase would reduce daily commuter traffic to the site.

4.13.3 Rail Network

The rail network, from Kinshasa to Matadi, is at present not being used for goods traffic. However, the government of DRC has initiated a plan to refurbish the country's railways for goods transportation.

Rail transport in the Democratic Republic of the Congo is provided by Société Nationale des Chemins de Fer du Congo (SNCC), the Office National des Transports Congo (ONATRA) and the Office of the Uele Railways (Office des Chemins de fer des Ueles, CFU). The national system is mostly operated by the SNCC.

ONATRA is responsible for operation of Matadi Port through the Port Authority of Matadi. A meter gauge line runs from Matadi Port to Kinshasa via towns of Songololo, Minkelo, Kwilu, Kimpese, Mbanza-Ngungu and Kasangulu, and operates two to three trains a week carrying passenger traffic. The line lost traffic to road transport when the Matadi-Kinshasa road was re-established in 2000, and it is now planned to refurbish it with Chinese assistance. An agreement was signed in July 2006 between Railway Authority and a Chinese company (CMIC) which will renovate the track, trains, telecommunications, signal system and electric supply.

NYA has already discussed with Railway Authority for provision of railway siding at the cement plant and arrangement for transportation of coal from Matadi Port to plant site. Coal transportation by railway will be preferable to road transportation. Figure 4-19 shows Google Earth image and Figure 4-20 an aerial view, of the railway marshalling yard at Matadi Port.



Figure 4-19: Google Earth image of railway marshalling yard



Figure 4-20: Aerial view of railway marshalling yard

The truck route from Matadi Port to the Plant site is presented in Figure 4-18 (Google Earth Image) and Figure 4-21 shows route through Matadi City.

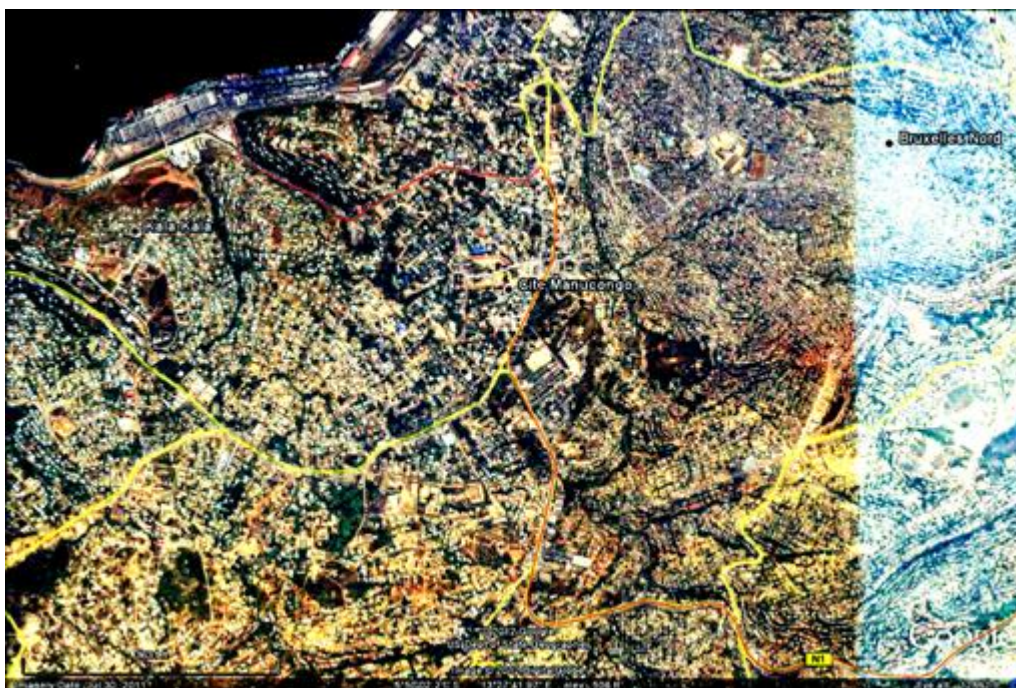


Figure 4-21: Route through Matadi City

The red line in the Figure 4-21 indicates the truck travel route from Matadi Port to Highway N-1 passing through most congested area of the City.

4.13.4 Matadi Port

Matadi is the chief sea port of the Democratic Republic of the Congo and the capital of the Bas-Congo province. Matadi is situated on the left bank of the Congo River 148 km (92 mi) from the mouth and 8 km (5.0 mi) below the last navigable point before rapids make the river impassable for a long stretch upriver. It is the nation's principal port, with one of the largest harbours in central Africa and consists of a mile-long waterfront that is cut in granite.

The deepening of the river's channels took place over four months towards the end of year 2011. The return to a 26ft (7.9 m) draft now allows transport of cargoes of 6,000 to 7,000 tonnes,

depending on the type of vessel, and in the case of units with a small draft because of their wider size, this can go up to 10,000 tonnes.

According to the Port Authorities, bulk coal carrying ships can be directly unloaded into the rail wagons, and the facilities to enable this were confirmed during SRK's site visit. The Logistic Manager at the port reported that 10,000 tonne coal bulk ships have previously used the port for unloading of cargo. No long term bulk storage facilities are currently available within the port, and physical constraints within the Port may preclude their development in the future.

A view of the Matadi Port from the opposite town of Vivi (located on the northern bank of the River Congo) is shown in Figure 4-22.



Figure 4-22: Port and City of Matadi

For truck traffic a separate entry/exit road from the port is used, as indicated in the Google Earth image (see Figure 4-23).

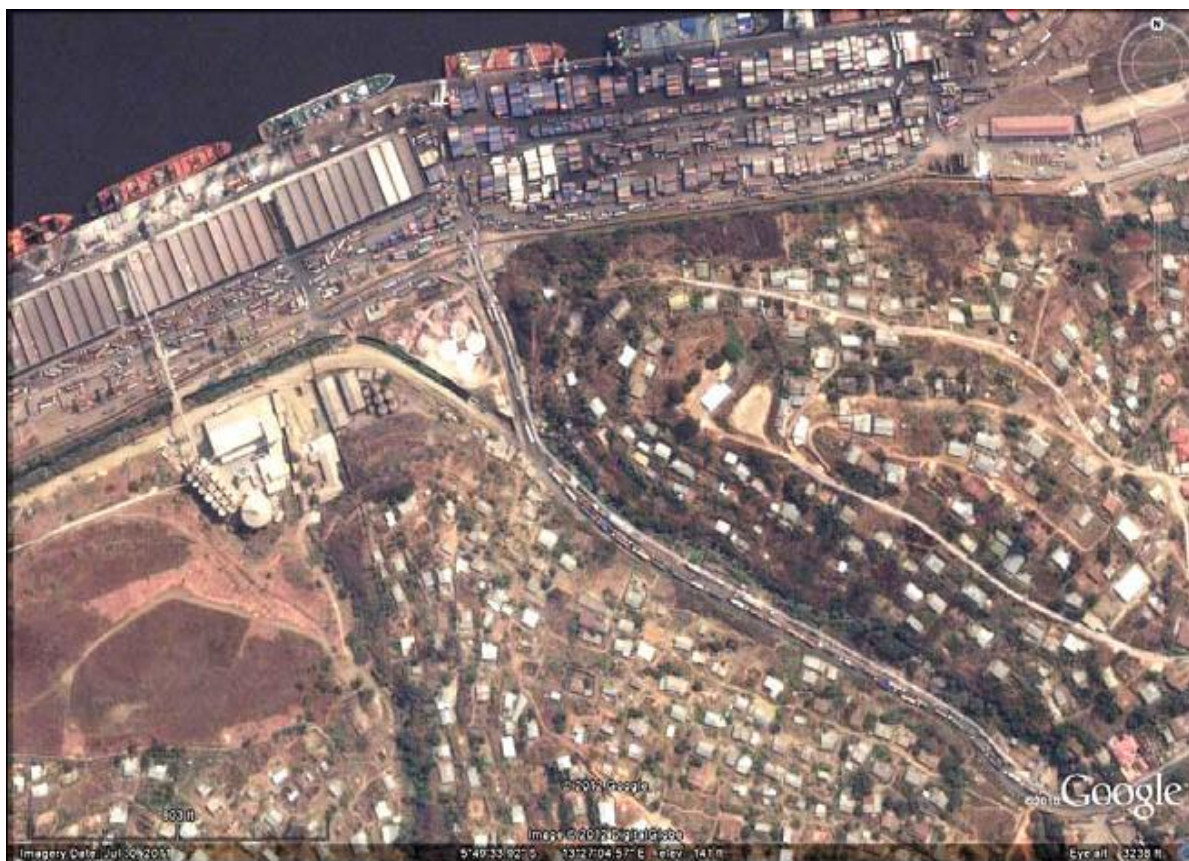


Figure 4-23: Separate entry/exit road from port for truck traffic

4.14 Employment

It is estimated that at peak activity (lasting for 5 – 6 months), 500 contracted personnel will be required during the construction phase of the Project. This is in addition to supervisory personnel from NYA and FLS. Most of the contractor non-local labour will be accommodated at the Yuku exploration camp and subsequently (once it has been built) at the accommodation camp near the cement plant.

During operation, the NYA Corporate Office will consist of 50 personnel and the cement plant and quarry will have 373 personnel at the plant site. A preliminary organisation structure for the project is presented in Figure 4-24.

The use of local labour (both from the project area and elsewhere in the DRC) will be maximised as per the Labour and Human Resources Plan (Appendix 11). It is estimated that up to 300 unskilled labourers will be locally sourced.

Security of the site, while the mining of the quarry and maintenance and management of operations at the plant will be handled in-house by NYA.

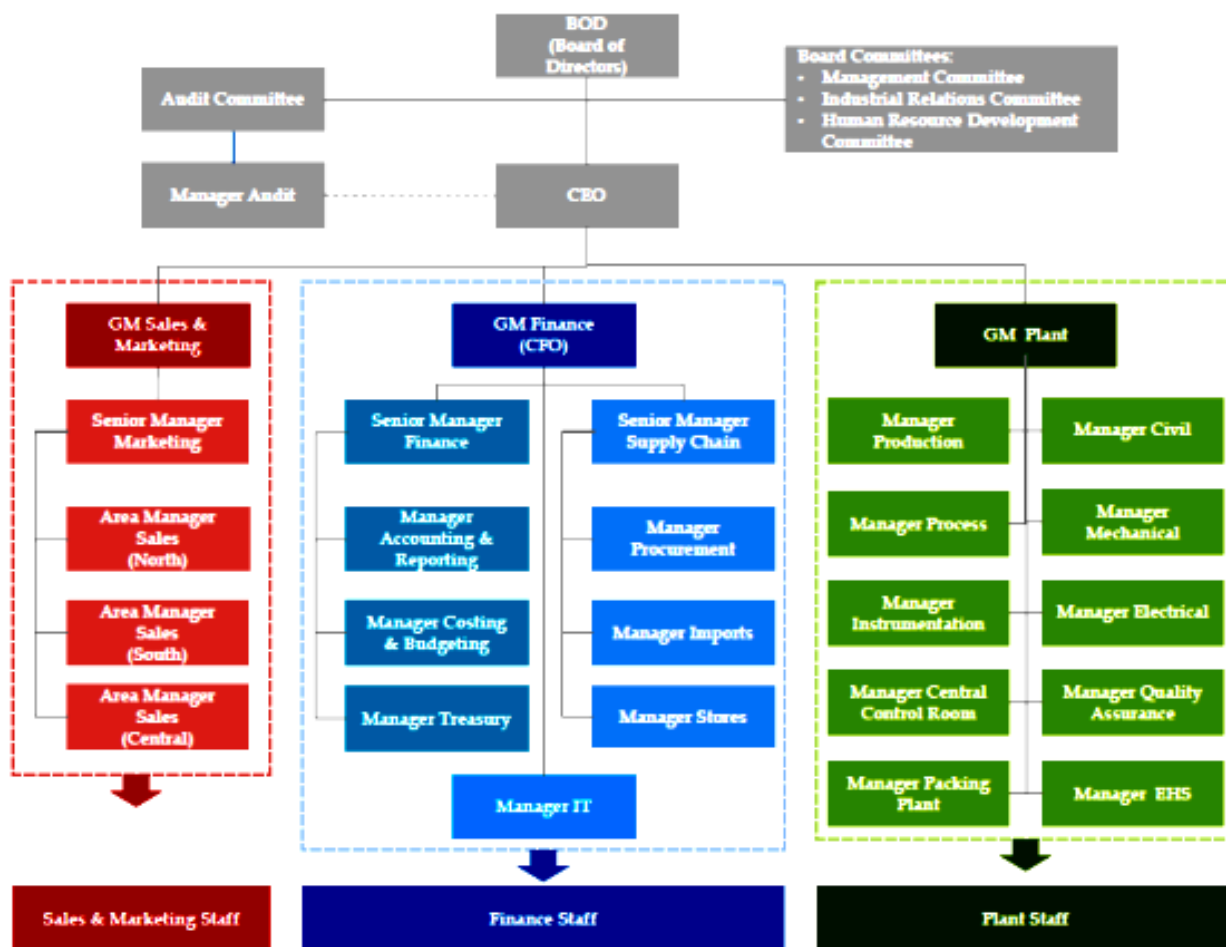


Figure 4-24: Preliminary Organisation Structure

Estimated breakdown of labour requirements for the operation phase is given below:

Plant	Manpower
Top Management	1
Senior Management	4
Middle Management	16
Specialists / Eng./ Officers	36
Supervisors/Staff/Foreman	160
Workmen/Labour	156
Total	373
General Shift	157
Shift	216

4.15 Decommissioning and closure

Once the mineable resource has been exhausted and continuation of operation ceases to be economically viable (after approximately 40 years), the project will enter the decommissioning and closure phase. This will entail the removal from the site of project infrastructure that has no post-closure use (such as the plant equipment), and rehabilitation of the area to as close to its pre-mining condition as possible, in accordance with a Closure Management Plan (see Section 9.13).

Infrastructure that has a post-closure use to the local communities or government (such as roads, water supply infrastructure, and housing) will remain on the site. Large quantities of waste (building rubble, scrap etc.) will be generated during decommissioning and closure, and will be handled in accordance with the Waste Management Plan (Appendix 15). Any unused explosives left on the site at closure will be removed by the supplier for proper disposal.

The quarry and overburden site will remain, and will be appropriately revegetated and secured to prevent safety risks to humans and animals.

4.16 Proposed Project Schedule

The proposed project schedule for construction and commissioning activities (over 30 months in total) is presented below:

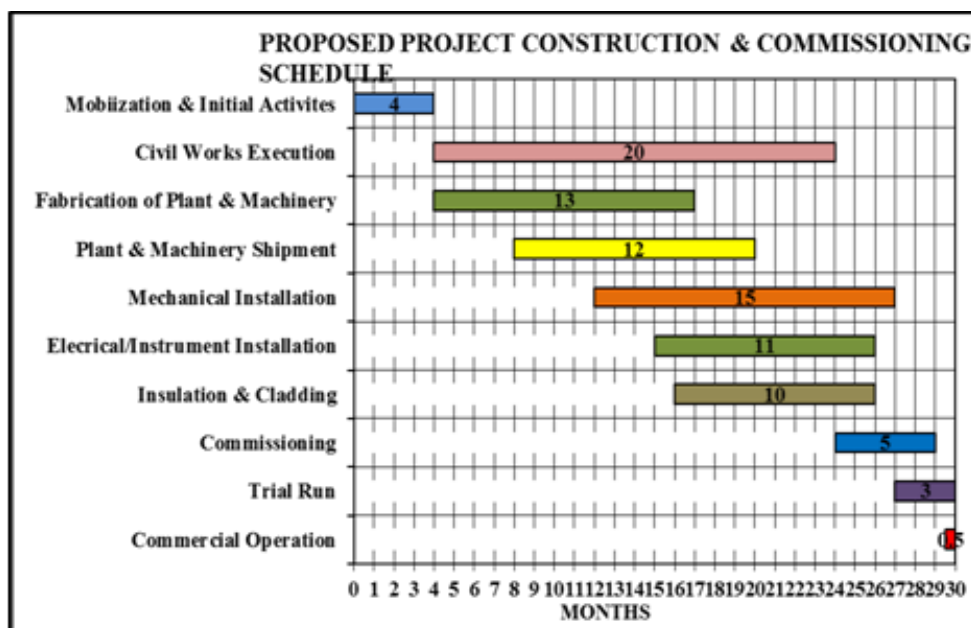


Figure 4-25: Proposed project schedule

5 Analysis of Alternatives

5.1 Introduction

This Section presents a discussion on the various alternatives considered during project planning and design, as well as reasons for the selection of the preferred alternative chosen.

A systematic comparison of feasible project alternatives, in terms of both the project (i.e., technology, design, operation, etc.) and site selection is provided. The assessment of project alternatives and site selection includes environmental, and social factors and includes the no-go (i.e. the situation if the project were not developed) scenario.

5.2 No-go Alternative

The ‘no-go’ alternative means that the project will not be developed and DRC will continue to import cement to meet its future needs and will be mostly dependent on world market fluctuations. DRC has abundant natural resources and especially high quality and easily extractable limestone and clay/laterite reserves which make the best location in Bas Congo Province a for cement plant. This single source alternative if not utilized will continue to sustain dependence on cement imports, but that could also very easily result in the cement supply shortages. Shortage of building material like cement will cause cement prices to rise.

As indicated in Section - 1.6, the domestic demand of cement is expected to increase from present 0.9 million tonnes to 1.8 million tonnes in year 2015 and 2.8 million tonnes in 2020. “Do Nothing” alternative will place DRC to further dependency on cement import or slow down its economic growth.

The ease of availability to basic building materials is needed to further develop DRC’s economy. The ‘Do Nothing’ alternative does not seem plausible given the legitimacy of the proposed project rationale and the benefits to be derived. DRC’s trade deficit would not improve, and the country will remain susceptible to high cement prices.

Although it will have negative social and environmental impacts, the proposed cement plant is expected to provide about 400 job opportunities during its operation phase and additional job and economic opportunities through development of supply/distribution chain and trucking. In addition, there will be a transfer of technology associated with installation, operation of the equipment and maintenance and savings on foreign exchange, hence this alternative was chosen.

The investment potential of US Dollar 200 million, as proposed by the Project Proponents, will not be utilized with “Do Nothing” option.

5.3 Project Site alternatives

Given that limestone, clay and laterite represent over 94% of the raw materials from which cement is manufactured, the availability of these unexploited raw materials is another primary criterion for determining potential sites for a new cement plant. The proposed plant site in Bas Congo Province located close to about 1.5 kilometres south of large reserve good quality limestone deposit with overburden consisting of clay and laterite. Shorter distance location of the plant from the limestone and clay/laterite deposit will reduce the transportation cost and in turn will lower the cost of cement production as well as minimize generation of greenhouse gases due to transport movement over shorter distance from quarry to plant site.

The proposed plant site is to be located in an area which is devoid of any biodiversity including forestry, wildlife, migratory birds, game reserves (flora and fauna), or protected species of fauna and

flora; fishery or aquatic biology; watershed. There is no cultural or any other heritage in the project area.

There are no scientific institutions anywhere in the project jurisdiction even up to long distances.

There is only one very small village namely Yuku Camp Village with 12 house structures – 9 of which are inhabited at the time of SRK's visit in June 2013. Yuku Camp Village has a population of 46 people. The Yuku Camp was constructed by Belgian Researchers and after its vacation by Belgian was occupied by people from other village in 1970's. This village basically is not an original village but a temporarily inhabited village, and the inhabitants of the village are descendants of Kisua [Kinsua].

Kokolo, Nkonda, Minkelo, Mbemba, Kisua [Kinsua] and Mbamba are the other villages situated at a distance of about 1 to 4 kms from the project site. Total population of the seven villages, as reported by the respondents of the Public Consultations conducted by the ECTECH Environment Team, is 1399 and total number of houses is 335. Average household size was 4.17. Very old traditional life style prevails in these villages.

Literacy rate is extremely low. The people are living in very acute poverty status. Agriculture is the major source of income for the people of these villages. Primitive tools for cultivation are being used by the farmers and the cultivation is not done on massive level as there is no proper machinery to the level the land and to plough it so more time is spent on agriculture as compared to the lesser outcome.

The limestone deposit is unexploited and is situated close to the proposed plant site

All raw materials, with the exception of gypsum, will be extracted from the proposed mining lease area. This option entails the execution of the proposed project, which involves mining limestone, clay and laterite from a dedicated quarry.

The proposed location was determined to be the most convenient location in close proximity to the limestone, clay and laterite reserves. The proposed site has least environmental and social impacts.

The site has proximity to National Highway, N-1, main Railway line from Matadi Port to Kinshasa. A 220 KV High Tension Line from Inga Dam to Kinshasa passes close to the proposed site and power supply for the plant will be provided from nearby Grid Station at Kwilu. These factors are also very much supportive of the project at the proposed site.

5.3.1 Location of the cement plant

In line with the GTZ-Holcim co-processing Guidelines (2006), the cement plant has been sited at a suitable distance from communities and surface water bodies (a minimum buffer between the wetlands bordering on the eastern and western sides of the proposed plant location has been established) as shown in Figure 3-1 (sensitivity map).

To provide convenient connection to major transportation infrastructure for import and export of materials, and to avoid the requirement for extensive additional road or rail connections, the plant is situated close to the N1 highway and national railway (connecting the site to Matadi Port). To ensure impacts on ground and surface water and risks to the development with regard to flooding and sinkhole formation resulting from the positioning of the plant will be minimised, additional surface and groundwater studies have been commissioned by NYA. The layout plans for the development will be amended as necessary, based on the outcomes of these studies.

5.4 Project layout alternatives

During SRK project team's visit to the site and subsequent discussions with the NYA design team, discussions were held with regard to the placement of various components of the project layout (such as the overburden stockpile, haul road and waste landfill site) to avoid environmentally sensitive areas. Further information on this high-level environmental sensitivity assessment process, and a map showing the areas that are likely to be of high environmental or social sensitivity, and therefore should preferably not be developed, are provided in Section 3.4.3. A brief discussion on each of the alternatives discussed is provided below.

5.4.1 Overburden stockpile

SRK was not provided with a footprint location for the overburden stockpile. In order to include it in the assessment, SRK has recommended a preferred location based on environmental sensitivity analysis. The overburden stockpile would need to be positioned close to the quarry. Options for its placement exist to the east and west of the quarry area, however due to the presence of the Sanzikua river and associated sensitive forest habitat, as well as Mbemba village east of the quarry, this area was determined not to be suitable for this purpose. The area to the west of the quarry, but east of the wetland / swamp area (approximately 2 km west of the quarry), was therefore recommended as the most environmentally and socially appropriate location for the overburden stockpile, subject to the appropriate geotechnical, groundwater and other relevant considerations. It is recommended that the existing road in the area is used as the western and northern boundary of the stockpile area.

5.4.2 Haul road alignment

The haul road between the cement plant and the quarry will largely follow existing clay tracks, which will be refurbished and upgraded as required to accommodate the mine traffic. Two alternatives exist regarding the alignment of the road in the area of the Yuku River crossing (close to the source of the Yuku River):

Development of a road crossing over the Yuku River

This route would be marginally shorter than bypassing the river, but would require additional design considerations (bridges / culverts) for the river crossing. This option is not preferred from an environmental perspective due to the increased risk of impacts on the quality (including dust from material in transit, accidental spills) and flow of the river, as well as impacts on sensitive vegetation and ecosystems along its banks (resulting in an increased potential for erosion and sedimentation).

Diverting the haul road west of the river source, avoiding the river

This option is environmentally preferred due to the environmental sensitivity of the river and surrounding area (banks and forest) at its source - impacts on the river would affect all downstream users, both ecological and communities. This route would also result in a reduction in noise and dust impacts on residents of Yuku village, to the extent that the negative socio-economic impacts of relocation of this village may be avoided. A route alignment following the topography and connecting to the western fork of the haul road towards the cement plant is therefore recommended, so that impacts on the Yuku village, river and surroundings can be minimised.

5.4.3 Waste management facility

Two alternative positions for the WMF have been proposed, based on the high level sensitivity assessment by SRK (see Figure 3-1), ensuring that the site would be positioned at an appropriate distance from sensitive ecological features and human settlements. The preferred alternative will be

decided based on the findings of more detailed site investigations into the geology, geohydrology and topographic characteristics of each site, and other relevant considerations.

5.5 Mining method alternatives

Two options can be considered for limestone quarrying, within the proposed site, i.e., sub-surface open cast mining and underground mining. Sub-surface open cast mining has been selected as the most efficient and suitable for the quarry operation, as it is considered to be safer and more economical.

5.6 Technology alternatives

The technology being offered by FLS is considered to be 'state of the art' in terms of environmental controls, energy efficiency and modern design.

Dry process technology has been preferred over wet or semi-dry technologies as it is more economical in terms of power consumption as well as heat and manpower requirement and less capital intensive.

The new plant will be built according to the applicable Best Available Technologies (BAT) defined for the cement industry, which include the adoption of pre-calcining technology in the clinker production and dedusting bag filters/ESP for gases.

5.6.1 Sewage treatment alternatives

Three alternatives with regard to wastewater treatment technologies were investigated, namely septic tanks, oxidation ponds, and package plants. The main findings with regard to the suitability of each technology alternative are listed below.

Septic Tanks:

- More suited for smaller communities/households
- The soils are largely consisting of clay which may become water logged and rendering this technology less efficient. The septic tanks may require emptying out on annual basis and can only discharge if there is sufficient porosity in the soil
- Potential to pollute the dolomitic aquifers
- Treated water cannot be re used in industrial processes.
- Oxidation Ponds:
- Require extensive land area.
- There are potential odour problems.
- Effluent quality standards may not be met - only Nitrates will be removed and not phosphates. This can pose a risk for eutrophication in downstream areas where flows in the river are slower.
- The installation and operational costs are generally lower than for other technologies assessed.
- Package plants:
- Consist of pre-engineered, pre-fabricated structures which are installed at the project site, therefore minimal construction impacts
- Simple to operate and requires low manpower
- Effective aerobic operational principal

- Requires electricity supply
- Requires regular maintenance to ensure efficient operation
- The use of a package sewage treatment plant was found to be the preferred technology and is recommended for the following reasons:
 - Sewage will be treated to higher standard
 - It is suitable for larger developments
 - Water can easily be reused in the plant, reducing raw water intake volumes
 - Package plant can be purchased in modular fashion, easily accommodating expansion

5.6.2 Process water cooling alternatives

When once-through water cooling is applied (i.e. no recycling), it requires large volumes of water. This water is fed through the cooling process as a bypass of a river. The water flow is not only a large local disturbance of the ecosystem around the intake point, but also thermal and other pollution can lead to local disturbances around the outlet point.

The use of surface water as cooling water has several consequences: aquatic fauna in the surface water can be damaged when they are sucked into the cooling system; when the heated cooling water is released to the surface water, the temperature of the water increases. Fish are not sensitive to temperatures between 10-24°C. Above 24°C temperature however stress will occur, and above 28°C lethal effects can occur for the most sensitive species.

In extreme hot summers, the temperature of the river water can rise so much that it is no longer effective as cooling water. When, because of continuous warm weather, the river water reaches temperatures of e.g. 27 °C, the relative water cooling capacity naturally drops, restricting process plants in their operation furthermore.

A so-called open recirculating cooling system forms an ideal compromise, in which the benefits of water-cooling are preserved and the environmental disadvantages are reduced. In these systems cooling water is recirculated in a cooling tower. The evaporation of a small part of the circulating water carries the largest amount of the heat away. The water intake that is needed to refill this part is a factor 50-70 lower than the water intake of a once through system with the same cooling capacity. Worldwide the advance of these systems led to a strong reduction of surface water for cooling purposes. During evaporation in the cooling tower only water disappears. All dissolved and floated particles remain in the water and will increase in concentration. The final salt concentration is regulated via a blowdown. Most cooling systems operate between a 3- to 8-fold increased salt concentrate. (TDS level) Every contaminant that can be found in the make-up water can be found in a 3 to 8 factor in the recirculating water. In a similar way, substances from possible process leaks and floating dust in the air can be accumulated in the recirculating water. In dusty surroundings a 200 MW cooling tower can scrub about 0.25 – 3 tons of dust/day from the air.

5.7 Process alternatives

The grinding efficiency of a ball mill is only half as efficient as a vertical roller mill, therefore, for this project, FLS has proposed vertical roller mills for Raw Grinding, Finishing Grinding and Solid Fuel (coal) Grinding. Ball mills result in significantly higher specific power consumption. In addition, the noise level of a vertical roller mill is significantly lower than that of a ball mill.

FLS has proposed 5-Stage Preheater with Pre-calciner. The preheater configuration selected offers an optimal solution with respect to heat economy and power consumption taking into account the moisture content of the raw materials as well as the height of the preheater tower.

In comparison with conventional kiln systems (without pre-calciner) the selected installation offers a considerable reduction in kiln dimension and a high degree of pre-calcination. Concerning the operational costs, the uniform operation and low brick consumption are favourable aspects of the pre-calciner kiln.

The kiln burner is a DUOFLEX two-channel burner with low primary air consumption, normally in the region of 6-8%. The primary air is supplied by a high pressure fan (up to 250 mbar).

FLS coal mill installations are designed to meet EU approved directives including the ATEX directive 94/9/EC, which must be followed for factory installations, where the risk of explosion is possible. The design of the coal plant is also made in accordance with the explosion protection standard EN 14491 (which is similar to VDI 3673, Germany and NFPA 68, USA).

On the clean side of the filter at the coal mill an oxygen analyser will be installed to monitor the oxygen content in the mill system at any time. CO analysis equipment will be installed to observe that no fire or smouldering of coal is taking place in the mill, filter or coal meal bin during stoppage. A CO₂/N₂ inertising

Several air pollution control technologies suitable for the proposed project were considered, the main equipment include bag house, cyclone and electrostatic precipitator (ESP). After assessing the various options available, it has been decided to install following dust collectors:

- Fabric Filters for kiln and raw mills,
- ESP for clinker cooler excess air,
- Fabric Filter for cement mill, and
- Fabric Filter for cement mill separator.

5.8 Construction Technology alternatives

The proposed project site is not exposed to any natural hazards. The highest structure in the cement plant is the preheater tower at approximately 120 meters in height. In this respect, concrete construction will be applied in the foundation and lower level of the pre-heater tower. The middle and top levels of the pre-heater tower will include structural steel. Alternatives, such as the use of fewer pre-heater stages to lower the height of the structure, would compromise and negatively impact on fuel efficiency of the plant and therefore increase emissions to the environment. Therefore, good engineering practices need to be implemented within the context of the preferred technology.

A thorough investigation of construction technology options will therefore depend on sound engineering design as well as field investigations (such as weather, climate, soil bearing capacity, the availability of construction materials locally and local labour skills). During the design phase, the EP and Contractor will choose the construction technology which best meets NYA's project schedule, safety, and quality as well as the economic benefit to the local community.

The proposed project site is located in an area of low seismic activity. Because of good soil bearing capacity, extensive and expensive civil piling work will not be required.

5.9 Waste management alternatives

The following three alternatives for the disposal of waste (both domestic and industrial) resulting from the project were assessed, based on their relative merits and practicalities for NYA:

5.9.1 Co-disposal with the overburden from the quarry

This alternative was determined not to be feasible as the geochemical properties resulting from mixing of the various waste types with the overburden material is unknown, as well as for practical reasons, and the different requirements for management and rehabilitation of the two types of waste facility.

5.9.2 Co-processing/ incineration of waste at the cement plant

This may be the most viable and appropriate option for disposal of oils, and would have the advantages of reducing coal consumption (and therefore greenhouse gas emissions), and waste production that would otherwise need to be managed by other means.

Other suitable waste streams, both from the project and possibly also surrounding local settlements, may also be processed in this way. However, hazardous waste from outside the facility should be excluded. This option would need to be subject to further investigation most likely via feasibility studies and assessment of the potential impacts on health and air quality (outside the scope of the current study) before its viability is confirmed.

5.9.3 Development of a waste management facility

The development of a new waste management facility (WMF) to accommodate domestic and industrial (non-mining) waste resulting from the proposed project is proposed. This facility would be designed and managed to cater for a wide range of waste types, as per the project's Waste Management Plan (see Appendix 15) and would not otherwise affect the plant of quarry operations from a practical perspective. The site would need to be situated in a suitable location within the project area, outside the environmentally and socially sensitive areas identified and shown on Figure 3-1, subject to the appropriate additional studies and design measures typically required for landfill site development.

Recommended alternative

It is recommended that a combination of co-processing and landfilling is used, as outlined in the project's Waste Management Plan (see Appendix 15). Co-processing of waste is in line with the waste hierarchy, cement industry guidelines on CO₂ reduction, and is in accordance with multilateral agreements including the Basel Convention (Holcim GTZ, 2006), and would result in both economic and environmental benefits. However, some waste streams would not be suitable for co-processing, and would be better suited to landfilling; hence the requirement for a landfill site would remain, although its size and design requirements would be reduced through combination with co-processing of waste, should this option prove to be feasible through further studies.

Should this proceed, co-processing will be undertaken in line with best available technology (BAT) and GIIP including implementation of the waste hierarchy.

5.10 Non-renewable resource alternatives

5.10.1 Fuel supply

Coal is preferred alternative due to cost. The only other alternative considered is HFO, which is considered to be less favourable due to high cost (including Government surcharges, and cost of installing appropriate storage facilities for the volumes required).

5.10.2 Power supply

Power will be supplied from the national electrical grid (an agreement in this regard has been reached with SNEL). The only other alternative is the use of a generator, which is less favourable due to the cost involved. The electrical power supply will however only connect to the plant area. For pumping of water during dewatering of the quarry, diesel operated generators will be used.

5.10.3 Water supply

The mine will utilise raw water for cooling in the process and for domestic use. Two alternatives with regard to sourcing the water exist – abstraction from surface water resources (the Yuku and Sanzikua rivers); or groundwater abstraction (possibly linked to pit dewatering at the quarry). The feasibility of surface water supply with regard to water quality and flow volume still has to be assessed. Groundwater supply also has not been assessed in detail, but it is likely that vast volumes of water are available and will be required to be removed from the pit during mining, either directly at the pit, or via boreholes intercepting the groundwater before it flows into the pit. The latter option is preferable as it will result in better quality water being abstracted (for discharge or use), and therefore less treatment requirements. Groundwater is currently not being utilised by any of the communities in the vicinity.

GIIP would be to reuse and recycle the water as far as possible. Process water at the cement plant will be recycled, reducing the raw water requirement.

Water can be sourced from both the Sanzikua and the Yuku Rivers for domestic supply. The demand of water for domestic use will be approximately 120m³ per day. Water is currently fit for domestic use pending confirmation of a comprehensive analysis.

6 Baseline Conditions in the Area Potentially Affected by Project

The environmental and social baseline data has been drawn directly from the ECTECH ESIA

Where relevant additional information has been included based on SRK's site visits undertaken between in June 2013 in relation to socio-economics, cultural heritage and noise.

6.1 Biophysical and Socio-Economic profile

6.1.1 National level

Democratic Republic of Congo (DRC) ⁽³⁾ is situated in the heart of Africa with total landmass of 2,345,000 Km², and ranked as the third largest country in Africa, after Algeria and Sudan ⁽⁴⁾. It shares 9,165 km-long boundaries with the Central African Republic (CAR) and Sudan to the north, Zambia and Angola to the south, Uganda, Rwanda, Burundi, Tanzania and Zambia to the east, and the Republic of Congo (Brazzaville) to the west, Angola's Cabinda enclave and a 40 km narrow strip on the Atlantic coast. The DRC is both equatorial and tropical and has a wide range of local ecology and climates. Three quarters (³/₄) of its territory is covered by a wide variety of forests, which constitute the natural habitat of a rich flora and teeming wildlife. The DRC is ranked the first African country in terms of the vast expanse of its forests and the conservation of the global environment. The country has one of the richest sub-soils in Africa, and abounds in highly coveted natural resources such as copper, cobalt, silver, gold, tin, columbite-tantalite (coltan), bauxite, iron, manganese, coal, oil, methane gas and oil shale. The 4,320 Km long Congo River, the largest river in the continent in terms of discharge, flows right across the country and provides it with an exceptional river network, which gives it a hydroelectric power potential estimated at about 106,000 MW (i.e. equivalent to 66 million tonnes of oil per year) ⁽³⁾

DRC, at present comprises of eleven (11) provinces. [DRC Constitution, 2006 requires formation of 26 provinces which is not yet been implemented]. The administrative hierarchy of Political subdivisions in the Democratic Republic of the Congo is as follows:

- Province (formerly "Région")
 - Mairies (in Urban Areas)
 - Cities
 - ❖ Commune or Incorporated Grouping (formerly "zone urbaine" (urban area)
- Quartier (neighbourhoods)
 - Territoriale (in Rural Areas)
 - District (formerly "Sub-region")
 - ❖ Territoire (formerly "rural zone")
 - Cité (Town)
 - Quartier (neighbourhoods)
 - ❖ Chefferie (Chiefdom formerly "Collectivité chefferie") or Sector
 - Groupement (Grouping)
 - ✓ Village

³ Economic and Sector Work Regional Economic Development in Bas Congo in the Context of Decentralization in the Democratic Republic of Congo (DRC) Country Operations Department, Centre Region (ORCE), October 2009

⁴ Courtesy Google

Based on a literature review undertaken by SRK in 2013, the following provides an account of the national economy and influences on the DRC economy.

The economy of the DRC has recently emerged from decades of economic contraction, hyperinflation, overspending and unsustainable debt levels. Following the stabilisation of the political situation and the implementation of some structural reforms in the mid 2000's, foreign investment in the country, particularly the mining sector, increased markedly and the economic performance has improved such that economic growth has been robust, inflation has reduced to near single-digits and the country has qualified for significant debt relief.

Since 2003 the economy has sustained growth rates of between 5.6% and 7.8% per annum (except in 2009), with an average growth rate of 6.5% between 2003 and 2011. Gross Domestic Product (GDP) was approximately US\$15.7 billion in 2011. GDP per capita growth has lagged behind GDP growth rates due to population growth. GDP per capita was approximately US\$216 per annum at in 2011 and is amongst the lowest in the world. Almost 70% of the population is classified as poor.

The main sectors supporting GDP growth are the tertiary (services) sector, mining and construction IMF (2011). The DRC remains largely dependent on the export of mostly non-beneficiated natural resources and the import of food and capital goods. Consequently, it is vulnerable to external shocks as well as to internal political and economic challenges.

The short and medium-term outlook for the DRC indicates growth prospects but continued challenges associated with spending pressures, debt, investment and export growth. The IMF estimates that the GDP growth rate will remain robust at an average annual growth rate of 7% between 2012 and 2017 on the basis of continued progress with structural reforms, strong mining exports and a favourable commodities market.

Despite the broadly favourable short- and medium-term outlook, the DRC's economy remains vulnerable to shocks:

1. **External shocks:** The positive outlook for the DRC's economy is based on the assumption that commodity prices will remain buoyant over the medium term. However, the international prices of these commodities have historically tended to be volatile and highly correlated, while at the same time international prices for food, a major import, have increased significantly, suggesting a high degree of uncertainty that clouds the medium-term outlook.
2. While the DRC's weak financial linkages with the Eurozone have largely shielded it from the financial crisis there, a spread of the crisis to the global community would be certain to also dampen growth prospects in the DRC.
3. **Policy slippages:** While the current administration has recently implemented relatively disciplined macroeconomic policies which have stabilised the economy, the challenge will be to ensure that this prudent approach is sustained.
4. While some structural reforms have commenced or implemented, many reforms have lagged and new issues have emerged, including weaknesses in external debt management (emergence of external payments arrears) and accountability and transparency in the operations of state-owned enterprises in extractive industries. These weaknesses could undermine recent progress (IMF, 2012).
5. **Military conflict:** Military actions are ongoing in the eastern parts of the DRC and an expansion of the conflict into areas that are currently critical for government revenue and foreign investment is highly likely to scare off investors.

6. **Upside opportunities:** Additional large-scale foreign direct investment projects in sectors such as mining and energy would boost growth and improve the DRC's longer-term balance of payment – especially if the associated increases in fiscal revenue are managed carefully.

6.1.2 Local level

The project site is situated in the remote area of the Territory of Songololo, Bas Congo Province of Democratic Republic of Congo. Population in the form of very small villages is present around the project site. None of the utilities like electricity, natural gas, telephone, drinking water, road network etc., are available in the project area.

Very old traditional life style prevails in these villages. Literacy rate is extremely low. The people are living in acute poverty status. Agriculture is the major source of income for the people of these villages. Primitive tools for cultivation are being used by the farmers and the cultivation is not done on massive level as there is no proper machinery to the level the land and to plough it, so more time is spent on agriculture as compared to the lesser outcome. Goats and sheep rearing and fish drying is carried out on very limited scale for self-consumption and supplementing sources of income are from other professions. Females also participate in these efforts.

Lacking any industry, commercial activity, traffic or other activity, the environment around the project site is free of pollution. Savannah forest (mostly grass) and crop residues burning, on a very limited scale, is among the source of air pollution in the area. But this does not affect the quality of air to any considerable degree. In other words, the huge carrying capacity of the environment is yet unutilized.

The nearest town Kimpese with population of approximately 53,660 (year 2010), in the Cataractes District of Bas Congo Province, lies on the main road and railway between Kinshasa and the provincial capital Matadi, at an altitude of 990 feet (301 m) above sea level. The town has a hospital, medical training centre, high school, technical training institute and an agricultural college. The 400 bed Kimpese hospital serves 150,000 people in the local area and another 600,000 in the surrounding district. The town also has an office of the UNHCR, which provides assistance to the nearly 60,000 Angolan refugees. ⁽³⁾.

Villagers near the project site are very poor with small scale agricultural activities as their source of earning and livelihood. All the land required for cement plant and quarry of the under referenced project belongs to Government. Government will get hefty amounts of earnings in the form of taxes and duties on recurring basis. Poverty alleviation, indirectly through generation of economic activity especially in industrial sector, will be yet another benefit besides meeting cement shortage in the region.

6.2 Physical Geography

This section describes the geology, topography, climate, air quality and water resources in the project area.

6.2.1 Topography

A summary of national and regional topography has been drawn from the ECTECH ESIA. Figure 6-1 shows the topography of the DRC

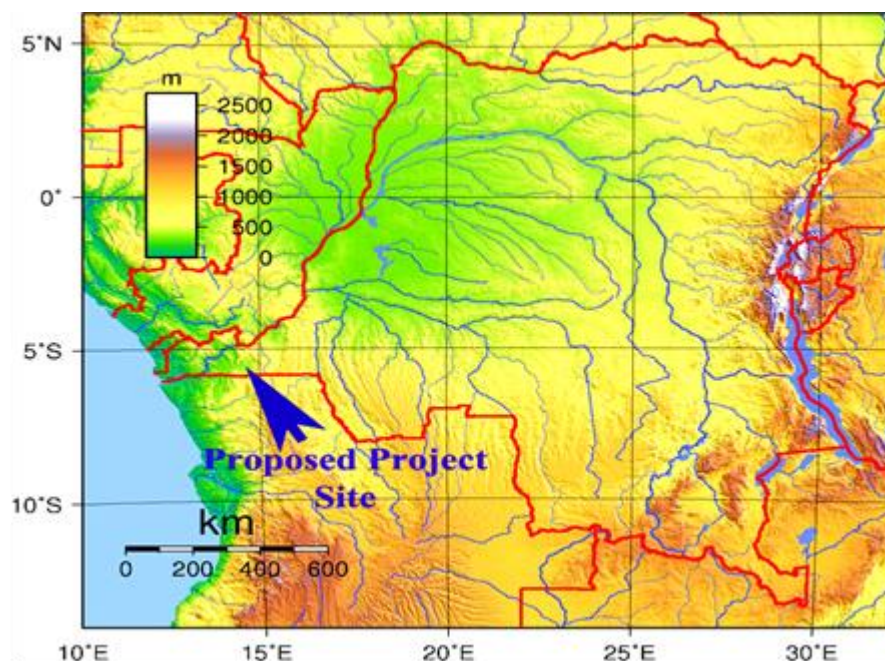


Figure 6-1: DRC Topography

According to earlier studies, the District of Cataractes, in which the proposed project is to be sited, can be subdivided into the following distinct geomorphological units:

- In the Northeast, the plateau of South Cataractes or Bangu coincides with the extension of Inkisi and sub-tabular Mpioka;
- To the south and east of this plateau, is a large schisto-calcareous depression divided into two parts by the relief of Ngangu ridge;
- To the west of these is Kimbundu massive, an area of Appalachian relief whose peak coincides with anticlines making anteschisto-calcareous formation outcrops and depressions with schisto-calcareous synclines.

Bangu plateau describes a wide syncline axis oriented north-east in the centre of which the upper beam of Inkisi outcrops. The plateau surface is smooth and bows gently to the north and east. So the culminating zone is located in the west of the plateau where high points are between 800 and 700 m in altitude. Further east, the dip of Ngungu crest culminates to 700 to 725 m.

Between these elevated areas and beyond, the plateau altitude, which is 650 to 700 m, drops gradually northwards and eastwards up to 550 to 600 m.

This curve corresponds on the one hand, to a broad synclinal which East-West axis is occupied by Congo River valley and on the other hand, to the connection with the planation of Inkisi basin in the east.

The plateau descends towards the west and south, by successive steps, up to its border dominated by more or less remarkable abrupt and reaching 200 to 300 m high in the schistocalcareous depression.

The above-mentioned ARPC perimeters are in this schisto-calcareous depression. The abrupt is often crowned by the cliff ledge.

In many places the contact between Mpioka formations and the schisto-calcareous one is faulted. The faults are not noticeable in a very remarkable way in the morphology. However in faulted zones

cliffs are usually absent. This implies that structures favourable to their formations are those of normal schisto-calcareous contact of Mpioka.

At the periphery, the plateau eroded by the river is deeply grown up to its slightly wavy central part. Geological formations and the dip are directed towards the interior of the plateau.

The crest is facing Ngungu Southeast, Northwest. It is marked with fragments of Cenozoic formations: Kalahari series and products of their rearrangements to Pliocene and Pleistocene.

The relief is hilly with elevations generally ranging from 290 to 350 m in the hilltops. The terrain is sedimentary but with the presence of neotectonic activity in the region extending from Malanga to Inga.

Thus, in outcrops of rocks of the region, dips sometimes exceed 30° .

Limestone outcrops are observed in ARPC 11737, 11942 and 11946 perimeters. They are often found along water streams (eroded area) and are in very advanced status of alteration sometimes presented in tilted blocks.

6.2.2 Geology, soil profile and land use

Geology

The following section on geology has been drawn from the ECTECH ESIA.

Figure 6-2 shows simplified geology of Congo Basin [Source: Muse.e royal de l'Afrique centrale / Koninklijk Museum voor Midden-Africa]

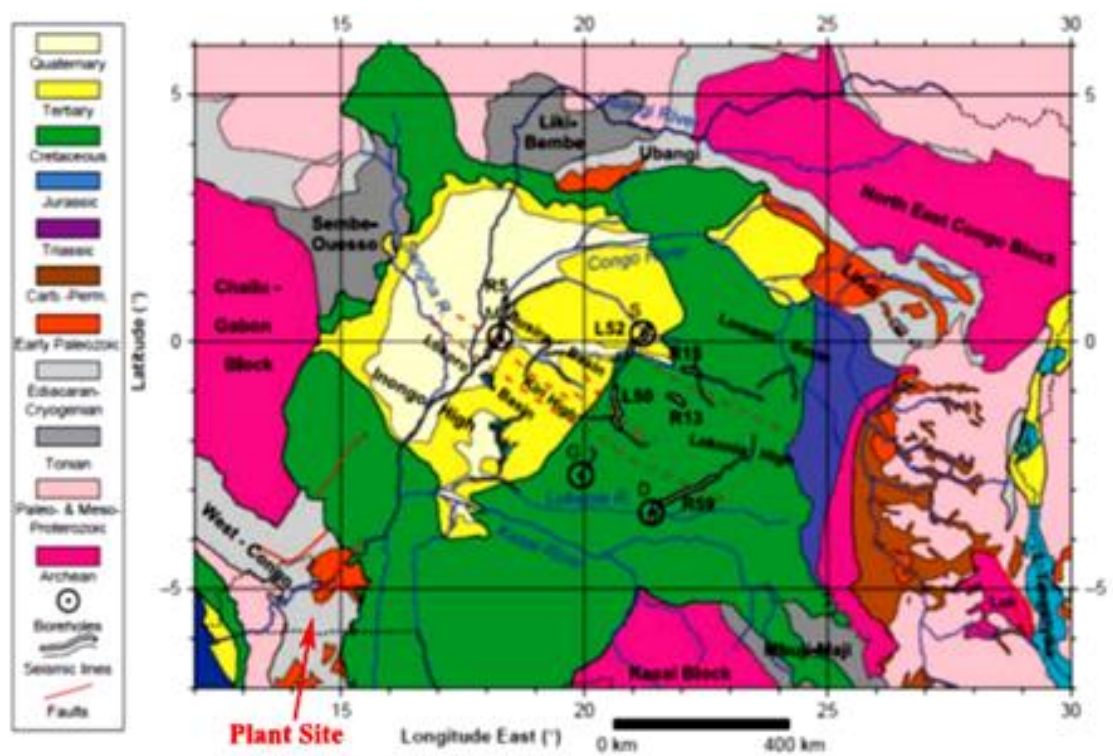


Figure 6-2: Congo Basin Geology

The province of Bas-Congo is one of the Democratic Republic of Congo well-known provinces in geological terms. In fact, out of the several geological studies the works particularly by geologists: RESHUEL-LORSHE (1892); DECHAYE at All (1909); L. CAHIEN and J. LEPERSONNE (1986) to quote a few, are of great importance.

According to these studies, three geological units grouped into two main sets were differentiated:

The Phanerozoic;

- i. Coastal land formations consisting of marine origin and Mesozoic and Cenozoic age;
- ii. The coverage formations including ocher sands and Cenozoic sandstones
- iii. The Proterozoic (from the oldest to the newest) are:
 - o Represented by the Archean complex of migmatites and gneisses Mpozo - Tombagadio;
 - o Represented by the Proterozoic Paleo Zadinian;
 - o Meso Proterozoic (Mayumbian);
 - o Neo Proterozoic (West Congolian).

The perimeters related to this study are located in the Neo Proterozoic grounds.

The desired limestone is located in the West Congolian group, Kwilu beam and Luanza formation. Therefore, special emphasis was laid on the West Congolian group.

The West Congolian is a section of the portion of the Pan African orogeny bordering the African southern part more or less parallel to the Atlantic coast.

Formations of super West Congolian group are essentially sedimentary and are due to the filling of the geosynclinal basin of the Western Congo and whose width is estimated at 1400 m and is divided in 6 groups, namely:

- Doleritic Sanzikua and sills;
- Lower diamictite and andesitic and doleritic lavas ;
- Higher Shiloango;
- Higher diamictite;
- Schisto-calcareous ;
- Shale-sandstone

According to previous studies, the super group West Congolian formations are all lagoonal but located in turbiditic feed areas, except the schisto-calcareous. This one presents calm deposition conditions where there are no significant contributions of detrital deposits and where rhythmicity of the deposits is not linked to similar inputs but is due to evapotranspiration action undoubtedly seasonal.

The presence of oolites in shale-limestone finds its passage on a slope giving it a turbidity facies. The schisto-calcareous group presents the following subdivision (from the oldest to the newest):

- Subgroup of pink dolomite (6 to 10 m thick);
- Subgroup of Kwilu (about 450 m, CI on the geological map);
- Subgroup of Lukunga (about 300 m thick, CII on the geological map);
- Subgroup of Bangu (225 m, CIII on the geological map);
- Subgroup of Ngandu (90 m, VIC on the geological map).

The subgroup of Kwilu:

- Kwilu tier (6 to 10 m, C4 on the geological map);
- Luanza bed (about 85 m, C3 on the geological map);
- Bulu bed (about 350 m, C2 on the geological map);
- Dolomite bed (6 to 10 m, C1 on the map).

On the ground, there are vast lateritic crusts, surmounting shales (purple or green) in some places and letting appear the latter in buttonhole.

The regional structure is tabular but in some places showing tilted blocks of rock and confirming the presence of tectonic activity in the region. There are also some outcrops of limestone (purple or gray). The dip of these limestones varies between 15° and 25°.

Thus, the geological section of the survey area is:

- Reddish brown laterite;
- weathered purple shale and calc-schist;
- Reddish purple shale and greyish yellow calc-schist;
- Psammitic purple shale, reddish gray, rich in silica;
- Shale and calc-schist alternance; and
- Various limestones
- Various limestones.

The geological map of the project area is presented in Figure 6-3. Figure 6-4 shows the Mineral Resource Map of DRC.

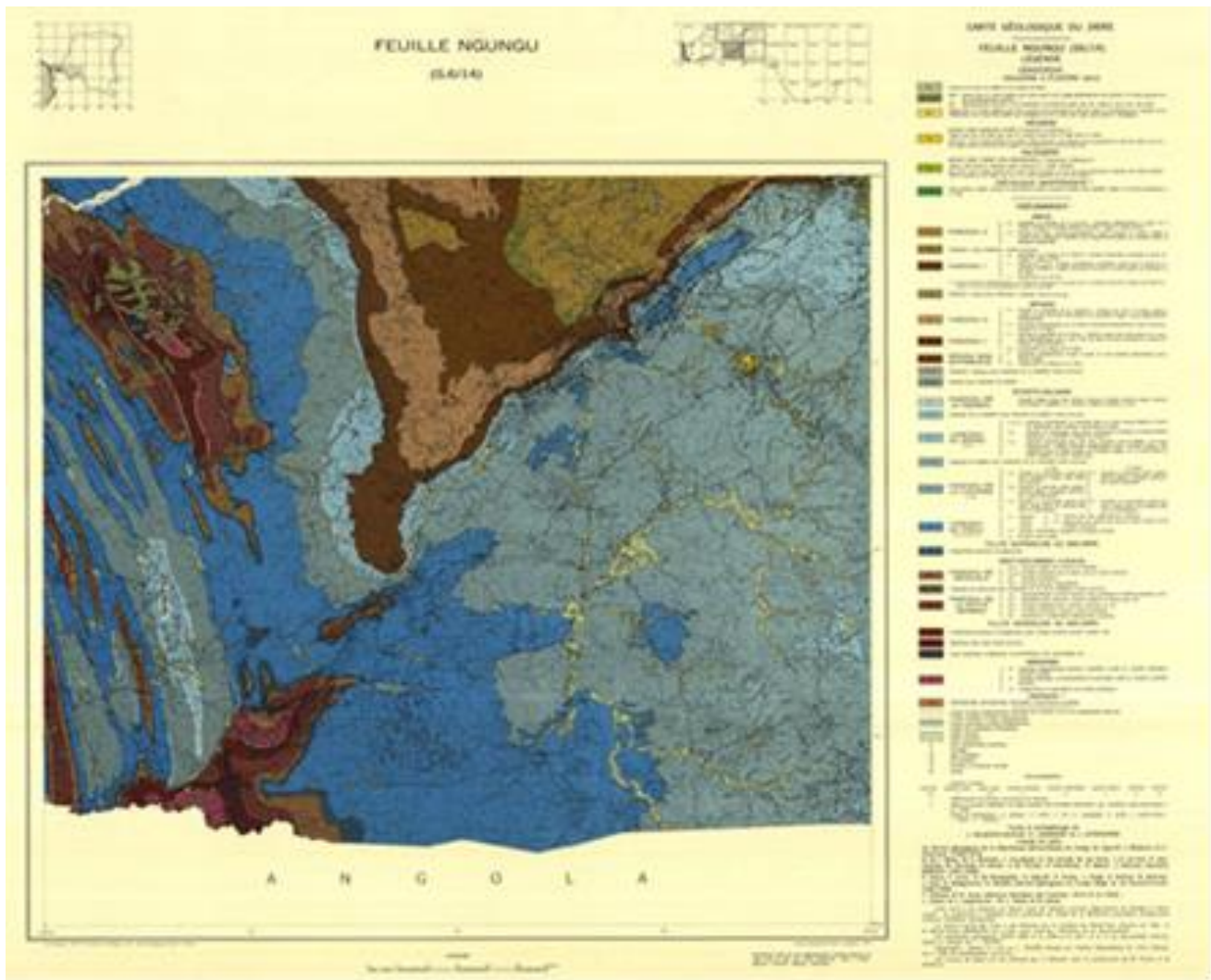


Figure 6-3: Geological Map of Project Area

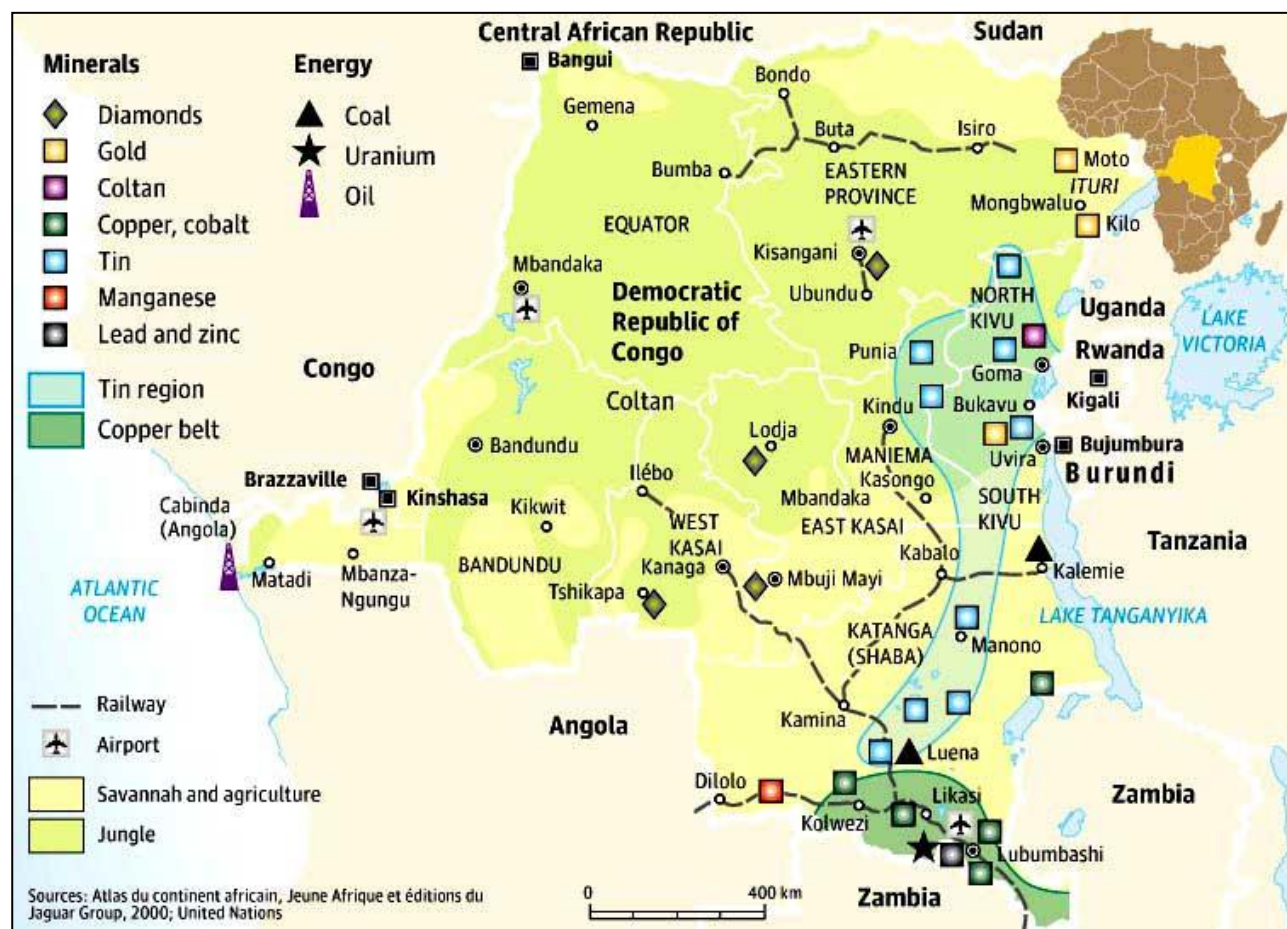


Figure 6-4: DRC Mineral Resources Map

Regional Soils

Based on a desktop review undertaken by SRK in July 2013, the following summarises the regional soils in the project area.

Regionally the soils located around the Project belong to the Food and Agricultural Organisation (FAO) Ferralsols group (FOA, 2006). These soils occur mainly under tropical climates, and cover extensive areas on flat, generally well drained land. They are considered as being strongly weathered, and to be associated with old geomorphic surfaces. There is usually no evidence of recent deposition in the profile, such as volcanic ash or fresh alluvium. The oxic horizon does not release nutrients by weathering of mineral particles. Ferralsols typically have a texture of sandy loam or finer (in the fine earth fraction of less than 2 mm) and contains more than 15 percent clay.

Ferralsols are usually deep soils because both the intensity and the duration of weathering have been considerable. Iron oxides contribute to the aggregation of clay and silt which creates porosity and most oxic horizons are friable and have a well aerated structure. Air and water can usually circulate freely though ferralsols; rainfall infiltration is usually faster than by most other soils of comparable texture; it also leaches quite rapidly to deeper layers that are beyond the reach of the common rooting of most cultivated crops. Physically, rooting space is abundantly available.

Strong leaching of nutrients and bases is a general property of ferralsols. Downward movement of water is seldom impeded, and the retention of nutrients by the clay fraction which should protect them against losses is not very active. As a result most ferralsols are low in cationic nutrients and the oxic horizons have low pH. The amount of available plant nutrients is almost completely dependent on the amount and the quality of the organic matter.

The content of available aluminium may reach toxic levels, as could manganese concentrations. On the other hand, the physical characteristics of these soils are quite favourable; because of their great depth, high permeability and stable micro-structure they are less prone to erosion. Ferralsols are easy to work but the surface is liable to contraction and crusting if heavy machinery is used to clear forest or if they are overgrazed.

Site soil profile

Information reported in the OEMS ESIA and observed in site photography, indicates that the dominant soil form in the Project area is soil belonging to the Ferralsol form. These soils are described by OEMS as sandy clays, yellow to light brown in colours, low fertility and good permeability.

OEMS identified that there are heavy clays on site, associated with the doleritic and andesitic lava, with these clays having a low permeability. OEMS also identified that there are sandy soils associated with the sandstone geological formations.

A total of seven lacustrine (open water) wetlands and one endorheic wetland have been recorded on site. Although not considered in the earlier ESIA, it is likely that hydromorphic soils are present on the fringes of these wetlands as well as on the fringes of the rivers and lakes that exist on site. Experience in tropical Africa suggests that these hydromorphic soils belong to the Gleysol soil form of the FAO.

Gleysols are wetland soils that, unless drained, are saturated with groundwater for long enough periods to develop a characteristic gleyic colour pattern. This pattern is essentially made up of reddish, brownish or yellowish colours at ped surfaces and/or in the upper soil layer or layers, in combination with greyish/bluish colours inside the peds and/or deeper in the soil.

Available information indicates that the soils on site are ubiquitous to the region and no unusual occurrences have been identified.

The deep weathering of the underlying geology that occurs under the tropical climate of the Project area has resulted in the formation of laterite across large areas of the site. The presence of laterite can often act as an aquiclude as a result of the low inherent permeability of this layer. However, weathering in tropical soils potentially occurs at depth (potentially tens of meters) with the result that the presence of laterite is unlikely to influence plant rooting depths. Laterite may however limit rooting depth on hills slopes and crests where overlying soils have eroded.

Data collected by OEMS, classifies the samples as having an acidic pH, a low cation exchange capacity, a low organic carbon content and generally low plant-macronutrient concentrations. These chemical characteristics of the soil limit their potential to support intensive agricultural activities, although there is sufficient fertility to support subsistence agriculture.

Ferralsols and the more clay material associated with the soils of the Project area tend to have a low inherent in situ erodability potential. This does however, increase as the soils are disturbed by agriculture or other anthropogenic activities such as those associated with mining.

In terms of the requirements of Article 28 of Schedule IX of the Mining Code, which requires information on the presence of a) immature non-climatic soils with alluvial input and b) hydromorphic soils, it is unlikely that immature non-climatic soils with alluvial input are present on site, however, there is a high probability that hydromorphic soils are present.

Both sheet and gully erosion was observed at various locations on site, with erosion being more predominant on the upper slopes of the topography. The erosion is not extensive and is likely to be limited by the soils physical properties and the presence of vegetation. Generally, the soils in their

natural state on site would classify as being resistant to erosion (Gleysols) or moderately resistant (Ferralsol and other clays) in terms of the Soil Erodibility Monograph of Wischmeier et al., (1971).

Land Capability

The following section is based on a desktop review undertaken by SRK in 2013.

As no DRC system is available for determining land capability, the FAO Framework (FAO, 2006) was utilized to determine the land capability. This system is based on the following concepts:

- The land suitability (topography, climate etc.) is qualified, not only the soil, with this combination being used to identify capability;
- Land suitability must be defined for a specific soil use (crop and management); and
- Land evaluation is to take into account both physical conditions as well as economic ones i.e. the concept of land evaluation is essentially economic, social and political.

In the system, four categories are utilized for the classification of land suitability with land with a high suitability having a high land capability and a low suitability and low land capability. A simplified example of this is illustrated in Figure 6-5 with detailed description provided below.

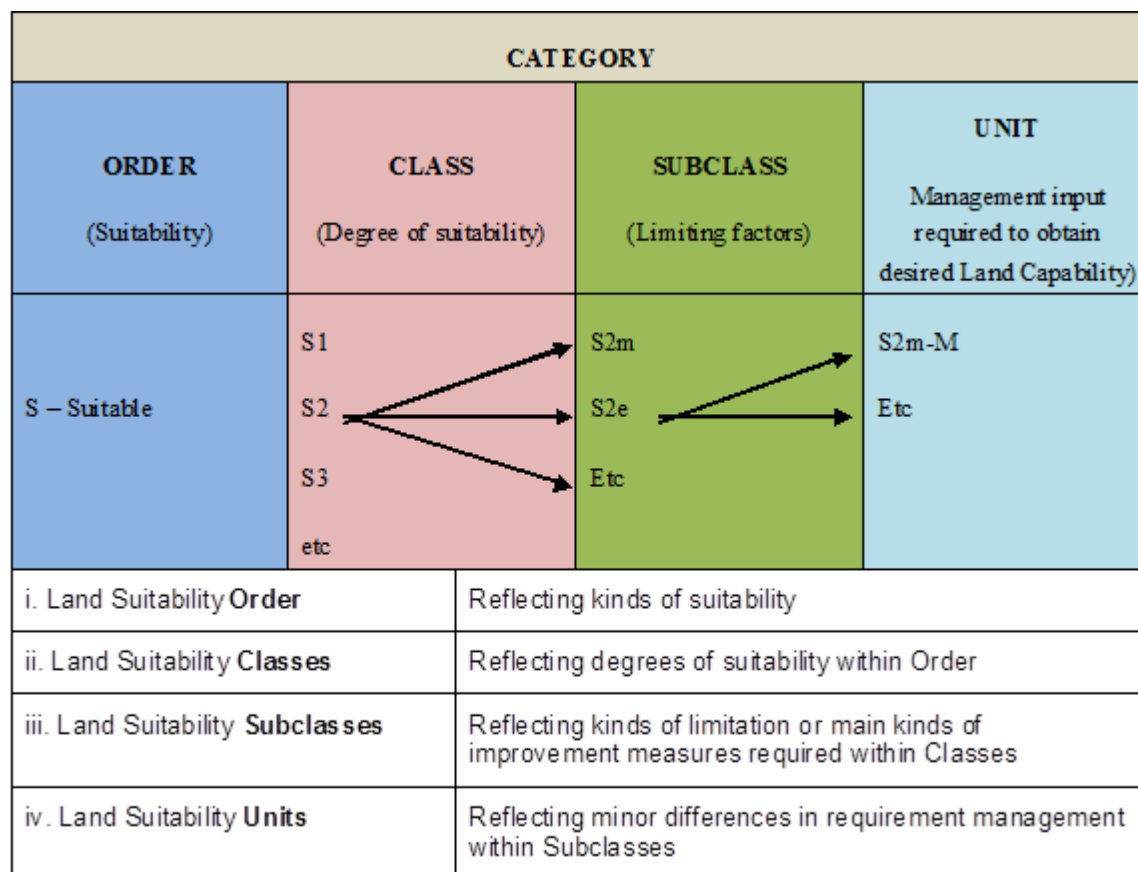


Figure 6-5: Schematic of the categories used to describe land capability

The highest category is the order that reflects, in broad features, whether a soil is suitable or not for a given use (in this instance use for subsistence agriculture, which is the dominant land use in the area). Two orders are recognized:

- S = Suitable. Land in which the benefits exceed the costs and sustained use does not incapacitate the soil over a sufficiently long period of time, assuming present farming practices;

- N = Not suitable. Land can be classified as not suitable for a certain use for diverse reasons. The use proposed may be deemed technically impractical, as in irrigation on steep terrain, or that it causes serious environmental degradation, as in cultivation on steep slopes. Frequently, however, the reason is economic, in that the profit expected does not justify the cost required.

The second category is the class that reflects degrees of suitability (for use as subsistence agriculture) within the order. These are numbered consecutively. For the order S (suitable), three classes are considered:

- S1 = Highly suitable. Without limitations for sustained use or minor limitations that do not affect productivity nor appreciably increase costs;
- S2 = Moderately suitable. Moderately serious limitations that reduce profits or involve risks of degradation in the sustained use of the soil; and
- S3 = Marginally suitable. The limitations for the sustained use are serious and the balance between the costs and benefits make the use only marginally justifiable. Its use is normally justified on other than economic grounds.

In the order N (not suitable), three classes are also recognized:

- N1 = Not currently suitable. Land with limitations that could be eliminated by technical means or investment, but that these changes are at present unfeasible;
- N2 = Permanently unsuitable. Serious limitations of generally a physical nature, which are assumed to be beyond solving over the long-term; and
- X = Land for conservation. Unsuitable for exploitation, being lands of special protection, due to their conservation, wildlife, or special scientific, ecological or social interest (e.g., parks, reserves or recreational zones).

The limits between the orders (S and N) and between the different classes (S1, S2, S3 and N1, N2, X) are established by the presence of limiting factors. These limiting factors are used to define the third category of the system, which is the sub-class. In the symbol of each sub-class, the number of limitations involved should be kept to the minimum one letter, or, rarely, two. The limitations proposed include:

- t, slope;
- e, erosion risk;
- p, depth;
- s, salinity;
- d, drainage;
- c, bioclimatic deficiency;
- r, rockiness; and
- i, flood risk.

Finally, the fourth category is the unit that establishes the differences within the sub-classes as a function of the desired use. As an example all of the units within a sub-class (S2rA, S2rM,) have the same degree of suitability at the sub-class level (S2) and analogous characteristics of limitation at the sub-class level (r). The units differ from each other in their characteristics of production or in secondary aspects of their management demands. Their examination enables a detailed

interpretation at the planning level of the exploitation. The units are distinguished by upper-case letters that are placed at the end. There is no limit at all for the number of units examined within a sub-class. These are defined as:

- A, intensification in the agricultural use without need of great improvements;
- M, intensification in the agricultural use with need of major improvements (irrigation, etc.);
- P, use for pasture for livestock; and
- F, forestation.

In summary, the FAO Framework for Land Evaluation (FAO,1976) that was used to assess land capability is based on the following concepts:

- The geomorphology and the physical, chemical and biological conditions are qualified, not only the type of soil;
- Land suitability must be defined for a specific soil use;
- Land evaluation must take into account, both the physical conditions as well as economic ones;
- The concept of land evaluation is essentially economic, social and political; and
- The evaluation requires a comparison between two or more alternative kinds of use.

Key to the evaluation process is defining a sustainable economic use for the soils within the Project area. As the economic use is mainly small-scale subsistence farming based on slash and burn agricultural practices, this is the soil use against which land capability has been assessed.

The presence of laterite across the site may limit root growth as roots may not be able to penetrate the plinthic layer and form a suitable anchor for plant growth, particularly on slopes and crests. This is not expected in the valley bottoms and flatter areas where erosion is unlikely to have significantly changed soil thickness.

Depending on the depth at which the plinthic layer is located within the profile and the type of plant grown, the fluctuating water table which may form above the plinthic layer potentially having a lower permeability than the overlying soils, might create air deficiency to plant roots. On the other hand, some plants can benefit from the fluctuating water table that brings added moisture to shallow roots. Depending on the type of plant grown, Ferralsols can be classified as moderately suitable for agricultural purposes (S2csM) where increased moisture due to fluctuated water table brings beneficial effect to plants, or marginally suitable (S3dcsP)⁵ in cases where increased moisture content has negative effects on plants.

Gleysols are generally sensitive to any kind of disturbance (e.g. tilling, drainage) and once disturbed it is difficult or almost impossible to restore their natural status. This sensitivity is primarily due to the loss of soil structure that occurs on disturbance. These soils often have unique ecological properties because of the unique floral and faunal communities that they can support. In areas where water is prone to eutrophication because of anthropogenic and agricultural nutrient loads, wetland soils can 'polish' the water, removing the excess nutrients before the water is discharged to a receiving watercourse.

Gleysols tend to have a higher nutrient status than other soils. Thus, if crop species tolerant of the saturated conditions are grown on gleysols, a higher yield compared to the other soil types is typically achieved.

⁵ 'S3' – marginally suitable, 'd' – drainage, 's' – stoniness, 'P' – use for pasture for livestock

In terms of the FAO (FAO, 1976) land capability classification based on subsistence agriculture, Gleysols would classify as highly suitable (S1) for the agricultural activities that occur within the Project area, given their good fertility characteristics and water retention capabilities. However, these gleysols serve a valuable ecological purpose and it may therefore be beneficial to classify areas occupied by Gleysols as land for conservation (X).

Land use

The following section is based on a review of aerial photography and site visits undertaken by SRK in June 2013.

Land use of the project site is limited, with much of the site existing in its natural state under a variety of different vegetation types. Anthropogenic land use does occur, but is limited to subsistence type agriculture, where a variety of crops such as cassava, corn, squash, peanuts, bananas and beans are cultivated. The typical agricultural practice is to implement sifting agriculture, where natural vegetation is burned prior to cultivation of a piece of land. When productivity of the cultivated land drops, a new area is burned to clear the natural vegetation and crops established. The abandoned field is then left fallow for colonisation following a process of natural succession.

Livestock rearing is also practiced, but on a small scale for household consumption, with pigs, goats and poultry used. The livestock is usually kept close to residential areas.

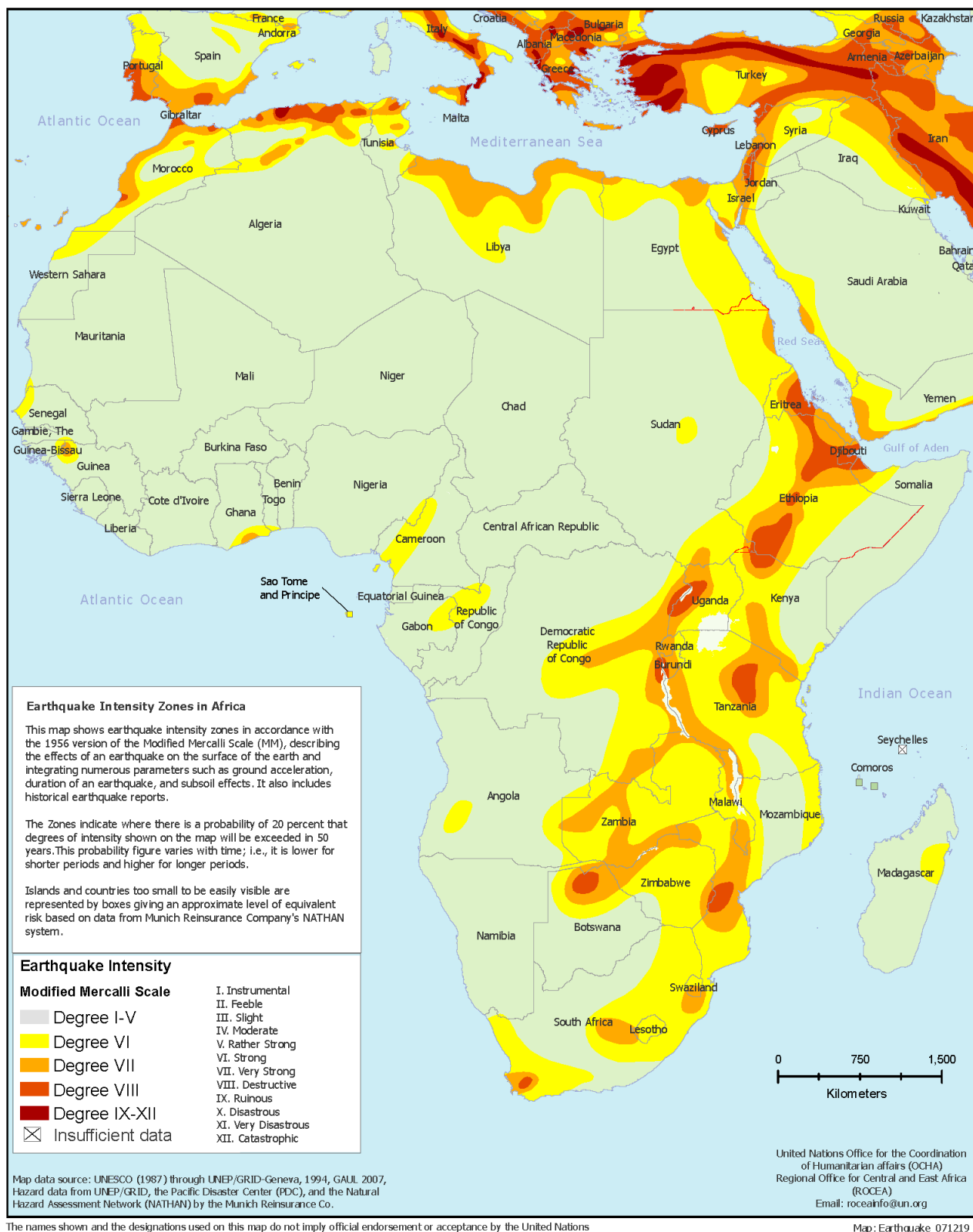
Article 28 of Schedule IX of the Mining Code, requires information on the soil percentages of area used for agricultural, breeding, industrial, commercial and residual purposes and soils left in a natural state, with the observations from site presented below:

- Agriculture – approximately 18%
- Breeding – 0%
- Industrial – 0%
- Commercial – 0%
- Residential – 0%
- Soils in natural state – approximately 82%

Seismicity and Earthquakes⁽⁶⁾

The Western Rift Valley of Africa has experienced several severe earthquakes with magnitude $M \geq 6$ and volcanic eruptions in recent historical times. Most of these earthquakes occurred in the Democratic Republic of Congo (DRC) and neighbouring countries such as Uganda and Tanzania. The largest earthquake on record, which occurred at Kasanga (Tanzania) on 13 December 1910 in the Lake Tanganyika area, had a magnitude of $M_s 7.3$. The most recent significant earthquake occurred approximately 20 km north of Bukavu City (DRC) on 03 February 2008 with magnitude $M_w = 6.0$ in the Basin of Lake Kivu. The Virunga volcano group, located at the northern edge of Lake Kivu, consists of eight major volcanoes (Muhavura, Gahinga, Sabinyo, Visoke, Karisimbi, Mikeno, Nyiragongo and Nyamuragira). The volcanoes Nyiragongo and Nyamuragira have been the most active since 1882.

⁶ (http://en.wikipedia.org/wiki/Category:Earthquakes_in_the_Democratic_Republic_of_the_Congo) Wikipedia

**Figure 6-6: Seismic Hazard Map of Africa**

[Source: [United Nations Office for the Coordination of Humanitarian Affairs - Regional Office for Eastern Africa \(OCHA\)](#)]

Four seismic zones (⁷) can be identified and rated as follows: Zone A (very high hazard), Zone B (high hazard), Zone C (moderate hazard), and Zone D (low hazard). The zone A includes the Lake Tanganyika Rift zone where Peak Ground Accelerations (PGA) values of 0.32g, 0.22g and 0.16 g are expected to occur with probability 2%, 5% and 10% in 50 years, respectively. Zone B includes the Lake Kivu Basin, Mount Ruwenzori and Lake Edouard region. Zone C includes Rutsuru, Masisi, Upemba area and a part of the Congo basin close to the Western Rift. The remainder of the Congo basin constitutes the Zone D.

The project site is located in the stable seismic zone. There is no active fault or tectonic activity reported in the project area, as shown in Figure 6-6.

There are also no known historical occurrences in the project area of natural disasters such as earthquakes, floods, fires, storms, volcanic eruptions, etc.

6.2.3 Climate and the Air Quality

Climate

Information obtained from the earlier environmental studies show that the climate of Bas-Congo in general and the one of the project area in particular belong to tropical Sudanese climate characterized by two seasons:

- the rainy season begins by the end of September and ends in early May;
- the dry season extends over the remaining of the year.

However, it is generally observed that as of January until February a short dry season of two or three weeks often interrupts the rainy season.

Temperature

The climate described above is characterized by a temperature of 18°C, during the coldest month (June). Under the influence of Benguela marine current, the latter leads to a strong inflection of isotherms of Bas-Congo, so that the average annual temperature, rather uniform in the province, fluctuates around 25°C in the rainy season and 20° C in the dry season. Furthermore, the variance amplitude does not exceed 10°C throughout the province. Ultimately, the average annual temperature is 25° C, the lower limit is 22°C and the upper limit is 28°C. During the same month, the variance amplitude does not exceed 4°C. This variance temperature is particularly striking between areas of different altitudes. This contrast is clearer in the season dry than in the rainy season and between the following reliefs: Bangu plateau and Ngungu crest and the schisto-calcareous plains.

Insolation

The insolation of the province in general and the project area, in particular, is particularly low (about 50% between 07 and 17 hours). Its annual duration does not exceed 1,300 hours per year, that is, 3 to 4 hours per day. This explains the weakness of evaporation especially in valleys which benefit from an advantage corresponding to a rainfall of 150 mm of water.

Rainfall

The rainfall in the area of the quarries perimeters are of short duration. They are concentrated on ten days per month and amount for the rainy season, an average monthly high of about 130 mm, with a maximum likely to exceed 200 mm in January. The average annual rainfall varies from 900 mm (Far South-Western Province) to 1,500 mm (far Eastern Province).

⁷ Wits Institutional Repository on D'Space

Temperature and rainfall data for Kula city, which is close to plant site, is shown in Figure 6-7. The data has been sourced from the World Weather Online.

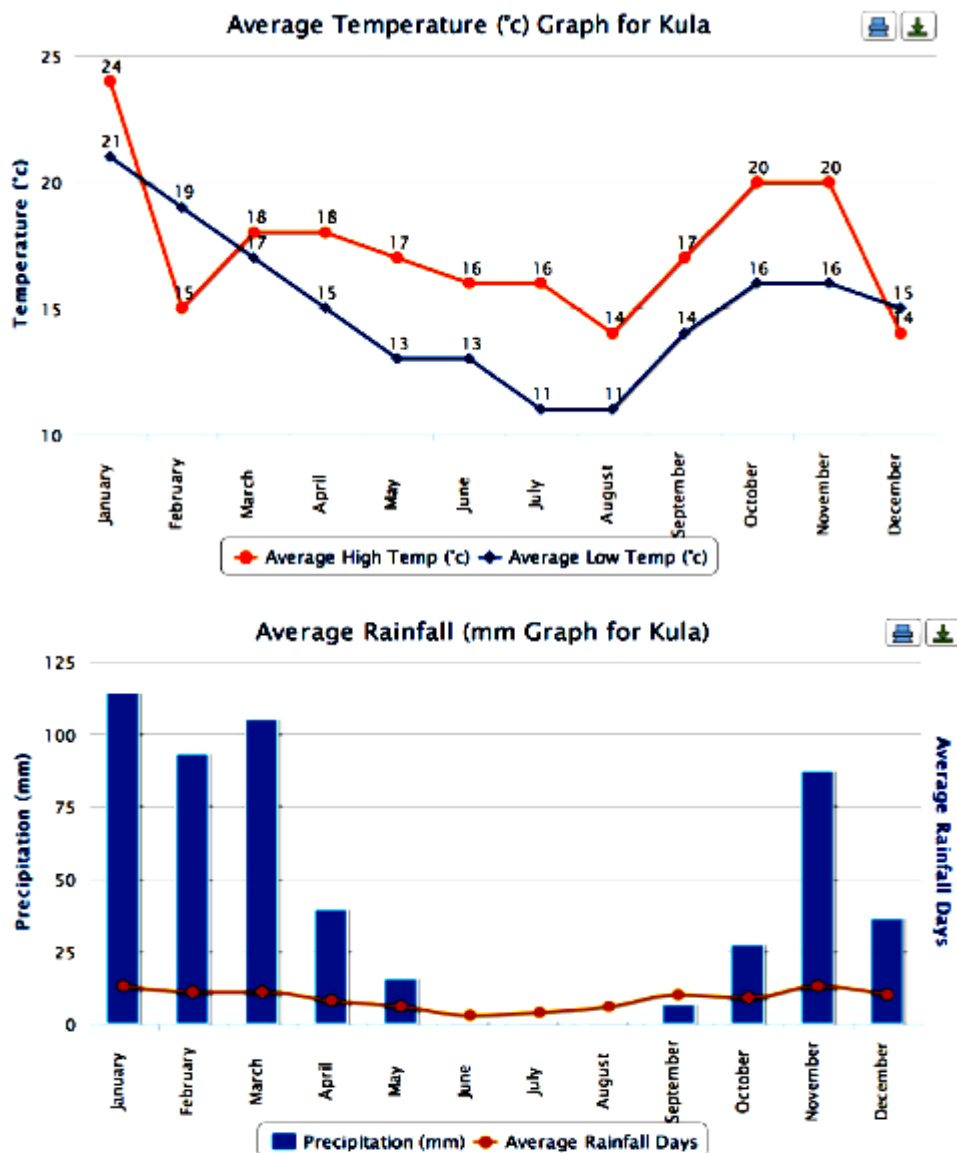


Figure 6-7: Temperature and Rainfall Data - Kula City

The data is based on three years average. Years 2007 and 2008 month-wise daily rainfall data reported in OEM EIA Report is presented in Appendix – 5.1. Regions Five Year average annual rainfall is indicated below (Table 6-1).

Table 6-1: Region's Annual rainfall (in mm) for the last 5 years

No.	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOT
1	2005-2006	154	247	219	159	42	2	-	-	15	70	232	151	1292
2	2006-2007	175	213	150	238	91	-	-	-	18	71	150	174	1280
3	2007-2008	142	115	134	132	40	3	-	-	22	101	191	228	1108
4	2008-2009	219	192	154	128	5	-	-	-	7	58	32	33	828
5	AVERAGE													1127

[Source: CINAT Observatory and Earth group]

Evaporation

Data collected from the nearest METELSAT, namely Kwilu-Ngongo station indicates that the extent of the yearly evaporation was approximately 2.66 mm in 2007 and 2.99 mm in 2008

Direction of prevailing wind

Despite the aerodynamic reversal noticed on the field, such as the movement recorded in Kimpese, the main direction of winds in the project area is:

- South to North (Inter-tropical wind);
- West to East (Benguela marine current).

Climatic studies carried out in the region reveal that the risk and the probability of release of weather disasters within the perimeters are limited to heavy rains and flooding during rainy seasons and the drought that has already been registered throughout the region in 1978. Other disasters such as hurricane, sandstorm or dust have not yet been recorded in the past.

Air Quality

There are no sources of environmental pollution in the project site which can contribute in the deterioration of air quality. There is neither any industrial nor commercial or any other activity around the project site. There is even no traffic access to most of the villages in the project area. The only source of air pollution is charcoal making process, which the villagers are producing to earn small amount of cash. However, during dry weather windblown dust, savannah and crop residue burning are the only sources of air pollution. Dust in the ambient air from all the above sources is just localized and is for very short time duration.

The dilution of air through strong wind is very dominant. Under such conditions the air in the project area is quite clean and free of any pollutants. Ultimately the great carrying capacity of the air in the project area is yet to be utilized.

Wind erosion also puts dust in the air during dry weather.

As such the air in the project area is virtually free of any pollution. Baseline ambient air quality conditions at the site based on measurements taken during ECTECH's site visit are described below.

Baseline Monitoring of the ambient air quality was done for SO₂, CO, NO_x PM (Particulate Matter) and noise.

Ambient Air Monitoring for SO₂, NO_x and CO:

The ambient air quality for Sulphur dioxide (SO₂), Nitrogen oxides (NO_x), and Carbon monoxide (CO) was carried out by ECTECH at different locations on the project site. The monitored data are shown in the following table:

Table 6-2: Ambient Air Quality Monitored Data for SO₂, NO_x and CO (24 hourly/8hourly values)

Sr. No.	Reference Point	Date	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)
Point # 1	Quarry Area	14-11-2012	B.D.L	B.D.L	B.D.L
		14-11-2012	B.D.L	B.D.L	B.D.L
		14-11-2012	B.D.L	B.D.L	B.D.L
Point # 2	Plant area	14-11-2012	B.D.L	B.D.L	B.D.L
		14-11-2012	B.D.L	B.D.L	B.D.L
		14-11-2012	B.D.L	B.D.L	B.D.L
Point # 3	Near Kokolo Village	16-11-2012	B.D.L	B.D.L	B.D.L
		16-11-2012	B.D.L	B.D.L	B.D.L
		16-11-2012	B.D.L	B.D.L	B.D.L
Point # 4	Near Kinsua Village	16-11-2012	B.D.L	B.D.L	B.D.L
		16-11-2012	B.D.L	B.D.L	B.D.L
		16-11-2012	B.D.L	B.D.L	B.D.L
Point # 5	Near Mbemba Village	15-11-2012	B.D.L	B.D.L	B.D.L
		15-11-2012	B.D.L	B.D.L	B.D.L
		15-11-2012	B.D.L	B.D.L	B.D.L
Point # 6	Near Yuku Village	15-11-2012	B.D.L	B.D.L	B.D.L
		15-11-2012	B.D.L	B.D.L	B.D.L
		15-11-2012	B.D.L	B.D.L	B.D.L
Point # 7	Near Matala Village	15-11-2012	B.D.L	B.D.L	B.D.L
		15-11-2012	B.D.L	B.D.L	B.D.L
		15-11-2012	B.D.L	B.D.L	B.D.L
Point # 8	Near Mbamba Village	14-11-2012	B.D.L	B.D.L	B.D.L
		14-11-2012	B.D.L	B.D.L	B.D.L
		14-11-2012	B.D.L	B.D.L	B.D.L
Point # 9	Road towards quarry	14-11-2012	B.D.L	B.D.L	B.D.L
		14-11-2012	B.D.L	B.D.L	B.D.L
		14-11-2012	B.D.L	B.D.L	B.D.L
Point # 10	Near Workers Camp Site	14-11-2012	B.D.L	B.D.L	B.D.L
		14-11-2012	B.D.L	B.D.L	B.D.L
		14-11-2012	B.D.L	B.D.L	B.D.L

{BDL: Below Detectable Limits BDL. [Below Detection Limits (BDL) of: SO₂= 10 µg/Nm³; NO_x= 6.0 µg/Nm³ and CO = 0-20 µg/Nm³}.

[Source: ECTECH ESIA]

Nitrogen oxides (NO_x) in the ambient air consist primarily of nitric oxide (NO) and nitrogen dioxide (NO₂) have much higher toxicity. Nitric oxide is readily converted to the much more harmful nitrogen dioxide by chemical reaction with ozone present in the atmosphere. The direct effects of NO₂, depending upon exposure time and concentration of NO₂, on the respiratory system include increased airway resistance, increase incidence of respiratory illness and damage to lung tissues and emphysema. Emphysema is a long-term, progressive disease of the lungs that primarily causes shortness of breath.

Sulphur Dioxide is particularly irritating to mucous membrane of upper respiratory tract. Chronic effects include rhinitis, dryness of the throat, and cough. Acute over exposure may result in death from asphyxia. Chronic exposure may result in nasopharyngitis, fatigue, altered sense of smell and chronic bronchitis symptoms such as dyspnea on exertion cough and increased mucous excretion.

Carbon monoxide combines with hemoglobin to form Carboxyhemoglobin which interferes with the oxygen carrying capacity of blood, resulting in a state of tissue hypoxia. The typical signs and symptoms of acute CO poisoning are headache, dizziness, drowsiness, nausea, vomiting, collapse, coma and death. Initially the victim is pale; later the skin and mucous membranes may be cherry red in color. Loss of consciousness at about the 50% Carboxyhemoglobin level. Severe CO poisoning has been reported to permanently damage the extra pyramidal system, including the basic ganglia.

Total Suspended Particulate (TSP)

Total Suspended Particulate (TSP) measurement in ambient air was carried out by ECTECH at the same locations as that for ambient air quality. The monitored data are shown in Table 6-3. Table 6-3: Total Suspended Particulates (TSP) (24 hourly/8hourly value in µg/m³)

Reference Point	Date	Total Suspended Particulate (TSP)	Total Suspended Particulate (TSP)
Quarry Area	14-11-2012	36.1	34.1
	14-11-2012	34.8	
	14-11-2012	31.4	
Plant area	14-11-2012	35.3	35.4
	14-11-2012	33.8	
	14-11-2012	37.1	
Near Kokolo Village	16-11-2012	29.5	30.3
	16-11-2012	31.3	
	16-11-2012	30.2	
Near Kinsua Village	16-11-2012	35.1	34.5
	16-11-2012	34.6	
	16-11-2012	33.8	
Near Mbemba Village	15-11-2012	35.0	34.8
	15-11-2012	34.1	
	15-11-2012	35.3	

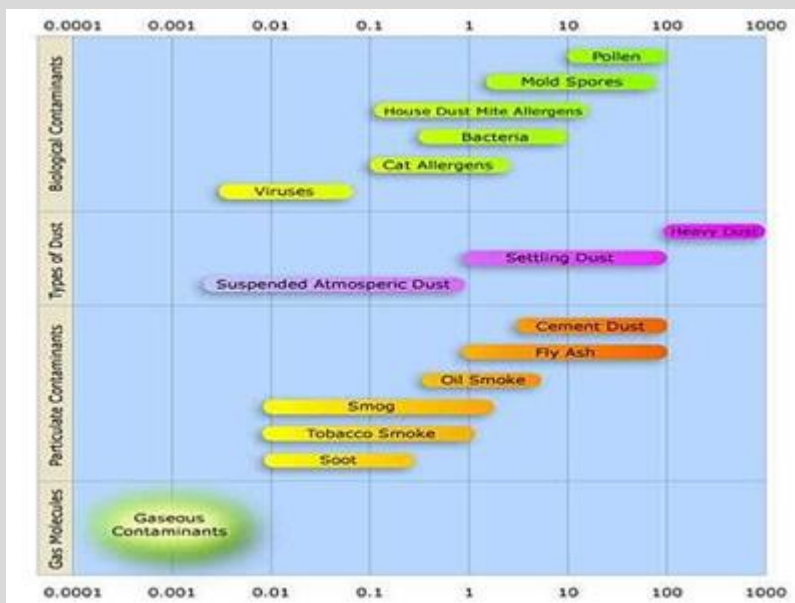
Updated ESIA for NYA Cement Project – updated in response to lender requirements

Near Yuku Village	15-11-2012	34.6	34.7
	15-11-2012	35.5	
	15-11-2012	34.1	
Near Matala Village	15-11-2012	32.1	32.4
	15-11-2012	32.0	
	15-11-2012	33.2	
Near Mbamba Village	14-11-2012	34.4	34.2
	14-11-2012	34.9	
	14-11-2012	33.4	
Road towards quarry	14-11-2012	34.1	34.9
	14-11-2012	35.9	
	14-11-2012	34.9	
Near Worker Camp Site	14-11-2012	35.4	34.4

[Source: ECTECH ESIA]

Particulates

Atmospheric particulate matter - also known as particulates or particulate matter (PM) - are tiny pieces of solid or liquid matter associated with the Earth's atmosphere. They are suspended in the atmosphere as atmospheric aerosol, a term which refers to the particulate/air mixture, as opposed to the particulate matter alone. They can adversely affect human health and also have impacts on climate and precipitation. Subtypes of atmospheric particle matter include suspended particulate matter (SPM), respirable suspended particle (RSP; particles with diameter of 10 micrometres or less), fine particles, and soot.



This diagram shows the size distribution in micrometres of various types of atmospheric particulate matter.

It also shows the different types of particulates in the atmosphere

Sources of atmospheric particulate matter

Some particulates occur naturally, originating from volcanoes, dust storms, forest and grassland fires, living vegetation, and sea spray. Human activities, such as the burning of fossil fuels in vehicles, power plants and various industrial processes also generate significant amounts of particulates.

Health effects

Increased levels of fine particles in the air as a result of anthropogenic particulate air pollution "is consistently and independently related to the most serious effects, including lung cancer and other cardiopulmonary mortality. PM pollution is estimated to cause 22,000-52,000 deaths per year in the United States (from 2000) and 200,000 deaths per year in Europe.

The World Health Organization (WHO) estimates that "... fine particulate air pollution (PM_{2.5}), causes about 3% of mortality from cardiopulmonary disease, about 5% of mortality from cancer of the trachea, bronchus, and lung, and about 1% of mortality from acute respiratory infections in children under 5 yr, worldwide."

[Courtesy of Wikipedia]

6.2.4 Water resources

The villages of Mbemba; Yuku; Mbamba; Minkola and Nkonda occur within the proposed project area and must be considered in terms of their water use. Although reference was made that these villages are not groundwater dependant, this needs to be confirmed by means of a hydro-census investigation, and the potential impact of the quarry and plant area on the resource used needs to be quantified. Surface water resources in the project area are shown on

Figure 6-8, and catchments in the area are shown on Figure 6-9.

Surface Water hydrology

A detailed hydraulic flow study is currently being commissioned by NYA to determine the seasonal flow of water in both the Yuku and Sanzikua Rivers.

During a study that was undertaken by ECTECH (29th of November 2012), stream flow was measured once off during the dry seasons at 6 measuring stations within the Yuku and Sanzikua Rivers. Four sampling points were within the Yuku River and two within the Sanzikua Rivers. The Yuku sampling sites were situated south and east of the proposed quarry site. The two sampling sites within the Sanzikua River, were situated upstream, before its confluence with the Yuku River. Flow that was measured at the time of the investigation was as follows:

- varied within the range of 0.24 – 0.43 m³/s for the Yuku River; and
- Between 1.49 – 1.75 m³/s for the Sanzikua River. Calculations undertaken by SRK in June 2013 for flow at the N-1 Bridge and the Sansukua River indicated that estimated flow in the river was 0,2 and 0,3 m³/s.

Surface water quality

The analysis of water samples, collected by OEM experts from one point of each river, was carried out at the laboratory of the Department of Soil Physics and Hydrology of the Centre Régional d'Etudes Nucléaires de Kinshasa (C.G.E.A. / CRENK).

According to the water quality results reported in the OEMS EIA, which were compared to the WHO Guidelines, as shown in Table 6-4, the nitrate concentration in streams is slightly elevated, with that of the Lubulu Nsadi (2) sample point above the threshold value of 50 mg/l (89 mg/l). All the sampling points have chromium concentrations which are highly elevated (not fit for human consumption).

Table 6-4: Water quality sampling results for Sanzikua River (as per OEMS EIA) relative to WHO guideline levels

Parameters	Unit	WHO Guidelines	Sample Name									
			Nsankwa	Lubulu I Nsadi (1)	Lubulu I Nsadi (2)	Kokolo	Minkunku	Yuku Pont	Confl Yuku	Yuku Source	Kisua nto Kok	Borehole C
Conductivity	µS/cm		260.00	113.00	52.00	328.00	365.00	392.00	250.00	310.00	290.00	
Temp	°C		26.00	26.00	25.00	26.00	25.00	27.00	26.00	25.00	25.00	
pH		6.5-9.5	8.30	6.10	6.00	7.70	7.80	7.80	7.40	6.30	6.80	
Turb	NTU		4.91	8.84	9.99	2.25	0.53	0.57	4.21	1.01	1.11	
Mg	mg/l		0.01	0.73	0.12	0.64	0.02	0.03	0.21	0.04	0.80	0.61
Ca	mg/l		2.49	1.31	1.11	3.14	2.58	0.10	2.04	1.21	1.40	10.68
HCO	mg/l		927.20	52.50	6.10	829.60	549.00	1227.00	98.30	49.70	58.40	
SO ₄	mg/l	500.00	3.40	2.00	25.60	2.00	5.00	7.00	3.10	1.80	2.30	
PO ₄	mg/l		15.70	4.40	82.90	29.10	28.80	28.20	7.30	3.90	5.10	
NO ₃ as N	mg/l	50.00	12.50	12.20	89.00	11.10	12.10	12.20	13.00	12.40	12.20	
Mn	mg/l	0.40	0.02	0.02	0.32	0.04	0.07	0.01	0.01	0.03	0.02	
Cr	mg/l	0.05	0.29	0.21	7.36	0.17	0.52	0.30	0.29	0.18	0.21	
Fe	mg/l	0.30	0.23	0.03	1.44	0.07	0.03	0.03	0.05	0.01	0.04	
I	mg/l		0.87	0.43	3.18	0.32	0.17	0.06	0.41	0.39	0.40	
Br ₂	mg/l		0.60	0.15	2.12	0.15	0.08	0.17	0.19	0.14	0.16	
Cl ₂	mg/l	250.00	0.28	0.05	1.02	0.05	0.09	0.05	0.06	0.03	0.04	

Water samples taken during the sampling run of 29 November 2012 (water quality and flows of the Sanzikua and Yuku Rivers) by ECTECH indicated the water quality of samples taken was good (compared to the WHO Guidelines). Iron concentrations were slightly elevated, as shown in Table 6-5. The analysis of water samples did not include chromium.

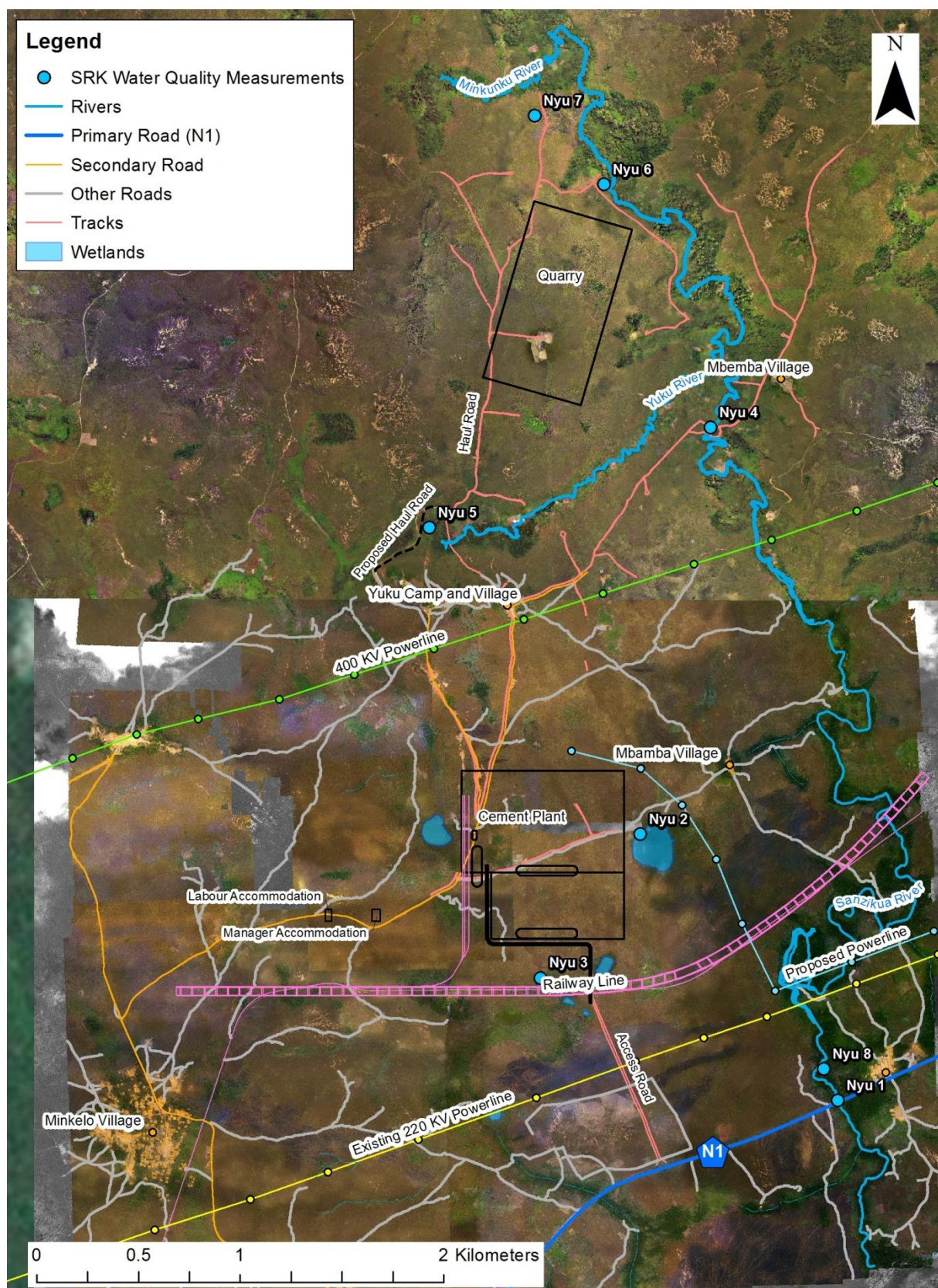


Figure 6-8: Location of surface water points sampled during SRK June 2013 site visit

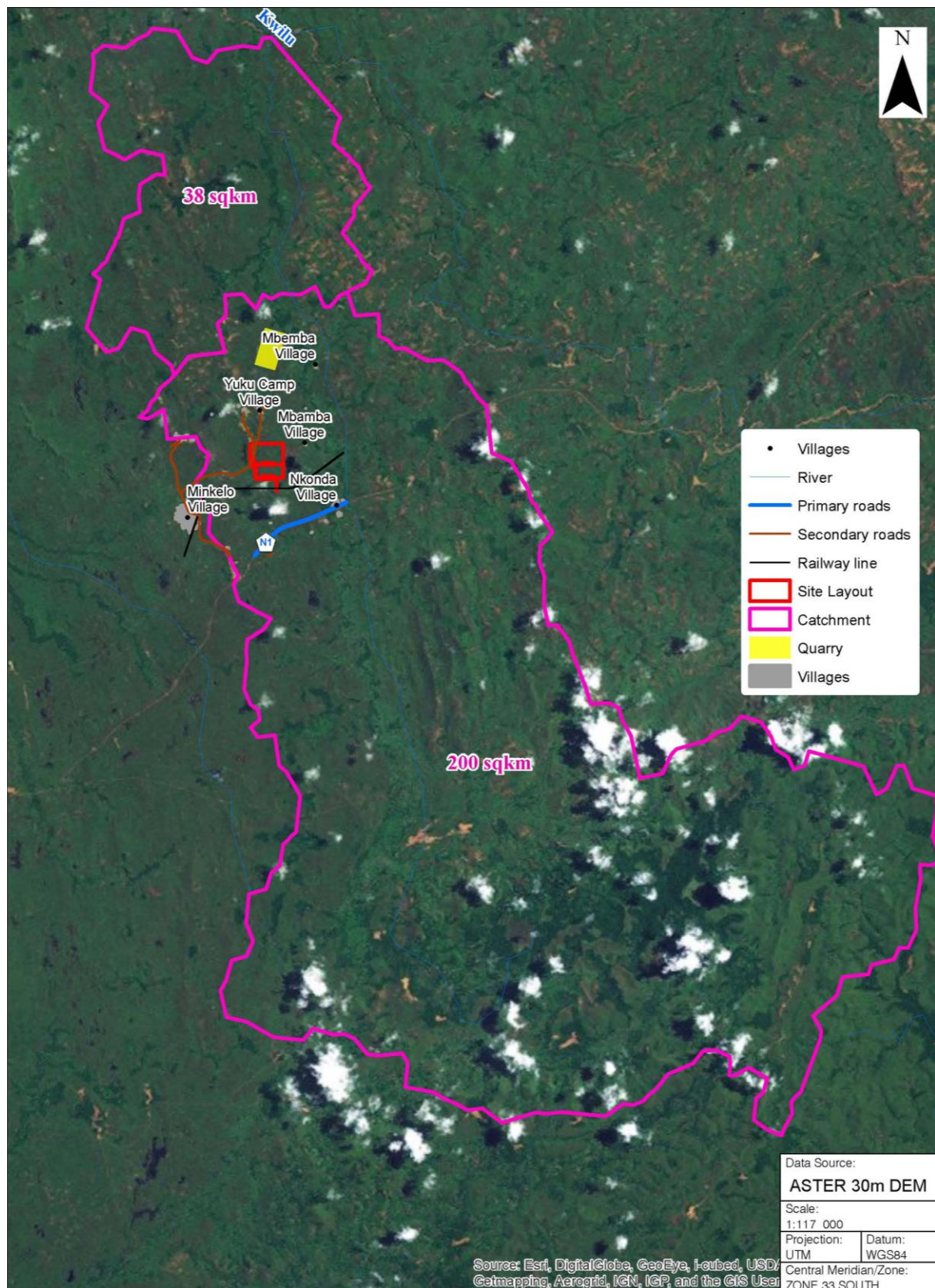


Figure 6-9: Catchment delineation in the project area

Table 6-5: Water quality sampling results for Yuku river (as per OEMS EIA) relative to WHO guideline levels

Parameters	Unit	WHO Guidelines	Sample Name							
			S1 Yuku	S2 Yuku	P1 Yuku	P2 Yuku	P3 Sansi	P4 Sansi B	Lake	Borehole C
Conductivity	µS/cm		383.00	177.00	325.00	324.00	193.00	196.00		
Temp	°C		26.00	25.50	26.70	26.80	25.60	25.40		
pH		6.5-9.5	6.90	6.32	6.85	7.65	7.32	7.21		
Alk			625.00		637.00	765.00				
CO ₂			192.00	165.00	59.00	1547.00	729.00	113.00		
Mg	mg/l		32.40	1.54	0.55	0.63	1.41	0.97	1.51	0.34
Na			11.70	12.80	9.80	8.80	9.65	8.98	7.20	10.68
K			2.40	1.80	2.10	1.90	1.60	0.90	1.10	2.30
NH ₄			0.08	0.11	0.08	0.09	0.12	0.11	0.10	0.15
Si			0.40	3.60	7.70	2.10	3.40	12.30	5.80	48.70
Ca	mg/l		80.32	84.16	70.72	64.96	0.27	1.81	0.89	2.65
F			0.07	0.01	0.02	0.01	0.06	0.09	0.11	0.08
HCO	mg/l		599.02	340.38	549.14	585.60	337.94	352.28	21.99	14.64
SO ₄	mg/l	500.00	4.00	3.00	2.00	2.00	2.00	2.00	3.00	21.00
PO ₄	mg/l		0.48	0.39	0.51	0.28	0.83	0.77	0.62	0.68
NO ₃ as N	mg/l	50.00	0.60	0.90	2.60	1.70	1.10	1.60	0.80	5.30
NO ₂ as N			0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Mn	mg/l	0.40	0.00	0.03	0.02	0.02	0.01	0.10	0.02	0.34
Fe	mg/l	0.30	0.63	0.25	0.54	0.38	0.24	1.94	2.70	0.97
Cl ₂	mg/l	250.00	28.05	13.20	21.45	6.60	13.25	8.25	4.95	15.80

SRK notes the following limitations to the current baseline data:

- Available baseline information was obtained from single sample runs during the dry season only;
- A long term monitoring programme need to be undertaken (approximately a year) to monitor flow and chemistry from both the Yuku and Sanzikua Rivers to get a better understanding of the baseline conditions
- In addition to the existing monitoring stations which were sampled once, the following is proposed:
 - A monitoring point after the confluence of the Yuku and Sazikwa stream, as flow might be impacted on by mining (baseflow reduction);
 - Monitoring points up-gradient within the Sazikwa stream to measure flow and baseline chemistry as the plant may impact on the stream (dirty water run-off)
 - Implement constant monitoring within the pond close to the plant area.
- It is assumed the hydrogeological study that is currently underway by CREN-K will include run-off estimations and baseline contributions (these components will be impacted on by the open pit mining. - reduced run-off and baseflow contributions to these streams).
- Analysis of a full spectrum of cations and anions needs to be undertaken for water samples from all monitoring points in streams and hydro-census sampling points. There is a preliminary indication that chrome concentrations (Cr6+) are highly elevated rendering the water not fit human consumption.

Groundwater

No baseline groundwater data currently exists for the study area, except that the water table is approximately 20 – 25 metres below ground surface. Reference is made to a “Borehole C” (table above) that was sampled, for which the position is not known. According to the water quality results the iron concentration of the borehole is slightly elevated (0.97 mg/l)

Reference is made to the fact that the area geology consist of a massive limestone deposit that contain many cavities (potential strong yielding aquifer which may contribute towards significant groundwater inflows into the limestone quarry).

Four boreholes occur within the study area (DH9, DH11; DH12 and DH 17). It is assumed water levels from these boreholes were measured, from which the average water depth was derived (20-25 mbgl). No reference is made that these boreholes were pump tested or that water samples were taken to be analysed to establish baseline chemistry conditions.

Gaps identified and recommendations made are as follow:

- That a gravimetric geophysics investigation be undertaken within the mining footprint area to investigate the occurrence of cavities, extent, depth etc.
- Drill testing holes to intersect such cavities to undertake pumping tests to acquire aquifer parameters (conductivity and storativity values), which can give an indication of underlying aquifer conditions;
- To measure water levels and take water samples for analysis from these boreholes to establish baseline conditions;
- The interpolation of water levels from the boreholes drilled and possible water level data to be obtained from villages (hydro-census investigation) will give an indication of groundwater flow directions and potential receptors that could be impacted by proposed mining activities;
- That a numerical groundwater model be developed which will be used to better quantify groundwater inflows into the open pit (the volume mentioned is not substantiated)

6.3 Biological Environment (Ecological Resources)

6.3.1 National and Regional Biodiversity Setting

The following section is provided on the basis of a desktop literature review undertaken by SRK in June 2013.

The Democratic Republic of Congo (DRC) has the highest number of species for almost all groups of organisms in Africa, with the exception of South Africa which has greater plant diversity, and possesses over 50% of Africa’s tropical forests (Sayer et al. 1992). Dense forests and woodlands cover half of the DRC’s total surface area of 2.3 million km² and play a critically important role in maintaining global climatic cycles. The DRC also harbours a number of spectacular endemic species like the okapi, Grauer’s gorilla, bonobo, and the Congo peacock. The DRC ranks sixth highest among countries worldwide for total numbers of mammal species (more than 425) and 9th highest for numbers of birds, which total 1,200 recorded species (Pedersen 2006; World Conservation Monitoring Centre, 1992). The DRC has one of the richest bird faunas in Africa and has a relatively extensive network of Important Bird Areas (IBAs) designed to protect the region’s avifauna (Demey & Louette, 2001). Most of the IBAs are associated with high centres of bird endemism in the Albertine Rift and eastern DRC lowlands. The total amphibian diversity of DRC is not yet known. Poynton (1998) providing a checklist and total of 232 species in 41 genera. A lower

total of 211 species was documented as at 2008 (Global Amphibian Assessment, 2008). The reptile fauna of the DRC has not been reviewed in detail since the seminal studies of Schmidt (1919, 1923). Broadley's (1998) checklist, although out of date, recognized 291 species, including 17 chelonians, 105 lizards, 166 snakes and 3 crocodiles. This diversity is greater than that of Western Europe. The Congo River is the largest in the country and the third largest and deepest river in the world. The river is recognised as the second most important site in the world for freshwater biodiversity, particularly fish, but some of the sections of the river have not been surveyed since Max Poll's expedition in 1953 (Poll, 1959) and others since the late 1970's such as the lower Congo rapids (Stewart and Roberts, 1976). The Congo River is home to at least 686 species of fish, 80% of which are found nowhere else in the world (endemic). The country has a total of 18 protected areas (see Figure 6-10), the majority of which are located in the east of the country.

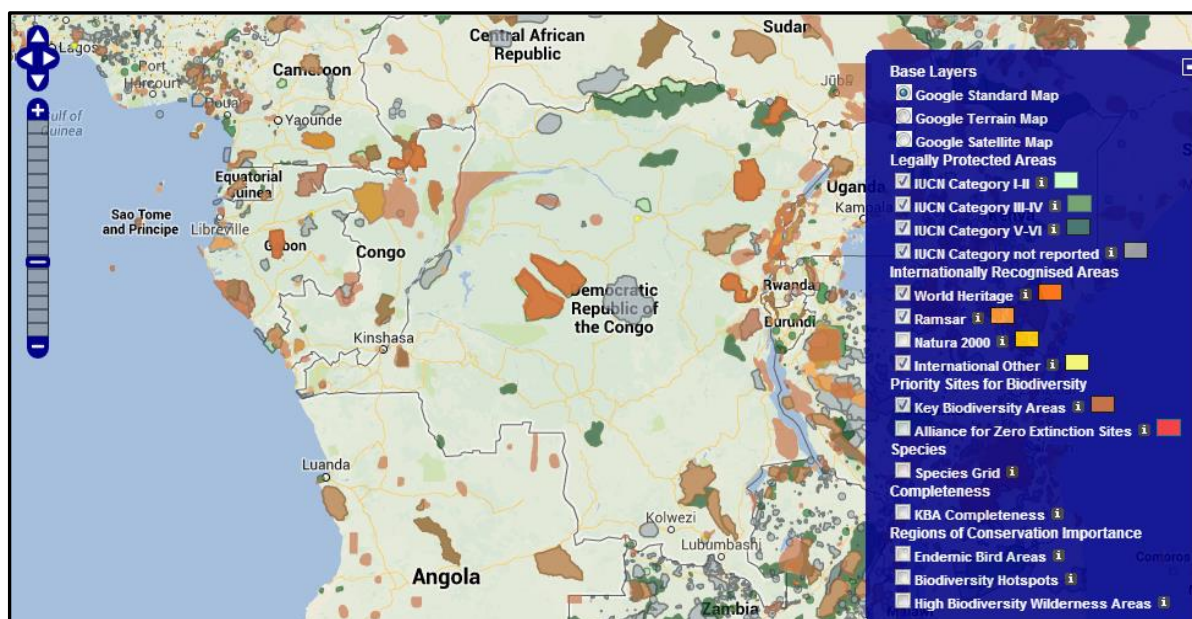


Figure 6-10: Protected Areas in the DRC (IBAT, 2013)

It is noteworthy that in the province of Bas Congo, 55 species of fish from 15 families have been reported (Shumway, 2003). Bas Congo is one of the most deforested provinces in DRC, with an average deforestation rate of 0.6% compared to the national rate of 0.3%. Deforestation in Bas Congo has a complex history, with the province having historically been the most accessible and consequently the most exploited. Consequently, most of Bas Congo is now devoid of primary forest. In the Cataractes District of Bas-Congo, where the project site is located, despite its high rainfall, the primary vegetation present is savannah that is intersected by forest fragments. Most of these forest fragments are secondary forest.

A rapid fauna survey was conducted historically of the provinces of Bandundu, Bas-Congo, and Equateur (Shumway, 2003). The survey covered fish, birds, mammals, amphibians, reptiles, macro invertebrates, and terrestrial and aquatic plants. The results of the survey can be found in Table 6-6, Table 6-7, Table 6-8, Table 6-9, Table 6-10, Table 6-11, Table 6-12 and Table 6-13.

Table 6-6: Summary table of fish species recorded in the Bandundu, Bas-Congo and Equateur Provinces

TABLE 1A. SUMMARY OF FISH SPECIES RECORDED PER PROVINCE					
+ = recorded ; sp. = unidentified, may not be the same across provinces.					
ORDER	FAMILY (common name)	SPECIES	BANDUNDU	BAS- CONGO	EQUATEUR
LEPIDOSIRENIFORMES	PROTOPTERIDAE (lungfishes)	1. <i>Protopterus dolloi</i>	+		+
POLYPTERIFORMES	POLYPTERIDAE (bichir)	2. <i>Polypterus</i> sp. 1 (black)	+		
		3. <i>Polypterus</i> sp. 2 (banded)	+	+ sp.	
		4. <i>Polypterus delhezi</i>	+		
		5. <i>Polypterus</i> sp. 4i			+ sp.
		6. <i>Polypterus ornatipinnus</i>	+		
CLUPEIFORMES	CLUPEIDAE (herrings/sardines)	7. <i>Odaxothrissa</i> spp.	+		
		8. <i>Clupeidae</i> spp.	+	+ sp.	+ sp.
GONORHYNCHIFORMES	CHANNIDAE (snakeheads)	9. <i>Parachanna obscura</i>			+
OSTEOGLOSSIFORMES	MORMYRIDAE (elephantfishes)	10. <i>Petrocephalus</i> sp. 1		+ sp.	+
		11. <i>Petrocephalus</i> sp. 2			+
		12. <i>Petrocephalus sauvagii</i>	+		+
		13. <i>Petrocephalus</i> sp. (stimus?)	+		
		14. <i>Petrocephalus microphthalmus</i>	+		
		15. <i>Gnathonemus petersii</i>	+		
		16. <i>Gnathonemus</i> sp.		+	+
		17. <i>Genyomys donnyi</i>	+		
		18. <i>Hippopotamyrus discorhynchus</i>	+	+	+
		19. <i>Hippopotamyrus plagiosoma</i>			+
		20. <i>Hippopotamyrus pictus</i>	+		
		21. <i>Hippopotamyrus</i> sp.			+
		22. <i>Mormyrops anguilloides</i>	+	+	+
		23. <i>Mormyrops mariae</i>	+		
		24. <i>Mormyrops nigricans</i>			+
		25. <i>Marcusenius greshoffi</i>	+		+
		26. <i>Marcusenius</i> sp. 1	+	+ sp.	+ sp.
		27. <i>Marcusenius</i> sp. 2	+		+ sp.
		28. <i>Marcusenius</i> sp. 3	+		
		29. <i>Marcusenius monteiri</i>		+	+
		30. <i>Stomatorhinus</i> sp. 1 (little, black)	+		
		31. <i>Pollimyrus adspersus</i>	+		
		32. <i>Pollimyrus</i> sp.	+		
		33. <i>Mormyrus probosciostris</i>	+		+
		34. <i>Mormyrus caballus bombanus</i>	+	+	+
		35. <i>Mormyrus ovis</i>			+
		36. <i>Campylomormyrus mivris</i>		+	

		37. <i>Campylomormyrus uirrostris</i>		+	
		38. <i>Campylomormyrus tamandua</i>	+		+
		39. <i>Campylomormyrus elephas</i>	+		
		40. <i>Campylomormyrus</i> sp. 1		+ sp.	+ sp.
		41. <i>Campylomormyrus</i> sp. 2		+ sp.	
	OSTEOGLOSSIDAE (bony tongues)	42. <i>Heterotis niloticus</i> (Cuvier)	+	+	+
	NOTOPTERIDAE (featherbacks)	43. <i>Xenomystus nigri</i> (Gthr.)	+		
		44. <i>Papyrocranus afer</i> (Gthr.)	+		
CHARACIFORMES	CHARACIDAE (characins)	45. <i>Bryconaethiops microstoma</i>	+		
		46. <i>Brycinus</i> sp.			
		47. <i>Hydrocynus goliath</i>	+	+	+
		48. <i>Hydrocynus vittatus</i>	+		
		49. <i>Alestes</i> sp.	+		+
		50. <i>Brycinus</i> sp. 1	+		+ sp.
		51. <i>Brycinus</i> sp. 2	+		
		52. <i>Bryconaethiops</i> sp.			+
		53. <i>Micralestes</i> sp.	+		
		54. Small characid sp. 1		+	+ sp.
		55. Small characid sp. 2		+	
		56. Small characid sp. 3		+	
		57. Small characid sp. 4		+	
		58. Small characid sp. 5	+ sp.	+	
	DISTICHODONTIDAE	59. <i>Ichthyoborus ornatus</i>	+		
		60. <i>Phago boulengeri</i>	+	+	+
		61. <i>Distichodus notospilus</i>			+
		62. <i>Distichodus fasciolatus</i>	+		
		63. <i>Distichodus atroventralis</i>	+		+
		64. <i>Distichodus antonii</i>	+		+
		65. <i>Distichodus maculatus</i>	+		
		66. <i>Distichodus affinis</i>	+		
		67. <i>Distichodus lusosso</i>		+	+
		68. <i>Distichodus sexfasciatus</i>		+	
		69. <i>Eugnathichthys</i> sp.	+		
		70. <i>Xenocharax spilurus</i>	+		
		71. <i>Nannocharax</i> sp.	+		
	CITHARINIDAE	72. <i>Citharinus gibbosus</i> (Blgr.)	+		+
		73. <i>Citharinus congicus</i>	+		
CYPRINIFORMES	CYPRINIDAE (minnows/carps)	74. <i>Barbus</i> sp.	+		
		75. <i>Labeo vellifer</i>		+	
		76. <i>Labeo coubie</i>		+	
		77. <i>Labeo lineatus</i>	+	+ sp.	+ sp.
		78. <i>Labeo weekslii</i>	+		

Updated ESIA for NYA Cement Project – updated in response to lender requirements

		79. <i>Labeo sp.cf. weekstii</i> 3	+		
		80. <i>Labeo nasus</i>		+	
		81. <i>Labeo macrostoma</i>		+	
		82. <i>Labeo sores</i>		+	
		83. <i>Leptocyrus sp.</i>			+
TETRAODONTIFORMES	TETRAODONTIDAE (puffers)	84. <i>Tetraodon mbu</i> (Blgr.)	+		
		85. <i>Tetraodon miurus</i> (Blgr.)	+		
SILURIFORMES	MALAPTERURIDAE (electric catfishes)	86. <i>Malapterurus electricus</i>	+	+	
	MOCHOKIDAE (squeakers)	87. <i>Synodontis acanthomias</i>	+		+
		88. <i>Synodontis sp. 1</i>	+	+ sp.	+ sp.
		89. <i>Synodontis sp. 2</i>	+	+ sp.	+ sp.
		90. <i>Synodontis sp. 3</i>	+	+ sp.	+ sp.
		91. <i>Synodontis sp. 4</i>	+	+ sp.	
		92. <i>Synodontis sp. 5</i>	+		
		93. <i>Synodontis sp. 6</i>	+		
		94. <i>Synodontis sp. 7</i>	+		
		95. <i>Synodontis sp. 8</i>	+		
		96. <i>Euchilichthys sp.</i>		+	
		97. <i>Mochokiella sp.</i>	+		
		98. <i>Microsynodontis</i>		+	
	CLARIIDAE (airbreathers)	99. <i>Heterobranchius longifilis</i> (Val.)	+		+
		100. <i>Channallabes apus</i> (Gthr.)	+		
		101. <i>Charallabes sp.</i>		+	
		102. <i>Clarias sp. 1</i>	+		+ sp.
		103. <i>Clarias sp. 2</i>			+ sp.
	AMPHILIIDAE (loach catfishes)	104. <i>Belonoglanis sp.</i>		+	
	BAGRIDAE (bagrids)	105. <i>Bagrus sp.</i>	+	+ sp.	
		106. <i>Bagrus ubangensis</i>			+
		107. <i>Auchenoglanis occidentalis</i>	+		+
		108. <i>Parauchenoglanis spp.</i>	+		
		109. <i>Chrysichthys sp. 1</i>	+	+ sp.	+ sp.
		110. <i>Chrysichthys sp. 2</i>	+	+ sp.	+ sp.
		111. <i>Chrysichthys sp. 3</i>	+	+ sp.	
		112. <i>Chrysichthys sp. 4</i>	+		
		113. <i>Rheoglanis dendrophorus</i>		+	
		114. <i>Parasilba congica</i>	+		
	SCHILBEIDAE (schilbeids)	115. <i>Schilbe sp. 1</i>	+		
		116. <i>Schilbe sp. 2</i>	+		
		117. <i>Schilbe mystis</i>		+	+
PERCIFORMES	CICHLIDAE (cichlids)	118. <i>Tylochromis sp.</i>	+	+ sp.	+ sp.
		119. <i>Tylochromis lateralis</i>		+	

		120. <i>Lamprologus sp. (new sp.)</i>	+	+ sp.	
		121. <i>Lamprologus congoensis</i>	+		
		122. <i>Haplochromis demersii</i>		+	+
		123. <i>Hemichromis elongatus</i>	+	+ sp.	+ sp.
		124. <i>Nannochromis sp.</i>	+		
		125. <i>Nannochromis consortus</i>		+	
		126. <i>Sarotherodon galileus boulengeri</i>	+		
		127. <i>Steatocranus casuarius</i>		+	
		128. <i>Steatocranus tinanti</i>		+	
		129. <i>Steatocranus glaber</i>		+	
		130. <i>Tilapia (Oreochromis) sp? = marichal</i>	+		
		131. <i>Tilapia sp.</i>		+	
		132. <i>Tilapia nilotica</i>			+
	ANABANTIDAE (climbing gouramies)	133. <i>Ctenopoma acutirostre</i>	+		
		134. <i>Ctenopoma pellegrini</i>			+
		135. <i>Ctenopoma kingsleyae</i>	+		+
		136. <i>Ctenopoma ocellata</i>	+		
		137. <i>Ctenopoma nebulosa</i>	+		
	MASTACEMBELIDAE (spiny eels)	138. <i>Mastacembelus sp. 1</i>	+		
		139. <i>Mastacembelus sp. 2</i>	+		
	CENTROPOMIDAE (snooks)	140. <i>Lates niloticus (L.)</i>	+		
CYPRINODONTIFORMES	POECILIIDAE (poeciliids)	141. <i>Aplocheilichthys sp. (new sp.)</i>		+	
		TOTAL SPECIES/AXIS	94	55	54

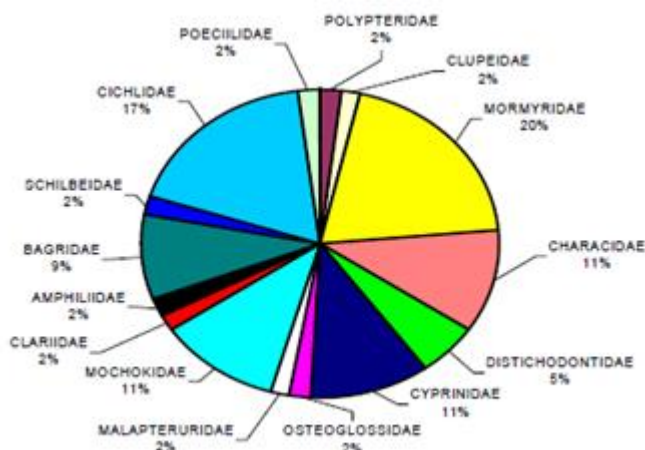


Figure 6-11: Proportional representation of fish species in each family found in Bas-Congo.

Table 6-7: Birds recorded in the Bas Congo Province

FAMILY	SPECIES	STATION				
		Inga (Tank)	Nziya	Shougho	Fwamalo	Pt. 50
ACCIPITRIDAE	1. <i>Gypohierax angolensis</i>	+	+		+	
ALCEDINIDAE	2. <i>Halcyon senegalensis</i>	+				
ARDEIDAE	3. <i>Egretta alba</i>		+			+
	4. <i>Egretta ardestiaca</i>					
CAPITONIDAE	5. <i>Egretta gularis</i>	+				
	6. <i>Pogonotulus bilineatus</i>	+	+			
COLUMBIDAE	7. <i>Pogonotulus sp</i>					+
	8. <i>Streptopelia sp</i>					+
CORVIDAE	9. <i>Corvus albus</i>	+				
CUCULIDAE	10. <i>Centropus senegalensis</i>	+	+			
ESTRILIDAE	11. <i>Lonchura cucullata</i>		+			+
	12. <i>Uraeginthus angolensis</i>		+			+
	13. <i>Hirundo abyssinica</i>	+				
HIRUNDINIDAE	14. <i>Hirundo rustica</i>				+	
	15. <i>Hirundo senegalensis</i>	+	+			+
	16. <i>Delichon urtica</i>				+	
MEROPIDAE	17. <i>Merops pusillus</i>					+
MOTACILLIDAE	18. <i>Motacilla alba</i>	+				
PASSERIDAE	19. <i>Passer griseus</i>					+
PHALACRO-CORACIDAE	20. <i>Phalacrocorax africanus</i>		+		+	+
PHASIANIDAE	21. <i>Francolinus sp.</i>	+				
PYCNONOTIDAE	22. <i>Pycnonotus barbatus</i>	+	+	+		
SYLVIIDAE	23. <i>Cisticola natalensis</i>				+	

Table 6-8: Amphibians recorded in the Bas Congo Province

FAMILY	SPECIES	STATION				
		Inga (Tank)	Nziya	Shongho	Fwamalo	Pt. 50
BUFONIDAE	1. <i>Bufo funereus</i>	+	+			
	2. <i>Rana fuscigula</i>	+				+
RANIDAE	3. <i>Rana sp. 1</i>		+			
	4. <i>Rana sp. 2</i>					+
	5. <i>Hymenochirus curteius</i>					+
	6. <i>Rana mascariensis</i>	+				
	Many larvae				+	+

Table 6-9: Reptiles recorded in the Bas Congo Province

FAMILY	SPECIES	STATION				
		Inga (Tank)	Nziya	Shongho	Fwamalo	Pt. 50
SCINCIDAE	1. <i>Mabuya maculilabris</i> (speckle-lipped skink)	+	+		+	+
AGAMIDAE	2. <i>Agama agama</i> (common agama)		+			+

Table 6-10: Mammals recorded in the Bas Congo Province

FAMILY	SPECIES	STATION				
		Inga (Tank)	Nziya	Shongho	Fwamalo	Pt. 50
BOVIDAE	1. <i>Tragelaphus speket</i> (Sitatunga)		+			
	2. <i>Cephalophus monticola</i> (Blue duiker)	M				
PTEROPODIDAE	3. <i>Eidolon helvum</i> (Straw-colored bat)	+ M				
	4. <i>Myonycteris torquata</i> (flying fox)				+	
POTAMOGALIDAE	5. <i>Potamogale velox</i> (Giant otter shrew)	Fisherman				

Table 6-11: Macro invertebrates recorded in the Bas Congo Province

ORDER	FAMILY	SPECIES	STATION				
			Inga (Tank)	Nziya	Shongho	Fwamalo	Pt. 50
CRUSTACEA	ATYIDAE	1. <i>Caridina africana</i>	+			+	+
		2. <i>Caridina sp1</i>	+			+	
		3. <i>Caridina sp2</i>	+			+	
		4. <i>Caridina sp. 3</i>					
	POTAMONIDAE	5. <i>Potamonautus dybowskii</i>	+			+	+
COLEOPTERA	DYSTICIDAE	6. <i>Cybister tripunctatus</i>					
HETEROPTERA	GERRIDAE	7. <i>Gerris sp. 1</i>	+				
		8. <i>Gerris sp. 2</i>					
HEMIPTERA	NEPIDAE	9. <i>Ranatra grandicollis</i>	+				
	BELOSTOMATIDAE	10. <i>Belostoma niloticum</i>					
ODONOTA	COEANAGRIONIDAE	11. <i>Megaloprepus caeruleatus</i>	+			+	
	LIBELLULIDAE	12. <i>Palpopleura lucta</i>					
		13. <i>Libellula quadrimaculata</i>	+				+
	AESHNIDAE	14. <i>Aeshnid sp.</i>					
MOLLUSCA	HYDROBIIDAE	15. <i>Hydrobia plena</i>				+	
	MELANIIDAE	16. <i>Melantiid sp.</i>					
	ASSIMINEIDAE	17. <i>Assimi oratidae</i>				+	
		18. <i>Pseudogibula dyponi</i>					
		19. <i>Pseudogibula pallidior</i>					
	SIBULINIDAE	20. <i>Pseudoglossoria bezzei</i>				+	
	AMPULLARIIDAE	21. <i>Aethria elliptica</i>					

Table 6-12: Plants recorded in the Bas Congo Province

FAMILY	Species (common name, where available)	Comments
POACEAE	1. <i>Panicum repens</i> L. (Australia torpedo grass)	Invasive grass
	2. <i>Panicum maximum</i> (guinea grass; colonial grass)	Medicinal value
	3. <i>Oryza barthii</i> (species of wild rice)	Valuable for agricultural diversity
	4. <i>Echinochloa pyramidalis</i> (antelope grass)	Nutritious fodder for dry-season grazing
	5. <i>Imperata</i> sp.	Grass
	6. <i>Hyparrhenia diplandra</i>	Dominant grass species of flooded wood savannah regions
CYPERACEAE	7. <i>Cyperus</i> sp.	Grass
CONVOLVULACEAE	8. <i>Ipomoea aquatica</i> Forsk (water spinach; aka swamp cabbage)	Invasive species; floating vine; Medicinal value
SALVINIACEAE	9. <i>Salvinia nymphaeifolia</i>	Floating plant
PONTEDERIACEAE	10. <i>Eichornia crassipes</i> (water hyacinth)	Invasive floating plant
POLYGONACEAE	11. <i>Polygonum acuminatum</i> H.B. and K. (knotweed)	Freshwater plant; medicinal value
MYRTACEAE	12. <i>Eugenia congolensis</i>	Tree found in flooded forest
EUPHORBIACEAE	13. <i>Hymenocardia acida</i>	Medicinal value
IRVINGIACEAE	14. <i>Irvingia smithii</i> Hook. F.	Tree in gallery forest
THELIPTERIDACEAE	15. <i>Cyclosorus dentatus</i> (Forsk) (lynnyolo)	Medicinal value
MORACEAE	16. <i>Ficus mucosa</i> (fig tree)	Medicinal value; documented to be used by chimps for same reason; timber species
RUBIACEAE	17. <i>Nauclaea latifolia</i> Smith (Pin cushion tree; aka African peach)	Small tree; medicinal value
ANACARDIACEAE	18. <i>Lannea antiscorbutica</i> (Hiern) Engl. (pink lannea)	Found in riverine forests with sandy soil
BOMBACEAE	19. <i>Ceiba pentandra</i> (kapok tree)	Invasive tree
FABACEAE	20. <i>Andansonia digitata</i> (African baobab)	Native tree; medicinal value; pollinated by bats
	21. <i>Mimosa pigra</i> (catclaw mimosa; aka giant sensitive plant)	Invasive, highly destructive; forms dense monocultures. Suppresses other vegetation as well as impacts on fish life.
ASTERACEAE	22. <i>Chromolaena odorata</i>	Invasive perennial shrub

6.3.2 Project Site

Aquatic biodiversity

A botanical survey of the aquatic habitats was conducted by the University of Lubumbashi in conjunction with SRK Consulting between 10 and 14 June 2013, which coincides with the early part of the dry season. Due to time constraints, a survey during the wet season also was not possible. Transects were undertaken in each of the habitats to record the species present and their respective abundance.

The study area is characterised by a number of rivers, streams, swamps, lacustrine wetlands, and an endorheic wetland. The Sanzikua River, which flows in a northerly direction through the eastern part of the study area, is the largest aquatic feature on site (see Figure 6-12). The Sanzikua River joins the Congo River approximately 50 km north-north-west of the study area. The banks of the Sanzikua River are dominated by *Piliostigma thonningii* (Camel's foot), *Panicum maximum* (Guinea grass), *Pteridium* sp., *Puereria javanica* (Tropical kudzu), *Senna spectabilis*, *Senna* sp, *Sida acuta* and *Cinnamomum* sp., with *Oxytenanthera abyssinica* (West African bamboo) present at the crossing with the N1 road.



Figure 6-12: The Sanzikua River immediately upstream (north) of the N1 road

Two notable tributaries of the Sanzikua River are present on site, namely the Yuku and Minkunku Rivers. The banks of the Yuku River (Figure 6-13) are dominated by *Ceiba pentadra* (Kapok), *Gmelina arborea* (White teak; naturalised), *Milicia excelsa*, *Mimosa* sp., *Musa sapientum*, *Ocimum cinamomum*, *Sida acuta*, *Solanum* sp. (Mutuza), *Spathodea campanulata*, *Terminalia catappa*, *Urena lobata* (Mpunga), Matiasi and Mukuisa, with *Carica papaya* (Pawpaw) planted in some areas. The invasive alien plant *Chromolaena odorata* was observed along the banks of the Yuku.



Figure 6-13: The source of the Yuku River

The banks of the Minkunku River (see Figure 6-14) are dominated by *Elaeis guineensis* (African oil palm) and *Myrianthus arboreus* (Giant yellow mulberry).



Figure 6-14: The Minkunku River

A total of seven lacustrine (open water) wetlands and one endorheic wetland were recorded on site. The Kawenga wetland is approximately three hectares in size and one meter deep (see Figure 6-15), and the Mbamba wetland (see Figure 6-16) is nine hectares in size and 1.5 meters deep. Both are located at the headwaters of minor streams that flow in a northerly direction. The wetlands are understood to be associated with a karst system, as both are located on a calcareous formation. The Kawenga wetland is located to the immediate west of the plant site and the Mbamba wetland to the east. The Kabuendi system of (four) wetlands is located to the south of the plant site (see Figure 6-17). These wetlands are surrounded by swamp, Swamp forest and Gallery forest. The flow of this system on the site is in a southerly direction, but after crossing the N1 road changes to an easterly direction before joining with the Sanzikua River. The pH of the Kabuendi and Mbamba wetlands were 5.02 and 6.18 respectively. A further lacustrine wetland was observed 3 km west of the Yuku camp village, which is associated with an extensive swamp system of approximately 4 km in length and a large patch of Swamp forest (see Figure 6-18). An endorheic wetland was also recorded 900 m north of the Mbamba village.



Figure 6-15: Kawenga wetland to the west of the plant site

The edges of the Kawenga wetland are dominated by two species of *Polygonum*. *Nymphaeus lotus* (Egyptian White Water-Lily) was also present on the open water in small numbers.



Figure 6-16: Mbamba wetland to the east of the plant site

The periphery of the Mbamba wetland is dominated by *Imperata cylindrica* and a *Paspalum* species. *Nymphaea lotus* (Water lily) was present in moderate numbers on the open water. *Elaeis guineensis*, *Erythrina abissinica*, *Mangifera indica*, *Milletia versicolor*, *Pseudolacnostilis* sp. and *Sarcocephalus latifolius* were present around the edges of the wetland. An area of swamp was also present to the south of the wetland.

The Kabuendi system of wetlands and swamps is characterised by *Nymphaea lotus*, *Lersia* sp., *Polygonum* sp., *Adansonia digitata*, *Elaeis guineensis*, *Sarcocephalus latifolius*, *Stipularia Africana*, and two species of *Scleria*.

Hyperhenia sp. and *Hymenocardia acida* surrounded all the wetlands and swamps where hydromorphic conditions were absent.



Figure 6-17: The north-eastern wetland in the Kabuendi system



Figure 6-18: Lacustrine wetland and extensive swamp system, including Swamp forest, 3 km west of the Yuku camp village

No surveys of aquatic fauna were conducted during SRK's site visit due to time constraints and the lack of available local experts, but according to information provided by a local villager/hunter, indigenous catfish are present in all the local wetlands and *Tilapia* sp were introduced historically. Table 6-13 specifies the aquatic faunal species described by the local communities to SRK as being present in the study area. Table 6-14 describes the aquatic faunal species that likely occur in the study area, as described by local communities to OEMS. A number of the fish species specified by the local communities are included in the IUCN Red List, but all as Least Concern or Least Threatened. Egrets and grebes were the only waterfowl observed on the wetlands. The wetlands on site and in the surrounding areas are apparently used by the brown Malimbe bird (*Malimbus* sp.) that frequents the wetlands at the end of the wet season, but not for breeding purposes.

Table 6-13: Aquatic faunal species described by the local communities to SRK as being present in the study area

Family	Name	Description	Usage	Location	Frequency
Fish	Tilapia	-	Consumption	Rivers throughout the site	Common
	Cat Fish	-			Common
	Carpe	-			Common
	Mongo	-			Common
	Mufungua	-			Common
	Vundu	-			Common
	Binkoko	-			Common
	Nzonzi	-			Common
	Kungan-Gando	-			Common
	Ntondi	-			Common
	Ntondi-Biongo	-			Common
	Ndadi	-			Common
	N'semo	-			Common
	Nsula	-			Common
	Nkunki	-			Common
	Ngolola	-			Common
	Mabundu	-			Common
	Babinta	-			Common

Table 6-14: Likely aquatic fauna species in the study area as identified by OEMS via community consultation

Family	Genus and species	Common name	Protected/Rare species
Lepidosireneidae	<i>Protopterus dolloi</i> (likely)	Slender lungfish	IUCN Least concern
Polypteridae	<i>Polypterus ornatipinnis</i>	Ornate bichir	IUCN Least concern
Mormyridae	<i>Mormyrops anguilloides</i> (likely)	Electric fish	IUCN Least concern
Mochokidae	<i>Synodontis</i> sp.		
Characidae	<i>Hydrolycus</i> sp.	Upside-down catfish	
Mormyridae	<i>Gnathonemus elephas</i>	Dogtooth characins	IUCN Least concern
Citharinidae	<i>Citharinus gibbosus</i>		IUCN Least concern
Arapaimidae	<i>Heterotis niloticus</i>	African arowana (bonytongue)	IUCN Least threatened
Distichodontidae	<i>Distichodus fasciolatus</i>	Shark tail distichodus	IUCN Least concern
Cyprinidae	<i>Labeo longipinnis</i>		IUCN Least concern

Terrestrial biodiversity

Botanical diversity

The study area and surrounds are characterised by rolling hills with gently incised valleys. Savannah is the primary vegetation type present. Gallery and Swamp Forests are present adjacent to rivers and streams within the valleys, and adjacent to swamps and wetlands in low-lying areas. Gallery Forest is also present in depressions on the hills which are presumably poorly drained.

A botanical survey of each of these habitats was conducted by the University of Lubumbashi in conjunction with SRK Consulting between 10 and 14 June 2013, which coincides with the early part of the dry season. Due to time constraints, a survey during the wet season also was not possible. Transects were undertaken in each of the habitats to record the species present and their respective abundance. A total of 102 species were recorded. It is estimated that a comprehensive survey that would include sampling during both the wet and dry seasons may yield in the order of 400 plant species.

The savannah was found to be strongly dominated by a grass cover (*Hyparrhenia* sp.), with *Hymenocardia acida* forming a sparse overstorey. Small termataria are a dominant feature at the plant site. The savannah at the plant site (see Figure 6-19) also has notably less overstorey than the quarry site (see Figure 6-20), but the overstorey at the plant site also included *Annona* sp. The savannah at the quarry site was characterised by a higher prevalence of bare ground and a less dense grass cover than the plant site, and was consequently determined to be steppic savannah.

The Gallery forest is characterised by *Piliostigma thoningii* (Camel's foot), *Gmelina arborea* (White teak) *Pteridium* sp., *Puereria javanica* (Tropical kudzu), *Senna spectabilis*, *Sida acuta*, *Cinnamomum* sp., *Ceiba pentadra* (Kapok), *Milicia excelsa*, *Mimosa* sp., *Musa sapientum*, *Ocimum cinamomum*, *Sida acuta*, *Spathodea campanulata*, *Terminalia catappa* and *Urena lobata* (Mpunga). The Swamp forest has a similar species assemblage to the Gallery forest, with the exception of *Elaeis guineensis*, *Adansonia digitata* and *Stipularia africana* only being present in the Swamp forest.

A habitat map for the southern part of the study area can be found in Appendix 7.1. A detailed list of species recorded in each of the habitats can be found in Appendix 7.2. A Jaccard Floristic Similarity Analysis of the various habitats is presented in Figure 6-22.



Figure 6-19: *Hyparrhenia* dominated savannah present at the Plant site



Figure 6-20: Steppic savannah present at the Quarry site



Figure 6-21: Savannah (in foreground) and Gallery forest (in background) present at the Spoil (topsoil and overburden) site

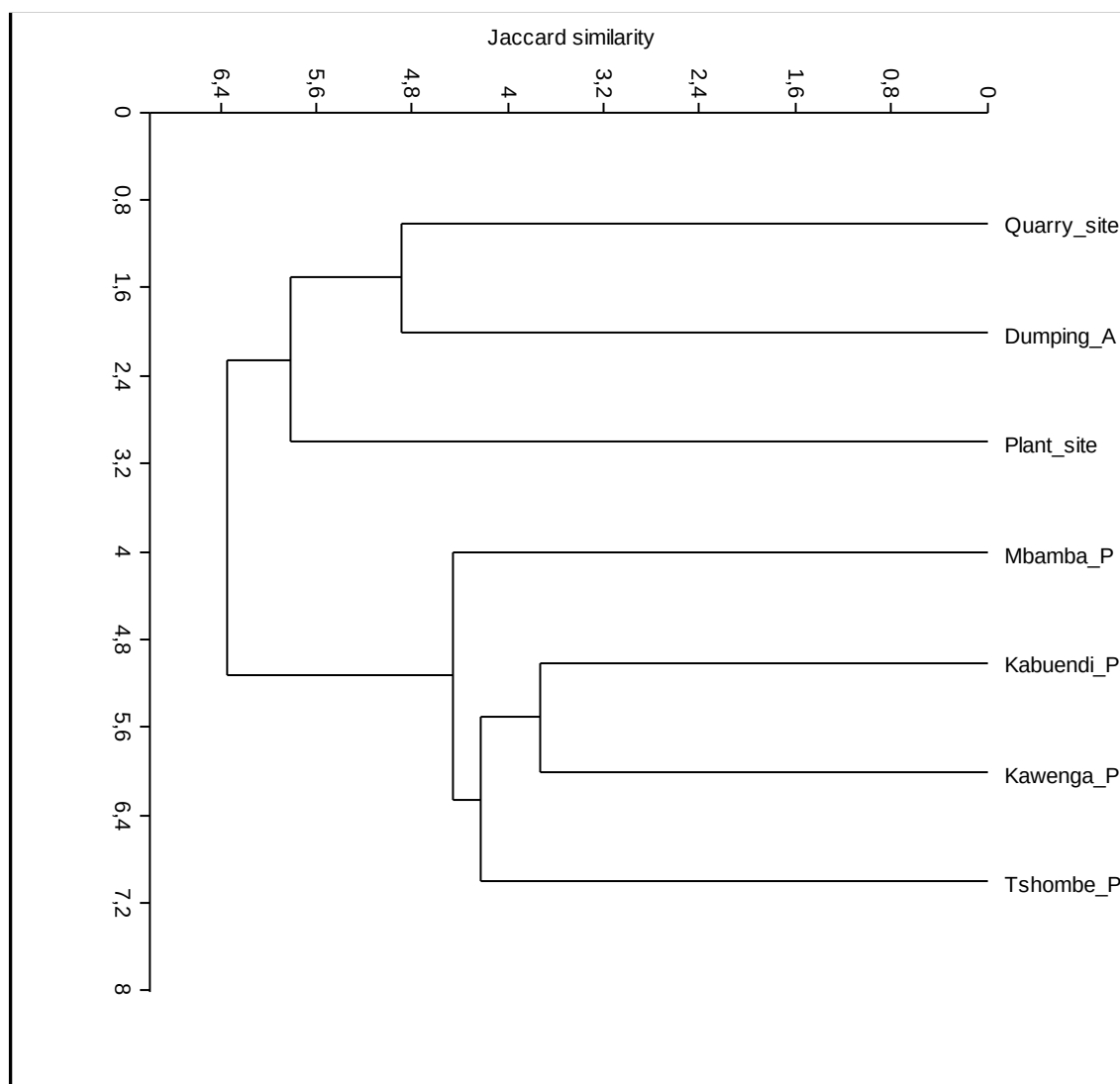


Figure 6-22: Jaccard similarity between sites according to species composition

Faunal diversity

A detailed faunal survey was not conducted by SRK in June 2013 due to a lack of available local experts and time however, various birds, mammals, and insects were observed during the botanical surveys that were conducted from 10 to 14 June 2013 and are described below. On the basis of these observations, the mammal diversity of the study area is believed to be low and bird diversity to be moderate. Mammals observed included rodents and bats, although the occasional presence of monkeys and small antelope in the study area was noted by local villagers and NYA staff. The following birds were observed on site: Red Bishop, Flycatcher spp. (yellow and white necked), Pied Crows, Kite sp. (brown; Eperivier), Swallow sp., Laughing Dove (*Spilopelia senegalensis*), Kingfisher sp. (medium size, white and brown), Sparrow sp., Francolin sp., Egret sp., Grebe sp., Woodhoopoe sp. and Hornbill sp (black with white underbelly and slightly yellow beak). A species of Malibe bird (*Malimbus* sp.) was noted by local villagers to frequent the wetlands of the study area and surrounds at the end of the wet season, but not for breeding purposes.

The insect diversity of the site is undoubtedly higher than that of mammals and birds. A wide array of ants, termites, moths, dragonflies, flies, wasps, praying mantis, crickets, butterflies, and various beetles were observed. High insect diversity is typical of African savannah ecosystems, where high levels of spatial heterogeneity are present (du Toit and Cumming, 1999). Photographs of various insects observed in the study area are provided in Table 6-15.

Table 6-15: Various insects observed in the study area including flies, beetles, moths, and praying mantis

Amphibians and reptiles recorded in the Bas-Congo Province are specified in Table 6-8 and Table 6-9. The faunal species described by the local communities to SRK as being present in the study

area are specified in Table 6-16. Table 6-17: describes the faunal species that likely occur in the study area, as described by local communities to OEMS. Only one species of frog was observed however on the project site during the site visit (see Figure 6-23).

Table 6-16: Faunal species described by the local communities to SRK as being present in the study area

Family	Name	Description	Usage	Location	Frequency
Fish	Tilapia	-	Consumption	Rivers throughout the site	Common
	Cat Fish	-			Common
	Carpe	-			Common
	Mongo	-			Common
	Mufungua	-			Common
	Vundu	-			Common
	Binkoko	-			Common
	Nzonzi	-			Common
	Kungan-Gando	-			Common
	Ntondi	-			Common
	Ntondi-Biongo	-			Common
	Ndadi	-			Common
	N'semo	-			Common
	Nsula	-			Common
	Nkunki	-			Common
	Ngolola	-			Common
	Mabundu	-			Common
	Babinta	-			Common
Birds	Moineaux	-	-	Throughout the site	Common
	Pigeons	-	-		Common
	Vulture	-	-		Common
	Crows	-	-		Common
	Eperviers	-	-	Throughout the site	Common
	Hiboux	-	-		Common
	Eagles	-	-		Common
	Fish Eagles	-	-		Common
	Perdrix	-	-		Common

Family	Name	Description	Usage	Location	Frequency
	Pintades	-	-		Common
	Nkuanki	-	-		Common
	Bikiyongo	-	-		Common
Reptiles	Vipers	-	-	Throughout the site	Common
	Mbamba	-	-		Common
	Nkungulu	-	-		Common
	Tavila	-	-		Common
	Boa	-	-		Common
	Nduma	-	-		Common
	Python	-	-		Common
	Salamander	-	-		Common
	Crocodile	-	-		Rare
	Lizard	-	-		Common
	Tortoise	-	-		Rare
Mammals	Antelope	-	-	Throughout the site	Common
	Monkey	-	-		Common
	Nkewa	-	-		Common
	Rats	-	-		Common
	Wild pigs	-	-		Common
	Aulacote	Medium size rodent	Consumption		Common

Table 6-17: Likely fauna species in the study area as identified by OEMS via community consultation

Family	Genus and species	Common name	Protected/ Rare species
MAMALIA			
Viverridea	<i>Veverra civeta</i>	Civet	IUCN Near Threatened
Canidea	<i>Lycaon pictus</i>	Hyena	
Suidea	<i>Phacochoerus ethiopicus</i>	Phacochere	
Bividea	<i>Cephalopus sylvicultor</i>	Cephalophe	
Manidae	<i>Phataginus tricuspis (likely)</i>	Tree pangolin	
Hystridea	<i>Hystrix africanus australis</i>	Porcupine	IUCN Least Threatened
Leporidae	<i>Lepus saxatilis</i>	Hare (lumba)	
Sciuridae	<i>Paraxerus cepapi</i>	Smith's bush squirrel	
	Unknown	Antelope (nkai)	

Family	Genus and species	Common name	Protected/ Rare species
REPTILIA			
Gekkonidea	<i>Henidactylus mabouia</i>	Tropical house gecko	
Hamaleonidea	<i>Camealeo owenii</i>	Owne's chameleon	
Tyhopidea	<i>Tyhlops</i> sp.	Blind snake	
Viperidae	<i>Bitis nasicornis</i>	Rhinoceros viper	
Pythonidae	<i>Python sebae</i>	African rock python (mboma)	
AVES			
	<i>Numida meleagris</i>	Helmeted guineafowl	
	<i>Hirundo angolensis</i>	Angolan swallow	
<i>Vulturidae</i>	Unknown	Vulture (mbemba)	
	<i>Corvus albus</i>	Pied crow	
	<i>Accipiter melanoleucus</i>	Black Sparrowhawk	
	<i>Passer griseus</i>	Northern Grey-headed sparrow (maseka)	
	<i>Streptopelia turtur</i>	Turtle dove	
	<i>Ploceus cucullatus</i>	Black-headed weaver	
<i>Titonidae</i>	<i>Tyto capensis</i> (likely)	African grass owl	
	<i>Streptopelia senegalensis</i>	Laughing dove	
	<i>Psittacus erithacus</i>	African grey parrot	IUCN Vulnerable
INSECTA			
Blattodea	<i>Blatta orientalis</i>	Oriental cockroach	
Gryllotalpida	<i>Gryllotalpa</i> sp.	Mole cricket	
Gryllidea	<i>Gryllis</i> sp.	Field cricket	
Formicidae	<i>Dorylus</i> sp.	Army ant	
Muscidea	<i>Musca domestica</i>	House fly	
Glossinidae	<i>Glossina</i> sp.	Tsetse fly	
PISCES			
Lepidosirenidea	<i>Protopterus dolloi</i> (likely)	Slender lungfish	IUCN Least concern
Polypteridae	<i>Polypterus ornatipinnis</i>	Ornate bichir	IUCN Least concern
Mormyridae	<i>Mormyrops anguilloides</i> (likely)	Electric fish	IUCN Least concern
Mochokidae	<i>Synodontis</i> so.	Upside-down catfish	
Characidae	<i>Hydrolycus</i> sp.	Dogtooth characins	
Mormyridae	<i>Gnathonenus elephas</i>		IUCN Least concern
Citharinidae	<i>Citharinus gibbosus</i>		IUCN Least concern
Arapaimidae	<i>Heterotis niloticus</i>	African arowana (bonytongue)	IUCN Least threatened
Distichodontidae	<i>Distichodus fasciolatus</i>	Sharktail distichodus	IUCN Least concern
Cyprinidae	<i>Labeo longipinnis</i>		IUCN Least concern

A number of the species identified by local communities as occurring in the study area are listed on the IUCN Red List, most notably *Psittacus erithacus* (African grey parrot) that is classified as Vulnerable and *Phataginus tricuspis* (Tree pangolin) that is classified as Near threatened. The

project however is not expected to affect populations of the IUCN Red List species in a substantial way in the study area.

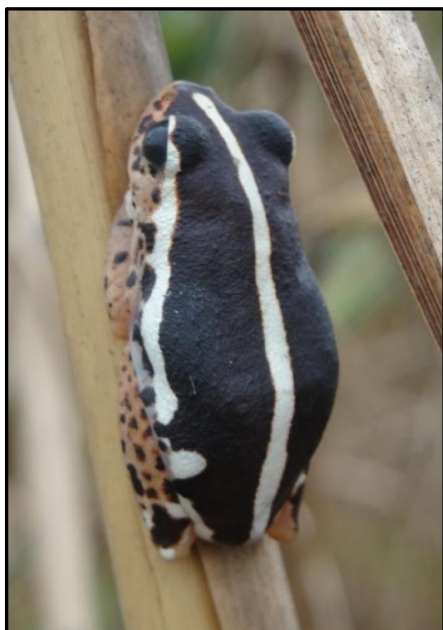


Figure 6-23: Tree frog observed at the project site

Protected areas

No Protected Areas, Important Bird Areas (IBA) or RAMSAR sites are present within a 10 km radius of the project site (see Figure 6-24) (IBAT, 2013; Evans and Fishpool, 2001; RAMSAR, 2013; Birdlife, 2013). The nearest IBA is the Luki Forest Reserve near Boma, approximately 120 km west of the study area (Birdlife, 2013).

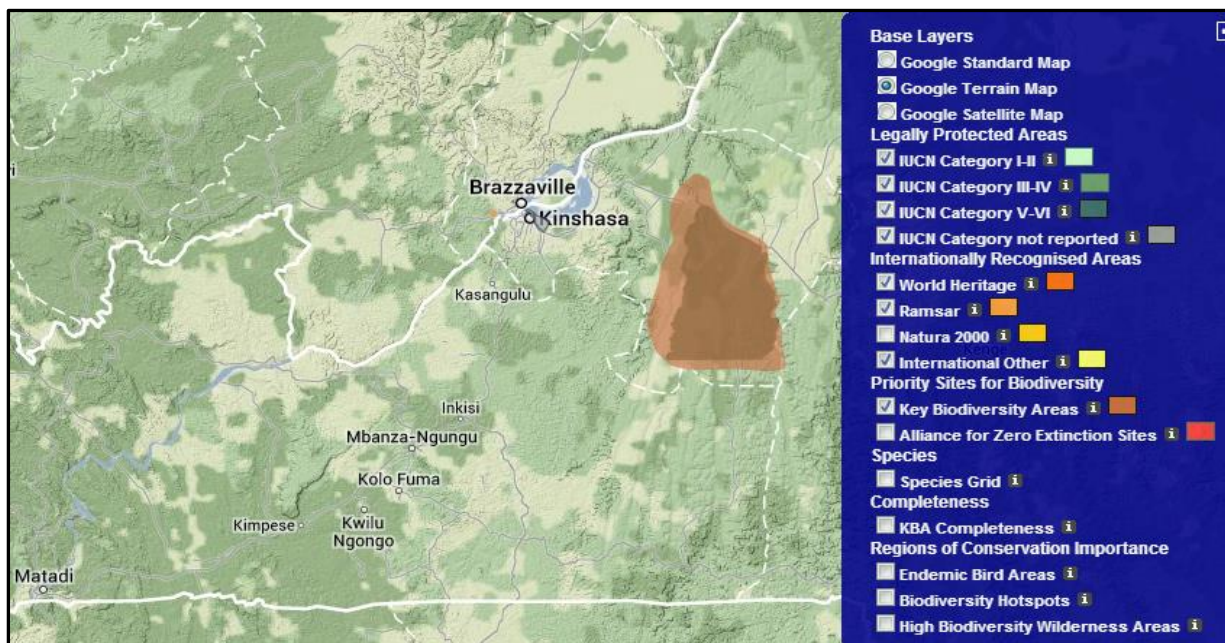


Figure 6-24: Protected Areas in the Bas Congo province and surrounds in relation to the project site (IBAT, 2013)

Ecosystem Services

The various aquatic and terrestrial natural resources in the study area provide a range of ecosystem services that are used by local villagers. These ecosystems services were documented via a social

survey undertaken by SRK in June 2013 (results are presented in Section 6.5. The most notable ecosystem services are:

- provision of drinking water,
- cultivation of crops (e.g. Cassava),
- wood collection for charcoal production,
- grazing land, and
- hunting for bush meat.

Existing anthropogenic impacts on biodiversity and current habitat condition

During the site visit in June 2013, SRK observed that the majority of the habitats in the study area are in a natural condition, but patches of vegetation have been cleared for the planting of crops throughout the concession (modified ecosystem), particularly adjacent to the wetlands, rivers and streams. Some areas of savannah have also been burned in order to improve human access to areas where the grass component had become particularly dense. Burning was also noted as a hunting method to drive mammals out of vegetative cover. A camp in the south-east of the study area for the grazing of cattle was noted, with evidence of intensive grazing and a higher prevalence of woody species present. Wood collection was observed at various sites in the study area. Such wood is typically either used as fire wood or for charcoal production. Bush meat is caught in the study area by local villagers via traps and hunting with rifles.

The vegetation in the study area is consequently deemed to comprise principally of intact savannah and forest (natural habitats), with some degraded natural areas and a number of cultivated lands present (modified habitats). None of the habitats in the study area were deemed to warrant classified as critical in terms of IFC PS6 (2012), but the wetlands, watercourses (including swamps), Gallery and Swamp forests were noted as important habitats and impacts thereon should be avoided to the greatest extent practically possible. The habitats in the study area were deemed Priority Ecosystem Services in terms of IFC Performance Standard 6 (i.e. High Conservation Value 5), by virtue of the natural and cultivated areas being fundamental to meeting the basic needs of the local communities.

6.4 Noise

The noise levels were measured by ECTECH on the same points as that for ambient air quality and total suspended particulates. Monitored data are shown Table 6-18.

Table 6-18: Noise Levels Measured Data (Source: ECTECH, 2013)

Date	dB(A)										Leq
Reference Point # 1: Quarry Area											
14-11-2012	43	43	43	44	44	44	45	45	46	46	44.44
14-11-2012	36	36	36	37	37	37	37	38	38	38	37.06
14-11-2012	31	31	31	32	32	32	32	33	33	34	32.20
Reference Point # 2: Plant area											
14-11-2012	40	40	40	40	41	41	41	42	42	42	40.98
14-11-2012	35	35	35	36	36	36	37	37	37	38	36.31
14-11-2012	38	38	38	38	39	39	40	40	40	41	39.22
Reference Point # 3: Near Kokolo Village											

Updated ESIA for NYA Cement Project – updated in response to lender requirements

15-11-2012	46	46	46	46	47	47	47	48	48	49	47.11
15-11-2012	42	42	42	43	43	44	44	45	45	45	43.68
15-11-2012	43	43	44	44	45	45	45	45	45	46	44.59
Reference Point # 4: Near Kinsua Village											
15-11-2012	42	42	42	42	43	43	44	45	45	45	43.48
15-11-2012	40	40	40	41	41	41	42	42	43	43	41.44
15-11-2012	36	36	36	37	37	37	38	38	38	39	37.31
Reference Point # 5: Near Mbemba Village											
14-11-2012	50	50	50	51	51	51	52	52	52	53	51.31
14-11-2012	46	46	47	47	47	48	48	48	49	49	47.62
14-11-2012	43	44	44	44	45	45	45	46	46	46	44.90
Reference Point # 6: Near Yuku Village											
14-11-2012	43	43	43	43	44	44	44	45	45	45	43.98
14-11-2012	37	37	37	38	38	38	38	39	39	39	38.06
14-11-2012	30	30	30	31	31	31	32	32	32	33	31.31
Reference Point # 7: Near Matala Village											
	43	43	43	44	44	45	45	45	45	46	44.41
	36	36	36	36	37	37	38	38	38	38	37.09
	33	33	33	34	34	35	35	35	36	36	34.54
Reference Point # 8: Near Mbamba Village											
14-11-2012	49	49	49	49	50	50	50	51	51	52	50.11
14-11-2012	39	39	39	40	40	40	40	41	41	41	40.06
14-11-2012	45	45	45	46	46	46	47	47	48	48	46.44
Reference Point # 9: Road towards quarry											
14-11-2012	45	45	45	46	46	47	47	47	48	48	46.54
14-11-2012	37	37	37	38	38	38	39	39	39	40	38.31
14-11-2012	40	40	41	41	42	42	42	43	43	43	41.38
Reference Point # 10: Near Workers Camp Site											
14-11-2012	47	47	47	48	48	48	49	49	49	49	48.17
14-11-2012	40	40	40	40	41	41	41	42	42	42	40.98
14-11-2012	43	43	44	44	45	45	45	46	46	47	44.97

Adverse Health Effects of Noise Pollution

Based on the World Health Organization Guideline for Community Noise, some of the effects of Noise pollution include direct and cumulative adverse health effects by degrading residential, social, working, and learning environments with corresponding real (economic) and intangible (well-being) losses.

The World Health Organization has documented seven categories of adverse health effects of noise pollution on humans of which some are:

- 1. Hearing Impairment:** Hearing damage is related to duration and intensity of noise exposure and occurs at levels of 80 dB or greater. Children seem to be more vulnerable than adults.
- 2. Interference with Spoken Communication:** Noise pollution interferes with the ability to comprehend normal speech and may lead to a number of personal disabilities, handicaps, and behavioural changes including problems with concentration, fatigue, uncertainty, lack of self-confidence, irritation, misunderstandings, decreased working capacity, disturbed interpersonal relationships, and stress reactions.
- 3. Sleep Disturbances:** Noise pollution is a major cause of sleep disturbances. Noise pollution during sleep causes increased blood pressure, increased heart rate, increased pulse amplitude, vasoconstriction, cardiac arrhythmias, and increased body movement. Secondary effects include fatigue, depressed mood and well-being, and decreased performance.
- 4. Cardiovascular Disturbances:** Noise pollution may be a risk factor for cardiovascular disease, acute exposure to noise activates nervous and hormonal responses, leading to increased blood pressure and heart rate and to vasoconstriction. If the exposure is of sufficient intensity, there is an increase in heart rate and peripheral resistance.
- 5. Disturbances in Mental Health:** Noise pollution is not believed to be a cause of mental illness, but it is assumed to accelerate and intensify the development of latent mental disorders. Noise pollution may cause or contribute to anxiety, stress, nervousness, nausea, headache, emotional instability, argumentativeness, sexual impotence, changes in mood, increase in social conflicts, neurosis, hysteria, and psychosis.
- 6. Impaired Task Performance:** Noise pollution impairs task performance, increases errors, and decreases motivation, reading attention, problem solving, and memory are most strongly affected by noise.

Groups Vulnerable to the Effects of Noise Pollution: Although everyone may be adversely affected by noise pollution, groups that are particularly vulnerable include infants, children, those with mental or physical illnesses, and the elderly. Because children are particularly vulnerable to noise induced abnormalities, they need special protection.

6.5 Socio-Economic Conditions

Socio-economic conditions prevailing in the project area are summarised below and reported in more detail under the subsections thereafter.

6.5.1 Methodology

Purpose of the additional baseline assessment

The purpose of the additional socio-economic baseline study was to cover the gaps identified by ERM following their ESDD of the original ESIA. These gaps were:

- More detailed information on the affected settlements;
- Accommodation requirements for workers during construction and operations;
- An assessment of the risks associated with the presence of the police used as a subcontractor of the security company; and
- An understanding of the potential health and safety risks and impacts associated with the activities of the proposed mine.

The additional information was collected in June 2013 by SRK in order to:

- Understand the socio-economic environment prior to the development of the project so as to predict and, where possible, quantify possible impacts;
- Have baseline data available to ensure that the proposed resettlement of Yuku Camp Village can take place efficiently and without prejudice to the affected community;
- Understand in more detail how people in the project area live i.e. determine their livelihood strategies, beliefs and customs ;
- Describe people's livelihood strategies and education levels in more detail;
- Identify the type of social services and infrastructure that is currently available on site; and
- Determine the development needs that have been identified by local communities.

This information was collected by SRK using primary data collection techniques, namely household surveys, focus group interviews and key informant interviews; and secondary data review, namely existing documents published by government departments,

Project team

The core socio-economic baseline project team included Vuyo Matshikiza, Philippe Katuta, Bertrand Nkouemou and Huguette Besa from SRK Consulting. The team was in the DRC from 12th to 21st June 2013. SRK used two interpreters from surrounding settlements who were proficient in various local languages to communicate with survey participants. These languages included French, Kikongo, and Lingala. The full site team is presented in Tab;e 6-19.

Table 6-19: Socio-economic fieldwork

Team member	Organisation	Duties and responsibilities
Vuyo Matshikiza	SRK Consulting (Johannesburg)	Lead Socio-Economist
Philippe Katuta	SRK Consulting (Lubumbashi)	Socio-Economic Coordinator
Huguette Besa	SRK Consulting (Lubumbashi)	Fieldworker/assistant
Bertrand Nkouemou	SRK Consulting (Yaoundé)	Social Specialist / Field worker
Adolphe Lubikulu	Nyumba Ya Akiba / community member	Translator
Simon Lubikulu	Nyumba Ya Akiba / community member	Translator
Antoine Bibangis	Nyumba Ya Akiba	Driver
Pathou Makumi	Nyumba Ya Akiba	Driver
Pierre Kisukisa	Nyumba Ya Akiba	Driver

Sources of information

Various data collection tools were used including:

- Key informant interviews,
- Focus group meetings; and
- Household surveys.

An introductory meeting was held between SRK Consulting members of the “*Ayants droit*” – adjacent communities living in the project area comprising Kinsua, Mawete, Nkondo-Kiombia, Nkonda, Tandu and Nionga, NYA and the leadership of the affected area on 7th and 11th June 2013. In attendance were the traditional chiefs and the village elders. An attendance register of the participants who attended the meeting is included in Appendix 8.1.

The objectives of the meeting were to:

- Formally introduce the SRK team to community leaders;
- Highlight the objectives of the fieldwork;
- Identify local interpreters who would eventually be used during the study; and
- Request assistance from the affected communities’ leadership to further meetings.

Household surveys

Eighty seven household surveys were conducted from 12th to 19th June 2013. SRK used an automated survey process which incorporated capturing survey data directly onto iPads. This component of the work covered Yuku Camp and the adjacent communities.

Ninety five household surveys were undertaken in the project area, covering approximately 440 people in total. Households were defined as compounds comprising a number of structures including bedrooms, toilets and kitchens, which were headed by one household head.

Data, including information on household members, economic activities and livelihood strategies, household structures, health and development needs, was collected.

Individual households were sampled randomly from classes based on their size and location, ensuring that large, medium and small households were included in each of the villages surveyed.

Table 6-20 shows the number of households sampled and surveyed in 9 surrounding villages. The survey questionnaire is presented in Appendix 8.2. The corresponding coding sheet is presented in Appendix 8.3. Figure 6-25 shows Yuku Camp where household surveys were undertaken.

Table 6-20: Villages included in the household survey

Household surveys	Number of households
Mbamba	5
Yuku Camp	9
Nkondo-Kiombia	18
Kokolo	5
Mawete	7
Minkelo	27
Nianga	3
Mbemba	8
Nkonda	5
Total	87



Figure 6-25: Yuku Camp

Focus group meetings

This component of the work included focus group meetings held separately with men, women and youths in Yuku Village, Kinsua, Kokolo, Minkelo, Nkondo-Kiombia. The meetings were held after the household survey and took approximately two days to complete. The size and nature of the settlements were key in determining the location of the meetings. Mawete, Minkelo and Nkonda were some of the largest and the more formal settlements in the project area. The villages and dates

during which the focus group meetings were undertaken are listed in Table 6-21. Focus group schedules are included as Appendix 8-4.

Table 6-21: Focus group meetings undertaken in project area

Focus group meetings	Stakeholder group	Dates
Yuku	Men, women	19 th and 15 th June 2013
Kokolo	Men, women	19 th June 2013
Nkondo-Kiombia	Men, women and youth	16 th June 2013
Mbemba	Men, women	19 th June 2013
Mawete	Men, women and youth	15 th and 13 th June 2013
Kinsua	Men, women,	19 th June 2013
Minkelo	Men, women and youth	15 th and 13 th June 2013

Key informant interviews

Semi-structured interviews were held in Songololo, Kimpese and site. The location and dates of these meetings are provided in. Table 6-22.

Table 6-22: Key informant interviews participants

Stakeholder group	Location	Date
Local traders	Minkelo and Mawete	21 st June 2013
Teachers	Kimpese	20 th June 2013
Health post superintendent	Minkelo and	19 th June 2013
Local Administration	Songololo and Mawete	21 st June 2013
Police	Mawete	21 st June 2013
Train station Superintendent	Minkelo	20 th June 2013
<i>Centre Regional d'Appui et de Formation pour le Developpement (CRAFOD)</i>	Kimpese	19 th June 2013

Assumptions and limitations

The following assumptions and limitations relate to the NYA Project:

Assumptions

- SRK prepared a Resettlement Action Plan (RAP) in Yuku Camp assuming that there were elements from the project description that warranted the resettlement of the settlement (physical and economic). These include haul roads and the cement processing plant;
- SRK assumed that there would be one household head per household and that a total of 82 household heads would be interviewed. In cases where the household head was absent at the time of the interview, the second person in charge of the household, usually the spouse, was requested to participate in the survey;
- It was assumed that interviewees responded truthfully to questions posed to obtain information for the social baseline study; and
- The village focus group and household survey discussions generated estimates rather than exact figures. Some of the quantitative data in this report, particularly relating to the ages of household members, incomes and expenses may therefore not be precise.

Limitations

- This work has been done without an accurate project description. SRK's knowledge of the project footprint was therefore limited at the time the fieldwork was undertaken. It is SRK's understanding that the project description will be finalised once the feasibility study is complete; and
- In the absence of a final project description, it is not possible to ascertain the full extent of the physical and economic displacement. This aspect will need to be re-examined once a finalised project description is available.

6.5.2 Regional context

Brief historical context

The project area once belonged to the Kongo Kingdom, which measuring approximately 1,685 square miles and comprised what is now known as western Congo Brazzaville, northern Angola, southern Gabon, the Central African Republic and the western DRC.

Following the Berlin Conference in 1885, France, Belgium, Britain, Portugal and other colonial powers, split Africa into colonies. The division meant that ethnic groups which were previously united by the same historical background, languages, culture and beliefs were divided by international boundaries. This is the case with the Territory of Songololo in the DRC in which the site is located, 12km away from Northern Angola.

In this context, cross-boundary exchanges between Angolans and Congolese in this region including trade, marriages, and the use of social amenities is and has always been common. During the intensification of the civil war in Angola in the mid-1975, Angolan refugees fled to the DRC, at the time known as Zaïre.

Following Jonas Savimbi's death in 2002, refugees returned to Angola. In 2009, Cabinda, an Angolan province landlocked between Congo Brazzaville and the DRC, deported DRC nationals who lived there. The DRC retaliated by deporting Angolan nationals who had been living in Bas-Congo for decades. Some Angolans have since return to the DRC.

From 2011 to 2012, the United Nations High Commission for Refugees (HCR) provided free and voluntary migration of Angolan citizens to Angola. The region around the border between Angola and the DRC has one culture and so there will always be constant migration between the two countries.

Land tenure

Land during the colonial era belonged to Belgium. These who lived there during the arrivals of the Belgians were dispossessed and treated like squatters or slaves. When the Congo Free State was established in 1885, Belgium became the sole custodian of the land. Although the law of 1885 recognised the use of the land by local people, much of the decisions affecting that land were taken by Belgium. In other words, Congolese people could use the land but only Europeans could own it.

After the independence in 1960, the new State became the sole custodian of the land including forests and mineral resources. This law was reinforced by the ratification of the “*Loi Foncier*” or Law of the Land 1973 (Cath Long, no date). According to Cath Long, this had done nothing to allow Congolese people to land. In fact, land remained in the hand of very few and rich individuals.

Today, the DRC government has sovereignty over the land but is not the proprietor of the land. The Constitution recognises private ownership of the land and its resources, obtainable through Common or Customary Law.

Governance

The project site is located in the province of Bas-Congo in DRC. The project site falls under the jurisdiction of district Cataractes and Territory of Songololo. Bas-Congo is also known as Central Kongo and is the only province with a coastline (Atlantic Ocean). It borders the provinces of Kinshasa to the north-east, Kwango to the east, and the Republic of Angola to the south as well as the Republic of Congo and Cabinda to the north. Matadi is the provincial capital of Bas Congo.

The Territory of Songololo is split into two *Cités* (Kimpese and Songololo⁸) and five *Secteurs* or Sectors, namely Bamboma, Kimpese, Luima, Palabala and Wombo. The NYA Project is in the Luima Sector which comprises the following:

- 3 *Groupements* (Ngombe Makulukulu - where the project is located, Kimpese and Palabala);
- 4 *Agglomerations*; and
- 95 villages (*Territoire de Songololo*, Annual Report 2012).

The Luima Sector covers approximately 1 700km² and is governed by a *Chef de Secteur Interimaire* or Interim Sector Chief. It was alleged during a key informant interview with the Interim Sector Chief that the official Sector Chief recently vacated his post and never returned. No reason was given for his departure.

Administratively, the Luima Sector comprises several departments, namely:

- The Sector Registrar – comprising three staff members. This registrar focuses on matters relating to demographic information, marital status and statistics on births and deaths;
- The Environmental Department – comprising one staff member. This department focuses on matters relating to environmental licenses for cutting trees, sanitation, environmental audits, taxes on pollution for companies including small traders (charcoal makers) and medium to large companies. The key informant meeting with the Interim Sector Chief revealed that this department is not well funded;

⁸ The Territory and Cité share the same name

- The Department of Agriculture – comprising three staff members;
- The Veterinary Services – comprising three staff members;
- The Small and Medium Size Enterprises (SMSE) – comprising one staff member;
- The Arts and Culture Department – comprising one staff member;
- The Tourism Department – comprising one staff member;
- The Police and Intelligence Department – comprising three staff members; and
- The Transport and Communication Department.

Table 6-23 summarises the manner in which the project area is sub-divided administratively.

Table 6-23: Administrative structure in the project area

Jurisdiction	Surface area (km ²)
Territory of Songololo	8 190
Luima Sector	1 700
Groupement Ngombe Makulukulu	-
Yuku village	-

Population

At territory level, there is an estimated 232 870 in Songololo, comprising 91.5% and 8.5% foreign. These figures are almost identical to the ones observed at Sector level (see below). The population density in Songololo is however higher (28.4 per km²).

Three main ethnic groups are represented in the territory, namely:

- The Bamboma;
- The Manianga; and
- The Bandibu.

The total population in Luima is estimated at 26 400 people (91.6% of the population is Congolese and 8.4% is foreign), giving a population density of approximately 15.5 people per square kilometre. No statistics were available at *Groupement* Level.

In 2012, the birth rate in the Territory of Songololo was estimated at 10.1% and the death rate was at 19.8%. This means there was a nett 9.7% decrease in the population in 2012.

Health

The 2012 annual report compiled by officials of the Territory of Songololo does not give an indication of the number of hospitals, clinics, and health posts in the area. Instead, it provides information on the state of health of the population. Figure 6-26 shows selected health indicators in the Territory of Songololo. Additional indicators have been tabulated on Table 6-24. The following trends emerge:

- Generally, there was a decrease in selected health indicators between 2010 and 2012. The criteria “access to health facilities for children aged five and under” and “access to modern latrines” are the only variables showing slight improvements; and

- There is a significant increase in the percentage of “HIV positive mothers receiving ARVs to prevent mother-to-child transmission”; from 0% in 2010 to 100% in 2012. No reason for the increase has been provided.

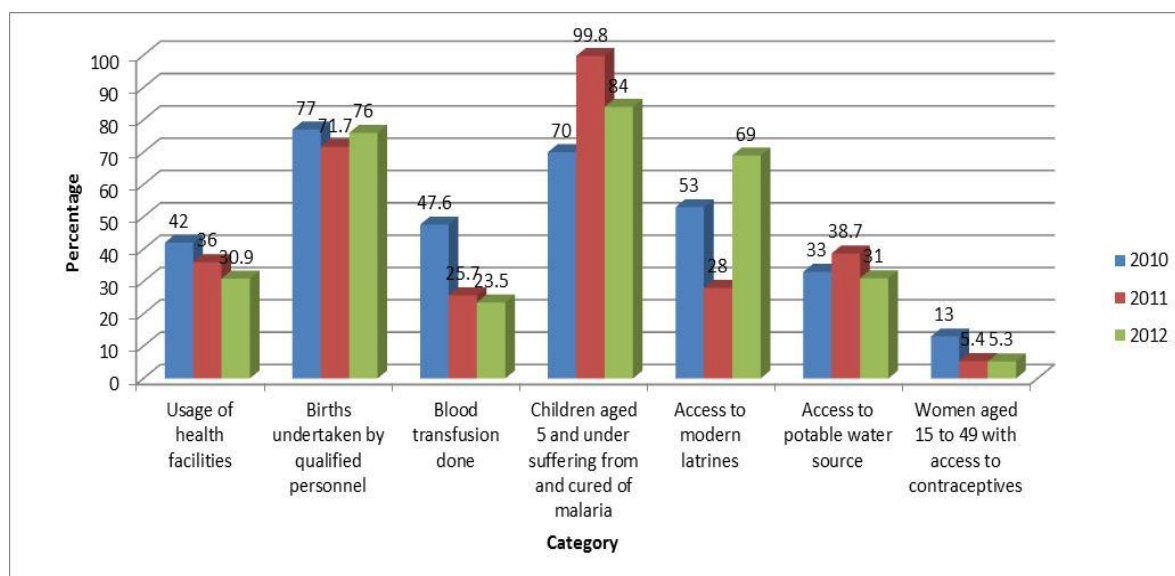


Figure 6-26: Selected health indicators in Songololo

Table 6-24: Additional health Indicators in Songololo

Performance indicators	2010 (%)	2011 (%)	2012 (%)
Occupancy rates at the General Hospital	18	26	31
First-time pregnant women who used health care facilities for the first time	80.3	89.3	88.5
Children aged 12 months or less who use health facilities	83	85	87
Adults infected with HIV and who are receiving ARV treatment	1	6	6
Children infected with HIV and who are receiving ARV treatment	0	1	6
HIV positive mothers receiving ARVs to prevent mother-to-child transmission	0	0.7	100

Healthcare in Songololo is faced with many challenges. These challenges range from a lack of qualified staff to a lack of adequate infrastructure. In particular, the following have been noted:

- A high prevalence of malaria (51.5%);
- Limited access to medication;
- Lack of qualified health personnel;
- Unaffordable consultation rates;
- Lack of funds; and
- Lack of adequate medical infrastructure.

Economics

Principal economic activities

Songololo's Annual Report 2012 states that farming is the main economic activity in the territory and is closely followed by animal husbandry. The region may export its goods to Angola, principally because of its proximity. The main produce grown includes:

- Cassava;
- Beans;
- Ground nut;
- Rice;
- Maize; and
- Butter fruit.

The diversity of animal husbandry in the Territory of Songololo is shown (see Figure 6-27). Two trends are worth noting here. Firstly, Kimpese Sector is by far the biggest economic node. The settlement produces far more of everything, except for cattle, than the other settlements and secondly Luima Sector – where the project is situated is the third biggest producer of farm animals in the Territory of Songololo.

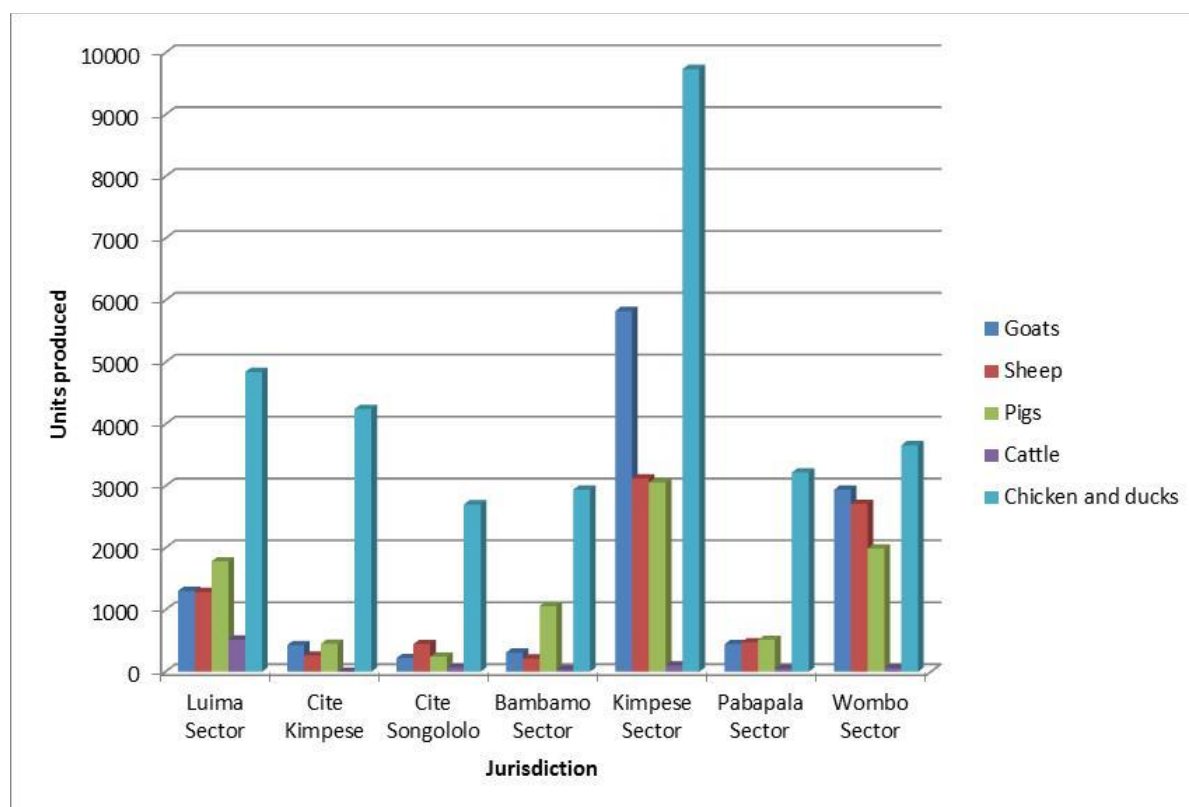


Figure 6-27: Statistics on animal husbandry in the Territory of Songololo

Fishing

Rudimentary methods for fishing are used in the area and because this livelihood strategy is not monitored, statistics on quantities and types of fish taken from the surrounding areas are unavailable.

Hunting

According to the Songololo Annual Report, there are few controls evident to regulate hunting. This means that permits for hunting are not being issued, hunting locations are unknown and the quantities and types of animals hunted are unknown.

Hospitality and tourism

There are three One Star rated hotels/guesthouses and around seven hotels/guesthouses without rating in the Territory of Songololo. For the most part, these hotels and guesthouses are situated in large settlements such as Kimpese.

There are no tourist attractions in the area and so the reasons for people checking into these hotels and guesthouses are assumed as business related and personal activities such as attending local government meetings, buying or selling of goods and services, or visiting family and friends. The occupancy and capacity of these hotels/guesthouses in 2012 are provided in Table 6-25.

Table 6-25: Capacity and occupancy of hotels and guesthouses in Songololo

Name of establishment	Total capacity		Occupancy by nationality			
	Rooms	Beds	Congolese	African	Other	Total
Espace Nzilco	14	16	87	5	9	101
Poulet Show	6	6	287	-	-	287
Ile Patmos	10	10	97	4	-	101
Makoso	12	12	793	18	-	811
La Grace	14	14	888	3	-	891
La Fleur	10	10	342	21	-	363
Le Galant	19	19	219	3	-	222
Acheminisha	4	4	132	-	-	132
Doyin Stars	16	16	371	18	-	389
M.C Amar	10	10	252	6	5	263
Total	115	117	4 356	78	14	3 560

Market place

Two governing bodies monitor the economic activities in Songololo. These are: the *Fédération des Entreprises du Congo* (FEC) and the *Confédération des Petites et Moyennes Entreprises du Congo* (COPEMECO).

The biggest economic node in the project area is Kimpese, where most or all the goods coming to and from Matadi and Kinshasa pass through. Kimpese is situated approximately 36 kms from the project site.

There are three main markets in the Luima Sector. Key informant said that traders occasionally come from Kimpese to sell their goods. These markets are:

- Minkelo which operates every week on Tuesdays;
- Lisonga which operates every week on Thursdays; and
- Lufu-Frontiere which operates twice a month on Saturday.

6.5.3 Local context

Settlement patterns and land use

Larger settlements such as Mawete and Minkelo Village consist of residential areas interspersed with basic social and commercial infrastructure. The village centre generally consists of a public area and a church, while the clinic, water boreholes and small businesses are scattered around the village. Cemeteries are usually located in the outskirts of the settlement.

Typically, villages are surrounded by agricultural fields and grazing occurs within the villages. The baseline assessment undertaken by SRK in June 2013 reveals that 97% of households are dependent on the land ecosystem services other than for agriculture. People use natural resources such as reeds/grass, mud, poles and wattle to build infrastructure. The different types of land uses are depicted on Table 6-26. The table shows that the overwhelming majority of households (82%) collect firewood for cooking.

Another significant activity for which communities need local resources for is when collecting grass for thatching. Most of the household structures the SRK team saw on site were made from grass collected from the surrounding environment.

Hunting for bush meat occurs occasionally. For the most part, bush meat is purchase rather than hunted by local communities. The meat hunted ranges from small rodents to buck. Figure 6-28 shows a trap used to hunt small rodents.

Table 6-26: Land uses by the population in the project area

Activity involving use of provisioning services	% of households engaging in activity	Typical frequency of use	Typical importance of resource
Collecting firewood for cooking	82%	Daily	Very important
Collecting grass for thatching	59%	When needed	Importance diminishing
Collecting medicinal plant	50%	When needed	Very important
Collecting wild fruits	44%	Very often (in season)	Very important
Fishing	37%	Often (~weekly)	Very important
Charcoal making	31%	Not available	Not available
Hunting small animals and birds	29%	Occasionally (~monthly)	Very important
Grazing of livestock	12%	Very often (~daily)	Important



Figure 6-28: Trap used to hunt small rodents

Population and demographics

The population in surrounding villages – including the Territory of Songololo is estimated at around 232 870 people. The male population represents approximately 48.4% (compared to 49.7% for the national average⁹).

The population in the project area is distributed between Yuku Village (approximately 50 people) and 95 surrounding villages (population unknown). It is estimated that 68% of the population between 0 and 35 years of age. The average age of the female population is identical to that of their male counterparts (26 years), making the overall average age also 26. Different ethnic groups are represented in each village and there is no conflict/rivalry between them. The main ethnic groups living in the area are the Mbomas (36%), the Ndibus (29%), and the Maniingas. The minority groups are the Kakongos (7%), the Yombes and the Sundis (1% each).

Kikongo is the most spoken language in the project area. Survey results show that 47% of the population is able to speak Kikongo. The other widely spoken languages in the area are Lingala (39%), French (14%), and Munukutuba (2%). People generally speak more than one language in the project area (Figure 6-29).

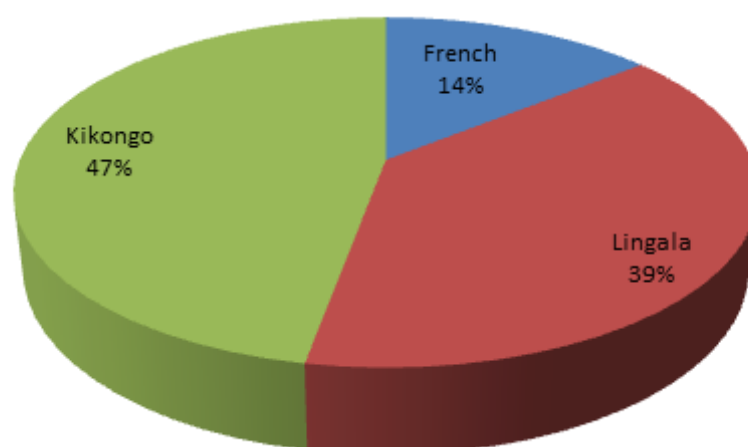


Figure 6-29: Relative percentages of languages spoken in the study area

⁹ Infinteinsight - <http://www.infiniteinsight.net/country/drc.html>

SRK's socio-economic study included a survey of approximately 390 people. SRK's findings relating to gender distributions and ethnicity are illustrated in Figure 6-30. The information shows that while the population group aged between 0 and 15 is predominantly male, the majority of people aged between 66 or more is predominantly female (diagram (a)). Gender distributions for people aged between 36 and 65 is almost identical.

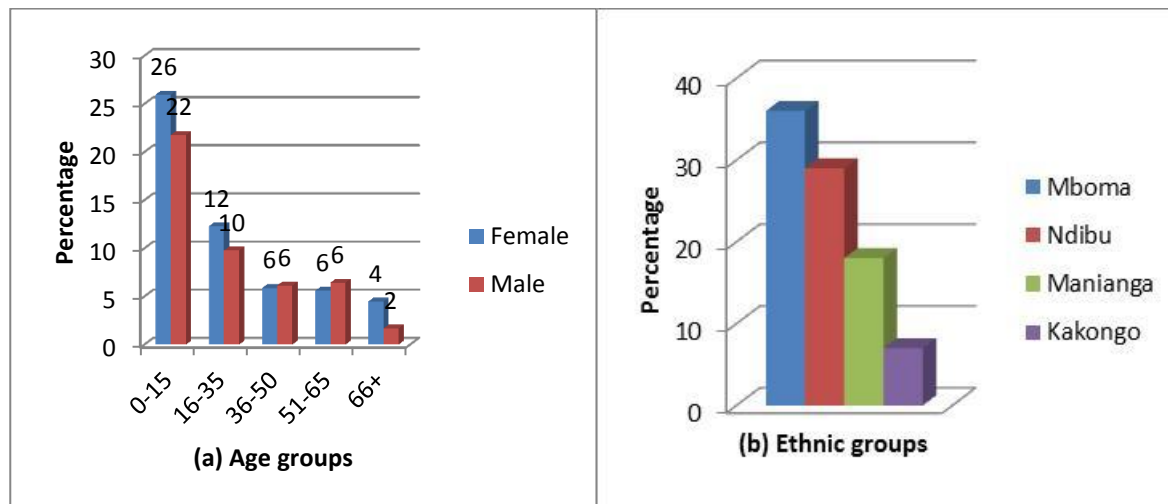


Figure 6-30: Population by age and ethnic groups

Marital status

The data collected during the fieldwork undertaken by SRK in June 2013 reveals that there are more single (63%) than married (32%) people in the project area. The data also shows that unlike most developing countries, people tend to marry relatively late – the proportion of people aged between 15 and 25 is higher in the singles category (13%) than it is in the married category (2%). Figure 6-31 provides a summary of marital status by age. The percentage of people aged 56 or more is also significant (7%).

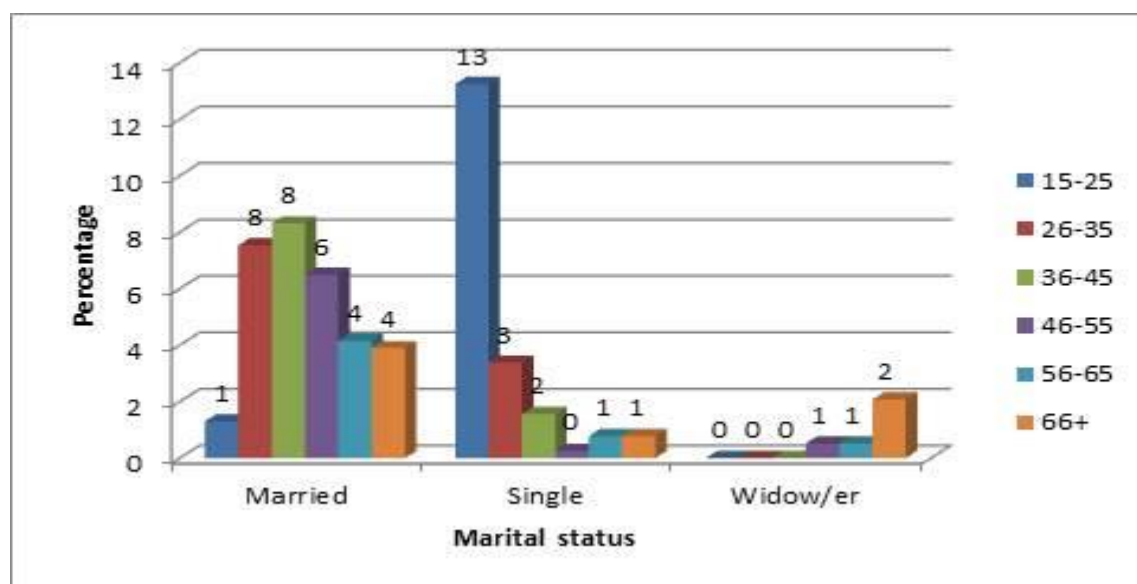


Figure 6-31: Marital status in the project area

Education

The following is reported from the ECTECH ESIA.

The availability of only one middle school in Minkelo for the entire population of these villages, reflects the very poor status of overall education. In absence of transportation means the children have to walk long distances to reach school.

There are no scientific institutes present in or in the near vicinity of the project site. Some small scale (primary and middle school) are present in the Minkelo Village at about 5 km from the plant site.

In 2009, following education institutions were identified in the entire Territory of Songololo:

- nursery schools;
- 186 primary schools;
- 105 high schools.

The nearest town with higher education facilities is Kimpese, which is located at a distance of about 35 km from the project site. Major scientific institutes, universities and collages located in Songololo and Kimpese are: Université Protestante de Kimpese (UPKI) Centre Interdisciplinaire pour l'Education Permanente (CIDEP), Institut Supérieur des Techniques et Chimie Alimentaires, Institut Médical Evangélique (IME) et Institut Médical de Kimpese (IMEK).

Access to education remains a real problem for the local population whose level is very low as it was largely shown above. They often use the so-called official schools where Infrastructures are in a status of dilapidation and where the level of the provided education is poor.⁽¹⁰⁾

In the 2013 socio-economic baseline undertaken by SRK it was noted that:

Three government ministries govern the education system in the DRC, notably the *Ministère de l'Enseignement Primaire, Secondaire et Professionnel* (MEPSP), the *Ministère de l'Enseignement Supérieur et Universitaire* (MESU) and the *Ministère des Affaires Sociales* (MAS).

The system is similar to that of Belgium in that there are six years of primary followed by six years of secondary education. Learners who attend primary school are usually between 6 and 12 years old and those who attend secondary school are typically between 13 and 18 years of age. The education system has suffered from decades of conflict although recent years have shown an improvement.

Education facilities are very poor in the project area. Only school present around the project area is in Minkelo which is about 5 km from the plant site. Some people have to travel to Kimpese and Songololo for higher education.

People in the project site have the choice between two schools, namely Institut Minkelo for primary and secondary school and *Communauté baptiste du CONGO* (CBCO) for primary and secondary school. The more popular of the two (Institut Minkelo) comprises a primary and secondary school. The primary and secondary schools occupy three and two buildings respectively. The school in Minkelo has seen a steady increase in the number of learners over the years due to the influx of people into the area in search of work opportunities. The villages where focus group meetings were conducted make use of these schools as illustrated on Table 6-27.

People who participated in the focus group meetings stated that the majority of school-going children did not attend school, stating lack of funds and the distance children need to travel to attend school as potential deterrents. In addition, literacy rates are said to be very low, ranging from 10% to 20% for men and 5% to 10% for women.

¹⁰ Environmental Impact Assessment and Environmental Management Project Plan, Nyumba Ya Akiba sprl

Table 6-27: Schools used by affected people in the project area

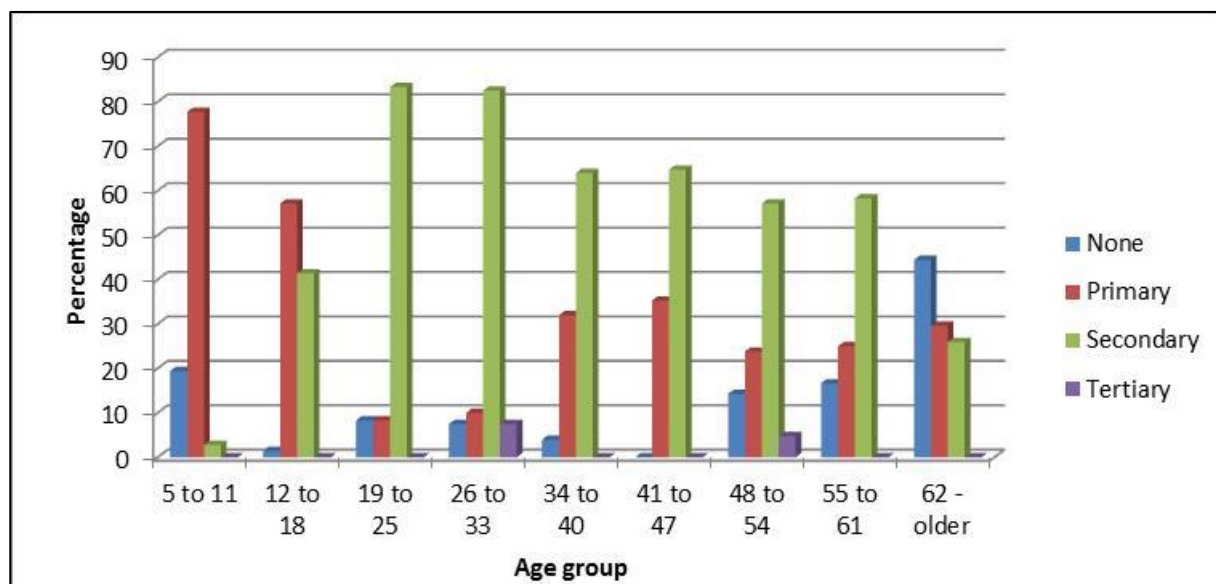
Name of village	Name of school	School level	Distance from village (km)	Annual cost in USD (Primary / Secondary)*
Yuku Camp	Institut Minkelo	Primary and secondary school	2	20 / 117
Kokolo			4	
Nkondo-Kiombia	CBCO Lulu	Primary	2	20
	Institut Minkelo	Secondary	5	117
Mbemba	CBCO Lulu	Primary	2.5	20
	Institut Minkelo	Secondary		117
Mawete	CBCO Lulu	Primary and secondary school	2.5	20 / 117
Kinsua	Institut Minkelo	Primary and secondary school	2.5	20 / 117
Minkelo	CBCO Lulu	Primary	2	20
	Institut Minkelo	Secondary		117

Source: Women focus group meetings

* This information was obtained from the school principal in Minkelo

Figure 6-32 shows SRK's baseline study results on education in the project area. The predominant feature in the figure is that the category of people aged 62 and older that has not been to school is higher than in any other age group and decreases with age. This may be due to the fact that education was not compulsory or available pre and shortly after colonisation.

The other noticeable feature is that very few people have received a tertiary education, making suitable skills challenging to source locally. Only 8% and 5% of people aged 26 to 33 and 48 to 54 has received a tertiary education.

**Figure 6-32: Education levels in the project area**

Housing

Results show that households would typically comprise one structure including bedrooms and living room, forming a compound. People cook and shower outside. These compounds typically have members of the same family, with nephews, uncles, in-laws or cousins on occasion. SRK did not come across instances where the household was too large to be accommodated in the housing. SRK's baseline results show that the average household size is 5 people.

Twenty six percent of the households that participated in the survey undertaken by SRK were established in the area for more than 20 years. This was particularly the case in Minkelo and Nkondo-Kiombia Village with the following being noted:

- 32% of the households have been in the area between 10 and 20 years;
- 16% of the households have been in the area between 5 and 10 years;
- 22% of the households have been in the area between 1 and 5 years and
- 4% of households have been in the area for less than 1 year.

Some of the reasons given for settling in the area were:

- inherited land (39%),
- close to fields and arable land (29%) and
- “other” (24%) - this relates to people who moved to the area because of opportunities other than the potential opportunities with NYA

Most of the resources used to build these houses are collected from the surrounding environment (88%). This is true for everything except for corrugated iron (likely to have been purchased from trading centres such as Kimpese).

Figure 6-33 (a) and (b) shows the types of material used to build roofs and walls for various household structures. As can be seen in Figure 6-33 (a), grass thatching is the main element used to build roofs (77%) and is followed by corrugated sheets (13%). Figure 6-33 (b) shows the materials used to build walls. The most common material used for this purpose is clay and mud. Figure 6-34 shows what a typical household in the project area looks like.

Living style of these people is very simple. They are living in small homes built by handmade bricks. In the past roofs of these houses were built by specific plant materials. Now days steel sheets are used for the roofs.

Ownership of household assets is kept to a minimum in Yuku Camp as well as in the surrounding villages. The main assets owned by households include plastic and wooden furniture (79%), beds with mattresses (83%), mosquito nets, (82%), tables (79%), and radios (54%).

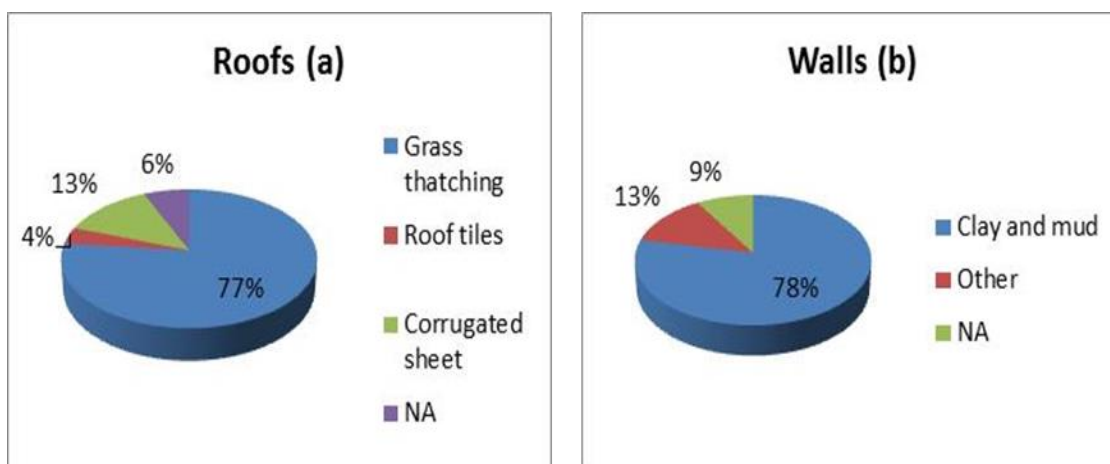


Figure 6-33: Roof and wall types in the project area



Figure 6-34: House in Mawete

Local markets

There are no industries present in and around the project site within the radius of 10 km. Only one site camp of an Indian company, involved in laying the main electric lines, is located at a distance of about 15 km from the project site.

There are no permanent markets in Yuku Camp or in the surrounding villages. The goods consumed on a daily basis are either grown locally or are purchased from Kimpese weekly. Every Tuesday of every week however customers and traders buy and sell goods and services in Minkelo Village. The market starts at 08:00 AM and ends at around 17:00 PM and is located in the middle of the village.

Table 6-28 shows some of the goods sold at the market and their relative prices per unit.

Table 6-28: Items sold at the market in Minkelo Village with their relative prices

Consumables			Non-consumables		
Goods or services sold	Relative price per item (USD)*	Profit margin	Goods or services sold	Relative price per item (USD)*	Profit margin (%)
Rice (25kg)	26.5	25	Clothes (blouses)	2.8	25
Wheat flour (50kg)	36.5	25	Anti-malaria pills (x3)	0.3	30
Bread per unit	Between 0.1 and 0.5	30	Soap (9 bars)	5.0	25
Cassava flour (25kg)	27.5	30	Cosmetics		30
Sugar (50kg)	55.5	30	Moto-taxi (from Minkelo to yuku)	2.8	25
Salt (20kg)	6.6	30	Plastic chairs	10.5	25
Oil (5liter bottle)	5.5	25	Cement (50kg)	14.5	30

* The Congolese Franc / USD exchange rate was estimated at 900:1

Congolese Francs is the currency used in this market for transactions while US Dollar is also accepted and there is no Barter System in this market. Grocery, Clothes and other utensils are being sold and purchased in this market.

Average income and employment levels

The concept of budgeting is not well understood in the project area. When asked how much is earned from a specific activity on a monthly basis, household heads were not able to respond to this question with reasonable accuracy. The analysis that follows is thus an approximation.

People in the project area are very poor. They are dependent on the small scale agricultural activities, small scale fisheries from the nearby rivers especially the Sanzikua River. Some the people from project site used to earn their livelihood by making charcoal from forest wood. They sell this charcoal in the local market and other nearby markets.

Figure 6-35 illustrates the contribution made by each activity to household budgets. Migrant remittances – originating from Kinshasa and Matadi, and the sale of crops, fruits and vegetable are the major contributors to household budget. They account for about USD150 and USD130 respectively. The average in income per household is USD350.

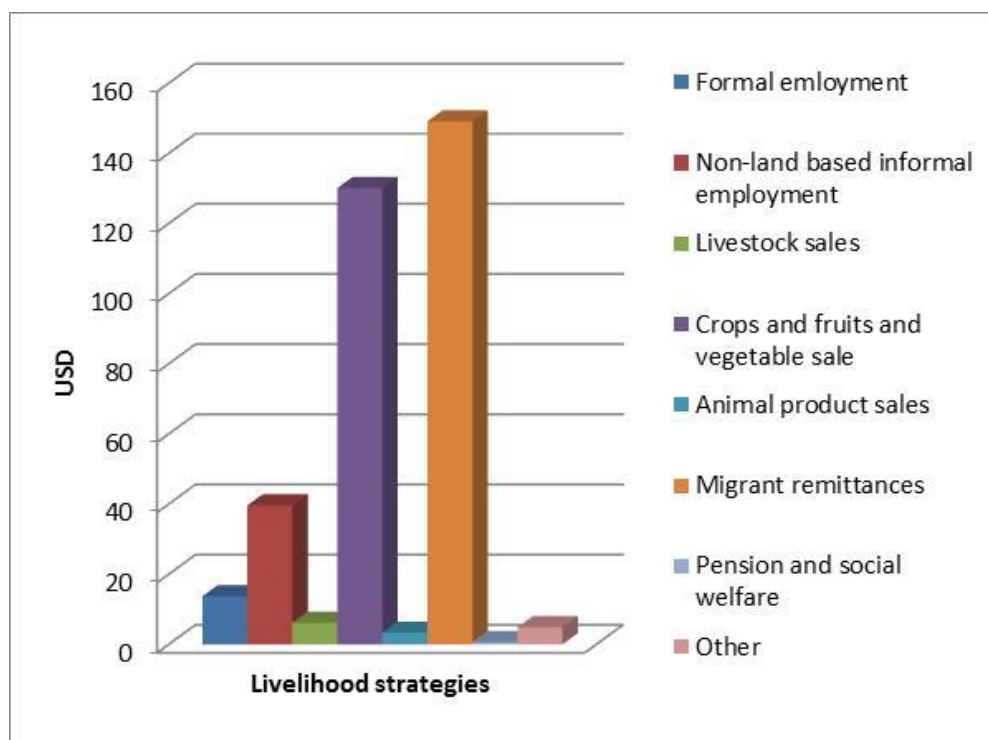


Figure 6-35: Contribution to household budgets by activity

Skills in the project area are limited. Focus group meetings with men, women and youths revealed that the majority of artisans come from neighbouring towns such as Kinshasa and Kimpese. There are no apprenticeship programmes in the area.

The following skills were identified as being available in the project area:

- Carpenters;
- Tailors;
- Blacksmiths;
- Nurses;
- Teachers; and
- Builders.

Some of the challenges that entrepreneurs are subject to include the lack of microfinance, the lack of adequate tools to practice a particular trade, and the lack of good roads and electricity. These challenges are beyond the control of the communities.

Most households practice multiple livelihood strategies as noted in Table 6-29.

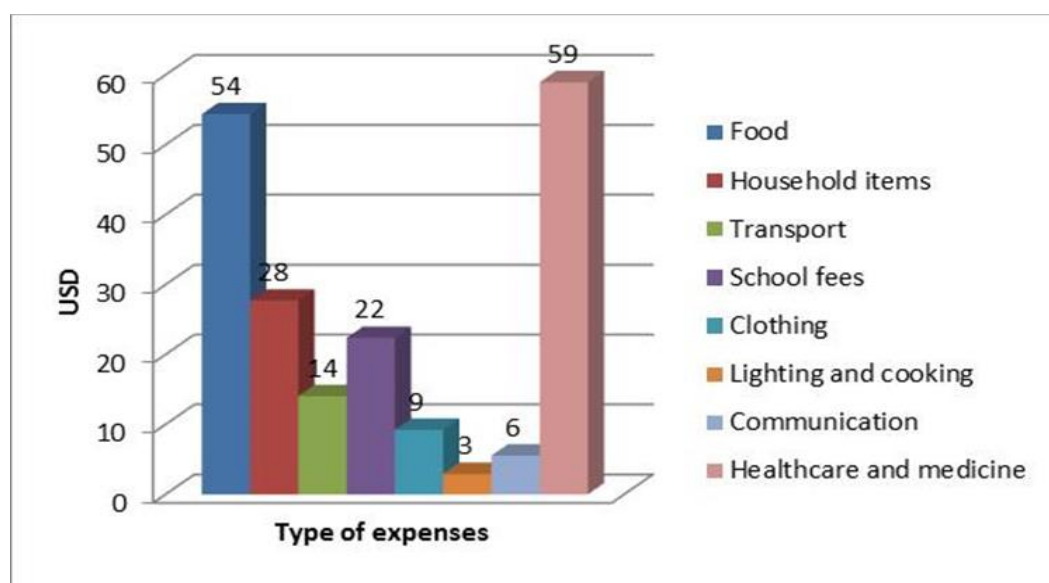
Table 6-29: Sources of Additional Income

Name of the Village	Agriculture	Fishery	Skilled Labor	Unskilled Labor	Business	Shops / Market
Kokolo	Yes	Yes	Yes	Yes	Yes	No
Yuku	Yes	Yes	No	Yes	No	No
Nkonda	Yes	Yes	Yes	Yes	No	No
Mbemba	Yes	No	No	Yes	No	No
Kinsua	Yes	No	No	Yes	Yes	No
Mbamba	Yes	No	Yes	No	No	No
Minkelo	Yes	Yes	Yes	Yes	Yes	Yes

Average expenses

According to the data collected during the survey, total household expenditure amounts to approximately USD 205 a month. When asked to elaborate on the level of expenditure (where it was from), respondents listed the categories below (Figure 6-36)

The results also show that the biggest expenditure item is healthcare and medicine (USD59), followed by food – salt, sugar and oil, (USD54), housing items, furniture and cutlery, (USD28) and school fees (USD22).

**Figure 6-36: Household expenditure per category**

Ownership and types of animals

Agropastoral activities are popular in the project area. This may partly be due to the lack of employment opportunities available in the project area. The survey results show that almost 63% of household own livestock. Households that did not have livestock either recently moved to the area or were involved in other income generating activities, or were young couples. These animals are for the most part sold, consumed or both.

Generally animals roam freely around the project area. The livestock on site eat what is available around the site. In villages where potable water was unavailable, rivers were the only water source for both animals and humans.

Veterinary care in the project area is unavailable. Herders generally did not have the means to vaccinate their livestock and stated that their animals often died as a result. Other challenges include stock theft.

Figure 6-37 shows that chickens and goats are the most popular animals in the project area with 50% and 26% respectively. Sheep and pigs and ducks also feature in the project area with 8% and 6% and 8% respectively. Price estimates for each type of livestock are shown in Table 6-30.

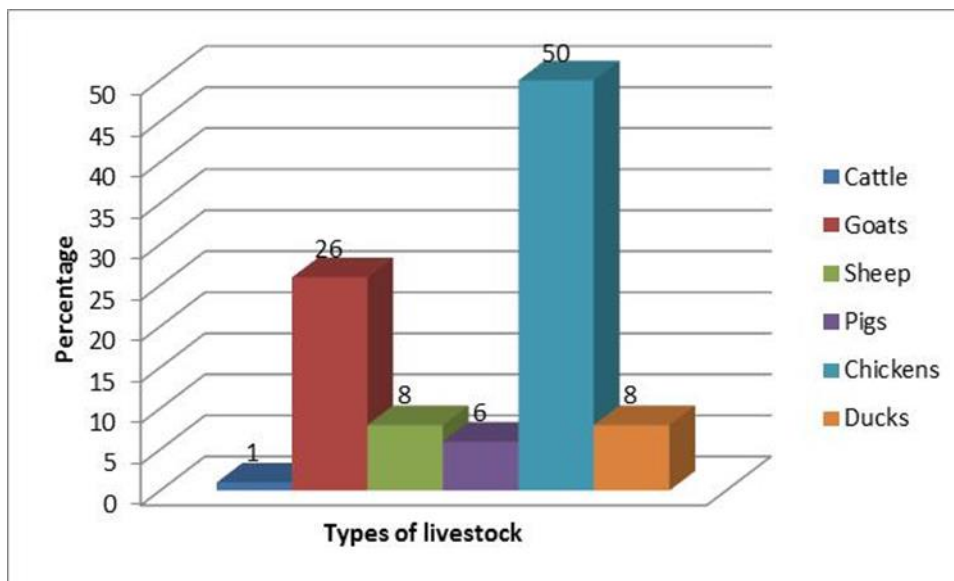


Figure 6-37: Livestock ownership and animal types

Table 6-30: Price by livestock type

Livestock type	Price per animal in USD
Sheep	72
Goat	72
Chickens	6
Pigs	120

Farming, ownership and types of trees

Subsistence farming is practiced by most households. Fifty nine percent of fields measure less than 1 hectare. Other common sizes include between 1 and 3 hectares (37%) and between 3 and 5 hectares (3%) The relative sizes of arable land in the project area are shown in Figure 6-38. The overwhelming majority of fields (80%) were harvested in 2012. None of these fields were irrigated and fertiliser is not used. Slash and burn is used for clearing farming areas.

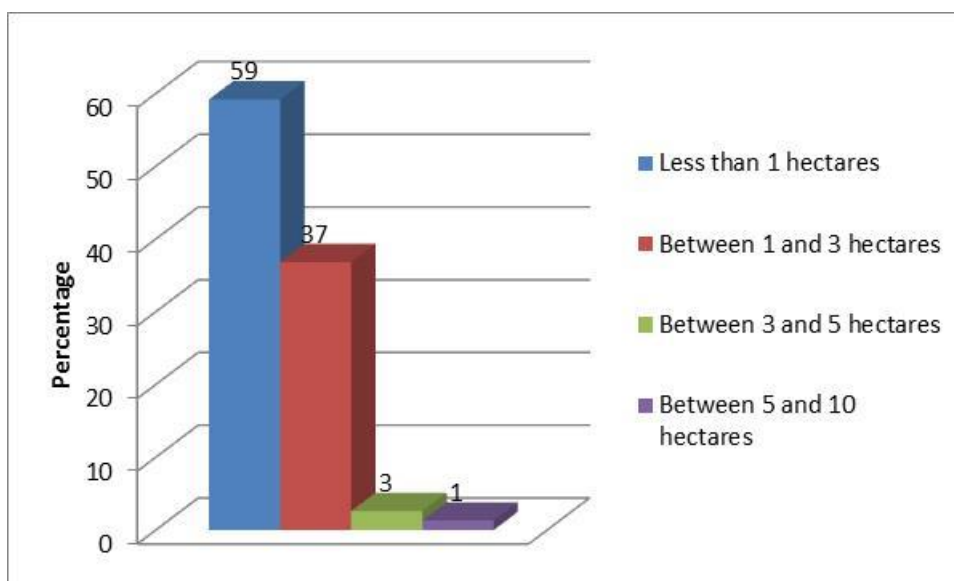


Figure 6-38: Size of arable land in the project area

Fruit trees are also common in the area. Most households (55%) stated they had fruit trees located either directly adjacent to their property or situated at a considerable distance from their houses (more than 5kms for some). These fruit trees are mostly inherited and active fruit planting in the area is rare. Crops and fruits grown by local communities are listed in Table 6-31.

Table 6-31: Crops and fruits grown by local communities (Source: SRK social survey)

Crop type		Fruit type	
Crop name	Percentage of households that grow a particular crop	Fruit name	Percentage of households that grow a particular crop
Cassava	66	Bananas	37
Maize	15	Oranges	36
Ground nuts	21	Avocado	47
Tomatoes	21	Mango	21
Peas	9	Butter fruit	41

There are no industries working in the project area. One Indian company, engaged in laying electric lines, has its site camp at an approximate distance of 12 km from the project site on highway.

Access to land

Land in the project area is easily accessible to households. Generally, both locals and people coming from outside the project area i.e. other regions in the DRC, are allowed to use the land free of charge provided that prior consent is given by the traditional authority – usually by the village chief. About 90% of households interviewed in the project area have access to land. Where households do not have land, it is either because they recently moved to the area or it is because they are involved in other economic activities and livelihood strategies such as carpentry and mechanics.

Establishment of the Villages

Minkelo is the oldest village of the area as it was inhabited in 1880 and which is why it has the maximum number of houses and population. The second oldest village is Kinsua which was inhabited in 1956 by the descendants of Kinsua line. Yuku, Mbemba, and Kokolo were inhabited in 1970, 1974 and 1999 respectively and all these villages belong to the same family of Kinsua. Nkonda was inhabited in 1962 while Mbemba was inhabited in 1974. Yuku was inhabited as a

Belgian Camp was later occupied by the Kinsua Family. All other villages were inhabited by the choice of their elders and there was no massive reason for migration.

Medical Facilities

*Centre de Santé*s (CSs) or clinics provide the required medical assistance in the project area. The CS that SRK visited was situated in Minkelo Village. The CS was built by missionaries in 1933 and staffed by a nurse, a deputy nurse and a midwife; all trained by a state institution called the *Institut Technique Médical* (ISTM).

There was no evidence of CSs existing in villages such as Kokolo and Nkonda although people who participated in the survey stated that they also use the CSs in Mawete, Nkula, Lumweno and Mbombo. Kimpese Hospital is also used in cases where the illness cannot be treated locally. The fact that some villages also use the CS in Minkelo adds pressure on the already struggling CS. People who do not make use of these facilities rely on traditional medicine to cure illnesses. According to the chief nurse, the five most prominent illnesses in the project area are:

- Malaria;
- Typhoid;
- Diarrhoea;
- Ulcers; and
- Tuberculosis.

It is alleged that only 40% of the patients who go to the clinic for treatment can afford to pay. The costs associated with some of the ailments listed above are as follows:

- Malaria treatment for children aged five and under: USD7;
- Births: USD 18; and
- Diarrhoea treatment: USD 1.5.

Despite the fact that sexually transmitted diseases exist in the project area, their incidence is reported to be small. The medication used at the clinic is purchased from Nsona-Mpangu

Overall, CSs are understaffed and ill-equipped to cater for the growing number of people in the villages. The CS has the following equipment:

- Ten beds: All made from Bamboo by local communities;
- One delivery room: with equipment not suited for births;
- One Stethoscope; and
- One sphygmomanometer.

People living in the project area have access to two healthcare programmes financed by an NGO called *Santé Rural* (SANRU), namely *Programme Elargi de Vaccination* (PEV) and a malaria programme – where malaria treatment is distributed free of charge. PEV is a vaccination programme which takes place once a month where people are vaccinated against the following illnesses:

- Yellow fever;
- Polio;
- Measles;
- Tetanus; and
- Tuberculosis.

Focus group meetings with women have revealed that people believe that the fees are too high. This is exacerbated by the fact that people also have to pay for the medication they need.

These results were gathered from the focus group meetings with men and women. It is apparent from the table that headaches and malaria affect all groups.

Basic Facilities

In the ECTECH study in 2012 respondents were asked about the basic facilities that were being utilized by them, the results show that throughout the seven villages surveyed, no electricity was found and lanterns (using Kerosene oil) were being used for lightening the houses.

Only in Minkelo were cell phone connections available but in the rest of the villages there were neither telephones nor cell phones available. Two rivers named as Sanzikua River and Yuku River were the main sources of water for these villages, there were also two water bodies available in the area.

Frequent rains are also a source of water for these villages. People of the project area are used to store the rain water in different containers for a variety of its end use. No sewerage system is available in any of these villages.

Public transport system for villages is virtually non-existent. No proper roads on the overall bases are available for these villages. However, some people use their own motor bikes as means of transportation.

Table 6-32: Availability of Utilities in Project Area

	Electricity	Water	Telephone	Sewerage	Proper Roads	Transport
Kokolo	No	Yes	No	No	No	No
Yuku	No	Yes	No	No	No	No
Nkonda	No	Yes	No	No	No	No
Mbemba	No	Yes	No	No	No	No
Kinsua	No	Yes	No	No	No	No
Mbamba	No	Yes	No	No	No	No
Minkelo	No	Yes	Yes	No	No	No

Recreational facilities

No recreational facilities in the form of recreational parks, gardens, play grounds and picnic spots are available in this area. Certain places are designated for internal meetings of the community like: under certain tree, or in Chief's house.

The following was reported in the 2013 SRK socio-economic baseline study.

Water and sanitation

Households in the project area typically use more than one water sources depending on the frequency with which they are used by a particular household and on the condition with in which the water source is in. For instance, people tend to use borehole water more frequently during the dry

season as rivers and springs tend to dry out during that time.

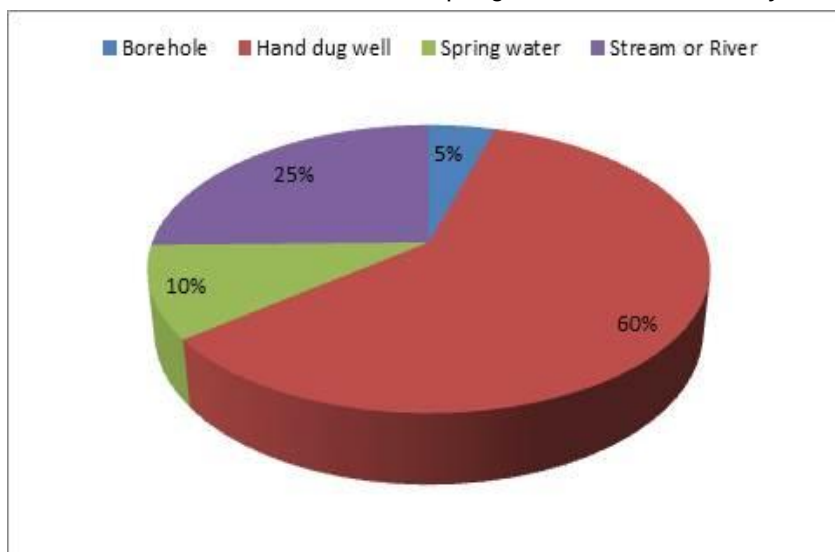


Figure 6-39 Figure 6-39 depicts the sources of water used in the project area. It can be seen from the diagram that hand-dug wells (60%) and streams/ivers (25%) are more frequently used. These water sources can be found scattered across the settlements and people's perceptions on the quality of the water is as follows:

- Always polluted (25%);
- Sometimes dirty (37%); and
- Always clean (38%).

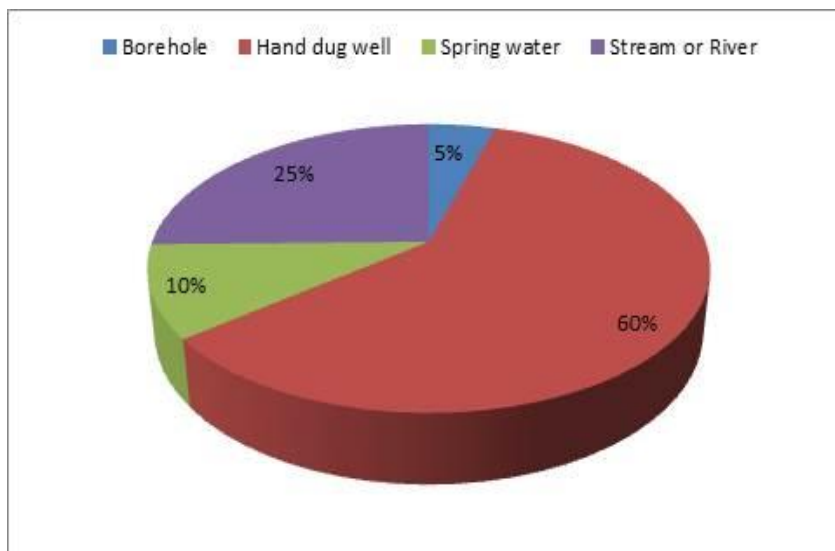


Figure 6-39: Water sources in the project area

The water used for cooking and cleaning in Yuku Camp comes from Yuku River. The river is situated approximately 500m from the settlement. The other villages use the following water sources:

- Kokolo Village – stream situated in Kokolo situated about 1km from the village. Residents consider this source to be always clean;
- Nkondo-Kiombia Village – borehole covered with concrete built by an NGO called *Association pour la Promotion du Développement Endogène des Communautés de base* (APRODEC). This

water source is situated approximately 300m from the village and residents consider this source to be always clean;

- Mbemba Village – stream from the Tadi River situated approximately 1km from the village. Residents consider this water source to be bad because it is not protected from the elements, animals, and potential human waste; and
- Mawete Village - hand dug well within the village (2km) and 7km away (from the Sanzikwa River). Water for drinking and washing is collected from different locations; and
- Minkelo and Kinsua villages – hand dug well situated in the villages. These water sources are not covered and therefore exposed to the elements, animal and human waste.

Sewerage facilities

Site observations revealed that the sewage system in Yuku Camp and in the other settlements is basic. Toilets are typically separate to the household and comprise a hole dug on the ground that is fenced-off using reeds or clay with mud. The structure is accessible to the whole household and changes location once the hole becomes too full. The number of toilets is usually a function of the size of the household. The households where the survey was undertaken either had one or no toilets. Those without toilets relied on the environment.

Refuse disposal

People in the project area do not have access to formal refuse disposal facilities. Household waste i.e. used water for cooking and washing, fish and meat bones, and vegetable skin, is thrown in nature. Larger settlements such as Mawete and Minkelo could benefit from the creation of adequate landfills.

Energy

For cooking, results from the baseline show that 89% of households use dry branches and twigs collected from the surrounding area. Women and young children are often responsible for collecting dry wood. Charcoal purchased from local traders or manufactured by families is also a popular source of energy for cooking (78% of households).

Four sources of lighting are used in the project area, namely battery torch (82%), petrol lamps (41%), candles (29%), and kerosene (28%). The people who participated in the survey mentioned that although they are available locally (Minkelo), petrol and kerosene are becoming too expensive for people to afford and they would prefer to have a stable source of lighting (electricity).

Minkelo Village is considered to be the most developed villages in the area. Many officials from the Songololo territory are settled there. This village has education and health facilities, but not up to the required level.

Transport

The transport system in the area is poor. Despite this, people frequently commute between the different villages to visit friends and family and to attend to their fields. People from the area also travel to Kimpese and Matadi (approximately 35 and 100kms from the project site respectively) to buy goods or to seek medical treatment for illnesses. Travelling is done by foot, by bicycle, or by motorcycle. Cars and trucks are generally not able to cover these distances particularly during the wet season when the roads are wet.

Communication

Long distance communication in the project area is done by mobile phone. It is estimated that 55% of households have access to mobile phones despite the fact that limited cellular signals were available at the study area. Those who participated in the survey stated that the cell phone coverage was inadequate and that mobile phones only worked in certain areas.

The communication between different villages in the study area is good in terms of family reunions, informal trade and community/religious celebrations. Social media are not used in the area.

Political Structure

Head of each village holds the central position as far as the decision making of the villages is concerned. The decision of Tribal head is assumed to be final but sometimes mild conflicts arise when more than one person struggle to become the head of the tribe. Generally the eldest person becomes the chief of the tribe. A person can become chief in his maternal family and sociologically this practice is termed as “Matriarcha”.

Family Structure

Nuclear family system prevails in all the villages, the moment a person get married, he with his wife are separated from his family. Women can take part only in decision making of the family matters. Women are also involved in cultivation and are responsible for housekeeping and child care.

Political and Family Structures in the local villages are shown in

Table 6-33.

Table 6-33: Political Structure and Family Structure of local villages

	Political Structure	Type of Family
Kokolo	Tribal	Nuclear
Yuku	Tribal	Nuclear
Nkonda	Tribal	Nuclear
Mbemba	Tribal	Nuclear
Kinsua	Tribal	Nuclear
Mbamba	Tribal	Nuclear
Minkelo	Tribal	Nuclear

Family dynamics

The communities that live in the project area are Bantus, and therefore follow the matriarchal system. This means that females, especially mothers, have authority over household assets, the land and assume responsibility for the wellbeing of their families. For instance, it is common to find women *Dukes* or chiefs in the villages adjacent to the project area.

In reality however, the matriarchy is not always upheld. Chores are typically split in terms of gender and age. Men are normally the heads of the household and they decide on how household budgets are spent as well as on any decision that may affect the household. Men assume the protector role and they are expected to find employment to feed the household. Women usually assume the supporting role. They look after the children, cook the food, collect firewood, water and medicinal plants, clean the household and are responsible for farming. It is worth noting that although women do most of the agricultural activities, men are expected to clear the land before any agro-pastoral activity can take place. It is alleged that men and women are responsible for building the house.

Supporting both men and women are boys and girls respectively. Boys are usually used to carry heavy loads such as water containers and are also used to do the herding and the hunting. Girls help their mothers cook the food and clean the house.

Nuclear family system dominates the population in and around the project area. Young boys have to build their own houses to get married. Old people are used to living alone at old age.

Population and Communities

Experts from ECTECH Environment Consultants surveyed the whole project area especially the villages which are surrounding or present in the area leased for NYA. Data regarding the local communities was obtained primarily by site survey and from other sources like, local EIA for Nyumba Ya Akiba, national and International survey reports and local authorities.

Development needs and expectations in the project area

Site interactions with stakeholders revealed that communities have high expectations about the project. These expectations are exacerbated by the lack of job opportunities and government's inability to fund development projects in the area. If not managed adequately, these expectations are likely to cause mistrust and tensions between NYA and communities.

In this context, communities have raised the following development needs:

- The creation of job opportunities. The NYA Project is the only large-scale project in the area and the perception is that all job seekers will be hired;
- The construction of new and refurbishment of existing roads and foot paths. This is likely to improve the transport of the goods and services produced in the area and enable people to commute to and from other settlements more easily;
- The need for electricity;
- The need for adequate medical facilities;
- The presence of institutions able to micro finance sustainable projects, particularly in agriculture;
- Assistance with agro-pastoral activities – fertilisers, trucks, irrigation systems and vaccination of livestock; and
- Access to potable water.

Vulnerable people

In terms of the study area the vulnerable groups include the elderly, the infirm, orphans and single or teen mothers who lack social and family networks. There are several vulnerable groups in the villages in the study area:

- **Children and Youth:** A few children and youth in the study area do not and have not attended school. Poverty is one of the drivers, with children often involved in income earning activities;
- **Women:** Among women, groups requiring particular support are single/teen mothers and widows. In all three cases, the women often find themselves caring for a household whilst also seeking to provide a living;
- **Elderly:** The household survey reveals several elderly people living with their families (fathers, mothers, aunts and uncles). Supporting elderly dependents is a challenge to poor households, but the old people mostly at risk are those without support; and
- **Disabled and Chronically Sick:** The survey revealed that there almost two percent of the population is disabled. These individuals are being supported by their families.

Development partners

Non-Government Organisations (NGOs) and Community Based Organisations (CBOs) can be important to the mobilisation of potential development initiatives in the area. The fieldwork undertaken by SRK revealed that *Association pour la Promotion du Développement Endogène des Communautés de base* (APRODEC) is active in the project area, particularly in the field of water and sanitation. No other NGO seemed to have been present in the area at the time of writing.

NYA could also partner with local and international agencies such as *Développement Intégral et Action d'Appui Communautaires* (DIACO) – a development NGO that focuses on community development and the implementation of sustainable development projects, and the United Nations. DIACO operated from Kimpese. A selected list of other NGO and CBOs is provided in Table 6-34. The full list is provided in Appendix 17.

Table 6-34: NGOs in the area

Name of NGO	Acronym	Location
Programme d'Assistance de Intégration des Vulnérables	PAIV	Kimpese
Association d'Encadrement des Veuves et Vieillards	ASSEVEV	Kimpese
Assistance des Vulnérables	ASSISUL	Kimpese
Orphelinat pour tous	OPT	Kimpese
Association des Volontaires pour Développement et Actions Humanitaires	AVDAH	Kimpese
Programmes d'Encadrement des Vulnérables Agriculteurs et Routiers	PEVAR	Kimpese
Œuvre pour la Protection de la Santé et Animation Rurale	OPSAR	Kimpese
Association pour le Bien-Etre Social	ABES	Kimpese

The

Presence of police on site

SRK also assessed people's perceptions of the use of the local police force as security personnel at the mine. The purpose of this was to ascertain whether local communities felt threatened by the presence of armed men in and around their villages. Results show that communities do not feel threatened and have not been harassed by the police. Many have stated that additional patrolling capacity is required in order to reduce the incidence of livestock theft.

6.5.4 Religion

Christianity is the main religion in the study area. It provides the spiritual and social framework for the local population. While smaller settlements only have one church and one pastor, larger settlements such as Kimpese, Minkelo and Mawete have several churches and pastors.

Pastors are responsible for the maintenance of the churches, as well as, facilitating ceremonies such as weddings, funerals, blessing, etc. They are regularly consulted in terms of spiritual counseling, family and community conflict resolution. They are elected by the elders and generally maintain a close relationship with the village Chief. Although their position is not remunerated, they receive voluntary donations and gifts in-kind from community members.

Several forms of Christianity are found in the project area. The most common of which are Catholicism, Kibanguism, Protestant and New Age Churches. These religions are discussed below.

Protestants

Protestantism is one of the major divisions within Christianity. It has been defined as any of several church denominations denying the universal authority of the Pope and affirming the Reformation principles of justification by faith alone, the priesthood of all believers, and the primacy of the Bible as the only source of revealed truth. Some of the protestant festivities include Baptism, Christmas and New Year. Protestant movements include:

- Pietism and Methodism;
- Evangelicalism;
- Adventism; and
- Pentecostalism.

There are no protestant churches in Yuku Camp. Residents use the facilities in neighbouring villages such as Mawete and Minkelo to worship.

New Age churches

Adherents are required to living simple lifestyles and adopt the Christian calendar – festivities and religious practices are identical to the other types of Christian faiths. These ideologies of these churches mainly center on evangelism and worship.

Catholicism

Catholicism is distinguished from other forms of Christianity in its particular understanding and commitment to tradition, the sacraments, the mediation between God, communion, and the See of Rome. Some of the practices include:

- Possession of the "threefold ordained ministry" of Bishops, Priests and Deacons.
- All ministers are ordained by, and subject to, Bishops, who pass down sacramental authority by the "laying-on of hands", having themselves been ordained in a direct line of succession from the Apostles;
- A belief in the necessity and efficacy of sacraments;
- The use of sacred images, candles, vestments and music, and often incense and water, in worship;
- The love of Mary, the mother of Jesus as the Blessed Virgin Mary, and veneration of the saints;
- A distinction between adoration for God, and veneration for saints;
- The use of prayer for the dead;
- The acceptance of canonisations; and
- Requests to the departed saints for intercessory prayers.

Kimbanguism

Kimbanguism is a sectarian branch of Christianity founded by Simon Kimbangu in what was then the Belgian Congo (now the Democratic Republic of Congo). The church's name is the Kimbanguist Church (fully Église de Jésus Christ sur la Terre par son envoyé spécial Simon Kimbangu, or The Church of Jesus Christ on Earth by His Special Envoy Simon Kimbangu), and is a large, independent African Initiated Church with an estimated 5.5 million believers.

The church eschews politics and embraces a puritan ethic, rejecting the use of violence, polygamy, magic and witchcraft, alcohol, tobacco, and dancing.

The three key dates in the Kimbanguist are:

- April 6 - marking the date of the start of the ministry of healing;

- October 12 - marking the day Kimbangu died; and
- May 25 - marking Christmas.

Protestantism is by far the most important religion (49%) and is followed by New Age churches (21%), by Kimbanguism (18%) and then by Catholicism (12%). Figure 6-41 shows a Kimbanguist church in Mawete.

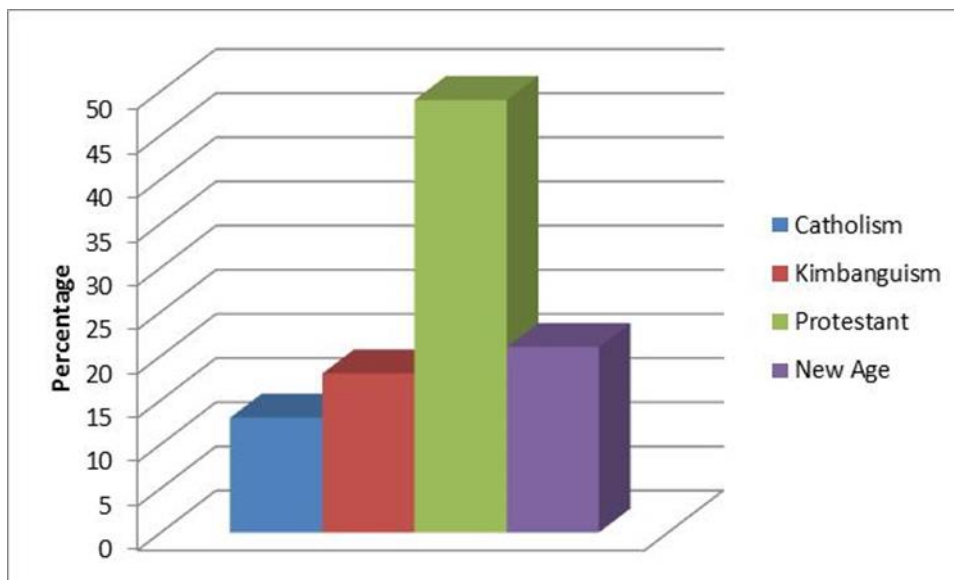


Figure 6-40: Types of religion in the project area



Figure 6-41: Kimbanguist church in Mawete

6.5.5 Indigenous people

On the basis of the IFC PS7 definition, there are no indigenous people in the area.

6.5.6 Ecosystem services

Ecosystems services were considered by SRK in the June 2013 social survey and are reported on below.

The natural functioning of ecosystems provides a number of so-called “ecosystem services”. These ensure the operation and regulation of critical environment systems that are vital to sustaining life on earth. Moreover, they produce critical inputs for economic activities and livelihoods and absorb wastes such as carbon dioxide and effluent from economic activities.

Dysfunctional ecosystems on the other hand may no longer provide resources that people depend on, thereby affecting livelihoods and increasing people’s vulnerability, or have insufficient capacity to absorb wastes from economic activities, in which case costly and potentially less effective engineering measures may have to be put in place.

The 2005 United Nations Millennium Ecosystem Assessment grouped ecosystem services into four broad categories:

- Provisioning services, which produce the material benefits or resources people obtain from their environment ‘for free’, including food, animal fodder (grazing), water, building materials and medicinal plants;
- Cultural services, which include the non-material benefits people obtain from their environment, such as recreation or religious sites;
- Regulating services, which maintain the environmental systems that provide water and air purification, climate regulation, carbon storage, attenuation of natural hazards such as floods or droughts and waste absorption; and
- Supporting services, which enable many provisioning services and economic activities and include soil formation, pollination and nutrient cycling.
- The characteristics and functioning of ecosystem services are important influences on the socio-economic conditions in an area, particularly in undeveloped areas where people depend directly on many of these services. Provisioning and cultural services are particularly closely interlinked with people and their wellbeing and most easily identified, while regulating and supporting services are often less apparent.

The following observations made by SRK in June 2013 pertain to ecosystem services in the project area:

- **Provisioning services:** The household survey undertaken by SRK has identified a number of resources that are routinely used by local residents. These include:
 - Wood harvested for cooking and to produce charcoal, which is an income generating activity;
 - Fish caught in the Sanzikua River by residents of Kokolo, Yuku, Nkonda and Minkelo villages and hunting of wild animals;
 - Collection of medicinal plants;
 - Building materials for dwellings collected in the areas surrounding the villages;
 - Grazing areas for domestic animals nearby the villages;
 - Water, collected mainly from the Sanzikua River and Yuku River, although many villagers also have access to wells.

Table 6-35 provides an overview of the main activities that involve the use of provisioning services and the approximate percentage of households engaging in these activities, based on responses provided to SRK’s household survey. The data indicates that natural resources and as such provisioning services are generally important for livelihoods and lifestyles in the area.

Table 6-35: Natural resource use by villagers in the study area

Activity involving use of provisioning services	% of households engaging in activity	Typical frequency of use	Typical importance of resource
Collecting firewood for cooking	82%	<i>Not available</i>	<i>Not available</i>
Collecting grass for thatching	59%	When needed	Importance is diminishing
Collecting medicinal plant	50%	When needed	Very important
Collecting wild fruits	44%	Very often (daily in season)	Important to very important
Fishing	37%	Often (weekly)	Very important
Charcoal making	31%	<i>Not available</i>	<i>Not available</i>
Hunting small animals and birds for bush meat	29%	Occasionally (monthly)	Important to very important
Grazing of livestock	12%	Daily	Important

Although only approximately one third of households engage in fishing or hunting, half of households consume bush meat on a regular basis (see Table 6-36) and consider it a very important addition to their diet.

Table 6-36: Consumption of bushmeat by villagers in the study area

Type of wildlife	% households using wildlife
Fish	51%
Mammals	50%
Reptiles	49%
Birds	41%

It has been observed that many of the resources in the area are gradually depleting due to pressure from unsustainable exploitation and interventions such as slash and burn agriculture.

- **Cultural services:** Certain elements of the natural environment have cultural significance, e.g. trees that are designated as sites for community meetings and lakes and mountains that hold religious or traditional value to members of the community. No formal recreational areas are available for the local communities and it is expected that certain areas are used for recreational purposes, e.g. as sports fields or social areas.
- **Regulating services:** The original forest cover has been largely exploited and destroyed in the area. This deforestation would have already compromised those regulating services that are closely interrelated with a forest ecosystem, including carbon storage, air purification and attenuation of natural hazards, and limited their capacity. Signs of erosion near village areas indicate that regulating services such as water retention and flood regulation are compromised. Villagers rely entirely on the environment for:
 - Waste absorption, as none of the villages are serviced by a sewerage system or any waste collection or treatment systems (although little waste has been observed in villages, indicative of a high level of poverty in the communities); and
 - Water purification, as water for drinking and domestic purposes is obtained from rivers and rain water.

- **Supporting services:** Agriculture is a main beneficiary of ecosystem supporting services. Villagers in the project area engage in subsistence agriculture and are dependent on natural supporting services as modern agricultural tools such as mechanical equipment or artificial fertiliser are not available to the farmers.

6.5.7 Cultural Heritage

As part of an updated ESIA and ESMP for the Project, SRK contracted Mr Jaco van der Walt of Heritage Contracts and Archaeological Consulting CC (HCAC) to report on the Cultural Heritage Specialist Study. This report is based on field data provided by John Mwamba (Congolese free-lance archaeologist), supervised by Prof Muya Donatien (Director of the Museum of Lubumbashi and Professor of Archaeology at the University of Lubumbashi). The study complies with DRC Legislation, as well as the relevant IFC guidelines and performance standards. The Equator Principles III (2013), Operational Policy 11.03 (Cultural Property), and Performance Standard 8 (IFC Guidelines January 2012) were applied for this assessment.

Neither the OEMS EIA (2010) nor ECTECH's ESIA (2012) identified any cultural heritage sites in the project area (apart from the cemetery at Yuku village) or seem to have appointed a heritage specialist. This knowledge gap was identified by ERM's due diligence report, and is filled through this study.

Methodology

The aim of the study was to identify, document, and assess the importance as well as evaluate cultural heritage sites and also to manage negative impacts on non-renewable heritage resources. After a review of legislation and reference to previous work on the project a physical survey of the project area was done. General site conditions and site features were recorded by means of photos, GPS location, and short description during a site visit (13 – 18 June 2013) followed by impact assessment (Chapter 7). Appropriate recommendations to assist the developer in managing heritage resources within the framework provided by heritage legislation (Chapter 2) are provided in Chapter 8.

Interviews and site surveys were undertaken from 13 to 18 June 2013. The integrated archaeological impact assessment process consisted of the following three steps:

Literature Review

This step was aimed at gathering information relating to known archaeological and heritage resources within and surrounding the proposed development area. Project information and data was obtained through literature research, data gathering and consultation, including a variety of primary and secondary sources such as journals, textbooks and records, national and provincial websites, archaeological field guides, national and international guidelines and maps. The literature survey was updated to address any possible gaps and assist in drawing inferences on the significance of sites where information was lacking.

With regards to the desktop assessment very little exists on the area and two kinds of sources were utilized: published data (publications and books) and secondly unpublished data. Due to time constrictions the archaeological databases/archives (Royal Museum of Central Africa in Belgium and the National Museum in Lubumbashi) could not be accessed.

Field visit and survey

As part of the public consultation and social impact assessment process, questions pertaining to living and intangible heritage were included. However, in addition to this, the field archaeologist Mr Mwamba's team also conducted interviews with the chiefs ("*Chefs de Localités*") and their advisors at the villages in the concession area (Table 6-37). Since the social team have already made

introductory visits to these villages the archaeologist made appointments to speak to the chiefs. The purpose of this was to discuss known heritage sites and the importance of the tangible and intangible aspects of these sites. In some instances the villages provided a guide to point out known sites, consisting mostly of graves.

Table 6-37: Details of Chiefs that were consulted for heritage study

Date	Village	Name	Age	Gender	Rank	Tribe and Clan	Language
Thursday, 13/06/2013	Tandu	KIVWILA Jean	85 years	Male	Village Chief	Bandibu, Nemasaki	Kikongo and Lingala
Friday, 14/06/2013	Nkonda	KANAVANGAWO Ndongala Boniface	77 years	Male	Village Chief	Bandibu, Nemasaki	Kikongo and Lingala
Friday, 14/06/2013	Mawete II	KIALANDA KAMIL	90 years	Male	Village Chief	Mboma, Temoyengimbi	Kikongo and Lingala
Saturday, 15/06/2013	Yuku	ADIEYI LUYILA	42 years	Male	Village Chief	Bandibu, Nsakunevunda	Kikongo and Lingala
Saturday, 15/06/2013	Mbemba	MASAI DI NDOSIBA	97 years	Male	Village Chief	Bandibu, Nsakunevunda	Kikongo and Lingala
Sunday, 16/06/2013	Kinsua	LUKUAMUSU TOKO	70 years	Male	Village Chief	Bandibu, Nsakunevunda	Kikongo and Lingala
Sunday, 16/06/2013	Mbamba	DIKUWILUKO Ferdinand	75 years	Male	Village Chief	Bandibu, Nsakunevunda	Kikongo and Lingala
Monday, 17/06/2013	Minkelo	LUZOLAWO TEKASALA	77 years	Male	Village Chief	Mboma, Do emavandu Ndambangolo	Kikongo and Lingala
Monday, 17/06/2013	Minkelo school (mission)	MWANGATUSUNG AMA Alphonse.	55 years	Male	Village Chief	Mboma, Do emavandu Ndambangolo	Kikongo and Lingala
Monday, 17/06/2013	Kokolo	UTIDI Alice	50 years	Female	Land chief	Bandibu, Nsakunevunda	Kikongo and Lingala
Monday, 17/06/2013	Kinfinda	ZANTUADI ELIKO Thomas	82 years	Male	Village Chief	Mboma, Do emavandu Ndambangolo	Kikongo and Lingala
Tuesday, 18/06/2013	Nkondoki ombia	KIFUANANA NDUANTONI and Ndongala MAKWEBO	75 years	Male	Village Chief	Mboma, Do emavangu Ndambangolo	Kikongo and Lingala
Tuesday, 18/06/2013	Nionga	Yayama KAMAVUAKO Samson	85 years	Male	Village chief	Mboma, Do emavangu Ndambangolo	Kikongo and Lingala

A physical survey in the proposed concession area was conducted, focusing primarily on villages in the area and disturbances in the topography like roads and cultivated fields since archaeological visibility was very low due to ground cover. The terrain was examined on foot and by vehicle and the surveys consisted of random inspections in the concession area and systematic surveys in areas with higher archaeological visibility. This survey was aimed at locating and documenting potential sites of archaeological and heritage significance that the proposed project could impact. No

archaeological excavations were conducted. General site conditions and features on site were recorded by means of photographs and GPS location. Site descriptions are lacking from the fieldwork team. For the report, sites followed a numerical numbering system. During the survey several sites of tangible and intangible heritage were recorded mostly located well outside of the project footprint in villages that will not be impacted on by the proposed project. 36 sites are represented in this report, consisting mostly of tangible cultural heritage as well as intangible heritage sites like sacred trees etc. This intangible cultural heritage, transmitted from generation to generation, is constantly recreated by communities and groups in response to their environment, their interaction with nature and their history, and provides them with a sense of identity and continuity, thus promoting respect for cultural diversity and human creativity.

Data Interpretation

The identified archaeological and heritage resources were assessed to determine their information potential and heritage value. Potential impacts on the heritage resources were assessed in terms of the assessment methodology as described in section 7 of this report.

HCAC bases site importance on five interrelated criteria: (1) primary (in-situ) versus secondary context (moved from original location); (2) depth of archaeological deposit; (3) number and variety of features; (4) uniqueness (rare or not commonly found); and (5), potential to answer present research questions. These criteria are used in conjunction with the heritage significance ratings as detailed in the Minimum Standards: Archaeological and Paleontological components of Impact assessment Reports (ASAPA standards for the Southern African Development Community) and South African Heritage Resources Agency (SAHRA) guidelines, in the absence of comparable DRC guidelines. The specialist rated identified heritage resources according to the criteria, which are based on guidelines described in the South African National Heritage Resource Act (Act 25 of 1999) (NHRA). The NHRA is based on international standards such as the Burra Charter, UNESCO guidelines and various other international heritage and cultural organizations that define significance of cultural heritage resources. The site significance rating is thus determined using certain parameters described in international standards and South African legislation, as well as the professional minimum standards of ASAPA and SAHRA.

Sites with no importance do not require management; low to medium sites may require limited management; while sites of high importance require extensive management. It is recommended that sites identified as; of outstanding universal value, including critical cultural heritage sites as defined by IFC Performance Standard 8 to be avoided. Recognizable graves and living heritage sites have high social value regardless of their archaeological importance. Sites recognized as graves and living heritage sites will require extensive management and are of high importance.



Figure 6-42: Some of the villagers that were consulted during fieldwork



Figure 6-43: Guide pointing to a grave in dense vegetation

Compliance with IFC PS8

The Nyumba Project will meet the requirements of the International Finance Corporation (IFC)'s Performance Standard 8 regarding Cultural Heritage, Table 6-38 outlines the performance standards assisting the developer to manage risks and impacts associated with archaeological, heritage and cultural risks related to the project.

Table 6-38: Summary of IFC Performance Standard 8 and its relevance for this study

PERFORMANCE STANDARD 8: CULTURAL HERITAGE	
Requirement/ Principle	Implications for this Study
Internationally recognized practices: In addition to complying with applicable DRC law that implements the host country's obligations under the Convention Concerning the Protection of World Cultural and Natural Heritage, the client will identify and protect cultural heritage by ensuring that internationally recognized practices for the protection, field-based study, and documentation of cultural heritage are implemented.	In accordance with Section 6 and 7 of the IFC Performance Standard 8 Guidelines, a professional archaeologist and a heritage specialist were appointed for this project to investigate archaeological and heritage sites in the project site. An archaeological site visit was undertaken by a Congolese archaeologist John Mwamba from 13 to 18 June 2013 for the identification of significant archaeological and heritage sites.
Chance Find Procedures: The client is responsible for siting and designing a project to avoid significant adverse impacts to cultural heritage. When the proposed location of a project is in areas where cultural heritage is expected to be found, either during construction or operations, the client will implement chance find procedures established through the Environmental and Social Impact Assessment. The client will not disturb any chance finds further until an assessment by competent professionals is made and actions consistent with the requirements of this Performance Standard are identified.	In accordance with Section 8 of the IFC Performance Standard 8 Guidelines, the archaeologist assessed the findings in the project site and made constructive recommendations for the management of sites that may be impacted by construction and operational activities. Archaeological and heritage monitoring and management measures (including chance find procedures) will be incorporated as part of the EMPP to ensure that sites of archaeological and heritage significance are protected during all phases of the project.
Consultation: Where a project may affect cultural heritage, the client will consult with Affected Communities within the host country who use, or have used within living memory, the cultural heritage for longstanding cultural purposes. The client will consult	In accordance with Section 9 of the IFC Performance Standard 8, the archaeologist consulted relevant community authorities during the site visit. The EIS process will ensure that affected communities are consulted on potential impacts to cultural heritage.

Affected Communities to identify cultural heritage of importance, and to incorporate into the client's decision-making process the views of the affected communities on such cultural heritage.	
Community Access: Where the client's project site contains cultural heritage or prevents access to previously accessible cultural heritage sites being used by, or that have been used by, Affected Communities within living memory for long-standing cultural purposes, the client will, based on consultations, allow continued access to the cultural site or will provide an alternative access route, subject to overriding health, safety, and security considerations.	Community access restrictions to any significant cultural heritage sites, such as sacred forests in the proposed development area are not predicted to occur.
Removal of Cultural Heritage: Most cultural heritage is best protected by preservation in its place, since removal is likely to result in irreparable damage or destruction of the cultural heritage. The client will not remove any cultural heritage, unless all of the following conditions are met: There are no technically or financially feasible alternatives to removal; The overall benefits of the project outweigh the anticipated cultural heritage loss from removal; and/or Any removal of cultural heritage is conducted by best available technique.	In accordance with Section 11 and 12 of the IFC Performance Standard 8 Guidelines, the project will not remove any cultural heritage, unless: There are no technically or financially feasible alternatives to removal; The overall benefits of the project outweigh the anticipated cultural heritage loss from removal; and/or Any removal of cultural heritage is conducted by the best available technique.
Critical Cultural Heritage: Critical cultural heritage consists of: Internationally recognized heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes; and Legally protected cultural heritage areas, including those proposed by host governments for such designation.	In accordance with Section 13 and 14 of the IFC Performance Standard 8 Guidelines, the project will not significantly alter, damage, or remove any critical cultural heritage without following best international practices.
Legally protected cultural heritage areas: In circumstances where a proposed project is located within a legally protected area or a legally defined buffer zone, the client, in addition to the requirements for critical cultural heritage cited above, will meet the following requirements: Comply with defined national or local cultural heritage regulations or the protected area management plans; Consult the protected area sponsors and managers, local communities and other key stakeholders on the proposed project.	In accordance with Section 15 of the IFC Performance Standard 8 Guidelines, the EMPP will make provision to ensure that the proposed project site is not located within a legally protected cultural heritage area or a legally defined cultural heritage buffer zone or ensure that best international practices are followed for operating in such areas. As part of the environmental impact study, all relevant national and local environmental and social policies, plans and guidelines should be implemented for all development activities associated with the project.

Context

Regional context

Little information is available on the archaeology of the Lower Congo or Bas Congo Province. Information on the general archaeology of the Congo and the greater area contextualizes the study area and this has been included in the background information. Archaeology in the Congo is well known for the extensive spread of metallurgy. Firstly the copper smelting furnaces that is found in the province of Katanga as well as the well-known copper crosses that was used as currency, probably since the first millennium AD (Swan 2007) until recently. Several publications exist on the archaeology of this province for example de Maret 1985a; 1985b; 1992; Nenquin 1958; 1963 and Cahen, 1975. Secondly, pertaining to the study area is investigations in Gabon and Congo that illustrate the beginning of early iron working (Phillipson 2005). Most of the published information on the archaeology of this area of the Congo relates to the Kinshasha area, most notably the work of Denbow (1990) that was conducted in the area of Pointe Noire (Phillipson 2005) dating to the early Christian era.

From research on the spread of metallurgy it is deduced that inland technology superseded coastal knowledge and iron smelting sites dating to 500 BC in the inland Gabonese provinces have been recorded. Oslisly and Peyrot (1992) suggested that the knowledge of metallurgy may have been introduced from the Savannah areas of the Congo and that is subsequently spread across Gabon by way of the Ogooue river system. According to Phillipson (2005) little has been published on these early iron smelting sites and if any occur within the study area they can be of scientific value like at the archaeological site of Tschissangana.

Tschissangana is an area in which two phases of occupation was recognized indicated by flat based pots with various decorations. There is no indication of the use of iron in the first phase, dated to the sixth century BC. Fragments of iron was identified in the later phase dated to the fourth century BC. Iron smelting sites comprised clay lined pits surmounted by clay shafts. Smelting is evident in the coast of the Congo dating to the second and third centuries at the large village site of Madingo-Kayes, but iron had have been brought in to Tschissangana from other areas. The technology exhibited at the site of Madingo Kayes is the same as that employed further south in later times (D. Miller 1998).

According to Phillipson (2005) in the lower Congo a group called Kay Ladio group was the earliest iron using peoples in the region. Pottery associated with this group and iron fragments date back to mid first century and early third century AD (Maret 1986). Contemporary settlement of peoples using iron is noted further up the Congo River at Gombe point which is fairly close to Kinshasha (Cahen 1981).

Local context

36 sites were identified during the survey in the concession area, consisting mostly of graves, sacred sites (including medicinal trees) and an Iron Age complex with evidence of smelting activities. Of these 37 recorded sites, only the Yuko cemetery (**Site 16**) the Iron Age smelting site (**Site 17**) and the grave at Kokolo 2 (**Site 36**) are likely to be indirectly affected by the proposed project infrastructure and associated activities (Figure 6-44). The locations of cemeteries and ceramics found in the project area are shown on Figure 6-45. The Iron Age complex (**Site 17-20**) is characterized by slag, *tuyere* fragments, ceramic fragments and burned daga (baked clay) of structures. These sites do not occur in isolation and there is a high possibility that more sites dating to this period have gone undetected during the survey.

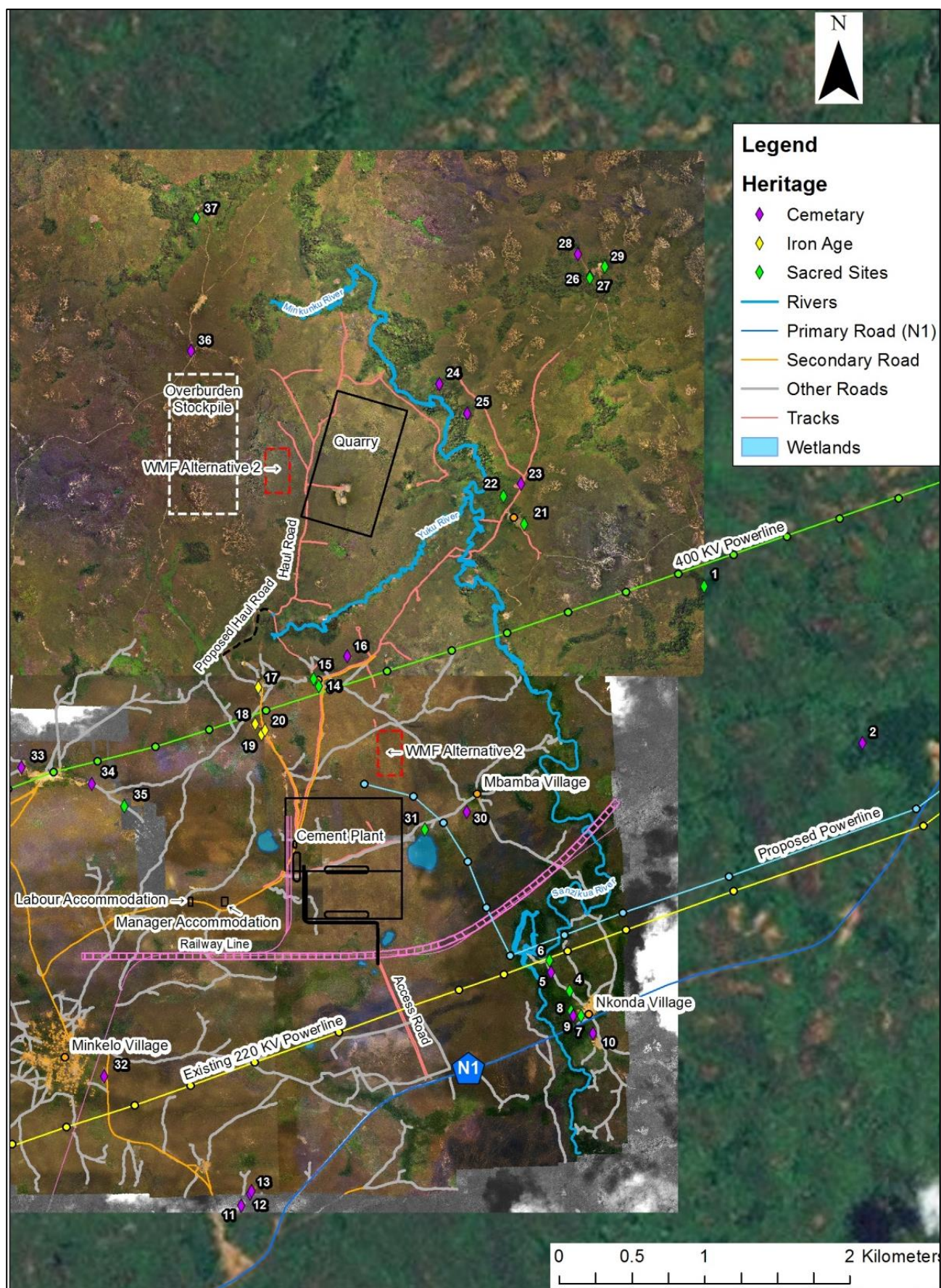


Figure 6-44: Distribution of heritage resources identified in the broader project area

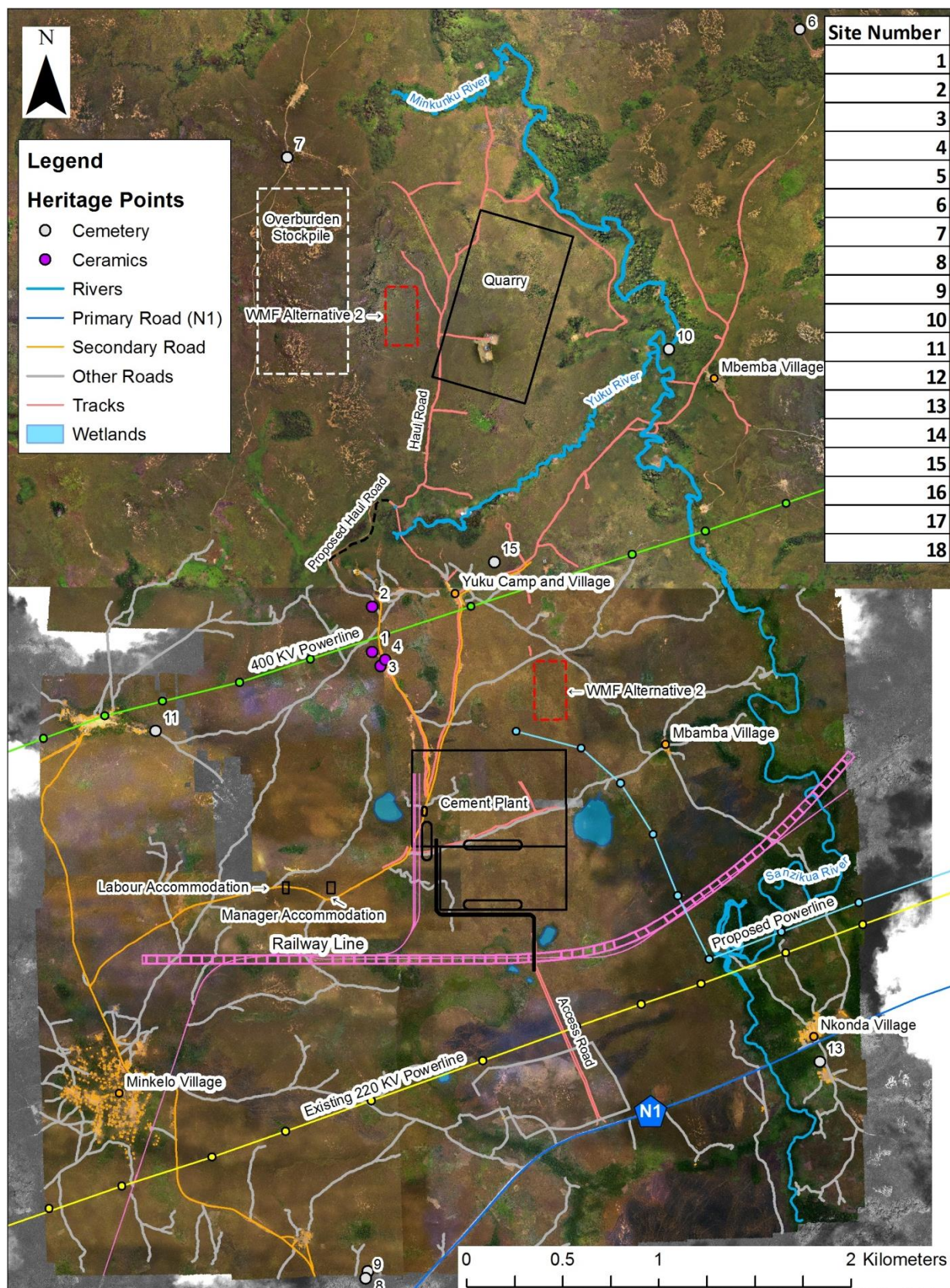


Figure 6-45: Locations of cemeteries and ceramics identified in the project area

Site descriptions

Table 6-39 presents the integrated findings and the foreseen impacts of the different infrastructure developments on the heritage resources. Site significance is colour coded. Low significance is green, medium significance is orange and high significance is red. All sacred trees are considered to be of medium to high significance and are indicated in orange.

Table 6-39: List of identified sites, their heritage significance and potential impacts*

Site	Site Name	Co-Ordinates	Site Description	Potential Impact
1	Village Tandu 8	0414380-9379309:	Nkasa Sacred Tree	None foreseen
2	Village Tandu 9	0415471-9378229	Cemetery Primarily Koumbi II	None foreseen
3	Village Tandu 10	0416092-9378144	Tandu Cemetery	None foreseen
4	Village Nkonda 2	0413456-9376524	Tree Nkondo	None foreseen
5	Village Nkonda 3	0413328-9376654	Angolan Cemetery	None foreseen
6	Village Nkonda 4	0413319-9376737	Medicinal Tree	None foreseen
7	Village Nkonda 6	0413535-9376355	Sacred Tree Yenge Kia Lubutu Lua Bantu	None foreseen
8	Village Nkonda 7	0413468-9376386	Sacred Tree Nsanda Vata And Sacred Place	None foreseen
9	Village Nkonda 8	0413481-9376355	Cemetery For Children	None foreseen
10	Village Nkonda 9	0413616-9376234	Nkonda Cemetery (Founder Of The Village)	None foreseen
11	Village Mawete II 2	0411197-9375049	Mawete Cemetery For Children	None foreseen
12	Village Mawete II 3	0411259-9375132	Mawete Cemetery Chief	None foreseen
13	Village Mawete II 4	0411269-9375147	Cemetery For Everyone	None foreseen
14	Village Yuku 2	0411732-9378622	Tree Akasha	Secondary impact through relocation of Village
15	Village Yuku 3	0411694-9378669	Nsanda Vata Tree	Secondary impact through relocation of Village
16	Village Yuku 6	0411927-9378826	Yuku Cemetery	Secondary impact through relocation of Village
17	Village Yuku 8	0411313-9378615	Smelting	Secondary impact through upgrading of road infrastructure
18	Village Yuku 1-5	0411293-9378361	Iron Age	None foreseen
19	Village Yuku 8-10	0411337-9378289	Iron Age	None foreseen
20	Village Yuku 11-17	0411362-9378320	Iron Age	None foreseen
21	Village Mbemba 3	0413144-9379733	Tree Nkondo	None foreseen
22	Village Mbemba 4	0413001-9379927	Nkazu Sacred Tree	None foreseen
23	Village Mbemba 5	0413121-9380010	Mbemba Cemetery For Children	None foreseen
24	Village Mbemba 6	0412560-9380699	Mbanza Cemetery Ancestors	None foreseen

25	Village Mbemba 7	0412753-9380496	Kongo Cemetery For Adults	None foreseen
26	Village Kinsua 3	0413595-9381437	Tree Nkondo	None foreseen
27	Village Kinsua 4	0413594-9381427	Sacred Tree Nsanda Vata	None foreseen
28	Village Kinsua 5	0413514-9381591	Nzau Cemetery	None foreseen
29	Village Kinsua 6	0413697-9381505	Sacred Tree Nsanda Vata	None foreseen
30	Village Mbamba 2	0412750-9377757	Mbamba Cemetery	None foreseen
31	Village Mbamba 3	0412460-9377634	Pond	None foreseen
32	Village Minkelo cité 2	0410255-9375938	Minkelo Cemetery	None foreseen
33	Village Minkelo école 5	0410168-9377950	Cemetery Minkelo School	None foreseen
34	Village Minkelo école 6	0410392-9377794	Shrine Mongo	None foreseen
35	Village Kokolo 2	0410852-9380925	Cemetery Of The Founding Of The Village	Indirect impact from overburden stockpile
36	Village Kokolo 5	0410889-9381840	Nkondo Sacred Tree	None foreseen

*Foreseen impacts are based on the current conceptual lay out and does not include exploration activities

The field report received from the Congolese Archaeologist lacked detailed sites descriptions and in many cases photographs of sites, and are therefore lacking in the report. Recorded sites are listed below, categorized as cemeteries, sacred sites (that include medicinal trees) and archaeological sites and clustered per village. Many of the sites are well outside of the development footprint of the proposed development but are included to contextualize the heritage of the area.

Cemeteries/Graves

Graves are always of high social significance regardless their heritage significance. According to tradition graves are aligned east to west. Access to cemeteries is governed by tradition handed down by previous generations. This is followed to the letter. For some tribes cemeteries are a place of ceremony. If the community is in trouble or facing a difficult problem, the Chief and his staff will go to the cemetery to offer palm wine and Makasu to the spirits and ancestors in order to find a solution to the problems of the community.

Tandu Village

There are 2 cemeteries (Figure 6-46) associated with Tandu Village: **Site 2** (0415471-9378229) and **Site 3** (0416092-9378144). Site 2 consists of at least 4 graves (Primarily Koumbi II) in dense vegetation that is cleared by community members and still visited. **Site 3** consists of a grave in Tandu village of Mama Nelyntanda who passed away on 15-06-1974. No further information is available for the site.

Both sites are located to the East of the project area and well away from any infrastructure. No Impact is foreseen on the sites. ***The sites are of high social significance.***



Figure 6-46: Site 2 on the left and Site 3 on the right

Village Nkonda

There are three graves associated with Nkonda village: **Site 5** (0413328-9376654) the Angolan cemetery, **Site 9** (0413481-9376355) a cemetery for children and **Site 10** (0413616-9376234) the grave of the founder of the village (Figure 6-47).

The sites are located to the South of the project area and well away from any infrastructure. No Impact is foreseen on the sites. ***The sites are of high social significance.***



Figure 6-47: Graves at Nkonda Village, Site 10

Village Mawete II

There are three graves associated with Mawete II village: **Site 11** (0411197-9375049) a cemetery for children, **Site 12** (0411259-9375132) the chiefs cemetery and **Site 13** (0411269-9375147) a cemetery for everyone (Figure 6-48 to Figure 6-50). The sites are located to the South of the project area and well away from any infrastructure. No Impact is foreseen on the sites. ***The sites are of high social significance***



Figure 6-48: Site 11



Figure 6-49: Site 12



Figure 6-50: Site 13

Yuku Village

One cemetery is associated with Yuku village **Site 16** (0411927-9378826). No direct impact by the proposed development footprint is foreseen on the site; however the fact that Yuku village will be relocated might mean that the community wants the cemetery to be relocated with them. This will have to be established through the social consultation process. ***The sites are of high social significance***



Figure 6-51: Grave at Yuku village

Village Mbemba

There are three grave sites associated with Mbemba village: **Site 23** (0413121-9380010) a cemetery for children (Figure 6-52), **Site 24** (0412560-9380699) the chiefs cemetery for the ancestors and **Site 25** (0412753-9380496) a cemetery for adults. The sites are located to the west of the quarry area and well away from any infrastructure. No Impact is foreseen on the sites. ***The sites are of high social significance***



Figure 6-52: Site 23

Village Kinsua

One cemetery is associated with Kinsua village **Site 28** (0413514-9381591). The site is located to the North East of the quarry area and well away from any infrastructure. No Impact is foreseen on the sites. ***The sites are of high social significance***



Figure 6-53: Cemetery at Kinsua Village Site 28

Village Mbamba

One cemetery is associated with Mbamba village **Site 28** (0412750-9377757). The site is located to the North East of the quarry area and well away from any infrastructure. No Impact is foreseen on the sites. ***The sites are of high social significance***



Figure 6-54: Graves at Mbamba Village, Site 28

Village Minkelo

There are two grave sites associated with Minkelo village: **Site 32** (0410255-9375938) **Site 33** (0410168-9377950) the Minkelo school cemetery. The sites are located to the South and South

West of the cement plant and well away from any infrastructure. No Impact is foreseen on the sites.

The sites are of high social significance



Figure 6-55: Site 32



Figure 6-56: Site 33

Village Kokolo

One cemetery is associated with Kokolo village **Site 35** (0410852-9380925) that belongs to the founder of the village. The site is located approximately 180 meters north of the overburden stockpile. No direct impact is foreseen on the site but in order to ensure no secondary impact occur on the site some management actions are necessary as per Section 8 of this report. ***The sites are of high social significance***



Figure 6-57: Grave at site 35.

Sacred Sites

For the purposes of this report sacred sites also includes medicinal trees and trees that fulfil special purposes in a village like the Nkasa tree. ***The sites are of high social significance***

Village Tandu

Sacred Tree Nkasa:

The tree oversees unclean spirits and serves to establish truth in the community where the established rules have been violated. When someone has broken the community rules and denies this they will be given a piece of bark of the tree to eat. If the person is guilty the community believes that their cells will inflate and that they will then die. .

Site 1 (0414380-9379309) Nkasa Sacred tree. The site is located to the East of the project area and well away from any infrastructure. No Impact is foreseen on the site.

Village Nkonda

- **Site 4** (0413456-9376524) Tree Nkondo
- **Site 6** (0413319-9376737) Medicinal Tree
- **Site 7** (0413535-9376355) Sacred Tree Yenge Kia Lubutu Lua Bantu
- **Site 8** (0413468-9376386) Sacred Tree Nsanda Vata And Sacred Place

The site is located to the south east of the project area and well away from any infrastructure. No Impact is foreseen on the site. ***The sites are of high social significance***



Figure 6-58: Medicinal tree at Site 6



Figure 6-59: Sacred Tree Yenge Kia Lubutu Lua Bantu at Site 7

Village Yuku

Sacred Tree Akasha.

The presence of birds (especially a small bird called Ngawu) on the tree shows the acceptance of the establishment of the village where the tree is found, and symbolises harmony, brotherhood, and fertility. The nests have an important significance indicating the number of homes as well as people living in the area and those who have already died. The birds are like a metaphor for the village and they are not to be hunted or eaten.

- **Site 14** (0411732-9378622) Tree Akasha
- **Site 15** (0411694-9378669) Nsanda Vata Tree

The sites are located to the North of the project area and well away from any infrastructure. No Impact is foreseen on the site. ***The sites are of high social significance***

*Village Mbemba*Village Mbemba: Sacred Tree Nkazu.

This tree bears fruit called Makasu.

The tree plays an important role in the community and has done so for past generations. Problems such as drought, diseases, lack of rain is brought to this tree in a ceremony where the head drinks palm wine and eats the fruit. Once a compromise is reached the head and his family goes to offer palm wine to the ancestors and Makasu at the cemetery. Here they have to explain the reasons for their presence and the concerns of the community. ***The sites are of high social significance***

Village Mbemba: Sacred Tree (Ceiba pentandra FAMILY Bombacaceae) BAOBAB.

This tree is the basis, the foundation and symbol of the existence of ancestors who lived before them in this place

- **Site 21** (0413144-9379733) Tree Nkondo
- **Site 22** (0413001-9379927) Nkazu Sacred Tree

The sites are located to the East of the quarry and well away from any infrastructure. No Impact is foreseen on the site. ***The sites are of high social significance***

*Village Kinsua*Village Kinsua: Sacred Tree Nkazu.

This tree bears fruit called Makasu.

The tree plays an important role in the community and has done so for past generations. Problems such as drought, diseases, lack of rain is brought to this tree in a ceremony where the head drinks palm wine and eats the fruit. Once a compromise is reached the head and his family goes to offer palm wine to the ancestors and Makasu at the cemetery. Here they have to explain the reasons for their presence and the concerns of the community.

Village Kinsua: Sacred Tree Nkondo (Ceiba pentandra family Bombacaceae) Baobab.

This tree is the basis, the foundation and symbol of the existence of ancestors who lived before them at this point.

- **Site 26** (0413595-9381437) Tree Nkondo
- **Site 27** (0413594-9381427) Sacred Tree Nsanda Vata
- **Site 29** (0413697-9381505) Sacred Tree Nsanda Vata

The site is located to the north east of the project area and well away from any infrastructure. No Impact is foreseen on the site. ***The sites are of high social significance***

Village Mbamba

Site 31 (0412460-9377634). No description or explanation is given for the recording of the pond close to Mbamba village by the field archaeologist. Sites like these are sometimes associated with sacred places and living heritage and are therefore recorded in this report. If the site do have any connection to living heritage must however be ascertained by the social team.

The site is located to the East of the cement plant and if part of living heritage a secondary impact might occur here. ***The sites are of high social significance***



Figure 6-60: The sacred Nkondo tree at Site 26



Figure 6-61: The pond at Mbambwa

Village Minkelo

- **Site 34** (0410392-9377794) Shrine Mongo

The site is located to the West of the cement plant and well away from any infrastructure. No Impact is foreseen on the site. ***The sites are of high social significance***



Figure 6-62: The Mongo Shrine at Site 34

Village Kokolo

Village Kokolo: Sacred Tree Nkondo (Ceiba pentandra FAMILY Bombacaceae) Baobab.

This tree is the basis, the foundation and symbol of the existence of ancestors who lived before them there.

- **Site 36** (0410889-9381840) Nkondo Sacred Tree

The site is located to the North of the overburden stockpile and well away from any infrastructure. No Impact is foreseen on the site. ***The sites are of high social significance***



Figure 6-63: Nkondo Sacred Tree at Site 36

Archaeological Sites

Village Yuku

Four archaeological sites (**Site 17 -20**) dating from the Iron Age period are associated with Yuku village. **Site 17** consists of the remains of smelting activities (slag and *tuyere* fragments) and **Site 18 – 20** consist of decorated and undecorated ceramics and pieces of daga. Unfortunately the ceramics

are too fragmented to be positively identified to the Early or Late Iron Age period and require further investigation. These kind of sites are not found in isolation and more sites dating to this period are expected. **Site 18-20** are probably part of the same complex.

The sites are located to the West of Yuku village and although no infrastructure is planned in the immediate vicinity upgrading of existing roads and the construction of the haul road might impact on these sites. ***The sites are of medium heritage significance as very little is known of the Iron Age of the Iron Age of the area and can contribute scientifically.***



Figure 6-64: Slag found at Site 17



Figure 6-65: Decorated ceramics



Figure 6-66: Ceramic clusters at Site 19

Consultations

From the field report received by HCAC very little pertaining to the consultation with representatives from the villages in the concession area was written up. However some important points were deducted.

The leaders interviewed did not disclose any relevant heritage information. After explaining to them how important it is to identify and protect these sites the field archaeologist was informed that they are withholding this information to protect their customs, traditions and secrets. The archaeological sites that were identified were found through systematic surveys. The people interviewed regarding archaeological artefacts and sites were unaware of any and no sites were pointed out. A list of people interviewed is provided below.

Table 6-40: Village representatives that were interviewed

Date	Village	Representative	Coordinates
Thursday, 13/6/2013	Tandu Village	Kiwila Jean	0415994 9378719
Thursday, 13/06/2013	Kumbi II Village	Ndongala Kanavangao	0415638 9377434
Friday, 14/06/2013	Nkonda Village	Kanavangawo Ndongala Boniface	0413535 9376374
Friday, 14/06/2013	Mawete II Village	Kialand Kamil	0411051 9374870
Saturday, 15/06/2013	Yuku Village	Adieyi Luyila	0411726 9378640
Saturday, 15/06/2013	Mbemba Village	Masaidi Ndosiba	0413031 9379789
Sunday, 16/06/2013	Mbemba Village	Masaidi Ndosiba	0413031 9379789
Sunday, 16/06/2013	Kinsua Village	Lukuamusu Toko	0413609 9381464
Sunday, 16/06/2013	Mbamba Village	Dikuwiluko Ferdinand	0413898 9380808
Monday, 17/06/2013	Minkelo Village Centre	Luzolawo Tekasala	0410034 9376170
Monday, 17/06/2013	Minkelo School (mission) Village	Mwangatusungama Alphonse	0409685 9378061
Monday, 17/06/2013	Kokolo Village	Utidi Alice	0410918 9381270
Monday, 17/06/2013	Kinfinda Village	Zantuadi Eliko Thomas	0407768 9380189
Tuesday, 18/06/2013	Nkondokiombia Village	Kifuanana Nduantoni and Ndongala Makwebo	0404624 9380606
Tuesday, 18/06/2013	Nionga Village	Yayama Kamavuako Samson	0405488 9385564

6.5.8 Traffic

The following section is a combination of a review of available desktop information and a traffic count undertaken by SRK in June 2013.

Existing road traffic in the vicinity of the site is limited to the national road between Matadi and Kinshasa (N-1). The national road between Kinshasa and Matadi (N-1) is a single lane highway in relatively good condition. The road pavement is approximately ± 6 m wide, with a narrow (± 0.7 m) asphalt verge on each side. The road is in generally in very good condition, and sections of the road between the project site and Matadi are currently being resurfaced. The N-1 is the principal logistics artery between the Matadi and rest of the country. Average annual traffic volumes are depicted in Table 6-41

Table 6-41: Annual Average Traffic Volumes on N-1

Total Vehicle Movements	Between Matadi & Lukala			Between Lukala & Kinshasa		
	Trucks	Buses	Light Vehicles	Trucks	Buses	Light Vehicles
per year	76,961	15,532	125,885	104,906	33,579	555,544
per day	211	43	345	387	92	1522
per hour	8.8	1.8	14.4	12.0	3.8	63.4
per minute	0.1	0.0	0.2	0.2	0.1	1.1
minutes per vehicle	6.8	33.8	4.2	5.0	15.7	0.9

Source: Rapport Annuel Statistiques Passage Vehicules Annee 2012, obtained from Societe de Gestion de Peage du Congo (SO.PE.CO.)

The results of an informal traffic count conducted by SRK during the site visit of the 10 to 14 June 2013 are shown in Table 6-42.

Table 6-42: Results of Informal Traffic Count on N1

Total Vehicle Movements	To Matadi			To Lukala		
	Trucks	Buses	Light Vehicles	Trucks	Buses	Light Vehicles
per hour	14.74	2.81	16.14	21.05	4.91	20.70

Pedestrians utilise the verges of the road, and depending on location this can vary from occasional pedestrian traffic to congested, particularly in the villages that the N-1 goes through.

7 Potential Environmental, Social, Health and Safety Impacts

The impact assessment methodology that has been used in this updated ESIA is described in detail in Section 7.1 and is consistent with GIIP and the DRC's requirements. Environmental and social impacts that have been identified are described and summarised. Impacts are described in terms of project phases, namely construction, operations, decommissioning and closure.

Where available, baseline data and relevant impact drivers are described on the basis of available baseline data and project description information. Impacts are described at a high level and impact significance is qualitatively assessed. Due to the low level of control that SRK has had over data collection and methodologies and unconfirmed project infrastructure locations, in most cases the level of certainty with respect to impact assessment is described as low or moderate. Management principles and recommendations are described and further work that will be need to be undertaken to increase the level of certainty with respect to impacts and management measures, is outlined.

The impacts of the project construction and operational activities as well as impacts that will persist post-closure were considered for the following parameters:

- Soils, land use and land capability
- Air quality
- Surface water
- Groundwater
- Noise
- Traffic
- Ecology and biodiversity
- Ecosystems services
- Socio-economics

7.1 Impact assessment methodology

7.1.1 Identification and definition of impacts

The impact assessment will be conducted in an integrated manner that links the socio-economic components with the biophysical components of the environment. The assessment is divided into issue identification, impact definition, and impact evaluation. Iteration of these parts occurs in each stage of an ESIA process to varying degrees.

The basic elements used in the evaluation of impact significance are described in Table 7-1 and the characteristics that are used to describe the consequence of an impact are outlined in

Table 7-2.

issue identification, impact definition, and impact evaluation. Iteration of these parts occurs in each stage of an ESIA process to varying degrees.

The basic elements used in the evaluation of impact significance are described in Table 7-1 and the characteristics that are used to describe the consequence of an impact are outlined in

Table 7-2.

Table 7-1: Key elements in the evaluation of impact significance

Element	Description	Questions applied to the test of significance
Consequence	An impact or effect can be described as the change in an environmental parameter, which results from a particular project activity or intervention. Here, the term “consequence” refers to: (a) The sensitivity of the receiving environment, including its capacity to accommodate the kinds of changes the project may bring about. (b) The type of change and the key characteristics of the change (these are magnitude, extent and duration). (c) The importance of the change (the level of public concern/ value attached to environment by the stakeholders and the change effected by the project). The following should be considered in the determination of impact consequence: (a) Standards and guidelines (thresholds). (b) Scientific evidence and professional judgment. (c) Points of reference from comparable cases. (d) Levels of stakeholder concern.	Will there be a change in the biophysical and/or social environment? Is the change of consequence (of any importance)?
Probability	Likelihood/chances of an impact occurring.	What is the likelihood of the change occurring?
Effectiveness of the management measures	Significance of the impact needs to be determined both without management measures and with management measures. The significance of the unmanaged impact needs to be determined so there is an appreciation of what could occur in the absence of management measures and of the effectiveness of the proposed management measures.	Will the management measures reduce impact to an acceptable level?
Uncertainty/ Confidence	Uncertainty in impact prediction and the effectiveness of the proposed management measures. Sources of uncertainty in impact prediction include: (a) Scientific uncertainty – limited understanding of an ecosystem (or affected stakeholders) and the processes that govern change. (b) Data uncertainty – restrictions introduced by incomplete, contradictory or incomparable information, or by insufficient measurement techniques. (c) Policy uncertainty – unclear or disputed objectives, standards or guidelines. There are a number of approaches that can be used to address uncertainty in impact prediction, including: (a) ‘Best’ and ‘worst’ case prediction to illustrate the spread of uncertainty. (b) Attaching confidence limits to impact predictions. (c) Sensitivity analysis to determine the effect of small changes in impact magnitude.	What is the degree of confidence in the significance ascribed to the impact?

Table 7-2: Characteristics used to describe impacts and impact consequence

Characteristics used to describe consequence		Sub-components	Terms used to describe the characteristic
Type			Biophysical, social or economic
Nature			Direct or indirect, cumulative etc.
Status			Positive (a benefit), negative (a cost) or neutral
Phase of project			During pre-construction (if applicable), construction, operation, decommissioning or post closure
Timing			Immediate, delayed
Magnitude	Sensitivity of the receiving environment/ receptors		High, medium or low sensitivity Low capacity to accommodate the change (impact)/ tolerant of the proposed change
	Severity/ intensity (degree of change measured against thresholds and/or professional judgment)		Gravity/ seriousness of the impact Intensity/ influence/ power/ strength
	Level of stakeholder concern		High, medium or low levels of concern All or some stakeholders are concerned about the change
Spatial extent or population affected The area/population affected by the impact The boundaries at local and regional extents will be different for biophysical and social impacts.			Area/ volume covered, distribution, population Site/Local (social impacts should distinguish between site and local), regional, national or international
Duration (and reversibility) Length of time over which an impact occurs and potential for recovery of the endpoint from the impact			Short term, long term Intermittent, continuous Reversible/ irreversibility Temporary, permanent
Confidence			High, Medium, Low

7.1.2 Impact significance rating

Practicable management measures will be recommended that avoid, and if avoidance is not possible, then reduce, restore, compensate/offset negative impacts, enhance positive impacts and assist project design. The impact significance rating system is presented in Table 7-3 and involves four parts:

- Part A: Defines impact consequence using the three primary impact characteristics of magnitude, spatial scale and duration;
- Part B: Uses the matrix to determine a rating for impact consequence based on the definitions identified in Part A;

- Part C: Uses the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from Part B) and the probability of occurrence; and
- Part D: Defines the Confidence level.

Table 7-3: Method for rating the significance of impacts

PART A: DEFINING CONSEQUENCE IN TERMS OF MAGNITUDE, DURATION AND SPATIAL SCALE					
Use these definitions to define the consequence in Part B					
Impact characteristics	Definition	Criteria			
MAGNITUDE	Major	Substantial deterioration or harm to receptors; receiving environment has an inherent value to stakeholders; receptors of impact are of conservation importance; or identified threshold often exceeded			
	Moderate	Moderate/measurable deterioration or harm to receptors; receiving environment moderately sensitive; or identified threshold occasionally exceeded			
	Minor	Minor deterioration (nuisance or minor deterioration) or harm to receptors; change to receiving environment not measurable; or identified threshold never exceeded			
	Minor+	Minor improvement; change not measurable; or threshold never exceeded			
	Moderate+	Moderate improvement; within or better than the threshold; or no observed reaction			
	Major+	Substantial improvement; within or better than the threshold; or favorable publicity			
SPATIAL SCALE	Site or local	Site specific or confined to the project area			
	Regional	May be defined in various ways, e.g. cadastral, catchment, topographic			
	National/ International	Nationally or beyond			
DURATION	Short term	Less than 3 years			
	Medium term	3 to15 years			
	Long term	>15 years			
PART B: DETERMINING CONSEQUENCE RATING					
Rate consequence based on definition of magnitude, spatial extent and duration					
		SPATIAL SCALE/ POPULATION			
		Site or Local	Regional	National	
MAGNITUDE					
Minor	DURATION	Long term	Medium	Medium	High
		Medium term	Low	Low	Medium

		Short term	Low	Low	Medium
Moderate	DURATION	Long term	Medium	High	High
		Medium term	Medium	Medium	High
		Short term	Low	Medium	Medium
Major	DURATION	Long term	High	High	High
		Medium term	Medium	Medium	High
		Short term	Medium	Medium	High
PART C: DETERMINING SIGNIFICANCE RATING					
Rate significance based on consequence and probability					
			CONSEQUENCE		
			Low	Medium	High
PROBABILITY (of exposure to impacts)		Definite	Medium	Medium	High
		Possible	Low	Medium	High
		Unlikely	Low	Low	Medium
PART D: CONFIDENCE LEVEL					
High		Medium		Low	

Notes: + denotes a positive impact.

Using the matrix, the significance of each described impact is initially rated. This rating assumes the management measures inherent in the project design are in place.

7.1.3 Modification of methodology for Heritage impact assessment

The SRK impact assessment methodology provided was modified for this study, as natural resources do not easily translate to cultural resources. The impact assessment methodology used is summarized in Table 7-4

Table 7-4: Modified method for rating significance of cultural heritage impacts

PART A: DEFINING CONSEQUENCE IN TERMS OF MAGNITUDE, DURATION AND SPATIAL SCALE		
<i>Use these definitions to define the consequence in Part B</i>		
Impact characteristics	Definition	Criteria
MAGNITUDE	Major	Impact on site about 100%
	Moderate	Impact on site about 50%
	Minor	Impact on site up to 25%

SPATIAL SCALE	Site or local	Site specific or confined to the immediate project area		
	Regional	May be defined in various ways, e.g. cadastral, catchment, topographic		
	National/ International	Nationally or beyond		
HERITAGE SIGNIFICANCE	LHS	Low heritage significance		
	MMHS	Medium to medium/ high heritage significance		
	HHS	High heritage significance		
PART B: DETERMINING CONSEQUENCE RATING				
Rate consequence based on definition of magnitude, spatial extent and duration				
MAGNITUDE	HERITAGE SIGNIFICANCE	SPATIAL SCALE/ POPULATION		
		Site or Local	Regional	National/ international
Minor	HHS	Medium	Medium	High
	MHHS	Low	Low	Medium
	LHS	Low	Low	Medium
Moderate	HHS	Medium	High	High
	MHHS	Medium	Medium	High
	LHS	Low	Medium	Medium
Major	HHS	High	High	High
	MHHS	Medium	Medium	High
	LHS	Medium	Medium	High
PART C: DETERMINING SIGNIFICANCE RATING				
Rate significance based on consequence and probability				
		CONSEQUENCE		
		Low	Medium	High
PROBABILITY (of exposure to impacts)	Definite	Medium	Medium	High
	Possible	Low	Medium	High
	Unlikely	Low	Low	Medium
PART D: CONFIDENCE LEVEL				
High		Medium	Low	

7.1.4 Management recommendations and post management significance

Practicable **management measures** were then listed, using the IFC's management hierarchy:

“Recommendations for management should focus on *avoidance*, and if avoidance is not possible, then to *reduce, restore, compensate/offset negative impacts*, enhance positive impacts and assist project design.”

The significance of impacts was then re-assessed **with** assumed management measures in place (“**after management**”). Specialists also recommended and described appropriate **monitoring** and review programs to track the efficacy of management measures. These are included in the Action Plans.

NYA was consulted throughout the ESIA update process, including the management measures proposed. However, as certain components of the project design have not yet been finalised, additional refinement of the relevant management measures (in consultation with NYA) may be required once those aspects have been finalised.

An example of the table used to report the significance rating for each impact before and after the implementation of mitigation / management measures, and listing these measures, is provided as Table 7-5

Table 7-5: Impact significance rating and mitigation measures for Impact xx

Impact xx: Habitat disturbance resulting in invasion by exotic fauna and flora								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: •								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>Medium</i>

7.2 Construction Phase Environmental Impacts

The construction activities will include:

- Site clearance, ground modeling and landscaping;
- Utilities and services connections to site;
- Foundation excavations and installation of concrete footings;
- Erection of building steel frames and cladding;
- Installation of equipment;
- Ancillary facilities erection;
- Services and utilities connections;
- Building fitting-out; and
- Supervision for the construction activities will be provided by NYA and FLS.

The various environmental impacts potentially resulting from the construction phase of the project have been subdivided according to broad categories based on the disciplines and are listed as follows:

- Visual impacts;
- Air quality
- Greenhouse gases;

- Ecology and biodiversity;
- Noise and vibration;
- Soils and land use;
- Traffic;
- Cultural Heritage;
- Ecosystem services;
- Social impacts;
- Economic impacts;
- Health and safety impacts.

7.2.1 Visual impacts

Visual intrusion and loss of a “sense of place” may occur directly as a result of installation of project infrastructure and changes to the landscape (due primarily to vegetation clearing and construction of the quarry, overburden facility and cement plant). Indirect impacts may also result from dust blown from exposed surfaces and from blasting creating a plume, as well as lighting of site infrastructure in an otherwise relatively unlit environment, both of which could be visible from a considerable distance. Non-mining waste such as building rubble and domestic waste, both directly and indirectly (due to increased population and development in the area) related to the Project, is another aspect that could result in a negative change in visual character of the area. Although a waste management facility is planned as part of the Project, indiscriminate dumping of litter and rubble resulting from secondary developments could contribute to visual degradation of the area on a local scale, particularly given the current greenfields nature of the site.

The scale or intensity of the visual impact may be perceived differently depending on the sensitivity of the viewer and their location relative to the impact. Sense of place is defined as a person’s sense of belonging to a place or area. The screening effects of topography or dense, tall vegetation (such as forest) may reduce the impact slightly, though this is unlikely to have a significant effect due to the generally flat topography and lack of forested areas in the vicinity of the visually significant infrastructure.

Although the area is currently undeveloped and is ecologically relatively pristine, it is not specifically recognised for its scenic beauty or touristic value. Potential viewers consist mainly of local communities, who are expected to have relatively low sensitivity towards these changes, especially given the potential benefits in terms of job creation the project may provide them. It is, however, recognised that the perception of a visual impact is by nature highly subjective and, where one viewer may consider the impact to be negative, another might perceive the increased development and lighting of the area positively. For this reason a change to the sense of place of an area is difficult to rate according to standard methodologies. Although local people may associate a particular sense of place with the area, what is difficult to gauge is the importance people attach to that sense of place and how this will change over time should other development occur in the area, together with how potential Project benefits may ameliorate any loss.

Visual disturbance and loss of sense of place impacts are difficult to manage and the loss is theoretically irreversible regardless of post-closure rehabilitation (although this will ameliorate this impact to some degree). The perception of the area may change over time with people becoming accustomed to a new sense of place and thus the actual impact is partially reversed. The closure measures proposed, such as rehabilitation of the site, will assist in reducing the impact at closure.

The visual impacts of the proposed powerline are expected to be insignificant as there are no sensitive receptors in the area, and it will run along an existing powerline and the N1 for much of its length, so will not significantly change the visual character of the area.

Impact VI1: Loss of sense of place affecting local communities due to site clearing and construction activities**Table 7-6: Impact significance rating and mitigation measures for Impact VI1**

Impact VI1: Loss of sense of place affecting local communities due to site clearing and construction activities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Short-term</i>	<i>Regional</i>	Low	Definite	Medium	-	<i>Medium</i>
Management Measures: - Minimize the disturbed footprint as far as practically possible. - Undertake stripping, stockpiling and stockpile management as per the Soil Management Plan (Section 9.9). - Revegetate and landscape disturbed areas as soon as possible, to reflect the surrounding topography and vegetation as much as possible. - Consider the use of screening tools such as dense vegetation where practical and appropriate to the surroundings. - Clear vegetation in phases so that only those areas required for immediate development are cleared. - Implement the waste management plan for the project (Appendix 15). - Refer to dust control measures under Impact AQ1 (Section 7.2.3).								
After Management	<i>Minor</i>	<i>Short-term</i>	<i>Regional</i>	Low	Possible	Low	-	<i>Medium</i>

Good practice measures include the following:

- Paint buildings and structures or use materials with colours that reflect and complement the natural colour and textures of the surrounding landscape.
- Use directional lighting in areas operating at night, if communities are affected by lighting.

7.2.2 Soils, land capability and land use

Introduction

This section describes and assesses the soil, land capability and land use impacts that are likely to occur during the construction phase as a result of the proposed Project. The findings here are based on on a desktop review undertaken by SRK in July 2013.

Assumptions

The following assumptions apply:

- Impacts on hydromorphic soils are not analyzed separately from the impacts on the other soil types. This is because this assessment focuses purely on impacts associated with a loss of resource and change in land capability.
- No impacts on loss of ecological function were considered, as it is assumed that the biodiversity study is considering this element.
- It is assumed that there are no unique soils present within the project area;
- It is assumed that in the majority of the area to be impacted, there is limited agricultural activity;
- It is assumed that there are areas adjacent the project area not directly impacted by mining activities with similar soil types and land capabilities that could be utilized for agricultural purposes.

Limitations

The following limitations apply:

- DRC has no system available for determining land capability, the FAO Framework (FAO, 2006) was utilized to determine the land capability

- Final footprint areas were not provided for some infrastructure which has affected the accuracy of impact predictions.
- The study was based on a desktop review of regional soils information and thus any specific anomalies on the site will not have been considered in this impact prediction.

The aspects of the mining and cement manufacturing operations are likely to change soil baseline conditions. The following broadly describes how these changes are likely to occur:

- The construction of infrastructure leading to a loss of soil resource and loss of land capability due to sterilization. During construction, soils under the cement plant, overburden spoil piles, linear infrastructure, and areas cleared for the pit etc., will be lost from the landscape. The loss of this resource will result in a change in land capability (bearing in mind that in this context land capability is assessed in terms of its potential to support agriculture) from agriculture to unavailable to support agriculture. In this assessment this aspect is split into two different impacts as discussed below:
 - The loss of soil resources limited to the period of operation, after which rehabilitation will be undertaken. This includes offices, soil stockpiles, workshops and the cement plant that are likely to be demolished or removed at the end of the operation. Following the completion of the activity, the soil resource can be made available to the environment through the implementation of rehabilitation activities.
 - The permanent loss of soil resource associated with infrastructure that will remain post closure. This includes open pit and the overburden spoil piles that will remain as permanent features in the landscape, irrespective of any soil placement that may occur at closure. Although the soils may be replaced during capping of the overburden spoils pile, there is a permanent change in land capability and land use potential.
- Construction activities may lead to the contamination of soils, particularly where there is the uncontrolled spillage of hydrocarbons in areas where they are not contained.
- The construction of infrastructure may lead to increased erosion resulting in a loss of soil resources. If water management measures are not implemented, there is the potential that the soils exposed as a result of construction (or soils on the perimeter of the infrastructure) may be exposed to greater water velocities than would occur if covered by vegetation. This increase in velocity could lead to erosion potentially followed by sedimentation in the downstream areas. There is also the potential for wind erosion during the dry season of the construction period, when soils are cleared of vegetation.

Impacts on hydromorphic soils are not analyzed separately from the impacts on the other soil types. This is because this assessment focuses purely on impacts associated with a loss of resource and change in land capability.

No impacts on loss of ecological function were considered, as it is assumed that the biodiversity study is considering this element.

This impact assessment is undertaken within the following context:

- That there are no unique soils present within the project area;
- That on the majority of the area to be impacted, the land uses are not associated with sustaining livelihood; and
- That there are areas just off the project area not directly impacts by mining activities with similar soil types and land capabilities that could be utilized for agricultural purposes.

Potential impacts

Impact SL1: Placement of project infrastructure, resulting in a temporary loss of soil resource, and change in soil characteristics, land capability and land use

This considers infrastructure which is required for the operation of the mining and processing activities, which is unlikely to be permanent in the landscape after closure i.e. infrastructure which can be decommissioned or rehabilitated (e.g. offices, workshops, roads, soil stockpiles, access and haul road etc.).

During construction, soils below the infrastructure will be lost from the landscape as infrastructure is placed onto the soils or the soils stripped for stockpiling. Infrastructure will take up a footprint area of approximately 150 ha resulting in an equivalent loss of soils area. The loss of this resource will result in a change in land capability (bearing in mind that the focus of the FAO system (FAO, 1976) is suitability for use as agricultural soils or food production) from one that is generally moderately suitable to one that is not suitable/not available.

The impact may manifest as construction commences and may endure through the operating phases to decommissioning and closure. As the nature of the impact will be the same during construction and operation, these phases have been combined into a single assessment. There is, however, the opportunity that with correct planning during the construction phases, the potential impact during decommissioning and closure could be minimized. Therefore, this phase in the life cycle has been assessed separately to the other phases.

Table 7-7: Impact significance rating and mitigation measures for Impact SL1

Impact SL1: Placement of project infrastructure, resulting in a temporary loss of soil resource, and change in soil characteristics, land capability and land use								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Minor</i>	<i>Medium-term</i>	<i>Site/Local</i>	Low	Definite	Medium	-	<i>Medium</i>
Management Measures: - Minimize the disturbed footprint as far as practically possible. - Undertake stripping, stockpiling and stockpile management as per the Soil Management Plan (Section 9.9), for reuse on footprint. - Implement livelihood restoration and compensation measures in areas where livelihood are impacted by the loss of agricultural lands. - Implement the Closure Management Plan as described in Section 9.13 to support the proposed project								
After Management	<i>Minor</i>	<i>Medium-term</i>	<i>Site / Local</i>	Low	Definite	Medium	-	<i>Medium</i>

The confidence level has been determined to be medium as although the project configuration has largely been finalized, the distribution of soils within the disturbed area has not been assessed at a sufficiently fine scale.

During construction and operation, the soil resource may be lost from the landscape, albeit through the stripping and stockpiling of the soils which should occur during the construction period. Stripping results in a loss of resource and there may also be a temporary loss in livelihood for the local community if these areas were being utilized for agricultural activities. This impact may continue for the duration of the project until the infrastructure is decommissioned and rehabilitation is undertaken. At closure, once the infrastructure has been decommissioned and the areas rehabilitated, there is the potential to re-establish pre-disturbance land capability.

Management measures

During construction and operation, there are limited management measures that can be implemented to mitigate the impact associated with the loss of the soil resource and the change in

land capability. However, constructing infrastructure on a footprint as small as practically possible will minimize the area impacted.

The stripping of soils during construction and proper stockpiling of such may allow these soils to be utilized at the end of the operation, thereby potentially returning the pre-disturbance land capability. At closure, the replacement of soil in the area where removal occurred will potentially return the soil resource and land capability close to that of the pre-disturbance condition.

Impact SL2: Placement of permanent project infrastructure, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use

This impact is very similar to that described above; however, as the activity will be permanent following closure, the impact will endure permanently with regards the quarry and overburden spoil piles.

As there are no opportunities to remove the infrastructure and/or replace soils onto the original footprint, thereby returning pre-disturbance land capability, the decommissioning and closure impacts have the same rating as the construction and operations post management, impact.

There is opportunity to use the stripped soils as cover material on the overburden spoil piles during closure to provide a growth medium. However, irrespective of the depth of placement, unless the slopes on the facilities covered are the same as those that existed prior to mining, land capability – which considers slope – is irreversibly lost. Finally, it is undesirable to allow the community to utilize the rehabilitated overburden spoil piles for agricultural activities as this may result in post closure impacts becoming manifest as the rehabilitation is disturbed.

Table 7-8: Impact significance rating and mitigation measures for Impact SL2

Impact SL2: Placement of permanent project infrastructure, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long-term</i>	<i>Site / Local</i>	Medium	Definite	Medium	-	<i>Medium</i>
Management Measures: - Contain the disturbance to as small a footprint as practically required for the activity. - Preserve topsoil for rehabilitation, by stripping soil during construction as per Soil Management. - Assist community members where livelihood impacted with establishing new agricultural areas on land of equal or better land capability. - Implement the Closure and Rehabilitation Plan as described in the report to support the proposed project								
After Management	<i>Minor</i>	<i>Long-term</i>	<i>Site / Local</i>	Medium	Definite	Medium-	-	<i>Medium</i>

The confidence level has been determined to be medium as although the project configuration has been finalized, the distribution of soils within the disturbed area has not been assessed at a sufficiently fine scale.

Management measures

During construction, operation and closure there are limited management measures that can be implemented to avoid or mitigate the impacts associated with the loss of the soil resource and the associated change in land capability. However, constructing infrastructure on a footprint as small as practically possible will minimize the impacted area.

The stripping and stockpiling of soil from the infrastructure footprint area will make this resource available for use in other areas during the decommissioning and closure phase of the project. The soil may be used for backfilling the areas where infrastructure is demolished.

Placing growth medium and vegetating the overburden spoil pile could allow the facility to blend in with the surrounding topography, thereby disguising it in the landscape. Furthermore, this rehabilitation is likely to reduce the sediment load generated from the facilities, post closure, although this may not re-establish pre-mining land capability.

From a safety perspective, which in turn has the potential to impact on NYA reputation, it would be undesirable to encourage community members to access these facilities. Therefore, only sufficient soil will be replaced to allow vegetation to become established which may reduce erosion on the slopes as well as disguise the facilities, but the thickness of soils is unlikely to support agriculture activities.

Impact SL3: Spillage of chemicals and seepage from waste resulting in permanent loss of soil resource, and change in soil characteristics, land capability and land use

There is the potential that during construction, spillage of chemicals such as hydrocarbons could affect the soils over a wider footprint than that disturbed by the actual activity. Where this occurs, phytotoxins could potentially accumulate in soils resulting in these soils no longer having the potential to support plant growth. There are a number of activities which could result in this occurring as described briefly below:

- Spills of the various hydrocarbons used for power, mining and lubrication requirements;
- Inadequate methods of storage and disposal of hazardous waste resulting in seepage of effluent;
- Breakdown of mobile equipment away from a workshop requiring the equipment to be repaired in areas where there may not be adequate protection from hydrocarbon spills.

Table 7-9: Impact significance rating and mitigation measures for Impact SL3

Impact SL3: Spillage of chemicals and seepage from waste resulting in permanent loss of soil resource, and change in soil characteristics, land capability and land use								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Moderate</i>	<i>Medium-term</i>	<i>Site / Local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>High</i>
Management Measures: • The preparation of procedures to ensure that spillage during mobile equipment maintenance is minimized. • The provision of appropriate secondary containment in areas where hydrocarbons, solvents and other potentially hazardous materials are stored. • Implement emergency preparedness and response measures plan as described in Section 9.11.								
After Management	Minor	Medium-term	Site / Local	Low	Possible	Low	-	<i>High</i>

Management measures

Appropriate secondary containment will be included in the design phase at all locations where there is the potential that chemical materials (hydrocarbons, lubricants, solvents etc.) or effluents could enter the environment through spill accidents or incidents. This is likely to include concrete or paved hard-standing, bunds etc. A preliminary emergency preparedness and response plan (Appendix 16) has been developed and should be updated as necessary to ensure that it contains appropriate management and remediation strategies to limit the potential impacts associated with accidents and incidents associated with the spills of material which could impact on soil quality.

Impact SL4: Site clearance resulting in a permanent loss of soil resource, and potential change in soil characteristics, land capability and land use as a result of increased erosion

Vegetation and soil stripping is likely to result in a high potential for erosion to occur as the binding effect of the vegetation is lost and the soil structure is exposed. There is also the potential that poorly constructed topsoil stockpiles, which are not vegetated and protected from erosion losses will result in an increase in the erosion rate. Increased erosion could lead to a loss of a soil resource in the area of the erosion and possibly an increase in the sediment load where the eroded soils are deposited. This impact is likely to occur at the pre-construction phase as land is stripped of vegetation and the soil structures disturbed, and persist until closure.

Table 7-10: Impact significance rating and mitigation measures for Impact SL4

Impact SL4: Site clearance resulting in a permanent loss of soil resource, and potential change in soil characteristics, land capability and land use as a result of increased erosion								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE ⁺ /-		Confidence
Before Management	<i>Moderate</i>	<i>Short-term</i>	<i>Site / Local</i>	Low	Definite	Medium -	-	<i>Medium</i>
Management Measures: - Minimize the area of disturbance. - Implement storm water control measures around infrastructure. - Appropriate topsoil stockpile management								
After Management	<i>Moderate</i>	<i>Short-term</i>	<i>Site / Local</i>	Low	Possible	Low -	-	<i>Medium</i>

The confidence level has been determined to be medium based on uncertainties regarding the distribution of soils to be impacted.

Management measures

The implementation of storm water controls to reduce water velocity should mitigate erosion. These controls could include:

- Berms, bunds, sediment control structures and diversions around the overburden disposal facility and roads. Where non-contact water diversions discharge to the environment, energy dissipaters such as gabions, established vegetation etc. should be included in the design; and
- Where needed, ensuring that exposed soil is re-vegetated as soon as practically possible.
- Construction of soil stockpiles that area benched if higher than 5m, with the slope angle not exceeding 20°. Establishment and maintenance of vegetation on the stockpiles prior to the commencement of the rainy season, following construction.
- Erosion can also be limited by ensuring that mine vehicles and human movement is limited to dedicated access ways, with off road travel authorized when required for critical mine operations.

7.2.3 Air Quality

Introduction

This section describes the air quality related impacts that the project could have on the communities within the project area during the construction phase. The findings here are based on SRK's review of the OEMS and ECTECH ESIA's.

Assumptions

The following assumptions apply:

- Based on the information supplied and SRK's experience and knowledge on similar operations, dust (TSP and PM₁₀ (i.e. particulates with an aerodynamic diameter of less than 10µm)) and gas (SO₂, NO_x, CO and VOC's) were identified as the main air quality pollutants of concern to be assessed in this study.

Limitations

The following limitations apply:

- The ambient air quality monitoring was undertaken over a three day period by ECTECH in 2012 and is not representative of long term conditions in the area;
- The wind patterns in the area are based on synoptic weather patterns and not site specific data, hence, accurate wind directions were not determined;
- The rainfall and temperature were also limited and not from site specific data, hence accurate meteorological conditions could not be determined for the site;
- The modelling study undertaken by ECTECH was for the kiln stack only and excluded emissions from other dust generating activities around the plant area such as roads, stockpiles, materials handling etc.;
- The impact assessment is based on a qualitative assessment as the modelling study did not incorporate all dust and gas sources and long term ambient air quality data was available; and
- This assessment only applies to the mine and the plant areas.

Sources of impacts

Expected impacts on air quality during the construction phase of the proposed project are:

- Dust generated during construction activities; and
- Emissions from vehicles and machines.

Dust generation from construction activities is an important concern during construction phase. Dust particles generally less than 10 µm will be suspended, resulting in visible deposition close to the construction activities.

The quantity of any emissions released during the construction process will generally be very low, but will vary on an hourly and daily basis as construction progresses. Fugitive dust emissions will increase during land clearing and site preparation phases, especially during dry season. Fugitive dust emissions will also increase during the more active construction periods as a result of increased vehicle traffic on the site.

The dust generated during construction activities will be mostly inorganic and of an inert nature. The impact of dust generation will depend on weather conditions, wind velocity, precipitation rate, and

type of construction activities. The major sources of dust emissions during the construction phase are:

- Land clearing
- Excavation
- Earthwork
- Ground leveling
- Vehicles movement.

Dust is expected to be present during the construction phase during the dry months, however the dust concentrations will decrease when the major civil works finish. Moisture control at may therefore be necessary during periods of dry weather in order to reduce the risk of dust entrainment in the ambient air. Peak dust generation, if construction activities coincide, will occur during the drier months and dust will be emitted into the atmosphere either by wind erosion of the vehicles entrainment of dust. It will therefore be necessary to ensure that loads are covered to prevent fine dust blowing from open-top trucks and to employ dust suppression methods such as water sprayers or chemical suppressants on the roads, paving and the placement of gravel will also reduce dust emissions.

There will be an overall increase in traffic and heavy machinery movement during construction phase for limited period leading to an increase in dust emission levels. These emissions together with exhaust emissions from equipment deployed during the construction phase are likely to result in marginal increases in the levels of SO₂, NO_x, CO, and unburnt hydrocarbons. However, due to the limited duration of the construction period, the impact on air quality can be considered as low. Certain sources and activities have short term durations e.g. earthmoving. Land clearing etc., hence the impact is low.

The background levels of these pollutants are considered to be low and are based upon the low frequency of traffic use in close proximity to the site. However, even with the predicted increase in construction related traffic and associated site activities, any increase in these pollutants is considered to be insignificant.

Spilled and tracked dirt (or other materials) will have to be removed from the adjacent road in a timely manner. All construction related fugitive dust emissions will be temporary and will stop once construction is completed. Emissions from open burning will have to be limited by removing materials whose burning would produce excessive smoke e.g., green vegetative materials.

Potential minor sources of volatile organic compounds include evaporative losses from onsite painting, refueling of construction equipment and the application of adhesives and waterproofing chemicals.

During construction there will be impacts on air quality. However, the proposed management measures will reduce the impacts to an acceptable level, especially as they are limited to the construction phase. The overall construction period is expected to have duration of 27 months.

Potential Impacts

Impact AQ1: Increase in PM₁₀ emissions resulting from land clearing, earthworks, and vehicular movement

Table 7-11: Impact significance rating and mitigation measures for Impact AQ1

Impact AQ1: Increase in PM ₁₀ emissions resulting from land clearing, earthworks, and vehicular movement								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	Minor	Short Term	Local	Low	Possible	Low	-	Low
Management Measures: • Apply dust suppressants to sections of roads used routinely by vehicles that pass through and close to villages; • Design road alignments to minimize travel distances and eliminate unnecessary traffic; • Locate stockpiles within site boundaries considering the location of potential sensitive receptors and the predominant wind direction; • Cover vehicles carrying dusty materials to prevent materials being blown from the vehicles; • Set speed limits to minimize the creation of fugitive dust within the project boundary; • Development of routine air quality monitoring program.								
After Management	Minor	Short Term	Local	Low	Unlikely	Low	-	Low

Impact AQ2: Increase in gas (SO₂, NO_x, CO and VOCs) emissions resulting from vehicle exhaust emission and biomass burning

Table 7-12: Impact significance rating and mitigation measures for Impact AQ2

Impact AQ2: Increase in gas (SO ₂ , NO _x , CO and VOCs) emissions resulting from vehicle exhaust emission and biomass burning								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	Minor	Short Term	Local	Low	Possible	Low	-	Low
Management Measures: • Limit vehicle idling and keep vehicles well maintained to minimize particulate and gaseous emissions; • Where possible, biomass burning should be considered and a schedule should be maintained to allow for pollutants to disperse into the atmosphere in a short amount of time; • Biomass burning should be conducted during the day and during the summer months; and • Development of routine air quality monitoring program.								
After Management	Minor	Short Term	Local	Low	Unlikely	Low	-	Low

7.2.4 Water resources

Surface Water

This section describes the surface water related impacts that the project could have on the drainage network in and downstream of the project area during the construction phase. The findings here are based on a review of the ECTECH ESIA.

Assumptions

The following assumptions apply:

- The scope of the project makes provision for approximately 1000 m³/d of wastewater that will need to be treated before discharge into the Yuku River. Based on the geology (karst limestone) large volumes of groundwater inflow volumes could be expected that would also require treatment before discharge.

- It is assumed that the requirement for pit dewatering will not be significant during the construction phase
- It is assumed the hydrogeological study that is currently underway by CREN-K will include run-off estimations and baseline contributions (these components will be impacted on by the open pit mining. - reduced run-off and baseflow contributions to these streams).

Limitations

The following limitations apply

- Cumulative mining Impacts have not been considered during the impact assessment;
- No hydrogeological and geophysical investigations were undertaken to assist in the aquifer characterization of the limestone deposit to be mined, and subsequent groundwater inflows that can be encountered (reference to the 10 000 litres/day that can be expected is not substantiated).
- No catchment studies were undertaken to establish run-off estimations, baseflow contributions etc. which are required to determine the impact of mining on surface water resources;
- No floodline studies have been undertaken which are crucial for placement of mining activities and the plant area in terms of possible flood events;
- No full scale hydro-census investigation work was undertaken to establish regional water use (ground and surface water), and the potential impact on those resources;
- Preliminary indications of surface water quality results are that elevated nitrate, iron and chromium concentrations occur within surface water bodies. The concentration of chromium exceeds the maximum limit (water will require treatment before use), This was based on one sample only taking during the dry seasons and needs to be confirmed with further sampling
- Previous baseline monitoring only included once-off sampling (groundwater largely excluded);
- No groundwater investigations were undertaken that could indicate, average groundwater depth, flow directions or inflows that can be expected in the pit;
- No geochemical characterization of overburden material has been undertaken. Preliminary indications are it contains pyrite, which may result in acid mine drainage and cause groundwater contamination. The neutralization potential of carbonatous minerals also needs to be established;
- A water & salt balance has not been undertaken
- Available baseline information was obtained from single sample runs during the dry season only;

The project area has surface water sources in the form of rivers and ponds. The construction activities are not directly expected to affect these surface water bodies. By avoiding uncontrolled discharges of liquids and waste, implementing adequate waste management and instigating appropriate organizational measures and mitigation actions, impacts on surface water can be reduced to a low level and will be limited to the construction period.

Impact WR1: Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste

Spills of fuel oil can have a potential adverse impact on surface water during both the construction and operational phases of the project. During construction, all fueling will have to be conducted in a manner consistent with the spill prevention and response plan to be prepared by the construction contractors. During construction, fuel oil will be required to be dispensed from tanks/drums located

onsite to construction vehicles. Fuel for construction activities will be delivered to the site by fuel truck drivers, who will be required to receive spill plan training prior to beginning work. The trucks will have to be equipped with oil spill response materials. Each transfer will need to be documented. Implementing management controls should minimize the potential for adverse impacts due to spills during site construction.

Inadequate waste management, especially of sewage and other hazardous waste, may result in contamination of surface water through runoff and seepage.

During construction all contractors, technicians and laborers will be required to implement practices to minimize the potential for spills of fuels or chemicals. Vehicle and machinery maintenance needs to be performed only in designated areas. In the unlikely event that spills do occur, they will have to be managed in accordance with the project's ESMP.

To further minimize potential environmental impacts it is recommended that full-time environmental monitoring is conducted during construction, particularly during all refueling operations to minimize potential concern.

Table 7-13: Impact significance rating and mitigation measures for Impact WR1

Impact WR1: Chemical contamination of surface water resulting from accidental spills during transportation and handling								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Short Term</i>	<i>Regional</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>
Management Measures: - Where contaminants are transported, emergency contaminant and mitigation measures must be developed to minimize impacts should accidental spillages occur along the transport routes - Equip all trucks and equipment carrying fuels or oil with spill response materials and train personnel in the use of such materials - Store all potential sources of contamination in secure facilities with appropriate Storm Water management systems in place to ensure that contaminants are not released to the water resource through Storm Water runoff								
After Management	<i>Minor</i>	<i>Short Term</i>	<i>Regional</i>	<i>Low</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>High</i>

Impact WR2: Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads

Table 7-14: Impact significance rating and mitigation measures for Impact WR2

Impact WR2: Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Short Term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>
Management Measures: - Construct access roads and infrastructure in a way that sensitive ecosystems are avoided; - Ensure that proper designs are prepared and implemented to manage stormwater runoff in a manner that minimizes sediment transport to the receiving water resource and minimizes erosion along runoff channels.								
After Management	<i>Minor</i>	<i>Short Term</i>	<i>Site / local</i>	<i>low</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>High</i>

Groundwater

NYA does not plan to utilize any ground water during the construction phase. ECTECH's baseline studies indicated that the water table in the project area ranges at a depth of 20 to 25 meters. The surrounding communities are not known to use ground water. Based on good construction practices, all precautions necessary will be required to reduce the potential for site impacts to a minimum on ground water.

While the proposed site preparation and facility construction activities for the project are not anticipated to cause any short-term or long-term groundwater impacts, GIIP will need to be employed during construction to ensure impacts (if any) are minimal and are properly mitigated.

Fluctuations in groundwater levels are expected to occur throughout the year due to rainfall, by surface percolation and infiltration through the rivers system. A dewatering system may be required during quarry development, and will continue to operate through operation of the quarry as the pit depth increases. Impacts on groundwater availability are not expected to be significant during construction, assuming the requirement for pit dewatering will not be significant during this phase. This impact therefore has not been rated and no mitigation measures are recommended.

Impact WR3: Contamination of groundwater resulting from seepage from sewage and other waste

The use of chemical toilets or septic tanks during the construction phase (when up to 500 workers are expected to be on site) may impact on groundwater quality through seepage if these systems are not appropriately managed. Waste (including hazardous waste) will also be generated and similarly may lead to groundwater contamination if it is not appropriately stored and disposed of. Although no current users of groundwater have been identified and the baseline quality of this resource has not been assessed, large volumes of groundwater are expected to exist in the area, and numerous wetland areas (where the groundwater table is at surface level) are present.

The installation of a package plant sewage treatment system and construction of a waste landfill site during the construction phase are proposed, and would reduce the probability of this impact occurring once they are in operation.

Table 7-15: Impact significance rating and mitigation measures for Impact WR3

Impact WR3: Contamination of groundwater resulting from seepage from sewage and other waste								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Minor</i>	<i>Short Term</i>	<i>Regional</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>
Management Measures: - Manage waste in accordance with the Waste Management Plan (Appendix 15) - Prioritise construction of a properly lined and designed waste landfill site and sewage treatment system as early as possible during construction								
After Management	<i>Minor</i>	<i>Short Term</i>	<i>Site / local</i>	<i>low</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>High</i>

7.2.5 Waste Management

Introduction

This section describes the waste related impacts that the project could have on the water and soil quality and health and safety of communities in the project area during the construction phase.

During construction it is expected that the waste streams generated will include the following:

- Putrescible waste from construction camp catering facilities

- Sewage waste from portable toilets
- Paper, card, toner and other office consumables from offices
- Plastic, card, wooden pallets and polystyrene from packaging of goods delivered to site
- Steel and plastic drums/containers from packaging of goods delivered to site
- Cement, rubble, wood and metal off-cuts from the construction of buildings
- Electrical cable and plastic fittings from electrical wiring work
- Pipework off-cuts
- Tyres, waste oils and obsolete parts from vehicle maintenance
- Waste material from road maintenance
- Spent process chemicals used during construction
- Spent non-hazardous chemicals, including herbicides, pesticides and their containers
- Batteries and fluorescent tubes
- Medical waste.

Since there is limited infrastructure currently on the site, it can be assumed that there will be no existing buildings, plant structures, infrastructure, pipelines and roads or foundations requiring demolition or refurbishment. Thus building rubble and related waste is unlikely to be generated until decommissioning/ closure.

Potential impacts resulting from inappropriate waste storage, handling and disposal include contamination of ground and surface water and soils through seepage of effluent containing contaminants. These impacts are included in the ratings provided in those respective subsections (Section 7.2.4 and Section 7.2.2), and a separate impact rating is therefore not provided in this section.

7.2.6 Noise and vibration

Introduction

This section describes the noise related impacts that the project could have on the communities in the project area. The findings here are based on a review of the ECTECH ESIA and modelling undertaken by SRK in June 2013.

Key assumptions and limitations relevant to this study are listed in section 7.3.3

Noise generating activities

Activities in the construction phase do not constitute a constant, continuous source of noise quantifiable in the same way as noise in the operational phase of the project. With changing levels of activity and shifting sources of noise, noise levels will vary considerably in magnitude and over time. Depiction of such variable noise on a noise map would be misleading more than anything else. Hence, although calculations were made to investigate the order of magnitude of construction noise levels, the assessment of construction phase noise is based largely on qualitative considerations.

Activities listed in Table 7-16 are potential but not necessarily significant or even audible sources of noise, depending on distance from the site. Activities which from a noise perspective, are irrelevant, have been omitted.

Table 7-16: Summary of sources of noise in the construction phase

Construction Activity	Primary sources of noise
Quarry Construction / excavation	
Site clearance – Earth-moving equipment	Diesel engine noise, bulldozing, loading, dumping, truck movements and reverse alarms
Removal and placement of overburden	
Drilling	Hammering and diesel engine noise
Blasting	Single event impulsive airblast noise
Plant construction	
Site clearance, ground modelling	Diesel engine noise, bulldozing, truck movements
Foundation excavations	
Building erection of steel frames, cladding	General construction noise
Road construction	
Clearance of vegetation	Diesel engine noise, bulldozing
Road modelling and earth works	

Potential Impacts

The potential impacts on residents of Mbemba village, as the closest receptor to the quarry operations and therefore most affected, are rated below, before and after implementation of the recommended mitigation measures. As the impact of continuous noise from the quarry will be greatest at night, the significance rating below is based on the night-time scenario.

Impact NV 1: Continuous noise impact on Mbemba Village resulting from night-time construction at the quarry

Daytime construction activities listed in Table 7-16 are not expected to have a significant noise impact on residents in the nearest villages. At Mbemba Village (approximately 1 km from the quarry), noise resulting from daytime site clearance and overburden removal is expected to vary from inaudible most of the time, to levels up to 48 dBA (3 dB impact). The impact will be negligible. Daytime quarry, plant and road construction noises are also not expected to be disturbing at any of the other villages which are all situated further away from the quarry and the plant sites.

Noise from night-time construction work (predominantly from the quarry) is expected under unfavourable atmospheric conditions (wind blowing from a south-west to north-west direction) to reach levels of up to 52 dBA at Mbemba Village. This amounts to an impact of 7 dB, which is significant. As the quarry will only operate during daylight hours however, it is likely that if night-time construction occurs, it will be short in duration.

Noises which will end up as audible and at times disturbing will be the continuous droning noise of diesel engines, the noise of dozer track clatter, as well as irregular impulsive loading and dumping noises. Reverse alarms on trucks and earth-moving equipment will emerge as a variable source of noise nuisance. The level of all these noises will vary from inaudible to clearly audible, depending on atmospheric conditions, including changes in temperature gradient and wind direction profiles as a function of height above the ground.

Noise from construction activities at the Cement Plant will be of a lower intensity and is not expected to be disturbing at the nearest villages.

Construction is a temporary phase expected to last for about 24 months, although it should be noted that some construction activities such as site clearance and removal of overburden in advance of pit operations at the quarry will continue into the operational phase.

Table 7-17: Impact significance rating and mitigation measures for Impact NV1

Impact NV 1: Continuous noise impact on Mbemba Village resulting from night-time construction at the quarry								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Moderate</i>	<i>Short term</i>	<i>Local</i>	Low	Possible	Low	-	<i>Medium</i>
Management Measures: Restrict construction activities at the quarry to daytime hours 07:00 am to 07:00 pm.								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Local</i>	Low	Unlikely	Low	-	<i>Medium</i>

Impact NV 2: Air-blast noise impact on Mbemba Village resulting from blasting at the quarry during construction

Although blast noise levels are highly variable for the same charge, it can be predicted with reasonable certainty that blasting at or near surface level at the quarry is likely to have a significant impact on residents in Mbemba Village (approximately 1 km from the quarry). It is estimated that if blasting takes place during the morning, peak air-blast sound pressure levels of up to 125 dB Peak may result for an NEC of 200 kg. Such a level will be disturbing, although it is not expected to cause structural damage to houses at that distance. Blast levels will however vary over a large range for the same charge, depending on atmospheric conditions, with maximum levels occurring if blasting takes place in the morning rather than during the afternoon hours of the day.

For a more detailed explanation and assessment, please refer to the discussion of Blast noise impact in the operational phase (Section 0).

Table 7-18: Impact significance rating and mitigation measures for Impact NV2

Impact NV 2: Air-blast noise impact on Mbemba Village resulting from blasting at the quarry during construction								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Moderate</i>	<i>Short term</i>	<i>Local</i>	Low	Possible	Low	-	<i>Medium</i>
Management Measures: Restrict construction phase blasting at the quarry to afternoon hours 14:00 to 17:00 pm.								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Local</i>	Low	Unlikely	Low	-	<i>Medium</i>

7.2.7 Ecology and Biodiversity

Introduction

This section describes the ecology and biodiversity related impacts that the project could have on the ecosystems and ecosystem services to communities in the project area. The findings here are based on the update to ECTECH's original study by specialists from SRK, with in-country assistance from local botanists. SRK's study consisted of a site survey (10 – 14 June 2013) and desktop study of the available information.

Assumptions

The following assumptions apply:

- It was assumed that all direct impacts of the project (e.g. loss of habitat due to site clearing during the construction phase) will be contained within the project development footprint, with the exception of roads where an additional area of influence of 10 m around all proposed roads was evaluated.
- The impacts of water abstraction on ecology or biodiversity were not assessed, as it was understood that they would be addressed under the Water Resources section.
- The impacts on Ecosystem Services were not assessed, as it was understood that they would be addressed under the Ecosystem Services section.

Limitations

The following limitations apply:

- A botanical survey of aquatic and terrestrial habitats was conducted by the University of Lubumbashi in conjunction with SRK Consulting between 10 and 14 June 2013, which coincided with the early part of the dry season. Due to time constraints, a survey during the wet season was not possible. Transects were undertaken in each of the terrestrial habitats to record the species present and their respective abundance. It was estimated that a comprehensive survey during both the wet and dry seasons may yield approximately four times more plant species than were recorded during the short survey in June 2013. The species and habitats (ecosystems) identified during the short fieldwork survey should not be treated as comprehensive.
- A detailed fauna survey was not conducted due to a lack of available local experts and time. Bird, mammal, fish, amphibian, reptile and insect species were observed during the botanical surveys that were conducted from 10 to 14 June 2013 and are documented in this report. Information was gathered from local communities regarding both aquatic and terrestrial fauna present in the study area, but much of this data could not be verified in the available time-frames. No surveys of aquatic fauna were conducted. The species identified during the short fieldwork survey should not be treated as comprehensive.
- Additional IUCN Red List species may (and in fact are likely to) be identified via further fieldwork during both the wet and dry seasons.

The spatial distribution of habitats in the study areas was mapped in GIS at a 1: 5,000 scale as a desktop exercise. Limited verification of the desktop mapping was undertaken based on the results of the fieldwork, but detailed ground-truthing was not possible due to time constraints and the timing of availability of high resolution imagery for the study area. The accuracy of the spatial delineation and categorisation of the habitats in the study area therefore cannot be guaranteed, should be treated as preliminary, and requires refinement and verification during the development of the Biodiversity Action Plan.

Potential impacts

A number of ecological impacts have been predicted to result during the construction phase of the project, including:

- Habitat loss due to site clearing;
- Loss or disturbance of species of special concern (protected, Red List, endemic) due to site clearing;
- Loss or degradation of ecological processes due to site clearing;
- Fragmentation of habitats and ecological processes;
- Introduction and invasion of alien plants;
- Alteration, modification or degradation of habitats due to altered hydrological regimes and altered surface or groundwater; and
- Impeded photosynthesis and the transpiration rate of plants due to dust generation.

Each of these impacts are explained and assessed, and mitigation measures are recommended below.

Impact EB1: Loss of savanna habitat due to site clearing and earthmoving activities

Habitat loss will result from various construction activities, including

- The clearing of natural areas during site preparation of the quarry, plant site, labour hostel and officer hostel (staff village), resettlement area for Yuku Camp Village, road construction, powerline pylon establishment, and construction of the waste water treatment plant and potential new railway siding; and
- The stockpiling of topsoil and overburden.

Approximately 44.3 ha of savanna will be lost via site clearing of the quarry; 39.9 ha via the plant site (including coal and gypsum storage facilities); 40.4 ha via the topsoil and overburden stockpile; 5.0 ha via waste management facility alternative 1 or 4.8 ha via waste management facility alternative 2; 10.4 ha via the haul road from the stockpile, quarry and plant to the national road (based on the proposed new crossing over the Yuku River); 3.0 ha via the railway siding; 0.18 ha via the labour accommodation; and 0.24 ha via the manager accommodation. The total extent of savanna that will be lost due to the project is estimated at 150.5 ha.

Table 7-19: Impact significance rating and mitigation measures for Impact EB1

Impact EB1: Loss of savannah habitat due to site clearing and earthmoving activities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>High</i>
Management Measures: • Site clearing to be conducted sequentially, not all at once; • Sequential rehabilitation to be conducted as soon as quarrying of an area has been concluded; • All cleared or degraded areas of savannah that do not form part of NYA's operations must be rehabilitated to a stable ecological state, as close to the pre-construction condition as practically possible; • Topsoil to be stockpiling separately from overburden for rehabilitation purposes, and protected against loss from run-off; • A Rehabilitation Plan to be developed and implemented, with different objectives and rehabilitation approaches established for each habitat/ecosystem. Development and implementation of the Rehabilitation Plan to be overseen by an appropriately qualified botanist/ecologist; • A Biodiversity Action Plan to be developed to inform NYA protection and management of biodiversity in the entire concession, taking cognisance of ecosystem services currently utilised by the local communities. The initial Biodiversity Action Plan should be informed by comprehensive baseline surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The Action Plan must be updated at least every 5 years to facilitate adaptive management, or more frequently if required.								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Low</i>	-	<i>High</i>

Impact EB2: Loss of forest habitat due to site clearing and earthmoving activities

A total of 0.56 ha of Gallery and Swamp Forest will be lost via the construction of the haul road from the stockpile, quarry and plant to the national road (based on the proposed new crossing over the Yuku River). This loss will be reduced to 0.29 ha if the current crossing over the Yuku River is

upgraded instead. A total of 3.0 ha of Gallery Forest will be lost via the development of the stockpile and an additional 0.24 ha via the construction of the railway siding. None of these habitats are deemed to warrant classified as critical in terms of IFC PS6 (2012), but are noted as important. Impacts thereon should be avoided and mitigated to the greatest extent practically possible. Biodiversity offsets are not deemed to be necessary.

Table 7-20: Impact significance rating and mitigation measures for Impact EB2

Impact EB2: Loss of forest habitat due to site clearing and earthmoving activities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>High</i>
Management Measures: - Gallery and Swamp forest to be avoided to the greatest practical extent possible; - A No-Go buffer of 50 m to be established around the Gallery forest present in the north of the proposed topsoil and overburden stockpile. No spoiling of material may be undertaken upgradient of this Gallery Forest. No spoiling of material to take place to the west of the existing (most western) road to the proposed spoil site, to avoid impacts to the extensive swamp and Swamp forest system west of the road; - The proposed haul road should be constructed via an upgrade of the existing road to the west of the current staff camp, as opposed to the development of a new road through/over the Yuku River to the east of the camp; - Roads and powerlines to be aligned to avoid Gallery and Swamp forest to greatest practical extent possible; - Re-shaping of slopes near Gallery and Swamp forest to be avoided to the greatest practical extent possible; - Site clearing to be conducted sequentially as required, not all at once; - Remaining Forest habitats that has been degraded during the construction phase must be restored to their natural, pre-construction condition; - Spoiling of material to be conducted sequentially and concentrated in a single area at a time to the greatest practical extent possible; - A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession, taking cognisance of ecosystem services currently utilised by the local communities.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>High</i>

Impact EB3: Loss of aquatic habitat due to site clearing and earthmoving activities

A total of 0.9 ha of wetlands, swamps and streams will potentially be lost via the construction of the new haul road (based on the proposed new crossing over the Yuku River). This loss will be increased to 1.8 ha if the current crossing over the Yuku River is upgraded instead. A further 0.3 ha will be lost via the railway siding; 1.6 ha via the stockpile, 0.7 ha via the quarry, and 0.2 ha via waste management facility alternative 2. None of these habitats are deemed to warrant classified as critical in terms of IFC PS6 (2012), but are noted as important habitats. Impacts thereon should be avoided and mitigated to the greatest extent practically possible. Biodiversity offsets are not deemed to be necessary.

Table 7-21: Impact significance rating and mitigation measures for Impact EB3

Impact EB3: Loss of aquatic habitat due to site clearing and earthmoving activities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Definite	Medium	-	<i>High</i>
Management Measures: - Construction in or near to wetlands, swamps, streams and rivers must be avoided to the greatest practical extent possible, including the road and powerline alignments; - The plant, railway siding and haul road must not be moved any closer to the Kawenga wetland (immediately west of plant) and no construction or earthmoving activities may take place within 50m of the wetland and the swamp surrounding it. The plant site must be fenced and no slope/bank modifications may be conducted along the eastern boundary of the plant site; - The proposed haul road should be constructed via an upgrade of the existing road to the west of the current staff camp, as opposed to the development of a new road through/over the Yuku River to the east of the camp; - No spoiling of material to take place to the west of the existing (most western) road to the proposed spoil site, to avoid impacts to the extensive swamp and Swamp forest system west of the road; - A stormwater management plan must be developed for both the construction and operational phases of the project, with particular attention paid to minimising increased sedimentation of the wetlands and swamps; - The largest practically possible size of culvert/s to be installed at any stream/swamp crossings, particularly at the intersection of the proposed haul road and current railway line, to minimise impacts on the hydrological regime and habitat loss of the streams, wetlands and swamps present; - The alignment of the new powerline must avoid the southern catchment of the Mbamba wetland (immediately east of plant) to the greatest practical extent possible; - A No-Go buffer of 100 m should be established around all other wetlands, with the exception of the proposed roads, where site clearing and bank modification must be minimised the greatest practical extent possible; - Aquatic habitats and areas immediately adjacent to them that have been degraded during the construction phase must be restored to their pre-construction condition; - All other cleared or degraded areas that do not form part of NYA's operations must be rehabilitated to a stable ecological state as close to the pre-construction condition as practically possible; - A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession, taking cognisance of ecosystem services currently utilised by the local communities.								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Unlikely	Low	-	<i>Low</i>

Impact EB4: Loss or disturbance of species of special concern due to site clearing and construction activities

Species of special concern covered under this impact include protected, Red List, and endemic species. A number of the species identified by local communities as occurring in the study area are listed on the IUCN Red List, most notably *Psittacus erithacus* (*African grey parrot*) that is classified as Vulnerable and *Phataginus tricuspidis* (*Tree pangolin*) that is classified as Near threatened. Detailed fauna surveys during both the wet and dry seasons may however result in additional Red List species being recorded. During the surveys of the study area, no nesting birds were observed, but are likely to be present.

Some species will either be disturbed or lost during the construction phase due to site clearing activities and associated increased vehicular traffic, such as plants, sessile fauna and noise sensitive birds including resident nesting species. None of these species however are deemed to warrant classified as critical habitats in terms of IFC PS6 (2012).

Impacts on species of special concern should be avoided and mitigated to the greatest extent practically possible. Biodiversity offsets are not deemed to be necessary.

Table 7-22: Impact significance rating and mitigation measures for Impact EB4

Impact EB4: Loss or disturbance of species of special concern due to site clearing and construction activities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Definite	Medium	-	Medium
Management Measures: - Sessile fauna present at construction sites to be relocated by relevant ecological experts prior to the commencement of site clearing and construction; - Site clearing to be conducted sequentially and from one corner of the site to the other, to enable highly mobile species to leave the construction area; - No fauna are to be hunted or destroyed by any project personnel; - An environmental education training programme to be developed and implemented, including regular refresher sessions; - Effective penalties (e.g. fines) must be imposed for the hunting or harm to fauna by any staff; - A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession.								
After Management	<i>Minor</i>	<i>Medium term</i>	<i>Site / local</i>	Low	Possible	Low	-	Medium

Impact EB5: Loss or degradation of ecological processes due to site clearing and construction activities

Various ecological processes in the study area will be degraded during site clear, dumping of overburden and topsoil, and road construction. Most notable are the hydrological processes, occurrences of fire during the dry season, forest areas serving as refugia for species during drought, and the wetlands, swamps and forest areas serving as biological corridors for the movement of biota. None of these processes are deemed to warrant classified as critical habitats in terms of IFC PS6 (2012), but are noted as important. Impacts thereon should be avoided and mitigated to the greatest extent practically possible. Biodiversity offsets are not deemed to be necessary.

Table 7-23: Impact significance rating and mitigation measures for Impact EB5

Impact EB5: Loss or degradation of ecological processes due to site clearing and construction activities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	Medium	-	<i>Medium</i>
Management Measures: - No diversions of any of the rivers, streams, wetland and swamps must take place; - The ecological water requirements of the aquatic ecosystems should be determined. Water abstraction from any of the rivers and from groundwater must not exceed levels that result in the ecological water requirements of the aquatic ecosystems being compromised. Abstraction from the wetlands and swamps must not be allowed; - Construction in or near to wetlands, swamps, streams, rivers, Gallery and Swamp forest must be avoided to the greatest practical extent possible, including the road and powerline alignments; - The plant, railway siding and haul road must not be moved any closer to the Kawenga wetland (immediately west of plant) and no construction or earthmoving activities may take place within 50m of the wetland and the swamp surrounding it. The plant site must be fenced and no slope/bank modifications may be conducted along the eastern boundary of the plant site; - The proposed haul road should be constructed via an upgrade of the existing road to the west of the current staff camp, as opposed to the development of a new road through/over the Yuku River to the east of the camp; - A stormwater management plan must be developed for both the construction and operational phases of the project, with particular attention paid to minimising increased sedimentation of the wetlands and swamps; - Culverts to be installed at the intersection of the proposed access road and railway line, should be sized in consultation with an hydrologist to minimise impacts on the hydrological regime and habitat loss of the wetlands and swamps present; - The alignment of the new powerline must avoid the southern catchment of the Mbamba wetland (immediately east of plant) to the greatest practical extent possible; - A No-Go buffer of 100 m should be established around all other wetlands, with the exception of the proposed roads, where site clearing and bank modification must be minimised to the greatest practical extent possible; - A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession, taking cognisance of ecological processes. - Natural fire regimes in the study area to be allowed to continue, or active management must be instituted to mimic natural regimes as advised in the Biodiversity Action Plan.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Unlikely</i>	Low	-	<i>Low</i>

Impact EB6: Fragmentation of habitats and ecological processes due to positioning of project infrastructure

The study area is currently traversed by a series of roads, railway lines and two powerlines (one of which has not been strung yet). The development will result in the construction of a number of additional access road that amongst other will traverse the wetland/swamp in the south. Such roads will result in the fragmentation of some habitats and ecological processes.

A new powerline will also run between the Mbamba wetland and the Sanzikua River, before connecting to the plant just north of the wetland. Due to the limited site clearing required to construct

the foundations for the powerlines, as evidenced from the installation of the new 220 kV line, the new powerlines are not predicted to result in the fragmentation of the adjacent habitats and ecological processes.

The new road and proposed railway siding will intersect the upper reach of the Kabuendi wetland/swamp system and fragment this ecosystem.

Table 7-24: Impact significance rating and mitigation measures for Impact EB6

Impact EB6: Fragmentation of habitats and ecological processes due to positioning of project infrastructure								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Possible	Medium	-	<i>Medium</i>
Management Measures: - Wetlands, swamps, streams and rivers to be avoided to the greatest practical extent possible, including the road and powerline alignments; - The proposed haul road should be constructed via an upgrade of the existing road to the west of the current staff camp, as opposed to the development of a new road through/over the Yuku River to the east of the camp; - The largest practically possible culvert/s to be installed at the intersection of the proposed access road and railway line, and all other river/stream/wetland/swamp crossings, to minimise impacts on the aquatic ecosystems; - A No-Go buffer of 100 m to be established around all other wetlands, with the exception of the proposed roads, where site clearing and bank modification must be minimised to the greatest practical extent possible. The powerline alignment to avoid the southern catchment of the Mbamba wetland (immediately east of plant) to the greatest practical extent possible.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Unlikely	Low	-	<i>Low</i>

Impact EB7: Modification or degradation of aquatic habitats due to altered hydrological regimes and surface or groundwater quality

The hydrological regimes of the Mbamba, Kawenga and Kabuendi wetland systems are likely to be impacted by modification of the landscape surrounding them and associated surface run-off upon construction of new roads, the plant, and the railway siding. No nutrient loading is anticipated in these systems during construction, but pollution events could occur if sources are not managed appropriately (e.g. petroleum storage facilities etc.).

Table 7-25: Impact significance rating and mitigation measures for Impact EB7

Impact EB7: Modification or degradation of aquatic habitats due to altered hydrological regimes and surface or groundwater quality								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Major</i>	<i>Long term</i>	<i>Site / local</i>	<i>High</i>	<i>Possible</i>	Medium	-	<i>Medium</i>
Management Measures: - No river diversions or bank modifications to be conducted on local Rivers; - Wetlands, swamps, streams and rivers to be avoided to the greatest practical extent possible, including the road and powerline alignments; - The largest practically possible culvert/s to be installed at the intersection of the proposed access road and railway line, to minimise impacts on the hydrological regime and habitat loss of the wetlands and swamps present; - The powerline alignment to avoid the southern catchment of the Mbamba wetland (immediately east of plant) to the greatest practical extent possible; - The plant, railway siding and haul road must not be moved any closer to the Kawenga wetland (immediately west of plant) and no construction or earthmoving activities may take place within 50m of the wetland and the swamp surrounding it. The plant site must be fenced and no slope/bank modifications may be conducted along the eastern boundary of the plant site; - The proposed haul road should be constructed via an upgrade of the existing road to the west of the current staff camp, as opposed to the development of a new road through/over the Yuku River to the east of the camp; - A No-Go buffer of 100 m to be established around all other wetlands, with the exception of the proposed roads, where site clearing and bank modification to be minimised to the greatest practical extent possible; - A weir or gabion system must be constructed at the toe of the Kawenga and Mbamaba wetlands if increased run-off into these wetlands results in associated erosion immediately downstream of these systems. The weirs must be constructed to maintain the natural water levels of the wetlands and must not facilitate increased flow out of the wetlands; - A stormwater management plan to be developed for all project components to address stormwater run-off volumes, velocity, water quality to minimise impacts on natural areas; - Leak and spill management systems to be in place at all potential major sources of pollution such as fuel, lubricant and hazardous product storage facilities, vehicle servicing areas, and workshops; - All plant components and vehicles to be serviced within the designated workshop areas; - A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession.								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	Medium	-	<i>Low</i>

Impact EB8: Introduction of alien invasive plants due to site clearing and disturbance of vegetation

Invasive alien plants are present at very low levels in the study area, but a much higher prevalence thereof was noted along the N1 main road. Such invasions related primarily to Bamboo present at road crossings over rivers and *Chromolaena odorata* at recently cleared areas.

The use of plant (machinery) to clear sites is likely to result in the further introduction of alien invasive plants into the study area. The introduction of invasive species into currently natural sites in the study area is likely to be of greater impact than the introduction of new species.

Table 7-26: Impact significance rating and mitigation measures for Impact EB8

Impact EB8: Introduction of alien invasive plants due to site clearing and disturbance of vegetation								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: - Minimise cleared or disturbed areas; - The specification for plant (machinery) contractors must include the washing of plant prior to it being dispatched to the study area; - A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession; - A programme for the control of alien invasive plants in the concession to be developed and implemented as a component of the Biodiversity Action Plan.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>Low</i>

Impact EB9: Impeded photosynthesis and transpiration rate of plants due to dust generation

The construction phase will result in the generation of dust in the study area, particularly from roads, cleared sites, and the spoil site. The generation of dust in high quantities may impede photosynthesis and the transpiration rate of plants in close proximity to the source of such dust.

Table 7-27: Impact significance rating and mitigation measures for Impact EB9

Impact EB9: Impeded photosynthesis and transpiration rate of plants due to dust generation								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>
Management Measures: Dust suppression methods (e.g. watering) must be instituted at cleared areas, construction sites, and material and overburden/topsoil stockpiles on at least a daily basis when high dust generating conditions are prevalent.								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>Medium</i>

7.2.8 Traffic

Introduction

This section describes the traffic related impacts that the project could have on the road network and associated intersections in the vicinity of the site and the Port of Matadi. The findings here are based on the traffic volumes predicted in the ECTECH report, on informal traffic counts conducted during SRK's site visit in June 2013, and the 2012 traffic statistics for the toll booths on the N-1, obtained from the Societe de Gestion de Peage du Congo (SO.PE.CO). In broad terms, the purpose of this section of the ESIA is to comment on the extent and nature of the traffic related impacts that could occur as a result of this project.

Assumptions

- This section assumes no rail transport will occur, although rail transport would have a number of environmental and logistical advantages and as such presents a worst case scenario of potential traffic impacts.

Potential Impacts

The following impacts have been identified as a result of the construction and operations activities of the project:

- An increase in traffic volumes, in particular heavy vehicles, on the N-1 between Kinshasa and Matadi impacting on utilisation capacity.
- Impact on the road pavement due to potential overloading.
- Increased traffic volumes resulting in increased road accident rates and therefore impact on road safety.
- The transportation of abnormal loads during the construction phase of the development.

Impact T1: Impact of construction related traffic on utilisation capacity on the N-1

During the construction phase materials, equipment, and personnel will need to be transported to the project site by means of road transportation resulting in more traffic on the N-1. Transportation of personnel is likely to occur at discreet times, resulting in peak flows, whereas transportation of materials and equipment would be more evenly spread over the course of a day. Construction personnel would largely be housed on site, reducing the impact of peak flows.

All road traffic would enter the N-1 at the intersection with the site access road, and then travel either in an easterly direction to Kinshasa, or in a westerly direction toward Matadi. Traffic related impacts are likely to be most noticeable at this intersection in that potential congestion may occur on a portion of the road that has not previously experienced congestion. More broadly, traffic on the N-1 would increase, and the utilisation capacity of the N-1 between Kinshasa and Matadi would be increased.

The estimated construction traffic will increase the average background traffic in the vicinity of the site by approximately 50 heavy vehicles per day (ECTECH EIA). Associated traffic could increase overall traffic to the site by between 300 - 350 total vehicle movements per day. Assuming a ten hour working day, this would result in an average increase in heavy vehicle traffic from 9 - 15 trucks per hour to 14 - 20 trucks per hour, and an average increase in total vehicle movements from 25 - 34 per hour, to 60 - 69 (assuming no staff accommodation on site during the peak of construction).

Factors that could reduce total vehicle movements per day include:

- Widening of the N-1 at the access road to allow for turning lanes would reduce the potential for accidents and congestion at this intersection.
- Clear signage and traffic calming measures on the N-1 warning motorists of the intersection would reduce potential traffic safety impacts at this intersection.
- Truck staging area and/or rest area would enable trucks to exit the N-1 safely, and enable site staff to schedule deliveries in an orderly manner.
- Provision of temporary on-site accommodation for construction personnel would limit the volumes of daily commuter traffic to the project site; and
- Provision of dedicated buses for construction personnel not accommodated on the site would reduce daily commuter traffic to the project site.

The duration of traffic related impacts during construction is rated as short term (less than 3 years). Traffic related impacts are likely to be most noticeable in the vicinity of the site and at the intersection with the N-1 in particular, and are therefore rated as being local in extent. The magnitude of the impact is rated as major as the increase in traffic volumes in the vicinity of the site has the potential to be substantial and the acceptable utilisation capacity of the N-1 in the vicinity of the site is unknown. Management measures have the ability to reduce the magnitude of the impact to moderate.

Table 7-28: Impact significance rating and mitigation measures for Impact T1

Impact T1: Impact of construction related traffic on utilisation capacity on the N-1								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Major</i>	<i>Short term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: • Widening of the N-1 at the access road to allow for turning lanes would reduce the potential for accidents and congestion at this intersection. • Clear signage and traffic calming measures on the N-1 warning motorists of the intersection would reduce potential traffic safety impacts at this intersection. • Truck staging area and/or rest area would enable trucks to exit the N-1 safely, and enable site staff to schedule deliveries in an orderly manner. • Provision of temporary on-site accommodation for construction personnel would limit the volumes of daily commuter traffic to the project site; • Provision of dedicated buses for construction personnel not accommodated on the site would reduce daily commuter traffic to the project site; • Schedule the delivery of materials outside peak traffic times.								
After Management	<i>Moderate</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>

Impact T2: Impact of construction related traffic on traffic flow in Matadi

For the purposes of this assessment it is assumed that during the construction phase, all equipment and building materials will be imported through the Port of Matadi, recognising that a considerable quantity of materials may be available within, and supplied from, the DRC. Therefore, in a worst case assessment, the transportation of materials through Matadi would at the peak of construction increase the number of heavy vehicles travelling through Matadi by 50 heavy vehicles per day.

The narrow roads through Matadi limit the ability for transportation of abnormal loads. Alternative transportation routes for abnormal loads through Matadi are unlikely, and do not exist between Matadi and the project site.

The scale of the impact is limited to the road network in Matadi and is therefore rated as being local in scale, and the duration of this impact would be short term (less than 3 years). No data on the traffic

volumes currently leaving the Port, or traffic counts on the N-1 through Matadi, were available for this assessment and consequently the rating of magnitude (as moderate) is of low confidence.

Scheduling of deliveries to avoid transportation during peak traffic times may reduce the probability of the impact occurring, and hence the impact significance. NYA must also ensure that equipment suppliers design equipment so that shipping of abnormal loads is not required. Because it may not be feasible to transport abnormal loads, this management measure does not reduce the impact rating.

Table 7-29: Impact significance rating and mitigation measures for Impact T2

Impact T2: Impact on traffic in Matadi during construction								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Short term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>Low</i>
Management Measures: - Schedule the delivery of materials and equipment outside peak traffic times. - NYA to specify maximum loads for shipping of equipment to site (size and weight).								
After Management	<i>Moderate</i>	<i>Short term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Low</i>	-	<i>Low</i>

Impact T3: Safety impacts to local communities and other road users due to increased road accident rates during construction

The increased traffic volumes during the construction phase of the project can be expected to result in an increase in the number of road accidents in proportion to the existing traffic volumes. Road accidents are likely to include (as is currently the case) incidents involving pedestrians, particularly as pedestrians use the verge of the road. There are many factors that increase the risk of road accidents, including the roadworthiness of vehicles and driving habits. NYA can implement a number of measures to reduce the road accident rate for vehicles associated with the construction phase of the project, although it is noted that the level of influence over the numerous contractors & sub-contractors during the construction period may in practice be lower than over a vehicle fleet during the operational phase.

The duration of impacts on road accident rates during construction is rated as short term (less than 3 years). The impact on road accident rates would be experienced on the whole road network, particularly between Matadi & the project site, and is therefore rated as regional in extent. The magnitude of the impact is rated as major as the increase in traffic volumes between Matadi & the Project Site are likely to increase by approximately 40 to 70% during construction, and between Kimpese and the project site (i.e. at a local extent) by 130 to 176%. On the basis that increased traffic volumes result in increased road accidents, a similar increase in accident rates, in the absence of mitigation, is likely. Management measures reduce the magnitude of the impact to moderate.

Table 7-30: Impact significance rating and mitigation measures for Impact T3

Impact T3: Safety impacts to local communities and other road users due to increased road accident rates during construction								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Major</i>	<i>Short term</i>	<i>Regional</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: - Widening of the N-1 at the access road to allow for turning lanes would reduce the potential for accidents and congestion at this intersection. - Clear signage and traffic calming measures on the N-1 warning motorists of the intersection would reduce potential traffic safety impacts at this intersection. - A maintenance schedule for all vehicles directly under the control of NYA must be developed and implemented to ensure on-going roadworthiness of vehicles. Suppliers, contractors, and sub-contractors must be instructed to implement the same maintenance schedule. - Random inspections for roadworthiness of all vehicles entering or leaving the site must be implemented.								
After Management	<i>Moderate</i>	<i>Short term</i>	<i>Regional</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>Medium</i>

7.2.9 Socio-economic Impacts

Introduction

This section is based on the ECTECH ESIA and the social baseline survey undertaken in June 2013, and economic desktop study (based on the available literature and data collected during the social baseline survey) by SRK. This section outlines socio-economic and health and safety impacts anticipated during the construction phase.

Assumptions

- SRK's baseline data collection in June 2013 was based on the assumption that the rationale for resettlement of Yuka Camp Village was based on impact prediction and that no other villages would require resettlement

Limitations

- Socio-economic surveys in June 2013 focussed solely on Yuka Village at NYA's direction. Subsequent changes to the project description suggest that socio-economic surveys of Mbemba Village may be required and that resettlement of Mbemba village may be motivated as a result of impacts to this village.
- Elements of the economic impact assessment are contingent on findings of the social surveys.
- Micro economic impacts (livelihoods) were excluded from the economic impact assessment.

Population and demographic movements

Impact PD1: Influx of potential job seekers into the area and associated risks

With the potential for creating direct employment opportunities for up to 500 people during the construction phase, most of which will not be from the local communities due to the shortage of skills in the area, there is a possibility for an influx of jobseekers into the surrounding areas. NYA is also planning the build a construction camp (Labour Hostel and Officer Hostel) approximately 1 km from the Cement plant. This will further encourage or attract people to the site, and in a way further exacerbate the influx of people, especially non-locals into the area. The impacts associated with this influx can be categorised as follows:

- Increased pressure on social services such as schools, clinics, police services, water supply, sanitation existing housing police stations etc.
- Increase in social pathologies such as petty trade, commercial sex, crime etc.

- Possibility for the development of spontaneous settlements, especially close to the construction camps if these are not properly managed.
- Potential tensions between in-migrants and existing communities (as a result of competition for existing resources and opportunities), and bring about increased health problems and sexually transmitted diseases.
- Increase in the spread of communicable diseases such as HIV and AIDS. See Impact HS1 under Health and Safety.

Table 7-31: Impact significance rating and mitigation measures for Impact PD1

Impact PD1: Influx of potential job seekers into the area and associated risks								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Short term</i>	<i>Site / local</i>	Low	Definite	Medium	-	<i>Medium</i>
Proposed mitigations • Optimise the use of local labour as far as practically possible as outlined in the Labour and Human Resources Management Plan (Appendix 11). • Develop a code of conduct with which contractors and their employees must comply. The code should deal with the interaction with local communities and substance abuse among other things. • Implement the Stakeholder Engagement Plan (Appendix 17) which clarifies the principles of engagement with community and other stakeholders, sets in place appropriate liaison forums and describes the grievance management procedure to be adopted by NYA. • Implementation of a programme of HIV/AIDS screening, counselling and (where necessary) treatment. • Develop and communicate a clear and concise employment and recruitment policy to prevent opportunistic job seekers from settling in the area (Appendix 17)								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	Low	Possible	Low	-	<i>Medium</i>

Health and Safety

Impact HS1: Increased chances of the spread of communicable diseases such as HIV/AIDS and STDs linked to influx of predominantly male job-seekers and workers

While there have been no specific mention of the prevalence of HIV/AIDS at the Minkelo Clinic, there are always concerns that HIV/AIDS might become a greater problem in the future with the development of this project, particularly due to the influx of single males and construction workers into the area. This would be further increased by the significant disposable income among construction workers which could encourage transactional and commercial sex work in the area. Kimpese Hospital, which is about 50km from the mine, and which is a referral hospital for Minkelo Clinic, has however confirmed, during the social baseline survey undertaken by SRK in June 2013, a prevalence rate of 2 -3 reported cases of STDs such as syphilis and gonorrhoea per month. It is possible for this rate to be higher than reported due to the stigma that is still associated with STDs and HIV/AIDS. Furthermore, the proximity of Kimpese town to the mine area also increases the possibility of people moving into the mine area, possibly as carriers of these diseases.

Table 7-32: Impact significance rating and mitigation measures for Impact HS1

Impact HS1: Increased chances of the spread of communicable diseases such as HIV/AIDS and STDs linked to the influx of predominantly male jobseekers								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Medium term</i>	<i>Regional</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>
Proposed mitigations measures NYA has developed a Health & Safety Policy with the objectives of promoting the health and safety of employees, but this does not make mention of the management of HIV/AIDS explicitly. The following mitigations are recommended: - Develop a comprehensive HIV/AIDS program to employees through employee wellness programmes which should include the following: - Awareness campaigns targeting project workers, senior management, contractors, sub-contractors and their spouses, communities near project facilities, risk groups (commercial sex workers, truck drivers) - Prevention, voluntary counselling for HIV testing, as well as anti-retroviral treatment for employees and surrounding communities. There are already HIV/AIDS programs developed by Kimpese Hospital, which NYA could potentially be involved in.								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>

Impact HS2: Increased pressure on healthcare infrastructure due to project related influx

There are limited health facilities in the project area. These are in poor condition with few available resources, and are unable to serve the healthcare needs of the communities adequately. The health questionnaire conducted at Minkelo Clinic during the SRK site visit in June 2012 has highlighted that this clinic, with a staff complement of 3 people, is required to service approximately 21 villages in the area. With the expectation that between 500 and 600 temporary employees will be required during the construction phase of the NYA project, there will be an increase in the pressure on this clinic to provide services to the additional employees, as well as their families who might come with them into the area.

Table 7-33: Impact significance rating and mitigation measures for Impact HS2

Impact HS2: Increased pressure on healthcare infrastructure due to project related influx								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Definite</i>	<i>Medium</i>	-	<i>Medium</i>
Proposed mitigations - Update an influx management plan as per management measures noted under Impact PD1. - Develop an MOU with the Local Healthcare Centres in Minkelo and Kimpese for service provision to the local workforce and their dependents. - Identify NGOs in the area that might support operations at the Minkelo Clinic and Kimpese Hospital, with special focus on refurbishment of key areas, equipment and building maintenance, as well as, improved healthcare management information systems. - Develop and implementation community development/sustainability plans to support infrastructure development in the area								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>

Impact HS3: Increased risk of accidents and injuries to communities from improved roads and additional traffic

The increased volumes of traffic as a result of the NYA project activities such as transportation to the port, workers transportation; final product delivery has the potential of increasing accidents and injuries affecting the local community. Nkonda village, situated along the N1 to Kinshasa, is more likely to experience accidents due to the quality of the road and the associated speed that vehicles travel on good roads. In addition, heavy vehicle traffic along the hauled road route between the quarry and cement plant may contribute to increased road safety risks as a result of the introduction of heavy vehicles, speeds and the lack of road safety and traffic awareness that is expected in the

area. It is assumed that the Yuka Camp Village will be resettled and that the road safety risks associated with the haul road will be mitigated for the households of this village. During construction this is expected to be of lower significance than at the operations stage when traffic level on the haul road will increase.

Table 7-34: Impact significance rating and mitigation measures for Impact HS3

Impact HS3: Increased risk of accidents and injuries to communities from and additional traffic								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Moderate</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>
Proposed mitigations - Awareness campaigns in neighbouring communities, particularly at Nkonda village, with a focus on school children and mothers, about risks related to traffic - Enforcement of speed limits and sanctions for any personnel found in violation of speed limits, including senior staff and contractors' and sub-contractors' employees - Appropriate signalling of moving heavy machinery, and escort vehicles where needed - All construction drivers to be given safety education focussing on speed and conflicts between pedestrians and cyclists. - Advanced warning signs including sirens to be erected at locations of high pedestrian and cyclist activity.								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>Medium</i>

Impact HS4: The visible presence of DRC police within the project area, and their secondment as a subcontractor for the mine security

During the focus group meetings, communities were asked about their concerns relating to the presence of the DRC police close to the site and the communities. About 90% of the respondents felt more safe and protected than threatened by the police presence. Community members have mentioned that petty crimes such as stock and crop theft are experienced from time to time, however, the police stations are not capacitated to deal effectively with these crimes, especially with the lack of police vans to transport them to the crime scene when required. However, it has been noted that since the police started patrolling the area on a regular basis, these crimes are decreasing.

While this looks like a win-win situation for both parties (the community and NYA), the relationship between the police and the communities should be closely monitored by NYA to ensure that the relationship between the community and the police does not deteriorate in relation to NYAs activities.

Table 7-35: Impact significance rating and mitigation measures for Impact HS4

Impact HS4: The visible presence of Congolese police within the project area, and their secondment as a subcontractor for the mine security								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	+	<i>Medium</i>
Proposed management measures - Develop a code of conduct for police personnel, especially in relation to handling community violence - Proper screening of appointed security personnel to ensure they were not implicated in human rights abuses in the past								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	+	<i>Medium</i>

Fire / explosion Risk

Fire and explosion hazard impacts are not expected during the construction phase due to the limited quantities of flammable and combustible materials to be imported to the site. The availability and use of portable extinguishing systems would limit the impacts of small fires, and personnel will be required to receive training on the proper use and locations of this equipment. During construction,

any waste disposal burning will have to be conducted in a cleared and dedicated area under controlled conditions, on those days when ambient air conditions will not permit embers to drift into the surroundings.

Land and natural resources

Impact LN1: Physical displacement of households residing at Yuku Camp Village

Yuku Camp Village, located at about 0.7 kms distance from the plant site, may need to be resettled as a result of the safety issues and other nuisance impacts associated with the location for the haul road past the village. Engagement with stakeholders from Yuku Village done by NYA and ECTECH in 2012, and the socio-economic baseline study and household questionnaires conducted by SRK in June 2013, are expected to have raised expectations around resettlement of the village in its entirety. While the haul road could possibly be realigned to avoid impacts to Yuku Village, for the purposes of this impact assessment it has been assumed that realignment may still not resolve the safety impacts and resettlement is inevitable. In the event that Yuku Camp Village is resettled, this process will be undertaken in terms for the Resettlement Action Plan outlined in Appendix 18.

The village has 12 houses (9 of which were noted to be occupied during the SRK survey in June 2013) and a population of 47 people. While the new site for the resettled village has not yet been decided on. NYA has commenced the development of its first Resettlement Action Plan (RAP) to manage the physical displacement of this community, including development of a Livelihoods Assessment and Income Restoration Plan (LAIR).

Table 7-36: Impact significance rating and mitigation measures for Impact LN1

Impact LN1: Physical displacement of households residing at Yuku Village and the protection of vulnerable groups								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	Major	Long-term	Local	High	Definite	High	-	High
Proposed mitigations - SRK Consulting has been contracted to develop a Resettlement Action Plan (RAP) to identify beneficiaries, (including vulnerable groups such as women and children headed households) compensation measures and assistance as well as livelihoods restoration measures. - Compliance with IFC's Performance Standard 5 "Land Acquisition and Involuntary Resettlement", which has the following objectives: - To avoid or at least minimize involuntary resettlement wherever feasible by exploring alternative project designs; - To mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of land by i) providing compensation for loss of assets at replacement cost; and ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected; - To improve or at least restore the livelihoods and standards of living and displaced persons; - To improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.								
After Management	Moderate	Long-term	Local	Medium	Definite	Medium	-	Medium

Economic impacts

Impact EC1: Local and regional benefits resulting from increased Revenue to Government

The government is expected to derive revenue from the project through various forms of taxes and duties, including import duty, personal and corporate tax and value added tax. However, the value of these revenue streams cannot be determined at present due to the uncertainty associated with various factors determining future government revenue, such as the value of imports and the profitability of the business.

During construction, income to the government is mostly expected to derive from import duties as well as taxes on locally procured services and goods. No detailed information regarding potential government revenues from and incentives (e.g tax holidays) for the project during the construction phase is available. Nevertheless, the project is expected to have a noticeable impact at a local and regional scale as it will be one of the largest commercial operations in the region.

Although a major project, the region is vast and the construction phase is thus expected to have a minor (positive) impact of short term duration and regional scale on government revenue. Government income is determined by tax regimes and corporate profit. As such, no optimisation measures are recommended to enhance this benefit.

Table 7-37: Impact significance rating and mitigation measures for Impact EC1

Impact EC1: Local and regional benefits resulting from increased Revenue to Government								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Minor+</i>	<i>Short term</i>	<i>Regional</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	+	<i>Low</i>
Management Measures:								
None								

Impact EC2: Stimulation of increased regional investment in the DRC Economy

Total investment in the DRC economy has grown steadily in the last decade and reached approximately 20.5% of GDP in 2011, or US\$3.2 billion (Table 7-38). Total investment in the DRC is estimated to reach US\$5.5 billion in 2013. NYA's anticipated investment of \$240 million amounts to approximately 5% of estimated total investment value in 2013, which is a significant investment for a single project.

Table 7-38: Investment in the DRC economy 2004 - 2013

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Investment (% of GDP)	12.8	13.8	13.2	18.2	22.4	18.0	23.5	20.5	28.2	28.7
GDP US\$ bn	6.54	7.18	8.82	10.03	11.60	11.11	13.12	15.71	17.70	19.31
Investment US\$ million	835	994	1,169	1,829	2,596	2,002	3,087	3,221	4,988	5,542

[Source: International Monetary Fund: World Economic Outlook Database]

Note: 2012 and 2013 values are estimates. GDP is provided in current prices.

The project may also act as an important signal to other potential investors in the DRC and thereby stimulate wider investment in the DRC.

The project is thus expected to have a noticeable and minor (positive) impact of medium-term term duration and regional scale on investment in the DRC and Bas-Congo Province in particular. Investment levels are determined by a host of business and economic factors and, as such, no optimisation measures are recommended to enhance this benefit.

Table 7-39: Impact significance rating and mitigation measures for Impact EC2

Impact EC2: Stimulation of increased regional investment in the DRC Economy								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Medium term</i>	<i>Regional</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	+	<i>Low</i>
Management Measures:								
None								

Impact EC3: Generation of direct, indirect and induced employment and income

Employment provides many socio-economic benefits to employees and their dependents, including:

- Improved material wealth and standard of living;
- Enhanced potential to invest and improved access to social services such as education and health services; and
- The employment and training of unskilled workers facilitates skills development and improves the future employment prospects of such workers.

Secure employment can also contribute towards a sense of independence, freedom, and pride, and may promote a good work ethic. The project will, however, provide employment for only a comparatively small portion of the population, and similar employment opportunities for the remainder of the population are very negligible and most residents rely on subsistence agriculture for survival. As such the project is likely to increase economic disparity in the project area. However, as the project will only employ a small percentage of locals, this effect is expected to be relatively limited.

The project will create various types of employment:

- Direct employment*, which includes project staff and contractors permanently based on site. Due to the limited technical skill set in surrounding communities, local¹¹ workers are likely to be tasked initially with low to medium-skilled activities until skills improve through work experience. The construction phase, which will extend over approximately two years, is expected to generate a total of 500 - 600 direct (temporary) jobs;
- Indirect employment*, which includes off-site contractors and service providers to the project. Equipment is likely to be sourced abroad, and most procurement benefits during construction are likely to accrue abroad. Local companies are likely to be appointed for site preparation and other local activities, including road construction, maintenance etc. The extent of indirect employment and income that will be created by the project cannot be determined at this stage but is likely to be limited because of the limited ability to outsource locally; and
- Induced employment*, which includes employment generated by increased spending at businesses and on services (the multiplier effect). The multiplier is higher if more money is spent locally and less money 'leaks out' of the local economy through, for example, spending in outside areas or tax payments. A higher multiplier signifies a larger (positive) impact on the local economy. There are very few local businesses and, therefore, spending opportunities, which will limit the potential scale of induced local employment and income generation. An increase in local income may provide a stimulus to local business, but given the dearth of economic opportunities

¹¹ This is considered to include residents in the villages surrounding the project, including Kokolo, Yuku, Nknonda, Mbemba, Kinsua, Mbamba and Minkelo.

in the immediate area it is unlikely that this project in isolation will have a significant impact on local business environment.

Local employment generated during the construction phase is expected to have an impact of moderate magnitude and short-term duration in the region, as it is likely that benefits will extend to nearby cities such as Matadi that may provide services such as transport.

Local employment benefits may be further increased by implementing the management measures listed below. However, technical requirements and constraints in local supply will likely limit procurement and employment options. As such, the significance of the benefit is not expected to increase after optimisation.

Table 7-40: Impact significance rating and mitigation measures for Impact EC3

Impact EC3: Generation of direct, indirect and induced employment and income								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Moderate</i>	<i>Short term</i>	<i>Regional</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	+	<i>Medium</i>
Management Measures: - Stipulate in the Recruitment Plan mechanisms to employ local workers if applicants with the appropriate skills are available. - Implement a local skills training programme to improve the opportunities for local procurement of skills - Procure goods and services locally, if available and improve opportunities through the development of local supply chain through the Community Development Plan (Appendix 19). - Work closely with the community before and during the project to identify and publicise skills and resources that the local community could provide. This should take place before construction commences. Establish relevant mechanisms in the relevant social and labour plans.								
After Management	<i>Moderate</i>	<i>Short term</i>	<i>Regional</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	+	<i>Medium</i>

7.2.10 Cultural Heritage Resources

Introduction

This section outlines the anticipated cultural heritage impacts that may occur during the construction phase and is based on a study by HCAC, with in-country support from local archaeologists, as described in Section 6.5.7. A modification to the standard SRK impact rating methodology was used as described in Section 7.1.3.

Assumptions and Limitations

- HCAC was appointed to compile this report based on information provided by the Congolese heritage specialist and it is assumed that the information received from him is accurate and applicable to the study.
- Due to the nature of cultural remains that occur, in most cases, below surface, there is a possibility that some cultural remains may not have been discovered during the survey.
- Low ground visibility is present throughout the project site due to dense vegetation cover.
- Parts of the project site are also completely inaccessible by vehicle. Thus, the possibility of the occurrence of unmarked graves and heritage sites cannot be excluded. It is assumed that the archaeologist responsible for the field work surveyed the area as thoroughly as possible;
- The relevant competent body for heritage matters should be informed if further cultural remains should be unearthed or laid open during the process of development. To address this, a summary chance find procedure is included in Section 9.

- It must also be kept in mind that the greatest care was taken to obtain accurate information from consultation with the chiefs and representatives of the local villages, but due to the reality that facts are erased by time from human memory it is very difficult to determine the accuracy of information presented in interviews (Vansina 1965). The representatives from the villages also did not provide very detailed information and no archaeological sites were pointed out. According to them it is to protect their heritage and culture.
- While this study identifies some intangible heritage sites, readers should also refer to the social baseline (section 6.5) for further details on these sites.
- The foreseen impacts are based on the project description and layout contained in this report.

Potential impacts

Cultural resources within the project site are at risk of being damaged through direct and indirect impacts, especially during the project's construction phase. The closure phase might pose an additional risk as it involves the removal of unwanted infrastructure which could cause accidental damage. Moreover, inadequate erosion control during decommissioning might have negative effects on buried sites or those sites avoided during the implementation of a Cultural Heritage Management Plan (CHMP). The timing of these impacts would be immediate and their duration permanent if no management or mitigation measures are implemented. Damage to burial sites and sacred sites will affect local communities, although no impacts on these are foreseen based on this layout (for management measures see section 8).

Impact CH1: Indirect damage to Iron Age archaeological resources through land transformation activities

Iron Age Complex (**Site 17-20**) may be affected by the construction of the haul road and upgrades of existing roads in this area. Any further earth works in this area might expose buried cultural material.

Table 7-41: Impact significance rating and mitigation measures for Impact CH1

Impact CH1: Indirect damage to Iron Age archaeological resources through land transformation activities								
	Magnitude	Scale	Heritage significance	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before management	<i>Moderate</i>	<i>Site or local</i>	<i>MHS</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>
Management measures: • Demarcate sites prior to construction, facilitating preservation of the site by avoidance. • The work activities can be monitored during this phase to successfully mitigate any chance finds. • A CHMP should be developed to manage and conserve the sites located on the periphery of the development footprint. This plan should include all sites recorded in the project area and make provision for communication channels to follow in the case of chance finds.								
After management	<i>Minor</i>	<i>Site or local</i>	<i>MHS</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>

Impact CH2: Indirect damage to cemeteries through land transformation activities

This impact will affect **Site 15** Yuku village cemetery and **Site 36** Cemetery of the founder of the village.

Yuku village will be relocated and the community members have a direct link to the cemetery at Site 15. Cemeteries play an important part in the religious activities of the community in order to interact with their ancestors or a place of ceremony. Therefore the community might want the cemetery to be relocated with them. The community's wishes in this regard will have to be determined by the social team. However as grave relocation is an emotional event for the families it is recommended that if

possible the cemetery to be preserved *in-situ* and fenced off with an access gate for family members.

The grave at Site 36 is located to the north of the overburden stockpile and no direct impact is foreseen however to protect the site during construction it is recommended that the site is demarcated during construction.

Table 7-42: Impact significance rating and mitigation measures for Impact CH2

Impact CH2: Indirect damage to cemeteries through land transformation activities								
	Magnitude	Scale	Heritage significance	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before management	<i>Moderate</i>	<i>Site or local</i>	<i>HHS</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>
Management measures: - Demarcate Site 36 prior to construction, facilitating preservation or accidental impact of the site by avoidance. In the case of Site 16 this will have to be agreed with by family members. - If Site 16 is to be preserved <i>in-situ</i> the site will have to be fenced off with an access gate for family members. - A CHMP should be developed to manage and conserve the sites located on the periphery of the development footprint. This plan should include all sites recorded in the project area and make provision for communication channels to follow in the case of chance finds.								
After management	<i>Minor</i>	<i>Site or local</i>	<i>HHS</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>

Impact CH3: Damage to all other identified archaeological and cultural resources through land transformation activities

No direct impact or immediate threat is foreseen on the other documented sites based on the current development layout. It should be taken into account that all impacts on heritage sites through land transformation are permanent and irreversible. A CHMP will ensure that the sites are monitored and protected from any adverse development effects.

Recommendations

- NYA should develop a site specific CHMP that describes the location of known cultural heritage sites and actions for managing those sites.
- It is recommended that a detailed heritage survey to be conducted prior to the commencement of construction. If any sites of significance are identified via such surveys, mitigation strategies (preservation or excavation) should be implemented;
- Cultural heritage and sacred sites should be avoided, and if avoidance is not feasible, then relocation measures will be considered. This must be determined by the social team.
- Cultural training and awareness program: Contractors, subcontractors and employees should be sensitized to the procedures that must be followed in case of a discovery and the potential presence of archaeological resources that may be discovered during land-clearance and mechanical excavation activities.
- Develop and implement plan for chance finds or “unforeseen discoveries” procedures of significant archaeological, cultural or historic features revealed during construction and operational activities.
- Routine monitoring of land-clearing activities should be undertaken by monitors trained to identify archaeological artefacts and sites.
- Routine review of *in-situ* preservation of cultural heritage and sacred sites and specifically graveyards in the area of the operations.
- Through the social consultation process it must be determined what the community would prefer to happen with the graves at Site 16. The best option would be the preservation of the cemetery *in-situ*, fenced off with an access gate for family members. If the community wants the graves to be relocated, this process should be done adhering to international minimum standards and to local customs and legislation.

- The grave at Site 36 should be demarcated, protecting the site during construction.

7.2.11 Ecosystem services

Introduction

This section describes the ecosystems services related impacts that the project could have on the environment and communities within the project area. The findings here are based on a desktop assessment conducted by an ecosystems services and economics expert from SRK, based on data collected during the social and ecological baseline studies (see sections 6.5 and 6.3).

Key limitations in this section are that seasonal studies were not undertaken (due to time constraints for the study).

Potential impacts

Ecosystem services functions in the area have been compromised due to widespread deforestation and localised human pressure on the environment. Nevertheless, people in the area directly depend on a number of ecosystem services, such as provisioning services (including fish, bush meat, building materials, wood and water), regulating services (waste absorption and water purification) and supporting services (including pollination and soil formation for agricultural production).

Impact ES1: Reduced availability of natural resources and ecosystem services to local communities

The savannah ecosystem present in the area is largely intact and provides a number of services that people directly depend on, such as provisioning services (including wood, water, fish, bush meat and building materials), regulating services (including waste absorption and water purification) and supporting services (including pollination and soil formation for agricultural production)¹².

The proposed project will also make use of a number of local ecosystem services, including provisioning services (e.g. water) and regulating services (e.g. waste, emissions and effluent absorption).

Construction of the project will impact on three wetlands (Mbamba, Kawenga and Kabuendi) and reduce by up to 100 ha land that is part of the system providing the area with ecosystem services (Section 7.2.7). This may in principle impact on several of the ecosystem services that people rely on, such as:

- Provisioning services, for example by:
 - Reducing the area that is available for collection of food, materials, medicinal plants or for grazing;
 - Reducing the area that is available as habitat for animals hunted for bush meat;
 - Polluting or otherwise modifying aquatic habitats such as wetlands and, to a lesser degree, rivers, potentially resulting in a decrease of available fish and deterioration in the quantity and quality of water available for abstraction; and
 - Increasing the local population through in-migration of hired and potential workers, thereby increasing demand for and pressure on services;
- Regulating services, for example by:

¹² The analysis of the project's impact on ecosystem services as per PS6 concentrates on those services over which the proponent has "direct management control or significant influence". Global-scale regulating services such as climate regulation are thus not further assessed in this section.

- Reducing vegetated area that can absorb and recycle certain wastes; and
- Reducing the capacity of aquatic features to retain, filter and purify water; and
- Supporting services, for example by reducing the area available as habitat for pollinators and bush meat.

However, the area directly affected by the project is located within a much larger area that is in good condition. SRK's survey and engagement of surrounding villages indicated that many of the above-mentioned ecosystem services, including bush meat, water, building materials and agricultural plots, are currently accessed by villagers in areas will remain accessible to people and fall outside of the plant and quarry footprint. The project area itself is thus not considered crucial to providing the ecosystem services that are important to the local area. Disturbance due to the project may reduce the availability of some ecosystem services in surrounding areas, e.g. animals can move away or come under increased hunting pressure from a larger population, but the project impact on the overall availability of ecosystem services is expected to be limited. Some agricultural plots may be located within the project footprint, but alternative land is likely to be available for relocation of these plots.

The wetlands impacted by the project are used by villagers for limited fishing during the dry season. While the project is expected to contribute to the modification of the aquatic habitat in those wetlands, the availability of fish is not expected to change significantly. The above ecosystem services are thus not considered Type I¹³ priority services as per PS6, as ecosystem services-related impacts on the communities are expected to be very limited. The overall impact of the project on ecosystem services is expected to be medium in the absence of mitigation, as some fields and aquatic resources could be impacted. The implementation of mitigation measures aimed at reducing impacts on ecological resources, which underpin ecosystem services, and compensation of communities is expected to reduce the impact to a low significance.

Table 7-43: Impact significance rating and mitigation measures for Impact ES1

Impact ES1: Reduced availability of natural resources and ecosystem services to local communities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Long term</i>	<i>Local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Low</i>
Management Measures: • Comply with GIIP for air emissions, water (stormwater and effluent) discharge quality and solid waste disposal to minimise impacts on ecosystem services. • Implement mitigation measures recommended in Section 7.2.7 to minimise impacts on ecological resources. • Implement mitigation measures recommended in Section 7.3.11 and the Resettlement Action Plan and Community Development Plan (Appendix 18 and 19) to maximise community resilience and ensure fair compensation where resources are directly affected.								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Low</i>

¹³ Type I priority ecosystem services are those services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts to affected communities.

7.3 Operation phase environmental impacts

The potential effects of the proposed development during operation can be divided as follows:

- Impacts on air quality as a result of emissions from the cement production process and dust from the quarry activities. Also, international scale impacts as a result of the emissions of greenhouse gases from the cement production process.
- Impacts associated with noise, particularly the impact of noise on nearby human receptors.
- Impacts of the plant and quarries by changes to the landscape and visual impacts.
- Impacts on the local ecology by the loss of habitat taken by the development and impacts associated with the operations on the surrounding ecology.
- Impact on the surface water regime (hydrology) by changes to the natural drainage of the landscape within the development area and potential emissions of fine particles (suspended solids) into the water as a result of the industrial activities. Potential release of contaminated effluents into the surface water drainage. Also, impact on the underground water, called groundwater (hydrogeology) as a result of extraction of raw materials for use in the industrial process.
- Use of significant volumes of raw materials and the production of waste on an industrial scale.
- Impacts of transport.

Each of these potential issues is addressed in the following sections:

7.3.1 Air Quality

Introduction

This section describes the air quality related impacts that the project could have on the communities within the project area. The findings here are based on the baseline information provided in section 6.2.3. In broad terms, the purpose of this section of the ESIA is to comment on the extent and nature of the air quality related impacts that could occur as a result of this project.

The sources of potential air quality impacts are the quarry and crusher, unpaved roads, and activities at the plant itself i.e. klinker and cement production and material storage and handling.

Potential impacts

Impact AQ3: PM10 emissions due to activities at the quarry and the vehicle entrainment of dust affecting air quality of nearby villages

The quarry and the hauling of raw material are likely to be the main sources of dust, during the operational phase. Dust will be emitted as a result of excavation, blasting, materials handling and vehicle movement in and out of the quarry. Periodic earth moving to remove and stockpile the overburden of soil will also result in dust emissions.

Dust from these sources tends to be of a larger particle size which is associated with a nuisance factor, rather than a health hazard. However, the larger particle size, low wind velocities and low population density will result in a low impact of this dust on people in the environment.

Since the crushed material will be transported by conveyor not by trucks. These measures will substantially reduce the dust emissions. It is inevitable that some vehicular movement around the site will be necessary. Water can also be used for dust suppression where required.

Table 7-44: Impact significance rating and mitigation measures for Impact AQ3

Impact AQ3: PM₁₀ emissions due to activities at the quarry and the vehicle entrainment of dust affecting air quality of nearby communities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Long Term</i>	<i>Local</i>	Medium	Possible	Medium	-	<i>Low</i>
Management Measures: • Apply dust suppressants to sections of roads used routinely by vehicles that pass through and close to villages; • Design road alignments to minimize travel distances and eliminate unnecessary traffic; • Locate stockpiles within site boundaries considering the location of potential sensitive receptors and the predominant wind direction; • Set speed limits to minimize the creation of fugitive dust within the project boundary; • Avoid constructing roads close to human settlements; • Vegetation and soil should be removed together (mixed) so that the plant matter helps to hold the soil. Alternatively, vegetation can be stripped and stockpiled and then spread over the newly made stockpiles of soil; • Where practical, rehabilitation of the quarry should be progressive – i.e. it should be implemented as soon as a section is worked out. (This is only possible if there is no water standing in the pit.); • Natural vegetation surrounding the quarry can play an important role in minimizing dust emissions. It will reduce surface wind speeds and also trap a lot of the dust. Therefore, vegetation should only be cleared where it is absolutely necessary for operation. As the quarry expands, clearing should not take place a long time in advance of quarrying. Planned planting of trees and vegetation outside the quarry limits will minimize spreading of dust to surroundings; and • Development of routine air quality monitoring program.								
After Management	<i>Minor</i>	<i>Long Term</i>	<i>Local</i>	Medium	Unlikely	Low	-	<i>Low</i>

Impact AQ4: Dust emission from activities at the cement plant affecting air quality for nearby communities

All dust emission sources within the cement plant will be provided with dust control measures.

SO₂ will be the most significant air pollutant from the combustion of coal and has the potential for negative health impacts. However, the use of low sulfur coal and the technology to be used will ensure compliance with the IFC/World Bank and EU accepted emission standards. Hence, with the distance from near neighbors and lack of other sources of industrial or urban pollution this should result in a very low level of human health impact.

High temperatures ensure complete combustion, thus minimizing any harmful emissions – which tend to occur only if combustion occurs at temperatures lower than 800°C.

High temperatures also ensure the minimum formation of harmful substances such as dioxins and furans. The technology to be employed will meet the EU directive 200/76/EC and ensure that emissions will be within internationally acceptable standards.

Dust is generated by the cement grinding plant, which will be fitted with the GIIP to limit dust emissions - in the workplace and emissions to the environment – to within internationally accepted standards. FLS has the experience from their plants in Europe to ensure that a high standard of air quality is achievable using tried and proven technology.

A detailed study of the potential atmospheric emissions from the proposed cement works was undertaken for the proposed development by air quality experts from SRK. This study addressed the emissions to air which may occur during the normal operation of the cement kiln, as well as the minor emissions of fine particulate matter from other process stacks. The aim of this study was to assess the effects of these emissions in terms of ground level pollutant concentrations at ground level. These changes in local air quality were then compared with the Environmental Quality

Standards relating to quarries, mining and cement manufacturing covered under Articles 47 and 49 of the “OFFICIAL NEWSPAPER OF THE DEMOCRATIC REPUBLIC OF CONGO, Office of the president de la République, DECREE N°038 / 2003 OF CARRYING MARCH 26TH, 2003, MINING REGULATIONS” as well as IFC “Environmental, Health, and Safety Guidelines, Cement and Lime Manufacturing (April 30, 2007), IFC “Environmental, Health, and Safety Guidelines, Mining (December 10, 2007), IFC “Environmental, Health, Safety Guidelines, General EHS Guidelines (April 30, 2007) and EU Emissions Standards.

Detailed air dispersion modeling has been undertaken using “SCREEN 3” Model. SCREEN 3 uses a Gaussian plume model that incorporates source related factors and meteorological factors to estimate pollutant concentration from point sources continuously.

According to the World Bank “Pollution Prevention and Abatement Handbook, Effective July 1998 – Section-Air Shed Models”, useful screening model is SCREEN 3. It is further stated that “if the concentrations determined by using a screening model are within the relevant guidelines, no additional modeling should be necessary.” This approach requires no site-specific meteorological input, as calculations are made for a spectrum of possible combinations of wind speed and atmospheric stability (using Pasquill classes). Concentrations at the downwind point of maximum impact, as well as at other specified distances, are determined. No consideration of wind direction is required because the output represents the concentrations directly downwind. This is internationally recognized as an advanced dispersion model and is widely used in industrial regulation.

Air Dispersion Model's detailed and the results of model run are presented in Appendix – 6.1.

The assessment focused on the locations of local residential areas (sensitive receptors) where individuals may be exposed for relevant time periods according to the air quality criteria. The wider surrounding area was also modeled in order to demonstrate the maximum effects due to the cement plant operation.

It was concluded that at all sensitive receptors, the maximum changes in sulphur dioxide, carbon monoxide, particulate matter and annual average nitrogen dioxide concentrations due to plant operation are a small fraction of the relevant air quality criteria, and future air quality will remain well within these criteria. The principal emission from the cement kiln is oxides of nitrogen.

Given the likely very good existing background air quality in these largely rural locations, air quality will remain well within the hourly limit value.

The overall conclusion from the dispersion modeling study is that when the plant is in operation future air quality will be well within the DRC Mining Regulations and IFC EHS Guidelines limits specified for the protection of human health. These limits are set well below the levels at which there are any observable effects on human health or respiratory function in order to protect vulnerable individuals within the population. On that basis, it is concluded that there will be no adverse health effects in the local population due to the operation of the cement plant.

The air dispersion modeling indicates that the emissions of SO₂, NO_x, CO and Particulate matter in all cases, from the proposed project are in compliance with the requirement of DRC Mining Regulations and IFC EHS Guidelines.

Thus protection of human health and all other segments of environment will be ensured during operational phase.

The Environment Management and Monitoring Plan provides safeguards against any likely adverse environmental impacts from the project operation.

The proposed cement plant site, as a new stationary point source, is unlikely to contribute significantly, if at all, to the acid rain phenomena based upon its use of low sulfur fuel. Furthermore, based upon the remote location of the project site from human settlements or any sensitive element of environment, and the height of the stack, it is also anticipated that atmospheric dispersal of any potential pollutants will be effective and no impacts to the closest potential receptor is anticipated. The impact on air quality associated with PM₁₀, SO_x, NO_x, and CO emissions is expected to be insignificant.

Screening level assessments of the potential impact from dust emissions from the quarry areas and the potential for pollution from traffic movements associated with the operational phase of the development were also undertaken. Both of these assessments indicated that there will be no significant effects on air quality either as a result of dust emissions from the quarries or due to vehicle emissions.

FLS has guaranteed that the content of solid particles in clean gases shall not exceed the below stated figures:

- Fabric Filters for Kiln and Raw Mill – 20 mg/Nm³ (dry)
- Electrostatic Precipitators for Clinker Cooler Excess Air – 30 mg/Nm³ (dry)
- Fabric Filter for Cement Mill – 20 mg/Nm³ (dry)
- Fabric Filter for Cement Mill Separator - 20 mg/Nm³ (dry)

FLS is committed to design the plant according to EU air quality directives.

Table 7-45: Impact significance rating and mitigation measures for Impact AQ4

Impact AQ4: Dust emission from activities at the cement plant affecting air quality for nearby communities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Long Term</i>	<i>Local</i>	Medium	Possible	Medium	-	<i>Medium</i>
Management Measures: • Regular maintenance at the cement manufacturing plant will ensure that the abatement technology will continue to meet supplier specifications and EU air quality directives with regards to emissions; • The installation of spray bars, enclosure of transfer points or other means of control will be employed as necessary to ensure dust emissions from the crushing and conveying systems is properly managed to meet emission and ambient air quality targets; • Start-up conditions should be short as possible as this will reduce emissions during this process; and • Development of routine air quality monitoring program.								
After Management	<i>Minor</i>	<i>Long Term</i>	<i>Local</i>	Medium	Unlikely	Low	-	<i>High</i>

Impact AQ5: Gas (SO₂, NO_x and CO) emissions from activities at the cement plant affecting air quality for nearby communities

Table 7-46: Impact significance rating and mitigation measures for Impact AQ5

Impact AQ5: Gas (SO₂, NO_x and CO) emissions from activities at the cement plant affecting air quality for nearby communities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Long Term</i>	<i>Local</i>	Medium	<i>Possible</i>	Medium	-	<i>Low</i>
Management Measures: - Regular maintenance at the cement manufacturing plant will ensure that the abatement technology will continue to meet supplier specifications and EU air quality directives with regards to emissions; - Start-up conditions should be short as possible as this will reduce emissions during this process; and - Development of routine air quality monitoring program.								
After Management	<i>Minor</i>	<i>Long Term</i>	<i>Local</i>	Medium	<i>Unlikely</i>	Low	-	<i>High</i>

Impact AQ6: Gas (SO₂, NO_x and CO) and dust emissions from the cement plant affecting air quality for nearby communities during upset conditions

During upset conditions, such as shut-down of the plant for emergency or other reasons (either routine maintenance or power outages, during which the kiln will discontinue operation and cool down), re-starting of the plant and kiln will result in higher concentrations of gas emissions being temporarily released. Under certain ambient conditions, particularly when the wind direction will direct emissions from the plant towards receptors (e.g. Mbamba village, which is situated close to the plant and down-wind of the prevailing wind direction). As this impact will be temporary (limited to the start-up time for the kiln) and the frequency of occurrence of upset conditions requiring re-starting of the kiln cannot be determined, the significance of this impact has not been rated. It could however result in acute health impacts (primarily respiratory-related problems) on local residents and possibly chronic impacts should this situation occur frequently. The following mitigation measures are strongly recommended to minimize health impacts on residents of nearby Mbamba village in particular:

- An emergency response plan is developed for the village if it is not moved and this will include on-going training and drills with the villagers. Impacts are likely to occur when the prevailing winds are towards the village during an upset condition.
- Start-up should be delayed when the prevailing winds are towards the village.
- Before any decision is made to move the village I suggest that a proper dispersion model be run to more accurately quantify the extent and level of impacts associated with air emissions during normal and upset conditions.

7.3.2 Emissions of Greenhouse Gases

Introduction

This section describes the greenhouse gas related impacts that the project could have on the environment. The findings here are based on the baseline description in 6.2.3, as well as calculations of predicted greenhouse gas emissions based on the project description (chapter 4) and experience with similar projects.

Assumptions

The following assumptions apply:

- It is assumed that a Grid Emission Factor based on the fact that hydro power is the predominant source of grid electricity was the most appropriate to use– as opposed to one reflecting the regional situation i.e. in terms of the DRC's membership of the South African Power Pool (SAPP).

- The use of generally accepted emission factors and default values was used to provide input into the calculations of the proposed plant's anticipated emissions of GHGs. This as it was expected there may be differences from the current information provided in terms of the key inputs into these calculations (e.g. the characteristics of the coal to be used). When operating, actual values should of course be used as far as possible to represent the situation accurately.

Limitations

The following limitations apply

- No assessment of liquid fossil fuel related use (e.g. in diesel use) and associated GHG emissions was made as a result of the lack of activity/use data.
- No assessment of the emissions associated with explosives use was made as a result of the lack of activity/use data.

Potential impacts

An assessment of the potential emissions of greenhouse gases from the proposed installation has been undertaken by an expert from SRK (Appendix–6.2). The assessment concentrated on the main greenhouse gas emission that will be released, which is carbon dioxide (CO₂). No other significant sources of greenhouse gas are likely to be released as a result of the proposed operations. As with all cement manufacturing processes, large volumes of (CO₂) are released as a result of the chemical reactions taking place during manufacture of clinker. In addition, the burning of large volumes of solid fossil fuels to drive the process leads to the release of significant volumes of carbon dioxide. Finally, energy is used to drive auxiliary processes associated with cement manufacture. The energy is delivered as electricity and as in NYA proposed plant's case is generated as hydropower on offsite site at Inga Dam which does not release any GHG.

The greenhouse gas assessment indicated that the proposed technology has BAT for cement manufacture. Since the cement will be produced locally and used for infrastructure development within the country, this will reduce the greenhouse gases produced to transport imported cement into the country.

To ensure that once operational the cement production process is as energy efficient as possible, the operator should conduct a detailed energy survey 2 years after the plant is fully operational. The aim of the assessment will be to ensure that the plant is operating as efficiently as possible in order to reduce the carbon footprint of the plant operations. The energy surveys should be linked to implementation of a formal energy management system (from the start of operations). The two-yearly surveys should be seen as a major energy management milestone at a point where the plant's operation (and its associated management systems) is expected to have matured sufficiently.

Impact GH1: Increased greenhouse gas emissions in the area resulting from the cement plant

Table 7-47: Impact significance rating and mitigation measures for Impact GH1

Impact GH1: Increased greenhouse gas emissions in the area resulting from the cement plant								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Long Term</i>	<i>Local</i>	Medium	<i>Possible</i>	Medium	-	<i>Low</i>
Management Measures: - Regular maintenance and with the plant operating efficiently will reduce greenhouse gas emissions at the cement manufacturing plant ; and - Development of routine air quality monitoring program.								
After Management	<i>Minor</i>	<i>Long Term</i>	<i>Local</i>	Medium	<i>Unlikely</i>	Low	-	<i>High</i>

Impact GH2: Contribution to climate change as a result of greenhouse gas emissions from the project

In terms of assessing significance it is extremely difficult to do so because of the absence of up to date information and crucially that the data, where it exists, is acknowledged to be unreliable and incomplete (IISD, 2013). In terms of the country inventory as defined under the United Nations Framework Convention on Climate Change (UNFCCC), the process emissions from a cement plant (i.e. from calcination) would be reported under the industrial processes source category. The emissions from the use of coal in the process (as well as transport and electricity related emissions) would be reported under the energy source part of the inventory. Using the IISD report, which is based on access to the latest data being used in the development of the DRC's Third National Communication to the UNFCCC, an indicative impact of the proposed plant's GHG emissions on national emissions is given below:

- **Energy** – The IISD report indicates that energy sources (2010 figures) contributed 9 270 000 tonnes of CO₂e to the DRC's emissions. The proposed plant's emissions from energy sources are anticipated to be 407199 t CO₂e per year. This constitutes a 0.04% increase.
- **Industrial Processes** – The IISD report indicates that the 2010 figure for GHG emissions associated with industrial processes was 250 000 tCO₂e. Therefore the proposed plant's anticipated process emissions of 540 045 tCO₂e per year represent a 116% increase.
- **Overall Emissions** – Finally considering the total emissions of the plant of 947 244 tCO₂e against the total 2010 emissions of 28 600 000 tCO₂e (excluding those associated with LULUCF i.e. land-use, land-use change and forestry, the use of which would skew the analysis), the plant represents an 0.03% increase (please note that in terms of the 2010 figures from the IISD report, agricultural sources are the largest contributor to this amount i.e. 16 030 000 tCO₂e).

From this analysis, even considering the inaccuracies and uncertainties associated with DRC country level data, the plant is not a significant contributor to the overall national emissions profile (though it does lead to a significant increase in the industrial process associated emissions). However it is also clear that the proposed plant's GHG emissions, when considered as a point source, are significant and should be managed as such.

The following mitigation measures are recommended:

- Implementation of GHG Management Plan including the development of a GHG inventory and on-going programme of GHG emission reduction initiatives (this would include regular evaluation of new technology options for GHG reductions including: carbon capture and storage and co-processing opportunities).
- Identification and implementation of offset opportunities e.g. reforestation, use of biofuels.

7.3.3 Noise and vibration

Noise Modelling Methodology

Calculation of noise propagation and dispersion in the NYA study is based on the principles of the Concawe method. CONCAWE (Conservation of Clear air and water in Europe) is an organisation established by a group of oil companies in 1963. A noise propagation model developed by CONCAWE (Manning *et al.*, 1981) has been validated over and over and has internationally become one of the most widely used methods in the simulation of small and large sources of noise and in the prediction of noise for purposes of environmental noise impact assessment (ISO, 1993), (ISO, 1996).

The model takes into account factors such as source emission characteristics, geometric divergence, losses, atmospheric propagation, ground effects and screening. The model used in the NYA study also simulates wind direction. Emission from all major noise-generating components and activities require acoustic emission (sound power) levels, as well as the frequency and directional characteristics of individual or groups of sources. This data was available from measurement data obtained in previous noise studies and from in-house noise data archives.

Confidence in the predictions which are based on appropriately scaled data obtained in measurements conducted at similar plants and processes, is moderate-to-high. It should nevertheless be cautioned that predicted noise levels and contours are not to be taken as absolute. Noise maps must be interpreted with caution. Although the confidence level in the acoustic model is high, predicted levels are valid for the assumptions made in respect of meteorological and other conditions. Since meteorological conditions in particular are highly variable, levels produced at a distance by a source at a constant acoustic output will vary considerably, even during the course of a single day-time or night-time period. Variance in noise level due to changes in atmospheric conditions increases with distance from the source. It should also be borne in mind that noise propagation is not only affected by distance and wind, but by temperature gradients in the atmosphere as well. Noise contours calculated for the NYA operation represent best estimates of continuous project activity noise levels averaged over a relatively long duration, in this case the nominal night-time (7:00 pm to 07:00 am) and daytime (7:00 am to 07:00 pm).

Equator Bank - World Bank Group Guidelines

World Bank Group and International Finance Corporation (IFC) Performance Standards in conjunction with General Health and Safety Guidelines advise that pollution in general be prevented by control at source. Noise abatement measures are required to achieve either of the following:

- Noise levels from the development at the most sensitive point of reception should not exceed the limits specified in Table 7-43; or
- Noise levels from the development at the most sensitive point of reception should not cause background levels to increase by more than 3 dB.

In the context of the NYA study, the background level is the ambient sound level prior to development, i.e. the baseline level. Where applicable and relevant, background levels are to be taken outside the project property boundary.

Implicit in Condition (a) is what is commonly referred to as the *acceptable level criterion*, allowing the use of a nominal table value, rather than the actual pre-development ambient level, as the baseline reference. Post-development noise is to be measured at noise receptors located outside the project property boundary and compared with the applicable baseline level derived from the table.

Condition (b) employs the so-called *noise emergence criterion*, using as baseline the actual ambient level determined by measurement at the receptor location; i.e. both pre- and post-development levels are determined by measurement.

Table 7-48: World Bank limits Noise level guidelines Maximum outdoor noise level dBA

Receptor (Type of district)	Noise level One Hour L _{Aeq} (dBA)	
	Daytime 07:00 – 22:00	Night-time 22:00 – 07:00
(a) Residential; institutional; educational	55	45
(b) Industrial; commercial	70	70

Levels in Table 7-48, in line with international practice, are quantified as A-weighted equivalent continuous levels, denoted as L_{Aeq} and with units in dBA. Such levels represent the true energy averages of the sound under consideration, regardless of impulsiveness, on-off ratios, or how the level may be fluctuating. The reference period or averaging time T is usually denoted in the level term as $L_{Aeq,T}$. Hence, daytime and night-time levels are commonly denoted as $L_{Aeq,d}$ and $L_{Aeq,n}$ respectively, or L_d and L_n , for short.

By specifying the One Hour L_{Aeq} in Table 7.2.3-1, World Bank guidelines implicitly require that measurement samples taken for the determination of average daytime or night-time levels be averaged over at least a one hour period. World Bank acceptable level criteria whereby a 55 dBA daytime level is adopted as a blanket development target, are in line with the policies and recommendations of the European Union as well as the World Health Organisation.

Definition of noise impact

Noise impact is defined as the increase in the ambient level (dBA) as a result of noise generated by a specific source under investigation, in this case the NYA Cement Project with all its components and activities. The increase in the ambient level (dB) is the difference between the total level (intrusive plus background noise) and the background level, all measured in dBA.

Noise contours and noise footprint of the project

The noise impact of the NYA project was calculated by means of a model programmed to simulate the geometric divergence, atmospheric propagation and topographical dispersion of noise originating from all components and activities. The model was then used to compute noise contours delineating the noise footprint of the project, i.e. the net result of noise generated by all noise components and activities collectively. It was also programmed to simulate and assess measures designed to mitigate noise impact.

Magnitude of impact

The noise footprint of the project is illustrated on maps with plots of 3 dB and 5 dB noise impact contours calculated for the various options. These footprints delineate the distances at which project noise elevates the ambient level by 3 dB (EU recommended upper limit) and 5 dB (high impact), respectively. The ambient level is elevated by 3 dB above its initial level (background level) if the specific level of project noise at any location rises to the point where it equals the background level. This represents a noise impact of 3 dB.

Assumptions and Limitations

Baseline levels

Communities nearest to the quarry and plant and most likely to be affected by noise, are Yuku camp Village, Mbemba Village about 1 km from the quarry and Mbamba Village approximately 500 m from the Cement Plant. In the baseline noise study conducted by ECTECH, ambient noise levels in these two villages were found to vary between 40 and 50 dBA.

In calculating noise impact contours in the SRK assessment, values of 40 dBA and 50 dBA were used for daytime and night-time reference levels, respectively. This is in line with the Equator Bank - World Bank Group Guideline (b).

Quarry operating hours

- In accordance with the schedule proposed in the HOLTECH report, quarry operations will be limited to 10 hours per day. It is assumed in the calculation of noise contours and in the noise assessment that those 10 hours will be restricted to the daytime period, i.e. no pit operations,

overburden stockpile construction, or transport of mined product between quarry and plant will take place at night.

- This assumption is crucial to the validity of predicted noise levels and the findings of the noise assessment.

Cement Plant operating hours

Daily operating hours and operating days per year, are assumed to be as reported in the HOLTEC feasibility study, as summarised below.

Table 7-49: Daily operating hours of equipment

Plant Component	Operating Hours per day	Days per year
Limestone/Clay crusher	10	330
Additive Crusher	10	330
Raw Mill	21	330
Coal Mill	16	330
Cement Mill	20	330
Packer	13	330

In line with the schedule above, it was assumed in the calculation of night-time noise levels that the limestone crushers will not be operating at night.

Blasting

It is assumed that blasting will be required, but that this will be restricted to daytime hours only.

Worst-case conditions

Depending on the time of day or night and on meteorological conditions in particular, noise levels produced by industrial sources over long distances fluctuate by a considerable margin. Such oscillations in level are caused by variable atmospheric absorption (losses) and by refraction (bending) due to ever-changing wind and temperature gradients as a function of altitude.

Unmitigated noise impacts in the SRK noise assessment were investigated for unfavourable, Probable Worst-Case conditions which would result in elevated project noise levels and maximum noise impact:

- Noise contours were calculated for day time as well as night-time conditions when background noise levels are low and when the area is most sensitive to intrusive noise;
- Noise contours were calculated to assess the impact on the nearest noise-sensitive recipients when they are located downwind relative to the source of noise.
- Noise contours for daytime operations were calculated for the most unfavourable state of operation and layout at the quarry, with surface operations and overburden stockpile operations taking place on the eastern side of the quarry. Calculations were made for the case where the haul road between the quarry and the plant traverses through or very close to Yuku Village.
- Noise contours for daytime operations were calculated for a quarry pit depth of 20 m, which affords considerable screening of noise generated by pit operations. This, however, has no effect or advantage in respect of noise generated in surface operations around the pit, including overburden stockpile operations.

Potential impacts

Impact NV3: Continuous noise resulting from daytime operations of the quarry, cement plant, haul road and associated infrastructure

The Noise Contour Map shown on Figure 7-1 shows the predicted unmitigated continuous noise footprint for the proposed NYA Cement Project calculated for unfavourable wind conditions during the daytime. The wind is assumed to be blowing from the south-west, which would be the most unfavourable condition for the nearest communities in Mbemba and Mbamba Villages to the east. All operations at the plant and quarry are assumed to be running. Haul road alignment is assumed to pass through Yuku Village. Contours in Figure 7-1 depict the increase in the daytime ambient level relative to a background ambient (baseline) level of 50 dBA.

Inspection of Figure 7-1 reveals that, based on predictions, haul road truck noise is expected to have a significant noise impact on residents of Yuku Camp Village. Elsewhere, the project is not expected to have a significant noise impact during daytime operation. The impact on the other nearest communities of Mbemba or Mbamba Villages to the east is insignificant. Plant and quarry noise during daytime will seldom be audible and will not be disturbing to any of these communities. The impact significance of the project overall has therefore been rated as low for Mbemba and Mbamba Villages, but high for Yuku Village for which mitigation measures will be required.

Two options may be considered to mitigate the noise impact of haul road traffic on Yuku Village residents:

Option 1: Change the alignment of the haul road between the Cement Plant and the quarry to bypass Yuku Village. Figure 7-2 shows the mitigated daytime noise footprint of the project with the haul road realigned to the west of Yuku Village.

Option 2: Relocate the residents of Yuku Village.

Table 7-50: Impact significance rating and mitigation measures for Impact NV3

Impact NV3: Continuous noise resulting from daytime operations of the quarry, cement plant, haul road and associated infrastructure								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	Major	Long term	Local	High	Definite	High	-	High
Management Measures:								
Option 1 – Realignment of Haul Road								
• Change the alignment of the haul road to bypass Yuku Village								
After Management	Minor	Long term	Local	Medium	Unlikely	Low	-	Medium
Management Measures:								
Option 2 – Relocation of community								
• Relocate Yuku Village								
After Management	Minor	Long term	Local	Medium	Unlikely	Low	-	High

Impact NV4: Continuous noise resulting from night-time operations of the cement plant and associated infrastructure

Figure 7-3 shows the night-time noise footprint of the project if the wind is blowing from the south-west. It is assumed that the Cement Plant is fully operational except for the limestone crushers which are assumed to be off at night. It is also assumed that no operations are taking place at the quarry; i.e. no pit works, overburden earth works or transport on the haul road at night.

Contours depict the increase in the night-time ambient level relative to a background ambient (baseline) level of 40 dBA. It is assumed (as per the project description) that quarry and crusher operations will be restricted to daytime, quarry operations will not cause any noise disturbance at night

Based on these noise level predictions, it can be concluded that at night, the Cement Plant is expected to have a small impact on residents of Mbamba Village 600 m from the plant. Assuming that the Limestone Crushers will not be running at night, the impact will most of the time be of minor and occasionally of moderate magnitude, with levels rising up to 44 dBA under conditions when the village is downwind relative to the plant. This amounts to an impact of only 4 dB, which is unlikely to cause a regular noise nuisance in Mbamba Village.

The project is not expected to have a significant noise impact on any of the other villages in the area.

Table 7-51: Impact significance rating and mitigation measures for Impact NV4

Impact NV4: Continuous noise resulting from night-time operations of the cement plant and associated infrastructure								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: Option 1 – Mitigation by Plant Design - Noise screening - Construct noise screens around Raw Mill. - Noise screen design by plant design engineers to be based on design input and specifications of acoustical engineer. - Because of complexity and weight of acoustic panels and structural considerations, noise screens may require a separate foundation and supporting framework detached from the mill main frame. This could also be achieved by locating the mill inside a steel clad building with acoustical treatment on the inside. - Screening of the mills can be expected to reduce the overall noise level and impact but it may be necessary to screen off additional equipment as well								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: Option 2 – Relocation of community Relocate Mbamba Village								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site</i>	<i>Medium</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>High</i>

Impact NV5: Air blast pressure and vibration resulting from blasting at the quarry

Seismic shock waves (ground-borne vibration) attenuate much faster with distance compared to air-blast (sound pressure) waves and blast-induced seismic vibration is not expected to have a significant impact on the nearest villages. The level of air-blast sound pressure levels produced by a given charge is highly dependent on the drilling, charge preparation, stemming and detonation methods employed. Blast levels at large distances from the source are also highly dependent on atmospheric conditions (temperature and wind gradient profiles) and are difficult to predict.

It is nevertheless possible to obtain rough estimates of the typical air-blast footprints which can be expected in the operational phase of the project. Noise contour maps Figure 7-4 and Figure 7-5 show typical air-blast sound pressure level footprints for two cases:

- Figure 7-4 shows a typical air-blast peak sound pressure level footprint for a 200 kg charge detonated during the morning at or near surface level.
- Figure 7-4 shows a typical air-blast footprint for the same charge and pit depth, if it is detonated during the afternoon.

The noise contours should not be interpreted as absolute, but the results of these simulations do serve to illustrate (a) the variability of air-blast pressure levels based on atmospheric conditions and (b) the substantial difference in level resulting from blasting during morning versus blasting in the afternoon (after 14:00). Blasting during the afternoon typically produce much lower levels of air-blast peak levels compared to blasting during morning hours. This is because atmospheric temperature gradients as a function of altitude are usually still positive in the morning, following the earth's cooling down during the previous night. This results in earth-bound refraction of sound and an intensification of the level over long distances. Later in the day, with the surface of the earth heating up, temperature gradients tend to reverse, resulting in skywards refraction and a reduction in level over long distances.

Inspection of Figure 7-4 reveals that blasting at the quarry during morning hours is likely to have a significant impact on residents in Mbemba Village approximately 1 km from the quarry. It is estimated that if blasting takes place during the morning, peak air-blast sound pressure levels of up to 128 dB Peak may result for an NEC of 200 kg. Such a level will be disturbing and may cause structural damage to houses at that distance. The same charge detonated in the afternoon (Figure 7-5) is expected to produce a level of only 117 dB Peak, which is insignificant.

It is concluded that, unless blasting is strictly managed to take place during the afternoon hours of the day, air-blast noise is likely to cause a significant impact on residents of the nearest villages.

The noise maps were calculated for blasting at or near surface level. Blast levels will of course be reduced quite significantly by noise screening offered by the pit walls, as the depth of the pit increases.

Seismic shock waves attenuate much faster with distance compared to air-blast (sound pressure) waves and the significant impact footprint is usually much smaller than that of the corresponding air-blast footprint. Seismic shocks and vibrations are not expected to have a significant impact on residents of the nearest villages. This opinion expressed by the acoustic specialist in respect of the seismic consequences of blasting should be reviewed and the finding verified by a seismic specialist.

Table 7-52: Impact rating and mitigation measures for Impact NV5

Impact NV5: Air blast pressure and vibration resulting from blasting at the quarry								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Major</i>	<i>Long term</i>	<i>Local</i>	<i>High</i>	<i>Possible</i>	<i>High</i>	-	<i>Medium</i>
Management Measures:								
Option 1 – Restrict blasting to afternoon hours								
Restrict blasting to afternoon hours 14:00 to 17:00. No blasting to be allowed during the morning hours of the day.								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures:								
Option 2 – Employ alternative mining techniques instead of blasting								
Apply alternative mining techniques, such as ripping, which will eliminate the need for blasting at the quarry.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site</i>	<i>Medium</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>High</i>

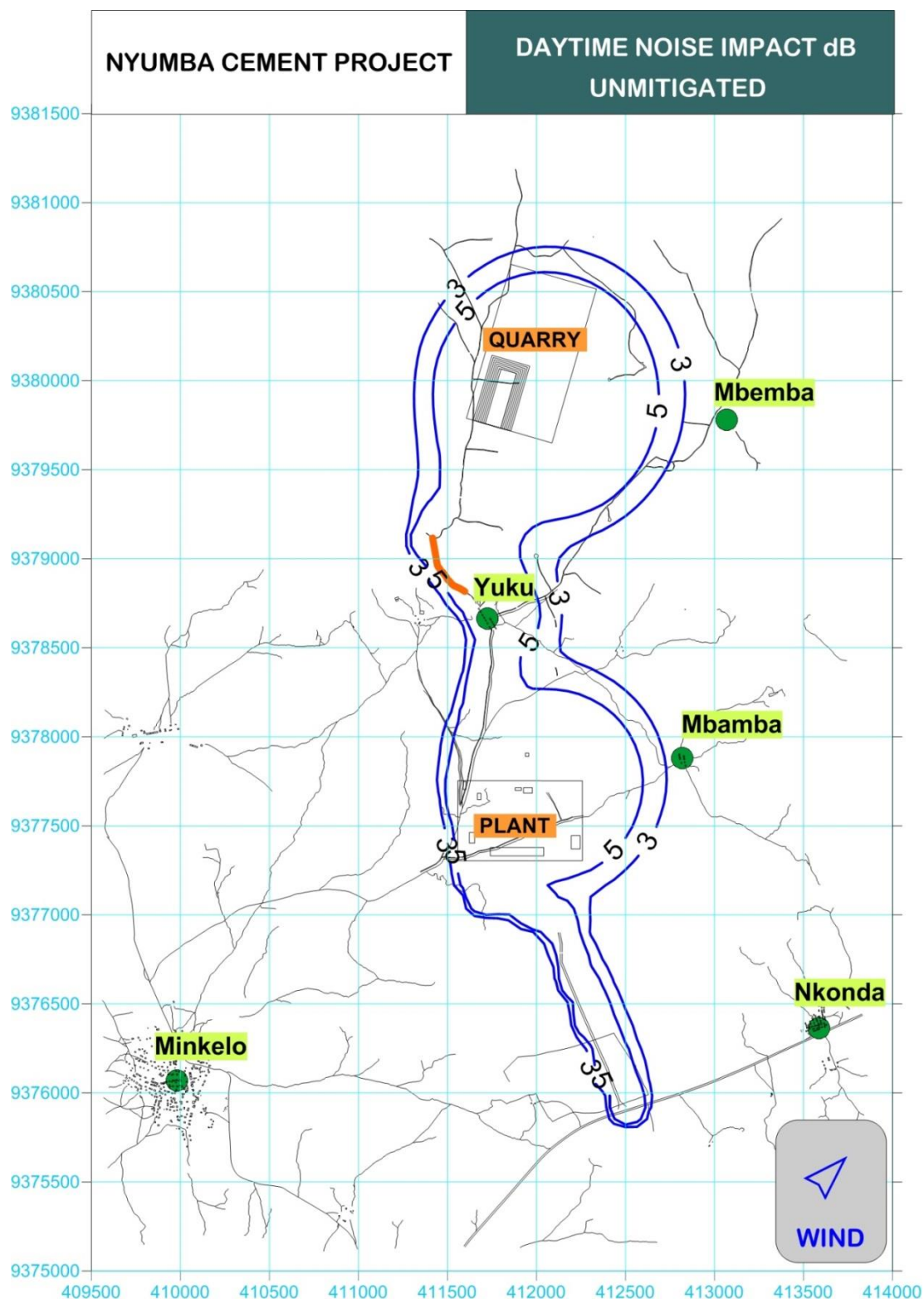


Figure 7-1: Noise contour map – predicted daytime unmitigated increase in ambient noise¹⁴

¹⁴ Map shows increase in ambient level dB, all operations at Plant and Quarry running, Wind blowing from the south-west. Predicted impact significance medium inside the 3 dB contour; high inside the 5 dB contour.

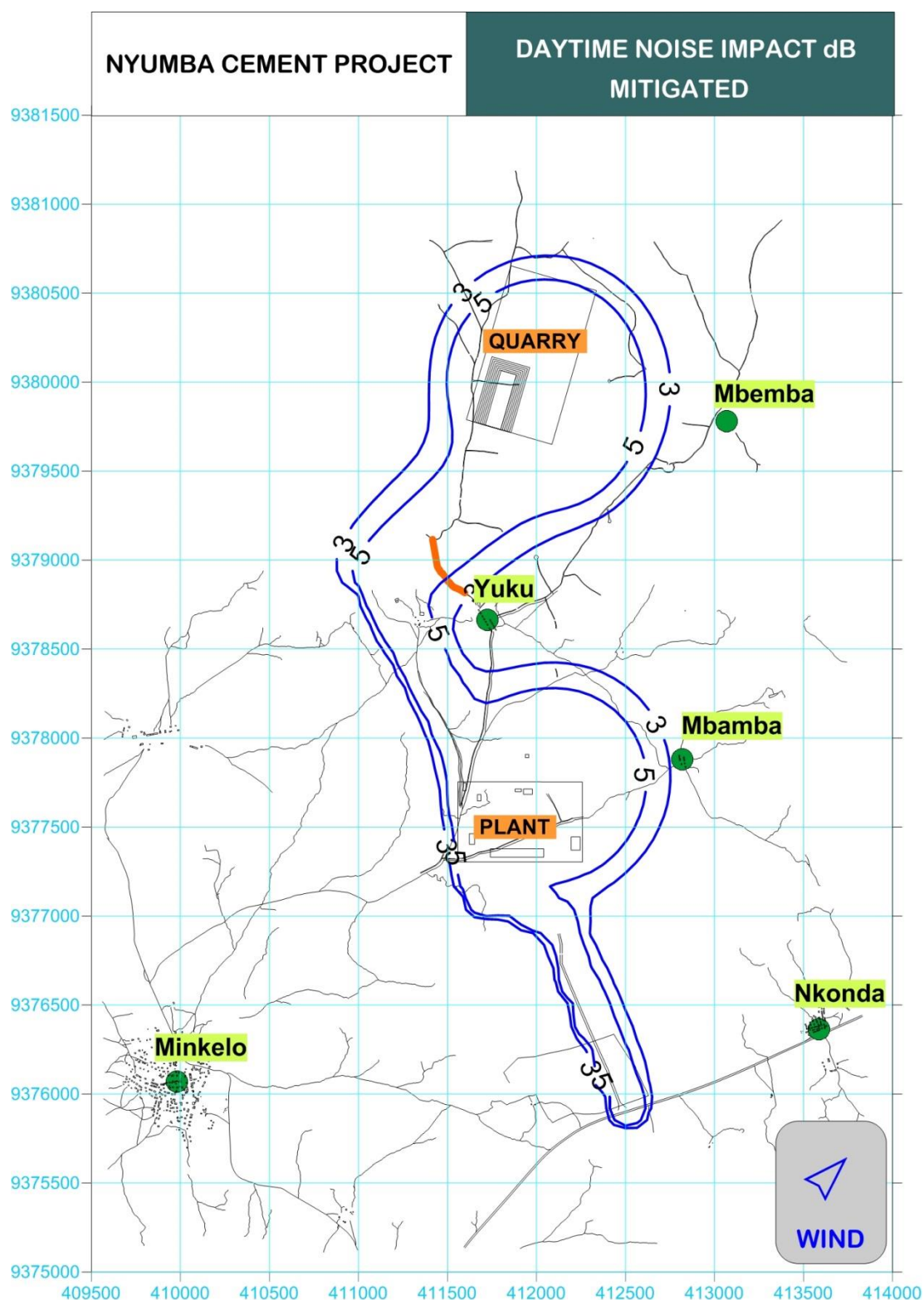


Figure 7-2: Noise contour map – predicted night time mitigated increase in ambient noise¹⁵

¹⁵ Map shows increase in ambient level dB, all operations at Plant and Quarry running, Wind blowing from the south-west. Haul road bypasses Yuku Village. Predicted impact significance medium inside the 3 dB contour; high inside the 5 dB contour.

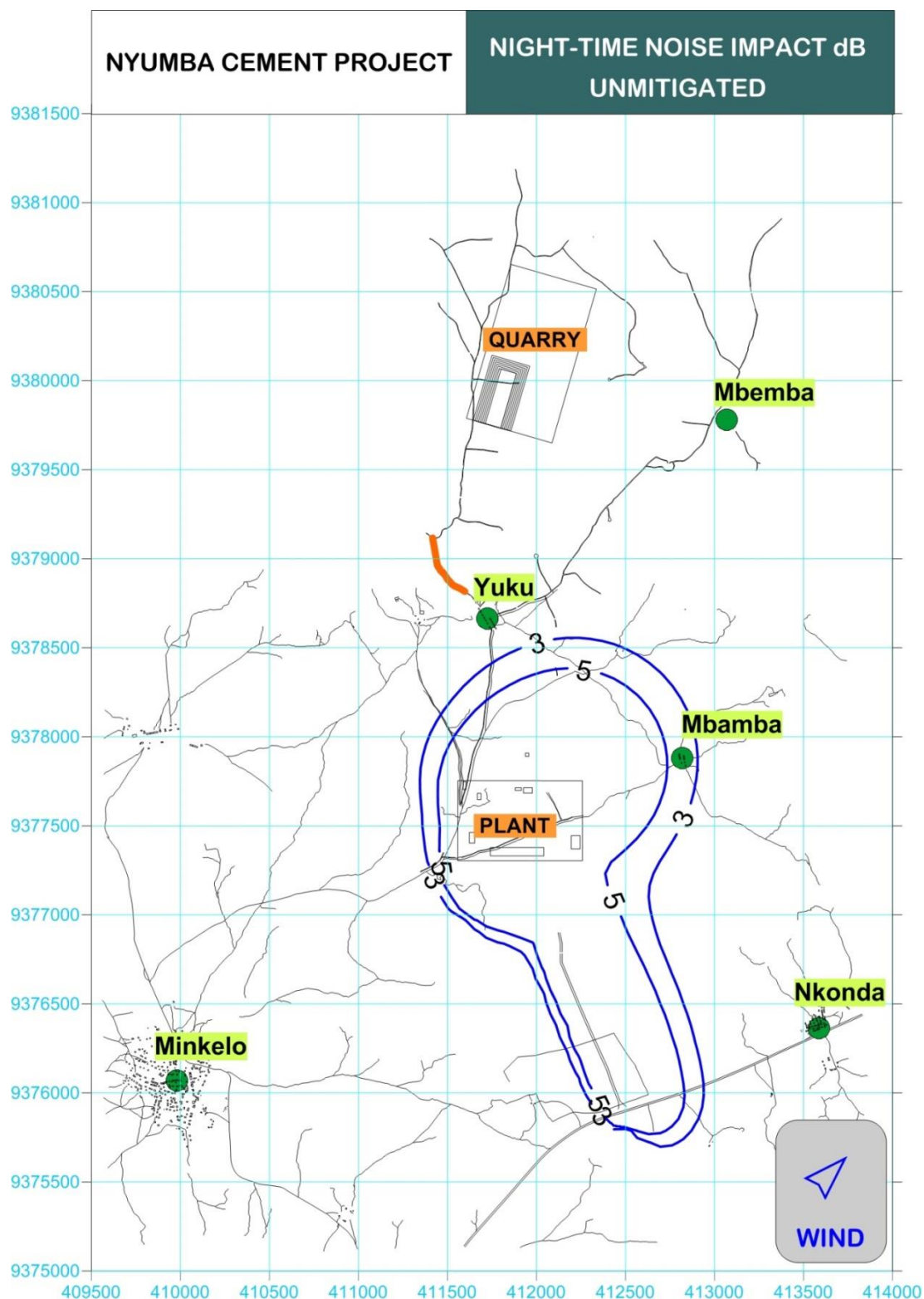


Figure 7-3: Noise contour map – predicted night time unmitigated increase in ambient noise ¹⁶

¹⁶ Plant running but with Limestone Crushers off - No Quarry operations; Wind blowing from the south-west; Impact significant inside the 3 dB contour; high inside the 5 dB contour

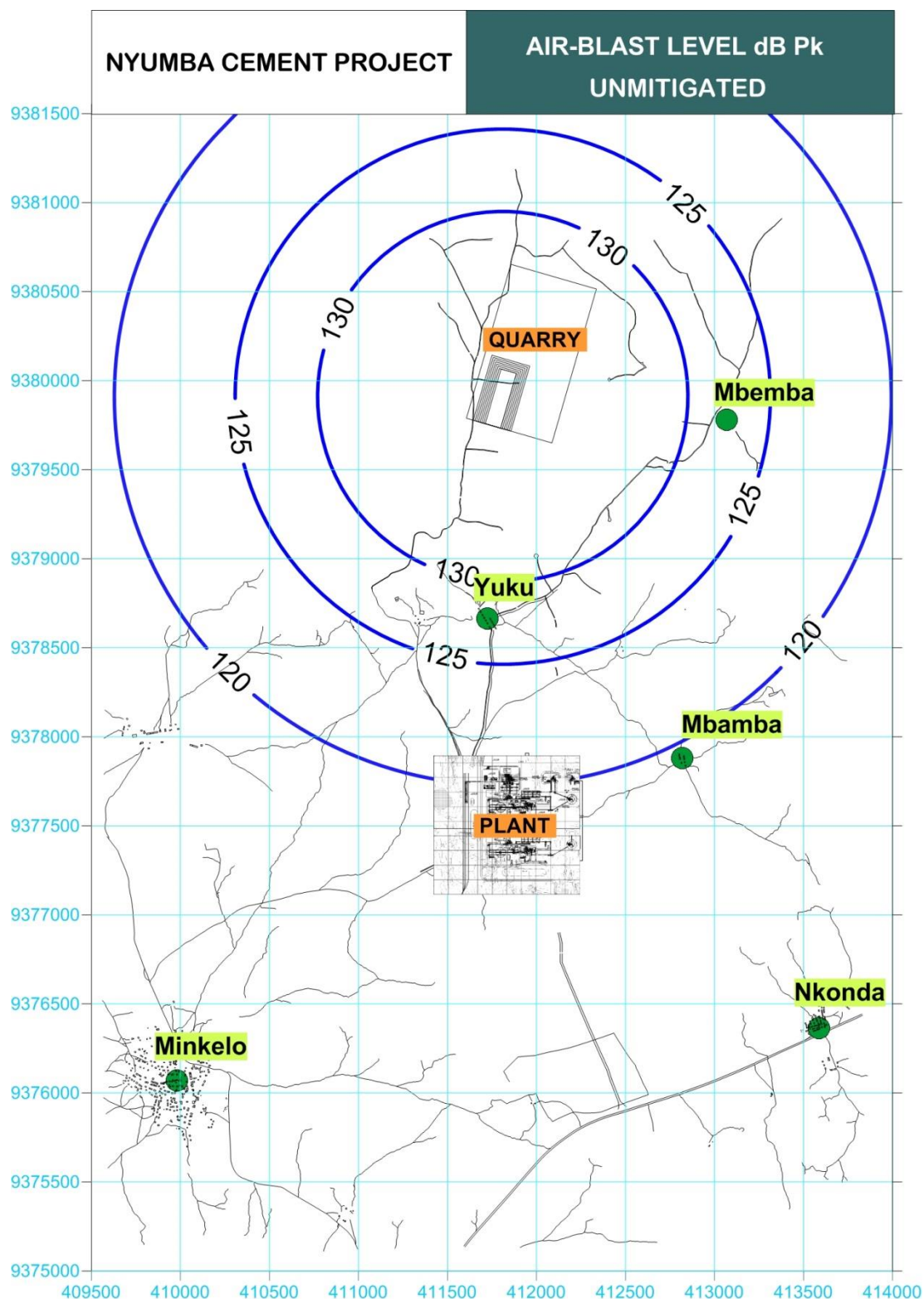


Figure 7-4: Noise contour map – predicted peak typical morning blast noise levels¹⁷

¹⁷ Blasting during morning hours (before 14:00); Impact significant inside the 120 dB contour

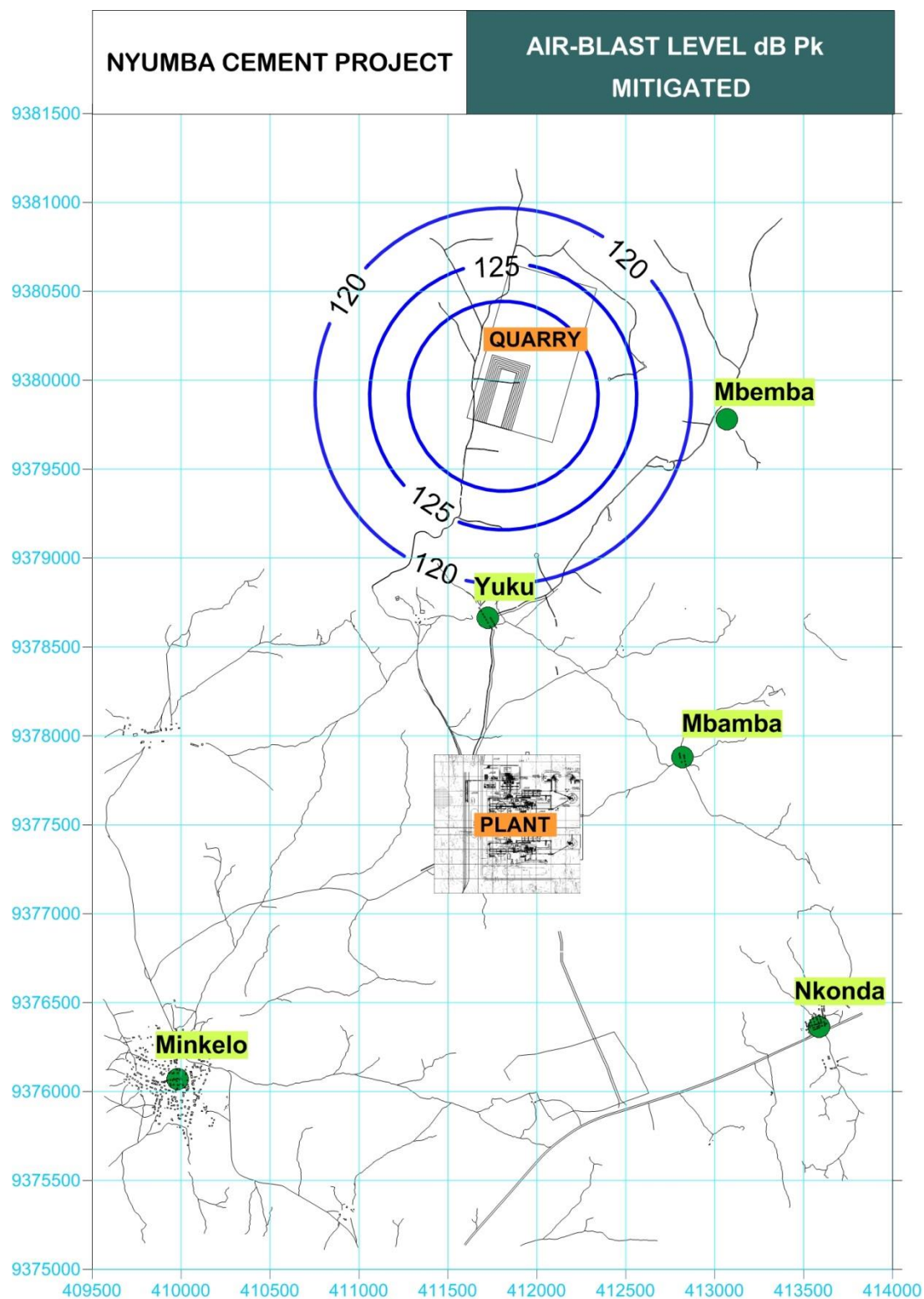


Figure 7-5: Noise contour map – predicted peak typical afternoon blast noise levels¹⁸

¹⁸ Blasting during afternoon hours (after 14:00); Impact significant inside the 120 dB contour

7.3.4 Ecology and Biodiversity

Introduction

Assumptions

The following assumptions apply:

- The impact on natural and/or critical habitats associated with the purchase and importation of raw materials (coal and gypsum) into the DRC was considered based on the understanding (as conveyed by NYA) that these products would be imported from South Africa. Insufficient information was available to assess or comment on the sourcing of other raw materials.
- The project will require a labour force, which will likely include staff from beyond the villages within the concession area. Such employment will result in employees, their families, and job seekers immigrating to the area. Some unsuccessful job seekers are likely to remain in the area and may turn to the hunting of wildlife as a form of livelihood (in part or in full). Increased hunting of wildlife for bushmeat in the study area was therefore anticipated.
- The impacts of water abstraction on ecology or biodiversity were not assessed, as it was understood that they would be addressed under the Water Resources section.
- The impacts on Ecosystem Services were not assessed, as it was understood that they would be addressed under the Ecosystem Services section.

Limitations

The following limitations apply

- A botanical survey of aquatic and terrestrial habitats was conducted by the University of Lubumbashi in conjunction with SRK Consulting between 10 and 14 June 2013, which coincided with the early part of the dry season. Due to time constraints, a survey during the wet season was not possible. Transects were undertaken in each of the terrestrial habitats to record the species present and their respective abundance. It was estimated that a comprehensive survey during both the wet and dry seasons may yield approximately four times more plant species than were recorded during the short survey in June 2013. The species and habitats (ecosystems) identified during the short fieldwork survey should not be treated as comprehensive.
- A detailed fauna survey was not conducted due to a lack of available local experts and time. Bird, mammal, fish, amphibian, reptile and insect species were observed during the botanical surveys that were conducted from 10 to 14 June 2013 and are documented in this report. Information was gathered from local communities regarding both aquatic and terrestrial fauna present in the study area, but much of this data could not be verified in the available time-frames. No surveys of aquatic fauna were conducted. The species identified during the short fieldwork survey should not be treated as comprehensive.
- Additional IUCN Red List species may (and in fact are likely to) be identified via further fieldwork during both the wet and dry seasons.

The spatial distribution of habitats in the study areas was mapped in GIS at a 1: 5,000 scale as a desktop exercise. Limited verification of the desktop mapping was undertaken based on the results of the fieldwork, but detailed ground-truthing was not possible due to time constraints and the timing of availability of high resolution imagery for the study area. The accuracy of the spatial delineation and categorisation of the habitats in the study area therefore cannot be guaranteed, should be treated as preliminary, and requires refinement and verification during the development of the Biodiversity Action Plan.

Potential impacts

A number of ecological impacts have been predicted to result during the operational phase of the project, including:

- Loss or disturbance of fauna species of special concern due to collisions with vehicular traffic and powerlines, and quarry and plant noise;
- Introduction and invasion of alien plants;
- Increased hunting/poaching of wildlife;
- Alteration, modification or degradation of habitats due to pollution, altered run-off, or nutrient loading; and
- Impeded photosynthesis and the transpiration rate of plants due to dust generation.

Each of these impacts are explained and assessed, and mitigation measures recommended below.

The impact on natural and/or critical habitats associated with the purchase and importation of raw materials (primarily coal and gypsum) into the DRC was considered. In the instance of coal and gypsum imported from South Africa, the associated impact on biodiversity in South Africa would have been assessed as a legal requirement in terms of this country's environmental impact assessment regulations. Insufficient information is currently available to assess or comment on the sourcing of other raw materials, but it is recommended that NYA formalise a supply chain protocol to govern the selection of suppliers. NYA should also periodically monitor its primary supply chain to identify any potential new impacts on natural and/or critical habitats by its suppliers and, if necessary, appoint new suppliers that are compliant with the requirements of IFC PS6.

Impact EB10: Loss or disturbance of fauna species of special concern due to collisions and noise disturbance

A number of the species identified by local communities as occurring in the study area are listed on the IUCN Red List, most notably *Psittacosis erithacus* (*African grey parrot*) that is classified as Vulnerable and *Phataginus tricuspis* (*Tree pangolin*) that is classified as Near threatened. Detailed surveys during both the wet and dry seasons however may result in additional Red List species being recorded. During the surveys of the study area, no nesting birds were observed, but are they very likely to be present.

Disturbances to resident and visiting fauna are predicted due to vehicular traffic and noise from operations, with impacts on nesting birds likely to be most substantial. The fatal collision of birds with the new powerline is also anticipated, particularly due to the proximity of the new powerline to the Mbamba and Kabuendi wetland systems.

Table 7-53: Impact significance rating and mitigation measures for Impact EB10

Impact EB10: Loss or disturbance of fauna species of special concern due to collisions and noise disturbance								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: - Bird collision minimisation technologies (e.g. bird flappers) to be installed on the new powerline from the grid station at Kimpese to the plant to minimise collisions. The most appropriate technology is to be determined by an experienced ornithologist; - A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession. The initial Biodiversity Action Plan should be informed by comprehensive baseline surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The Action Plan must be updated at least every 5 years to facilitate adaptive management, or more frequently if required.								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>High</i>

Impact EB11: Introduction of alien invasive flora and fauna

Invasive alien plants are present at very low levels in the study area, but a much higher prevalence thereof was noted along the N1 main road. Such invasions related primarily to bamboo present at road crossings over rivers and *Chromolaena odorata* at recently cleared areas. The transportation of products to and from the site, Matadi port and Kinshasa may result in the introduction of new alien invasive flora and fauna into the study area or into part of the site where such species currently are not present. The introduction of new insect and mammal species (e.g. rodents) from outside of the DRC via the port of Matadi poses the greatest alien invasive fauna risk.

Table 7-54: Impact significance rating and mitigation measures for Impact EB11

Impact EB11: Introduction of alien invasive flora and fauna								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: - An invasive alien species control programme to be developed and implemented as a component of the Biodiversity Action Plan, including adaptive management measures; - The initial Biodiversity Action Plan should be informed by baseline surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The Biodiversity Action Plan should be updated every five years, with particular emphasis to be placed on the control of invasive alien flora and fauna; - All invasive alien species control measures specified in the Biodiversity Action Plan must be implemented.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>Medium</i>

Impact EB12: Increased hunting/poaching of wildlife

The project will require a labour force, which will likely include staff from beyond the villages within the concession area. Such employment will result in employees, their families, and job seekers immigrating to the area. Some unsuccessful job seekers are likely to remain in the area and may turn to the hunting of wildlife as a form of livelihood (in part or in full). Increased hunting of wildlife for bushmeat in the study area is therefore anticipated.

Table 7-55: Impact significance rating and mitigation measures for Impact EB12

Impact EB12: Increased hunting/poaching of wildlife								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Definite	Medium	-	<i>High</i>
Management Measures: - A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession; - An environmental education programme to be developed and implemented for all NYA employees, their families, and villages within the concession; - Effective penalties (e.g. severe fines) to be implemented for project staff that are found to be hunting or purchasing wildlife (e.g. bushmeat). Current villagers that are not employed by NYA should be allowed to continue hunting as a form of livelihood, but measures to ensure such hunting is undertaken within sustainable limits should be identified with the community as a component of the Biodiversity Action Plan.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Unlikely	Low	-	<i>Medium</i>

Impact EB13: Modification or degradation of aquatic habitats due to pollution or nutrient loading

The hydrological regimes of the Mbamba, Kawenga and Kabuendi wetland systems are likely to be impacted by modification of the landscape surrounding them. The volume, chemical composition and percentage of TDS in surface run-off will also be altered, with run-off into the Mbamba and Kawenga wetlands likely to be of a higher pH than present due to the presence of limestone dust in and around the plant site during operations. No nutrient loading is anticipated in these systems, but pollution events could occur if sources are not managed appropriately (e.g. petroleum storage facilities etc.). The discharge of effluent from the waste water treatment plant, or seepage from secondary treatment ponds, could also result in pollution impacts to the wetland systems.

Table 7-56: Impact significance rating and mitigation measures for Impact EB13

Impact EB13: Modification or degradation of aquatic habitats due to pollution or nutrient loading								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Major</i>	<i>Long term</i>	<i>Site / local</i>	High	Possible	High	-	<i>High</i>
Management Measures: - A stormwater management plan to be developed for all project components to address stormwater run-off volumes, velocity, and water quality to minimise impacts on natural areas, and all relevant mitigation measures identified in the plan to be implemented prior to the commencement of operations; - A weir or gabion system must be constructed at the toe of the Kawenga and Mbamaba wetlands if increased run-off into these wetlands results in associated erosion immediately downstream of these systems. The weirs must be constructed to maintain the natural water levels of the wetlands and must not facilitate increased flow out of the wetlands; - Bunding and impermeable surfacing to be constructed around all potential major sources of pollution such as fuel, lubricant and hazardous product storage facilities, vehicle servicing areas, and workshops; - All plant components and vehicles to be serviced within the designated workshop areas or at appropriately designated off-site facilities; - The waste water treatment plant to be constructed at least 100m from all wetlands. - No discharge of treated or untreated effluent to be permitted into any wetlands; - Any ponds for the secondary treatment of effluent to be located at least 200m from any wetlands and swamps; - A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession.								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Possible	Medium	-	<i>Low</i>

Impact EB14: Impeded photosynthesis and transpiration rate of plants due to dust generation**Table 7-57: Impact significance rating and mitigation measures for Impact EB14**

Impact EB14: Impeded photosynthesis and transpiration rate of plants due to dust generation								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Low</i>
Management Measures: Dust suppression measures (e.g. watering) to be instituted at the quarry, plant site and on roads on at least a daily basis when high dust generating conditions are prevalent.								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>

The operational phase will result in the generation of dust in the study area, particularly from roads, the quarry, and the spoil site. The generation of dust in high quantities may impede photosynthesis and the transpiration rate of plants in close proximity to the source of such dust.

7.3.5 Soils, land capability and land use

This section assesses the impacts that are likely to occur as a result of the operation of the proposed project assuming no measures are specifically implemented to manage the impacts on soils and land capability

The aspects of the mining and cement manufacturing operations are likely to change soil baseline conditions. The following broadly describes how these changes are likely to occur:

- Operational activities may lead to the contamination of soils, particularly where there is the uncontrolled spillage of hydrocarbons in areas where they are not contained and where there is runoff of contact water from the mining and process areas
- Increased erosion resulting in a loss of soil resources. If water management measures are not implemented, there is the potential that the soils on the perimeter of the infrastructure may be exposed to greater water velocities than would occur if covered by vegetation. This increase in velocity could lead to erosion potentially followed by sedimentation in the downstream areas.

Potential impacts

Impact SL5: Chemical spills and release of contact water resulting in permanent loss of soil, and change in soil characteristics, land capability and land use

There is the potential that during operations, spillage of chemicals such as hydrocarbons could affect the soils over a wider footprint than that disturbed by the actual activity. There may also be the potential that runoff of contact water from the overburden spoil pile, coal yard and spillage of any process water may affect soils in the flow path of this water. Where this occurs, phytotoxins could potentially accumulate in soils resulting in these soils no longer having the potential to support plant growth. There are a number of activities which could result in this occurring as described briefly below:

- Spills of contaminants includes the various hydrocarbons used for power, mining and lubrication requirements as well as any reagents used in the processing activities;
- Breakdown of mobile equipment away from a workshop requiring the equipment to be repaired in areas where there may not be adequate protection from hydrocarbon spills;

- Runoff of contact runoff from the overburden spoil pile;
- Release of acidity, heavy metals and salinity from contact water generated at the coal yard; and
- Spillage of process water in the mining and cement manufacturing area.

Table 7-58: Impact significance rating and mitigation measures for Impact SL5

Impact SL5: Chemical spills and release of contact water resulting in permanent loss of soil, and change in soil characteristics, land capability and land use								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Moderate</i>	<i>Medium-term</i>	<i>Site/Local</i>	Medium	Definite	Medium	-	<i>Low</i>
Management Measures: • The preparation of procedures to ensure that spillage during mobile equipment maintenance is minimized. • The provision of appropriate secondary containment in areas where hydrocarbons, solvents and other potentially hazardous materials are stored. • Implement emergency preparedness and response measures plan as described elsewhere for the proposed project.								
After Management	<i>Minor</i>	<i>Medium-term</i>	<i>Site/Local</i>	Low	Possible	Low	-	<i>Low</i>

The confidence level of this impact is low as the geochemical characteristics of the overburden and the coal has not been determined. Based on the geology it is unlikely that acidity will be released from the overburden, however, this material may release salinity which may impact on the soils. It is likely that the coal stockpiles in the coal yard will be transient as material is continually deposited and then utilized. As this material is transient, there may not be sufficient time for acidity to generate in significant quantities, however, secondary precipitates in the coal may be solubilized during rainfall events and washout of the coal stockpiles.

Management measures

It is assumed that appropriate secondary containment will be included in the design phase at all locations where there is the potential that chemical materials (hydrocarbons, lubricants, solvents etc.) or effluents could enter the environment through spill accidents or incidents. This is likely to include concrete or paved hard-standing, bunds etc. Appropriate design and management of the overburden spoil pile should reduce the sediment load and contact water emanating from these facilities during operation and running over the soils on the perimeter of the infrastructure. Appropriate water containment facilities will be required at the coal stockyard to contain and manage contact water generated during rainfall events. The site should develop and implement an emergency preparedness and response plan that contains appropriate management and remediation strategies to limit the potential impacts associated with accidents and incidents associated with the spills of material which could impact on soil quality.

Impact SL6: Operational activities causing increased erosion, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use

Unmanaged operational activities have the potential to increase the erosion potential, particularly from the presence of infrastructure where runoff from disturbed areas is likely to be higher than would occur under natural conditions where there may be higher infiltration as a result of the vegetation, can lead to increased water velocity in runoff during rainfall events and may result in the erosion of soils on the periphery of the infrastructure.

If this was to occur, it could lead to a loss of a soil resource in the area of the erosion and possibly an increase in the sediment load where the eroded soils are deposited. This impact is likely to occur around the plant area, around workshops and other hard standing and from the slopes of the overburden spoils pile.

Table 7-59: Impact significance rating and mitigation measures for Impact SL6

Impact SL6: Operational activities causing increased erosion, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Medium-term</i>	<i>Site/Local</i>	Low	Definite	Medium-	-	<i>Medium</i>
Management Measures: - Minimize the area of disturbance. - Implement storm water control measures around infrastructure. - Appropriate topsoil stockpile management								
After Management	<i>Minor</i>	<i>Medium-term</i>	<i>Site/Local</i>	Low	Possible	Low	-	<i>Medium</i>

The confidence level has been determined to be medium based on uncertainties regarding the distribution of soils to be impacted.

Management measures

The implementation of storm water controls to reduce water velocity should mitigate erosion. These controls could include (and are detailed in the water specialist report):

- Berms, bunds, sediment control structures and diversions around the overburden disposal facility and roads. Where non-contact water diversions discharge to the environment, energy dissipaters such as gabions, established vegetation etc. should be included in the design; and
- Where needed, ensuring that exposed soil is re-vegetated as soon as practically possible.
- Construction of soil stockpiles that area benched if higher than 5m, with the slope angle not exceeding 20°. Establishment and maintenance of vegetation on the stockpiles prior to the commencement of the rainy season, following construction.
- Erosion can also be limited by ensuring that mine vehicles and human movement is limited to dedicated access ways, with off road travel authorized when required for critical mine operations.

7.3.6 Water Resources

This section provides a description and assessment of potential impacts of the mining and related activities on the water resource. Expected impacts relate both to water quality in terms of run off from contaminated surfaces and sediment washing into rivers due to the soil being disturbed. The abstraction of water from ground and surface source will reduce the available water to the environment and downstream water users. Abstraction of groundwater, via discharge from the pit may potentially increase the probability of sinkhole formation and even subsidence in the area of the cone of depression.

The Sanzikua and Yuku Rivers are used by the local communities for domestic purposes and all impacts in terms of water quality therefore need to be measured against their domestic requirements

Potential impacts

Impact WR4: Contaminated stormwater runoff from cement plant, roads and other surfaces affecting surface and groundwater quality

Stormwater runoff from the cement plant may be contaminated with dust and runoff from materials such as coal, gypsum, cement product, as well as fuel, oil and lubricant spills. If not properly managed this contaminated stormwater may enter the wetlands situated on either side of the

proposed plant, impacting on communities using these wetlands for water supply and fishing, as well as the aquatic ecology of these systems.

Oil or fuel spillage may also occur on haul and access roads used by haul trucks and other project vehicles. Rainfall events could result in these pollutants mobilizing and reaching surface water bodies and the groundwater table.

The expected impact is of minor magnitude, long term based and site specific which will result in a medium order consequence of medium significance. Management and mitigation measures to be applied will cause the impact to be of lower significance and unlikely to occur.

Table 7-60: Impact significance rating and mitigation measures for Impact WR4

Impact WR4: Contaminated stormwater runoff from cement plant, roads affecting surface and groundwater quality								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Moderate</i>	<i>Long Term</i>	<i>Regional</i>	<i>High</i>	<i>Possible</i>	<i>High</i>	-	<i>Medium</i>
Management Measures: - Implement a stormwater management plan which will separate dirty water from clean water and divert run off from dirty areas to a pollution control dam which should have a silt trap to settle any sediment - Re-use water from the pollution control dam as a first resort. Only discharge after treatment and compliance with discharge limits can be demonstrated - Store all potential sources of contamination (e.g. coal, hazardous materials, gypsum, cement product) in secure facilities with appropriate bunding and storm water management systems in place to ensure contaminants are not released to the water resources through storm water runoff - Construct concave run surfaces to ensure run-off is directed - Where contaminants are transported along roads, emergency spill management measures must be developed to minimize impacts should accidental spillages occur along the transport routes - Use oil & silt traps to remove these types of contaminants from stormwater								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Regional</i>	<i>Medium</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>Medium</i>

Impact WR5: Discharge of contaminated pit water to surface water resources, affecting downstream users

Water removed from the pit during dewatering will need to be discharged or used elsewhere. It is proposed that this water (providing it is of sufficient quality) is used for dust control, irrigation, and process water. Large volumes of water are expected in the pit and excess water that cannot be used will need to be discharged to local surface water bodies, most likely the Sanzikua and Yuku rivers. Water quality generally deteriorates in operating pits due to contact between the water circuits and explosives, oils and greases used in the mining operation and bacterial contamination from poor sanitary practices and other chemicals used in the mining operation. Discharging of poor quality water into a surface water resource may therefore have adverse effects on the water users including communities and the aquatic ecology.

Table 7-61: Impact significance rating and mitigation measures for Impact WR5

Impact WR5: Discharge of contaminated pit water to surface water resources, affecting downstream users								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Major</i>	<i>Long term</i>	<i>Regional</i>	<i>High</i>	<i>Definite</i>	<i>High</i>	-	<i>Medium</i>
Management Measures: - Optimise water reuse and reclamation within the mining operations - Where practical, intercept clean ingress water as close as possible to its source in order to prevent or minimize water quality deterioration and to allow this water to be pumped up to surface for appropriate use or discharge - Where appropriate, undertake dewatering operations ahead of the mine to keep the mine dry and prevent water quality deterioration. - Discharge pumped underground water into a dam for treatment and possible re-use as a first priority rather than discharging into the surface water resource								
After Management	<i>Minor</i>	<i>Long Term</i>	<i>Regional</i>	<i>Medium</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>Low</i>

Impact WR6: Risk of flooding of project infrastructure due to placement within the 1:100 year floodline

The 1:100 year floodlines for the area have not yet been determined. However, the presence of rivers and low-lying wetland areas in the project area suggests that some project infrastructure may be located below the 1:100 year floodline level. The risk of flooding of the open pit, plant area or associated infrastructure (including the river crossing of the haul road over the Yuku River) as a result of the 1:100 year storm event therefore exists, and would affect both operations, as well as the safety of personnel on site. The increase in hardened surfaces in the area due to project infrastructure may also change the flood flow dynamics of the rivers due to increased runoff, possibly contributing to flooding.

The expected impact is of major magnitude, short term based and of regional scale which will result in a medium consequence of medium significance. As the floodlines have not yet been confirmed the confidence in the rating is low. Management and mitigation measures such as [cut-off trenches](#) and [storm water control measures to contain the 1:100 year flood event \(size to be determined during the storm water management plan\)](#) will reduce the magnitude and probability of the impact. Construction of berms would effectively change the floodline should the project infrastructure fall within the 1:100 year floodline area.

Table 7-62: Impact significance rating and mitigation measures for Impact WR6

Impact WR6: Risk of flooding of project infrastructure due to placement within the 1:100 year floodline								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Major</i>	<i>Short Term</i>	<i>Regional</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Low</i>
Management Measures: - Undertake flood line study investigation to establish 1:100 year flood line - Locate plant, associated infrastructure and quarry outside the 1:100 year floodline - Construct cut-off trenches and storm water control measures to contain the 1:100 year flood event								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Regional</i>	<i>Medium</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>Low</i>

Impact WR7: Dewatering of the quarry resulting in groundwater drawdown and reduced contribution to surface water baseflows and wetlands, affecting users

Quarrying the limestone deposit at depths lower than 20-25 metres below surface is likely to result in groundwater inflows (mining below groundwater table). Dewatering will therefore be required to continue deeper pit excavation, and will cause groundwater levels in the area around the pit to decrease (cone of depression), reducing the baseflow contribution to rivers, streams and wetland areas close to the pit. This may potentially impact on users in terms of reduced water availability and wetland areas within the area may shrink or disappear, affecting both natural vegetation and cultivated areas reliant on wetland habitat. Any users of groundwater and springs within this area may also be affected due to the drop in groundwater levels. It is noted however that no villages are located close to the pit, apart from Mbemba, which is located close to the Sanzikua River, and therefore is likely to use this as its water source, and Yuku village, which will be relocated. The impact on water availability to communities will therefore largely be determined by the impact on baseflow of the rivers, and the extent (if any) of agricultural land affected. It is proposed however that the water removed from the pit is used for irrigation purposes, provided it is of sufficient quality, which may offset any impact of groundwater drawdown on agricultural land in the area. In addition, excess water from the pit may be discharged to the streams, offsetting the impact of reduced baseflow.

This impact will only be significant if groundwater inflows (and hence dewatering) substantially exceed 10,000m³/day, which is expected based on experience in areas of similar geology). The degree of impact will vary throughout the year but will be more severe during the dry season, when there is less recharge to groundwater resources from rainfall.

As hydrogeological investigations and modeling have not yet been performed to predict the amount of groundwater inflows or the extent of the area affected by the groundwater drawdown, the significance of this impact cannot be rated with a high degree of confidence. The expected impact is of major magnitude, long term based (for the life of the quarry) and of high consequence and significance. The impact can largely be mitigated by removal of groundwater before it reaches the pit through pumping wells, which would also result in the discharge of cleaner water, as oppose to potentially contaminated water from within the pit.

Table 7-63: Impact significance rating and mitigation measures for Impact WR7

Impact WR7: Dewatering of the quarry resulting in groundwater drawdown and reduced contribution to surface water baseflows and wetlands, affecting users								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Major</i>	<i>Long Term</i>	<i>Regional</i>	<i>High</i>	<i>Possible</i>	<i>High</i>	-	<i>Low</i>
Management Measures: - Groundwater can be removed by pumping wells before it flows into the pit. The quality of the water will be of better quality for discharge purposes, compared to that within the pit. - Monitor groundwater levels to determine extent of dewatering impact - Ensure water supply for domestic and agricultural purposes to communities affected through dewatering activities - If necessary, treat removed groundwater to a quality that is suitable for discharge to streams and agricultural use - Monitor discharge water quality to ensure it is compliant with the necessary guidelines								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Regional</i>	<i>High</i>	<i>Unlikely</i>	<i>Medium</i>	-	<i>Medium</i>

Impact WR8: Stormwater inflows into the pit, reducing surface water flows and availability to users

The drainage of the quarry area is served by Minkuku and Yuku streams which are bordering the proposed activities, from where they flow into the Sanziku River, further north.

Mining the quarry will intercept run-off and rainfall that would normally have contributed towards river flow in the specific catchments.

The expected impact is of moderate magnitude, long term based and of regional scale which will result in a high consequence of high significance. Management and mitigation measures involve a detailed storm water management plan and design around the facility that will prevent excessive stormwater inflows into the pit.

Table 7-64: Impact significance rating and mitigation measures for Impact WR8

Impact WR8: Stormwater inflows into the pit, reducing surface water flows and availability to users								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Moderate</i>	<i>Long Term</i>	<i>Regional</i>	<i>High</i>	<i>Definite</i>	<i>High</i>	-	<i>Medium</i>
Management Measures: - Cut of trenches should be installed around the pit perimeter to manage the extent of pit inflows (divert clean water away from the pit) - Inflows can be removed by pumping and discharging to the surface resource or distributing to other water users (community), provided the quality is not compromised. If quality is not fit for discharge treatment should be undertaken before discharge or distribution								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Site/ local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>High</i>

Impact WR9: Raw water abstraction for the project reducing availability to other users

Based on the single sampling run baseline investigation that was undertaken by SRK in June 2013, the estimated flow within the Yuku River is 29 944 m³/d. (average flow of .355 m³/s)

Water consumption within the plant area is expected to be in the order of 750m³/day, which will be abstracted from the Yuku River. In comparison the intended abstraction volumes if a small component of the available flow, which implies that abstraction will only result in a medium consequence impact of medium significance to both community and ecological users (in terms of the river's flow requirement to maintain its ecological functioning). The magnitude of this impact would be highest in the dry season, when river flows are lowest. Monitoring of river flows during the dry season is recommended to confirm the impact significance.

The potential discharge of treated effluent back into the stream as a mitigation measure will reduce this impact (providing that the quality complies with the IFC effluent guidelines).

Table 7-65: Impact significance rating and mitigation measures for Impact WR9

Impact WR9: Raw water abstraction for the project reducing availability to other users								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Minor</i>	<i>Long Term</i>	<i>Regional</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>Low</i>
Management Measures: - Discharge treated effluent into streams to compensate for abstraction losses (provided it meets the quality criteria) - Implement the optimal reuse of pit water and purified waste water to limit raw water abstraction								
After Management	<i>Minor</i>	<i>Long Term</i>	<i>Regional</i>	<i>Medium</i>	<i>Unlikely</i>	<i>low</i>	-	<i>Medium</i>

Impact WR10: Seepage from waste affecting surface and groundwater quality

The various types of waste (including hazardous waste) generated during operations may impact negatively on groundwater quality. Waste including kitchen/canteen wastes, liquid effluents, wastes for workshops and maintenance areas, will be generated. Leaks or seepage from waste may occur, contaminating surface and groundwater resources.

The expected impact is of minor magnitude, long term based and of local scale which will result in a medium consequence of medium significance. Management and mitigation will not cause a lower significance impact.

Table 7-66: Impact significance rating and mitigation measures for Impact WR10

Impact WR10: Seepage from waste affecting surface and groundwater quality								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Minor</i>	<i>Long Term</i>	<i>Local</i>	<i>Medium</i>	<i>Definitely</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: - Design the waste landfill in accordance with the requirements (e.g. lining and cover) for the type of waste handled - Cap waste landfill facility after closure to limit artificial recharge and seepage forming - Implement groundwater monitoring around waste disposal facility								
After Management	<i>Minor</i>	<i>Long Term</i>	<i>Regional</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Low</i>

Impact WR11: Wastewater effluent discharge to streams, affecting water quality for downstream users

Two sources of wastewater will be generated during operations:

- Industrial wastewater: from workshops, laboratory, cement processing, etc. Overflow cooling waters, tanker washing and floor washing water will be collected and conveyed by open drains. These process wastewaters will be channelled into a solids 'gravity' separator then to the wastewater treatment plant prior to discharge.
- Domestic (human) Wastewater: from departments, offices, central control room, workshops, canteen and clinic (dispensary). Domestic wastewater generated from the employee accommodation toilets and the canteen is estimated to amount to about 225 m³/day. All wastewater will be routed to the package wastewater treatment plant prior to disposal. The treated effluent will comply with "IFC Environmental, Health, and Safety (EHS) Guidelines, General EHS Guidelines Environmental Wastewater and Ambient Water Quality (April 30, 2007)".

Discharge of either of these wastewater effluent types into the river without treatment may cause a major negative impact in terms of water quality, depending on the volume discharged and the quality thereof. This may in turn impact negatively on the health of downstream community users and on the aquatic biota.

In contrast, discharge of treated effluent (provided it meets the effluent quality guidelines).may have a positive impact on the water quality and flow in streams, as it will supplement water to be abstracted from the streams (reported by ECTECH to have elevated nitrate concentrations) with potentially better quality water.

Table 7-67: Impact significance rating and mitigation measures for Impact WR11

Impact WR11: Wastewater effluent discharge to streams, affecting water quality for downstream users								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Major</i>	<i>Long Term</i>	<i>Regional</i>	<i>High</i>	<i>Definite</i>	<i>High</i>	-	<i>High</i>
Management Measures: - Discharge only treated wastewater to streams, to compensate for abstraction losses - Especially ensure the removal of nitrates from treated water as streams and rivers already contain elevated nitrate background concentrations; - Water to be discharged need to comply with maximum concentrations of contaminants in waste water as prescribed by Article 66 of the Congolese Law. - Undertake monthly monitoring up-gradient and down gradient of the discharge point (see monitoring plan in Section 9.12)								
After Management	<i>Minor</i>	<i>Long Term</i>	<i>Regional</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	+	<i>Medium</i>

Impact WR12: Sinkhole formation resulting from dewatering of subsurface cavities, resulting in safety and structural stability risks

The dropping of groundwater levels around the quarry area as a result of pit inflows or an active dewatering programme (proposed as a mitigation measure against pit inflows), may cause sinkholes to form, if cavities below the surface are dewatered. Sinkholes that may form within the “dewatering zone of influence” may result in safety risks and even loss of human life, damage to surface infrastructure and will render the land unsafe and not suitable for agriculture.

There is no mitigation against sinkholes from forming if the dolomitic aquifer is dewatered. Detailed hydrogeological investigations however will determine and characterize the presence and size of sub-surface cavities, and thus determine the extent of this risk in the project area and inform the requirement for amendments to the project layout to avoid areas of subsurface cavities.

Table 7-68: Impact significance rating and mitigation measures for Impact WR12

Impact WR12: Sinkhole formation resulting from dewatering of subsurface cavities, resulting in safety and structural stability risks								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Major</i>	<i>Long Term</i>	<i>Regional</i>	<i>High</i>	<i>Possible</i>	<i>High</i>	-	<i>Medium</i>
Management Measures: There are no mitigation against sinkhole formation if mining takes place								

Limitations

- Cumulative mining Impacts have not been considered during the impact assessment;
- No hydrogeological and geophysical investigations were undertaken to assist in the aquifer characterization of the limestone deposit to be mined, and subsequent groundwater inflows that can be encountered (reference to the 10 000 litres/day that can be expected is not substantiated). A numerical groundwater model would be required to more accurately simulate inflow volumes;
- No catchment studies were undertaken to establish run-off estimations, baseflow contributions etc. which are required to determine the impact of mining on surface water resources;
- No floodline studies have been undertaken which are crucial for placement of mining activities and the plant area in terms of possible flood events;

- No full scale hydro-census investigation work was undertaken to establish regional water use (ground and surface water), and the potential impact on those resources;
- Preliminary indications of surface water quality results are that elevated nitrate, iron and chromium concentrations occur within surface water bodies. The concentration of chromium exceeds the maximum limit (water will require treatment before use), This was based on one sample only and therefore need to be confirmed with further sampling
- Previous baseline monitoring only included once-off sampling (groundwater largely excluded);
- No groundwater investigations were undertaken that could indicate, average groundwater depth, flow directions or inflows that can be expected in the pit;
- No geochemical characterization of overburden material has been undertaken. Preliminary indications are it contains pyrite, which may result in acid mine drainage and cause groundwater contamination. The neutralization potential of carbonatous minerals also needs to be established;
- A water & salt balance will need to be developed for the mine to quantify all sinks and sources (rainwater; groundwater and run-off contributions);
- The scope of the project makes provision for approximately 1000 m³/d of wastewater that will need to be treated before discharge into the Yuku River. Based on the geology (karst limestone) large volumes of groundwater inflow volumes could be expected that would also require treatment before discharge.

Recommendations

The following additional studies are recommended to gain a better understanding of the surface and groundwater conditions in the area and increase the confidence in the impact significance ratings provided above. These studies have already been initiated by NYA, however the results were not available at the time of finalization of the ESIA update, and therefore have not been included in this report.

Surface water Hydrology:

- Detailed baseline investigation including continuous monitoring of flow & chemistry within streams & lakes down gradient of plant and quarry
- Flood line studies (rivers; lakes and wetlands)
- Stormwater Management Plan;
- Catchment delineation;
- Base-flow Study;
- Water Balance (for the plant and quarry).

Groundwater / Hydrogeology

- Geophysics investigation (gravimetric method – to detect sinkholes & sub-surface cavities (dolomitic formation) that may cause significant groundwater inflows into open pit);
- Drilling testing & establishment of monitoring boreholes (for the plant & quarry);
- Conceptual Hydrological Modelling;
- Geochemical studies – establish acid rock drainage and mineral leaching potential of waste rock / discard material;

- 3-dimensional Numerical Groundwater Model (for the pit dewatering) to simulate:
 - Groundwater Inflows;
 - Baseflow reduction;
 - Contaminant Transport Modelling (downstream receptors);
 - Decant simulation study.

Surface- and ground water monitoring plan

Accurate and reliable data forms a key component of many environmental management actions. Water monitoring is a legal requirement and can be used in negotiations with authorities for permits etc. The most common environmental management actions require data and thus the objectives of the water monitoring programme at NYA will have to include the following:

- Development of environmental and water management plans based on impact and incident monitoring (facilitate in decision-making, serve as early warning to indicate remedial measures or that actions are required in certain areas) for the mine and region.
- Generation of baseline/background data before project implementation.
- Identification of sources of pollution and extent of pollution (legal implications or liabilities associated with the risks of contamination moving off site).
- Monitoring of water usage by different users maximizing of water reuse).
- Calibration and verification of various prediction and assessment models (planning for decommissioning and closure) Identification and design of appropriate water treatment technology.
- Control of unit processes such as water treatment plants or process plants (through process control loops).
- Evaluation and auditing of the success of implemented management actions
- Assessment of compliance with set standards and legislation
- Assessment of impact on receiving water environment.

Requirements for ground and surface water monitoring are included in Section 9.12.

7.3.7 Raw Material Use

The bulk of the raw materials used in the production process will be obtained locally from the NYA leased limestone and clay quarries. Available information indicates that the company has investigated the nature of the raw material reserves and that there should be no issues associated with the use of inappropriate raw materials leading to significant emissions to air from the process. Further, online testing in the production process will ensure that no unsuitable materials will enter the process. The process produces very little waste and that which is produced will be recycled back into the process.

Waste effluent produced from domestic activities will be treated using a treatment plant which will be permanently situated at the site and will be operational at the operational activities. The treatment plant will be designed to take into account the load placed during the maximum number of persons on site.

7.3.8 Waste Management

The types, sources, and management of wastes anticipated to be generated during the operation of the proposed project facilities are listed and discussed in the Waste Management Plan for the project (Appendix 15). Impacts potentially resulting from waste, such as seepage and contamination of surface and groundwater resources, soil contamination and visual impacts resulting from indiscriminate littering and dumping are rated and assessed under the relevant sections (Section 7.3.5, 7.3.6 and 7.3.9), and a separate rating is therefore not provided in this section.

7.3.9 Visual impacts

Changes in visual character and sense of place for local communities as described in Section 7.2.1 will continue through the operational phase of the project. In this phase illumination of project facilities and the physical presence of infrastructure will contribute most to the impact, and dust plumes will be less of a contributor. As explained before, visual impacts can be subjective and are difficult to rate and mitigate. It is also likely that with time, and given the potential gains in terms of employment to local communities, communities will become more accepting of the impact. The duration of the impact is therefore rated as medium term, rather than long term, which would typically be the case for operation phase impacts.

Impact VI2: Loss of sense of place affecting local communities due to project infrastructure and illumination

Table 7-69: Impact significance rating and mitigation measures for Impact VI2

Impact VI2: Loss of sense of place affecting local communities due to project infrastructure and illumination								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Medium-term</i>	<i>Regional</i>	Low	Definite	Medium	-	<i>Medium</i>
Management Measures: - Minimize the disturbed footprint as far as practically possible. - Undertake stripping, stockpiling and stockpile management as per the Soil Management Plan (Section 9.9). - Clear vegetation at the quarry in phases so that only those areas required for immediate development are cleared. - Implement the waste management plan for the project (Appendix 15). - Refer to dust control measures under Impact AQ3 and AQ4 (Section 7.3.1). - Use directional lighting in areas operating at night, if communities are affected by lighting.								
After Management	<i>Minor</i>	<i>Medium-term</i>	<i>Regional</i>	Low	Possible	Low	-	<i>Medium</i>

7.3.10 Traffic

Access to the plant site will be achieved through a 4-Lane paved road from Highway N-1. This is clearly an easy connection especially for heavy vehicles both from the geometric and road safety point of view.

A second access to the limestone quarry locations is provided through a clay road mostly using modified existing tracks.

The raw materials of limestone and clay will be transported to the cement plant using twelve dumper trucks of 35 tonnes capacity each. It is not expected that there will be any public exposure to emissions from these vehicles.

The dispatch of 3,580 tonnes of cement per day will require 129 trucks of 25 tonnes capacity. Daily 13 trucks of 25 tonnes capacity will be bringing in imported materials. A total of 142 to 145 trucks per day will be required for inbound and outbound materials.

This figure translates to one truck movement every 5 minutes in each direction. In addition, private cars and buses/wagons will be required for manpower transportation to and from their place of residence.

Some increase in the use of local roads should be anticipated as a direct consequence of the operation of the proposed plant. The increase in local road use is anticipated during peak hours and between changing operator shifts. However, based upon the remote location of the site, no concerns are anticipated with respect to increased traffic activity.

Impact T4: Impact on utilisation capacity on the N-1, affecting other road users

During the operational phase materials, equipment, and personnel will need to be transported to the project site by means of road transportation resulting in more traffic on the N-1. Transportation of personnel is likely to occur at discreet times, resulting in peak flows, whereas transportation of materials and equipment would be more evenly spread over the course of a day. Provision of on-site accommodation will reduce daily traffic volumes, which may be replaced by longer term (e.g. weekly) peak flows.

The receiving environment in the immediate vicinity of the site for traffic related impacts during the operational phase is described above under construction related impacts.

The estimated traffic volumes during operation would increase the average background traffic in the vicinity of the site by an estimated 144 heavy vehicles per day (ECTECH EIA). Associated traffic (personnel, deliveries, etc.) would contribute to a lesser extent, especially given that accommodation is planned on the site. Based on similar projects, it is estimated that the additional traffic could contribute an additional 30 vehicle movements per day. This translates to an average increase in heavy vehicle traffic from 9 - 15 trucks per hour to 24 - 30 trucks per hour, and an average increase in total vehicle movements from 25 - 34 per hour, to 43 - 52 per hour over the envisaged 10 hour day working day.

By supplying the local market, the project will however directly reduce the (currently substantial) requirement for cement imports, partially reducing the magnitude of the potential increase in traffic volumes on the N1 to moderate as opposed to major.

Factors that could reduce total vehicle movements per day include:

- Widening of the N-1 at the access road to allow for turning lanes would reduce the potential for accidents and congestion at this intersection.
- Clear signage and traffic calming measures on the N-1 warning motorists of the intersection would reduce potential traffic safety impacts at this intersection.
- Truck staging area and/or rest area would enable trucks to exit the N-1 safely, and enable site staff to schedule deliveries in an orderly manner.
- Provision of dedicated buses for construction personnel not accommodated on the site would reduce daily commuter traffic to the project site.

The duration of traffic related impacts during operation is rated as long term as they would potentially occur for the duration of the project. It is noted that in the long term road traffic has the potential to be supplemented by rail transport, which has the potential with time to reduce the magnitude of traffic related impacts.

Traffic related impacts are likely to be most noticeable in the vicinity of the site, and at the intersection with the N-1 in particular, and are therefore rated as being local in extent. The magnitude of the impact is rated as moderate as the increase in traffic volumes in the vicinity of the site has the potential to be relatively substantial and the acceptable utilisation capacity of the N-1 in

the vicinity of the site is unknown. Management measures under the direct control of NYA have the ability to reduce the probability of the impact to possible, and with the refurbishment of the rail network, to minor. The impact rating after management measures have been implemented assumes that transportation with rail will occur over time. The confidence rating is considered low as the potential to use rail may not be under the direct control of NYA.

Table 7-70: Impact significance rating and mitigation measures for Impact T4

Impact T4: Impact on utilisation capacity on the N-1, affecting other road users								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: - Widening of the N-1 at the access road to allow for turning lanes would reduce the potential for accidents and congestion at this intersection. - Clear signage and traffic calming measures on the N-1 warning motorists of the intersection would reduce potential traffic safety impacts at this intersection. - Truck staging area and/or rest area would enable trucks to exit the N-1 safely, and enable site staff to schedule deliveries in an orderly manner. - Provision of dedicated buses for construction personnel not accommodated on the site would reduce daily commuter traffic to the project site; - Schedule the delivery of materials and dispatch of cement avoid peak hour traffic. The dispatch of vehicles should be staggered throughout the day; and - NYA management to pursue the revitalisation of the rail network with the relevant authorities.								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Low</i>

Impact T5: Impact on traffic in Matadi, affecting other road users

The importing of raw materials for the project has the potential to reduce imports of cement through the Port of Matadi, and the subsequent transportation by road to Kinshasa and beyond (importation of 400 tons/day coal, 188 tons/day gypsum, and 40 tons/day iron ore, has the potential to offset the importation of 3000 tons/day of cement). Other cement projects within the Bas-Congo region, while also increasing traffic from these facilities, would similarly have the potential to reduce traffic related impacts from imported cement.

Therefore, assuming no growth in the demand for cement in the DRC, the production of cement within the DRC will with time have a net positive impact on traffic related impacts in Matadi specifically, and on the N-1 to Kinshasa in general. It is recognised that significant growth in the demand for cement within the DRC may occur, and consequently, impacts on road networks in general are expected to increase as the economy, including the demand for cement, grows. For the purposes of this assessment, it is assumed that road & rail networks will be improved concurrently with the growth in the economy.

The scale of the impact is limited to the road network in Matadi and is therefore rated as being local in scale, and as the impact could occur throughout the lifetime of the project, is rated as being long term in duration (although it is recognised that the substitution of transportation by road with transportation by rail may occur over the life of the project). No data on the traffic volumes currently leaving the Port, or traffic counts on the N-1 through Matadi, were available for this assessment and consequently the rating of magnitude (as moderate) is of low confidence. The reduction in traffic over time would have a positive impact. No management measures are applicable.

Table 7-71: Impact significance rating and mitigation measures for Impact T5

Impact T5: Impact on traffic in Matadi , affecting other road users								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	+	<i>Low</i>
Management Measures: Not applicable								

Impact T6: Increased road accident rates, affecting road safety of other users

As is the case in the construction phase, road accident rates have the potential to increase during the operational phase. Whether a fleet of vehicles is owned and operated by NYA, or whether a logistics company is appointed to transport raw materials and product, NYA is likely to have a better level of control over vehicle fleets during the operational phase as compared with the construction phase. Noticeable impacts on road accident rates are also more likely to extend to Kinshasa.

The duration of impacts on road accident rates during operation is rated as long term. The impact on road accident rates would be experienced on the whole road network, extending from Matadi to Kinshasa and is therefore rated as regional in extent (the impact on road accident rates on a national scale are considered to be negligible). The magnitude of the impact is rated as moderate as the increase in traffic volumes on the N-1 during the operational phase due to heavy vehicles is to increase by approximately 100 to 170%, and total vehicle movements by 60 to 80% (note however that these estimations exclude the anticipated reduction in current traffic volumes related to cement importation, which would also result from the project). On the basis that increased traffic volumes result in increased road accidents, a similar increase in accident rates, in the absence of mitigation, is likely. Management measures could potentially reduce the magnitude of the impact to minor.

Table 7-72: Impact significance rating and mitigation measures for Impact T6

Impact T6: Increased road accident rates, affecting road safety of other users								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Regional</i>	<i>High</i>	<i>Possible</i>	<i>High</i>	-	<i>Medium</i>
Management Measures: - Widening of the N-1 at the access road to allow for turning lanes would reduce the potential for accidents and congestion at this intersection. - Clear signage and traffic calming measures on the N-1 warning motorists of the intersection would reduce potential traffic safety impacts at this intersection. - Rest area for drivers should be implemented, and maximum driving hours per driver established and enforced. - A maintenance schedule for all vehicles directly under the control of NYA must be developed and implemented to ensure on-going roadworthiness of vehicles. Suppliers, contractors, and sub-contractors must be instructed to implement the same maintenance schedule. - Random inspections for roadworthiness of all vehicles entering or leaving the site must be implemented.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Regional</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>

7.3.11 Socio-economic Impacts**Population and demographic movements****Impact PD2: Influx of potential job seekers into the area and associated risks**

Approximately 370 direct jobs will be created (see Section on Construction Phase Environmental Impacts for a discussion of the different types of employment generated). Of these, 156 are unskilled

positions and 160 are supervisor positions, while the remainder are specialist and management positions.

With the potential for creating approximately 370 direct jobs during the operation phase of the NYA, 224 of which will be supervisor, specialist and management positions, which might not be available locally, there is a possibility for an influx of jobseekers into the surrounding areas. The construction camp, (Labour Hostel and Officer Hostel) close to the Cement plant will still be available to house employees during this phase. This will further encourage or attract people to the site, and in a way further exacerbate the influx of people, especially non-locals into the area. The impacts associated with this influx can be categorised as follows:

- Increased pressure on social services such as schools, clinics, police services, water supply, sanitation existing housing police stations etc.
- Increase in social ills such as petty trade, commercial sex, crime etc.
- Possibility for the development of spontaneous settlements, especially close to the construction camps if these are not properly managed.
- Potential tensions between in-migrants and existing communities (as a result of competition for existing resources and opportunities), and bring about increased health problems and sexually transmitted diseases.
- Increase in the spread of communicable diseases such as HIV/ AIDS and malaria. See Impact HS5 under Health and Safety

Table 7-73: Impact significance rating and mitigation measures for Impact PD2

Impact PD2: Influx of potential job seekers into the area and associated risks								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Moderate</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Definite</i>	<i>Medium</i>	-	<i>Medium</i>
Proposed mitigations • Optimise the use of local labour as far as practically possible. • Develop a code of conduct with which contractors and their employees must comply. The code should deal with the interaction with local communities and substance abuse among other things. • Implement the Stakeholder Engagement Plan (Appendix 17) which clarifies the principles of engagement with community and other stakeholders, sets in place appropriate liaison forums and describes the grievance management procedure to be adopted by NYA. • Implementation of a programme of HIV/AIDS screening, counselling and (where necessary) treatment. • Develop and communicate a clear and concise employment and recruitment policy to prevent opportunistic job seekers from settling in the area. See Recruitment strategy								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>

Health and Safety

Health impacts associated with, limestone mining operations and cement plant operations are known to be upper and lower respiratory disease, asthma, cardiopulmonary diseases and birth defects.

Nearly all communities are located at more than 1 km distance from project area, except for Yuku Camp Village, which will be relocated. Most of these communities are unplanned low income settlements.

Cement operations directly emit particulate matter (PM) as well as gases that undergo chemical reactions to form fine particles in the atmosphere, such as SO₂ and NO_x. The emissions of PM, SO₂ and NO_x increase the ambient concentration of PM less than 2.5 microns in diameter (PM_{2.5}). Exposure to PM_{2.5} has been consistently linked with increased mortality from cardiopulmonary diseases, lung cancer, and numerous other respiratory illnesses and associated morbidity.

It is recommended that the project incorporate modern pollution controls such as, vegetation barriers, programme of wetting of exposed areas and roadways, bag filters, and electrostatic precipitators (ESPs) resulting in substantial human health risk reductions. Continuous emission monitoring should also be done and an appropriate system put in place to take action if and when parameters exceed permissible levels. A programme to monitor health impact of the project should also be developed and implemented.

Potential accidents may require the use of emergency services and hospital facilities nearby at Kimpese at a distance of 35 kms from plant site.

It is recommended that:

- NYA should establish an understanding with hospital in Kimpese to handle emergencies,
- Personnel on site should be trained in handling emergencies such as response to fire, accidents etc.
- A well-equipped ambulance with paramedical staff should be based at plant site.

Qualified personnel should make regular trips to the quarry and plant to give training updates and check emergency equipment, such as fire-fighting equipment.

Impact HS5: Increased chances of the spread of communicable diseases such as HIV/AIDS, STDs and malaria linked to influx of job-seekers and workers

While there have been no specific mention of the prevalence of HIV/AIDS at the Minkelo Clinic, there are always concerns that HIV/AIDS might become a greater problem in the future with the development of this project, particularly due to the influx of single males and construction workers into the area. This would be further increased by the significant disposable income among construction workers which could encourage transactional and commercial sex work in the area. Kimpese Hospital, which is about 50km from the mine, and which is a referral hospital for Minkelo Clinic, has however confirmed a prevalence rate of 2 -3 reported cases of STDs such as syphilis and gonorrhoea per month. It is possible for this rate to be higher than reported due to the stigma that is still associated with STDs and HIV/AIDS. Furthermore, the proximity of Kimpese town to the mine area also increases the possibility of people moving into the mine area, possibly as carriers of these diseases.

Table 7-74: Impact significance rating and mitigation measures for Impact HS5

Impact HS5: Increased chances of the spread of communicable diseases such as HIV/AIDS, STDs and malaria linked to influx of job-seekers and workers								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Medium term</i>	<i>Regional</i>	<i>Low</i>	<i>Possible</i>	Low	-	<i>Medium</i>
Proposed mitigations measures NYA has developed a Health & Safety Policy with the objectives of promoting the health and safety of employees, but this does not make mention of the management of HIV/AIDS and malaria explicitly. The following mitigations are recommended: • Develop a comprehensive HIV/AIDS program to employees through employee wellness programmes which should include the following: ○ Awareness campaigns targeting project workers, senior management, contractors, sub-contractors and their spouses, communities near project facilities, risk groups (commercial sex workers, truck drivers) ○ Prevention, voluntary counselling for HIV testing, as well as anti-retroviral treatment for employees and surrounding communities. There are already HIV/AIDS programs developed by Kimpese Hospital, which NYA could potentially be involved in. • Collaborate with local health authorities and other relevant stakeholders to develop an integrated mosquito control strategy, which should include: ○ Awareness campaigns to inform employees of symptoms and treatment available for workers and community members								

○ Elimination of potential breeding habitats for mosquito larvae such as pools of unusable standing water ○ Spraying residual insecticide to walls of living quarters ○ Provision of prophylactic drugs to non-immune workers ● Promoting and supplying repellants, netting and clothing to employees to prevent bites								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	Low	Possible	Low	-	<i>Medium</i>

Impact HS6: Increased pressure on healthcare infrastructure due to project related influx

There are limited health facilities in the project area. These are in poor condition with few available resources, and are unable to serve the healthcare needs of the communities adequately. The health questionnaire conducted at Minkelo Clinic during the site visit has highlighted that this clinic, with a staff complement of 3 people, is required to service approximately 21 villages in the area. With the expectation that between 500 and 600 temporary employees will be required during the construction phase of the NYA project, there will be an increase in the pressure on this clinic to provide services to the additional employees, as well as their families who might come with them into the area.

Table 7-75: Impact significance rating and mitigation measures for Impact HS6

Impact HS6: Increased pressure on healthcare infrastructure due to project related influx								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	Low	Definite	Medium	-	<i>Medium</i>
Proposed mitigations								
● Update an influx management plan as per management measures noted under Impact PD1. ● Develop an MOU with the Local Healthcare Centres in Minkelo and Kimpese for service provision to the local workforce and their dependents. ● Identify NGOs in the area that might support operations at the Minkelo Clinic and Kimpese Hospital, with special focus on refurbishment of key areas, equipment and building maintenance, as well as, improved healthcare management information systems. ● Develop and implementation community development/sustainability plans to support infrastructure development in the area								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	Low	Possible	Low	-	<i>Medium</i>

Impact HS7: Increased risk of accidents and injuries to communities from improved roads and additional traffic

The increased volumes of traffic as a result of the NYA project activities such as transportation to the port, workers transportation; final product delivery has the potential of increasing accidents and injuries affecting the local community. Nkonda village, situated along the N1 to Kinshasa, is more likely to experience accidents due to the quality of the road and the associated speed that vehicles travel on good roads. In addition, heavy vehicle traffic along the hauled road route between the quarry and cement plant may contribute to increased road safety risks as a result of the introduction of heavy vehicles, speeds and the lack of road safety and traffic awareness that is expected in the area. It is assumed that the Yuka Camp Village will be resettled before operations commence and that and that the road safety risks associated with the haul road will be mitigated for the households of this village.

Table 7-76: Impact significance rating and mitigation measures for Impact HS7

Impact HS7: Increased risk of accidents and injuries to communities from and additional traffic								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Moderate</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>
Proposed mitigations								
- Awareness campaigns in neighbouring communities, particularly at Nkonda village, with a focus on school children and mothers, about risks related to traffic - Enforcement of speed limits and sanctions for any personnel found in violation of speed limits, including senior staff and contractors' and sub-contractors' employees - Appropriate signalling of moving heavy machinery, and escort vehicles where needed - All construction drivers to be given safety education focussing on speed and conflicts between pedestrians and cyclists. - Advanced warning signs including sirens to be erected at locations of high pedestrian and cyclist activity.								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Unlikely</i>	<i>Low</i>	-	<i>Medium</i>

Impact HS8: The visible presence of Congolese police within the project area, and their secondment as a subcontractor for the mine security

During the focus group meetings, communities were asked about their concerns relating to the presence of the Congolese police close to the site and the communities. About 90% of the respondents felt more safe and protected than threatened by the police presence. Community members have mentioned that petty crimes such as stock and crop theft are experienced from time to time, however, the police stations are not capacitated to deal effectively with these crimes, especially with the lack of police vans to transport them to the crime scene when required. However, it has been noted that since the police started patrolling the area on a regular basis, these crimes are decreasing.

While this looks like a win-win situation for both parties (the community and the quarry), the relationship between the police and the communities should be closely monitored by NYA to ensure that the relationship between the community and the police does not deteriorate as a result of NYAs activities.

Table 7-77: Impact significance rating and mitigation measures for Impact HS8

Impact HS8: The visible presence of Congolese police within the project area, and their secondment as a subcontractor for the mine security								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>
Proposed management measures								
- Develop a code of conduct for police personnel, especially in relation to handling community violence - Proper screening of appointed security personnel to ensure they were not implicated in human rights abuses in the past								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Site / local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Medium</i>

Economic Impacts

Impact EC4: Local and regional benefits resulting from increased Revenue to Government

The government is expected to derive revenue from the project through various forms of taxes and duties, including import duty, personal and corporate tax and value added tax. However, the value of

these revenue streams cannot be determined at present due to the uncertainty associated with various factors determining future government revenue, such as the value of imports and the profitability of the business.

During operations, direct income to the government is mostly expected to derive from duties and taxes paid on locally procured services and goods and on company profits. No detailed information regarding potential government revenues from and incentives (e.g. tax holidays) for the project during the operation phase is available. Nevertheless, the project is expected to have a noticeable impact at a local and regional scale as it will be one of the largest commercial operations in the area.

Demand for cement in the DRC is increasing and most cement is imported as local production is insufficient to meet demand. Increasing the local production of cement might thus reduce the reliance on imports and stimulate other local business sectors, such as construction, through improved availability and lower cost of cement. The project may thereby indirectly increase the government's revenue base.

Although a major project, the region is vast and the operation phase is thus expected to have a minor (positive) impact of long-term duration and regional scale (due to the relative significance of the operation in the area) on government revenue. Government income is determined by tax regimes and corporate profit. As such, no optimisation measures are recommended for this benefit.

Table 7-78: Impact significance rating and mitigation measures for Impact EC4

Impact EC4: Local and regional benefits resulting from increased Revenue to Government								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Long term</i>	<i>Regional</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	+	<i>Low</i>
Management Measures:								
None								

Impact EC5: Generation of direct, indirect and induced employment and income

Employment provides many socio-economic benefits to employees and their dependents, but may also lead to increased economic disparity in the project area. As the project will only employ a small percentage of locals, this effect is expected to be relatively limited.

Approximately 370 direct jobs will be created (see Section on Construction Phase Environmental Impacts for a discussion of the different types of employment generated). Of these, 156 are unskilled positions and 160 are supervisor positions, while the remainder are specialist and management positions. Due to the currently limited technical skill set of potential workers in surrounding communities, local workers are likely to be initially tasked with low to medium-skilled activities until skills improve through work experience. It is thus anticipated that a portion of the 150 to 300 lower-skilled positions could be filled by local people.

Based on the definition provided earlier, the extent of indirect employment and income that will be created by the project is directly dependent on the amount of work that is outsourced and sub-contracted by the project at a local level. This information is not available at this stage, but the magnitude of local indirect economic stimulus is likely to be limited especially in the initial stages, because more specialized – and hence profitable – tasks are likely to be outsourced to national or international companies due to a lack of local skills.

Induced employment and income is determined by the local multiplier. Multipliers are determined through Input / Output Models that are based on accurate statistical data and are not available for the rural DRC. However, multipliers are typically higher, and hence indicate higher impacts on the local economy, the more money is spent locally. Multipliers are often lower than 2, especially for

smaller areas. Due to the limited number of local businesses and, thus, spending opportunities, the multiplier and potential scale of induced employment and income generation are considered to be limited¹⁹ at least initially, although an increase in local income is likely to provide a stimulus to the local business environment by increasing the demand for local goods and services that residents of the area cannot currently afford. Given the potential positive downstream effects of the improved availability and lower cost of cement on industries such as construction, the project might have a significant impact on the local commercial environment despite the dearth of economic opportunities in the immediate area.

The local direct, indirect and induced employment and income generated during operations is expected to have an impact of moderate magnitude and long-term duration and to impact at a regional scale. Local employment and income benefits may be further increased by implementing the management measures listed below. However, technical requirements and constraints in local supply will likely limit procurement and employment options. As such, the significance of the benefit is not expected to increase after optimisation.

Table 7-79: Impact significance rating and mitigation measures for Impact EC5

Impact E5: Generation of direct, indirect and induced employment and income								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Regional</i>	<i>High</i>	<i>Possible</i>	<i>High</i>	+	<i>Medium</i>
Management Measures: - Stipulate in the Recruitment Plan (or equivalent plan) mechanisms to employ local workers if applicants with the appropriate skills are available. - Provide on-the-job and other skills training for local workers. - Procure goods and services at a local level, if available. - Consider establishing a local procurement programme to increase local content over time. - Work closely with the community before and during the project to identify and publicise skills and resources that the local community could provide. This should take place before construction commences. Establish relevant mechanisms in the relevant social and labour plans.								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Regional</i>	<i>High</i>	<i>Possible</i>	<i>High</i>	+	<i>Medium</i>

Ecosystem services

Ecosystem services functions in the area have been compromised due to widespread deforestation and localised human pressure on the environment. Nevertheless, people in the area directly depend on a number of ecosystem services, such as provisioning services (including fish, bush meat, building materials, medicinal plants (traditional medicines), wood and water), regulating services (waste absorption and water purification) and supporting services (including pollination and soil formation for agricultural production).

¹⁹ However, Davies and Davey (2007) estimated a multiplier of between 2.02 and 2.45 for an emergency cash transfer programme the rural Dowa region in Malawi, and quoted similarly high multipliers for developing countries derived in other studies: 2.94 for the whole of Malawi (derived by Giles and Jennings in 1982 for the Vipha Paper Mill Project) and 2.24 for a village health bank project in Ecuador (derived by Woller and Parsons in 2002). One of the reasons cited for the high multiplier is the fact that several economic actors are likely to exchange any good before it reaches the consumer, even once that good is inside the local area. Each agent adds value to the consumer and thereby increases the multiplier. A 2005 study by Haggblade, Hazell and Reardon identified typical regional income multipliers from agricultural growth in Africa of between 1.3 and 1.5 (cited in von Braun, 2006). The authors note that the strength of multipliers is influenced by the distribution of initial income gains, density of rural infrastructure and population, available technologies, social and political structure and physical distribution of urban settlements (quoted in Bradley, 2008).

Impact ES2: Reduced availability of natural resources and ecosystem services to local communities due to use by the project and impacts on these resources

The savannah ecosystem present in the area is largely intact and provides a number of services that people directly depend on, such as provisioning services (including wood, water, fish, bush meat, medicinal plants and building materials), regulating services (including waste absorption and water purification) and supporting services (including pollination and soil formation for agricultural production).

The proposed project will also make use of a number of ecosystem services, including provisioning services (e.g. quarry material and water used during production) and regulating services (e.g. absorption of waste, emissions and effluent in the environment, generated by operations and the workforce).

Operation of the project will have a number of impacts on the ecological resources that underpin ecosystem services, most notably fauna (through disturbance from noise and light, collision with vehicles and increased poaching) and aquatic habitats (through run-off and effluent discharge) (Section 7.2.7). A larger population in the area, attracted by the real or perceived economic opportunities provided by the project, may also increase the general demand for and pressure on ecosystem services (Section 7.3.11). This may in principle impact on several of the quantity and quality of ecosystem services that people rely on, such as provisioning services (e.g. fish and bush meat) and regulating services (when larger volumes of waste, effluent and emissions need to be absorbed).

However, the area directly affected by the project is located within a much larger area that is largely intact and ecologically functional. SRK's survey and engagement of surrounding villages indicated that many of the above-mentioned ecosystem services, including bush meat, medicinal plants, water, building materials and agricultural plots, are currently accessed by villagers in areas that will remain accessible to people and fall outside of the plant and quarry footprint. The project area itself is thus not considered crucial to providing the ecosystem services that are important to the local area. Most disturbances associated with the loss of land will take place during the construction phase and additional disturbance in this regard will be minimal during operations.

The above ecosystem services are thus not considered Type I priority services as per PS6, as ecosystem services-related impacts on the communities are expected to be very limited. The overall impact of the project on ecosystem services is expected to be low. Mitigation measures aimed at reducing impacts on ecological resources and communities and recommended in the relevant sections must be implemented.

Table 7-80: Impact significance rating and mitigation measures for Impact ES2

Impact ES2: Reduced availability of natural resources and ecosystem services to local communities due to use by the project and impacts on these resources								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Short term</i>	<i>Local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Low</i>
Management Measures: - Comply with GIIP for air emissions, water (stormwater and effluent) discharge quality and solid waste disposal to minimise impacts on ecosystem services. - Implement mitigation measures recommended in Section 7.2.7 to minimise impacts on ecological resources. - Implement mitigation measures recommended in Section 7.3.11 and the Resettlement Action Plan and Sustainable Development Plan (Appendix 18 and 19) to maximise community resilience and ensure fair compensation where resources are directly affected.								
After Management	<i>Minor</i>	<i>Short term</i>	<i>Local</i>	<i>Low</i>	<i>Possible</i>	<i>Low</i>	-	<i>Low</i>

7.3.12 Health and Safety risks

The health and safety hazards discussed below have been identified as those most pertinent to the Project. Risks to local communities resulting from these hazards are described, and relevant good practice measures are listed. As these fall outside the normal operations of the mine, and therefore are considered to be risks rather than impacts, a significance rating has not been provided.

Potential risks identified

Impact SS1: Blasting, resulting in fly rock

Fly rock refers to uncontrolled rock that is flung into the air as a result of blasting. It may result in death or serious injury on impact with humans or animals within the area around the pits and is one of the most common causes of injury related to blasting. To reduce the risk of injury the Project will conduct blasting in accordance with international safety standards. Open pit blasting will be conducted using standard mining industry practices and procedures for securing personnel and equipment. This includes the development and implementation of standard operating procedures, blasting rules and a safety management plan that:

- Delineates the danger zone associated with each blast of at least 400m and clear workers from this zone before, during and after each blast; and
- Provides an audible warning at least three minutes before a blast is fired.

Impact SS2: Community exposure to toxic or hazardous substances

Community exposure to toxic or hazardous substances is most likely to occur as a result of two factors. The first is accidental spills of these substances to the environment during handling, storage, disposal or transportation. The second is via WMF disposal of substances in proximity to communities. Spills may occur during construction and operation, or decommissioning (when any hazardous substances stored on site would be removed and either disposed of or used elsewhere). Hazardous substances that will be stored and used on the site include fuels (both HFO and diesel), oil, coolant and hydraulic fluid for mining equipment. Impacts resulting from spills, seepage and contamination of water resources are discussed and rated under Impacts WR10 and WR11.

The potential impact associated with each release will depend on the source of material released, its inherent hazard potential (toxic, acidic, flammable etc.), the volume released, the extent of release and sensitivity of any human or ecological receptors. Particularly spills close to water courses (or other water resources) could result in significant ecological and health impacts due to the rapid spread of contaminants in water, affecting downstream users.

The risk of exposure of communities to decaying (and potentially toxic) organic matter in the WMF can be effectively mitigated with particular attention to the following:

- Implementation of standard management practices such as ensuring appropriate site security and fencing, to prevent unauthorised access to the waste landfill site.
- Thorough and regular compaction and covering of wastes with inert materials (at least weekly). This would also greatly reduce the likelihood of pests being attracted to the landfill, and the associated health hazards.

The potential impacts associated with spills of toxic or hazardous materials can be reduced through the implementation of standard management measures, which aim to minimise the risk of spills occurring and the extent of any damage should a spill occur. Recommended general good practice measures include the following:

- Design hazardous material containment structures taking into consideration natural hazards and the implications of these on structural integrity of the containment facilities.
- Size containment areas to contain 110% of the contents of the largest tank within the facility or provide facilities to direct excess volume to an alternative spill containment facility.
- Pave (with an impermeable surface such as concrete) fuel delivery and dispensing pump areas and designed these areas to drain into the adjacent storage tank containment areas.
- Prohibit construction of hazardous material facilities (including temporary and permanent refuelling areas) within drainage lines or the 1 on 100 year flood lines of watercourses.
- Treat (for example with an oil separator), evaporate or dispose of as a hazardous material any polluted water collected in hazardous material containment facilities.
- Require vehicle maintenance to be undertaken in the designated workshops where appropriate pollution control measures are provided to prevent leaks or spills of fuel or lubricants reaching the environment.
- Develop and implement a Spill Prevention Control and Countermeasure Plan for the site.

Impact SS3: Fire or explosions due to storage of explosives and use of combustible materials

The storage and use of both fuels (and other combustible materials) and explosives on the site poses an inherent fire – and therefore safety – risk both to workers on site and surrounding communities. To minimise the risk, standard international good practice will be followed with regard to storage and handling of these materials, and occupational health and safety guidelines with regard to safe working conditions and the use of PPE will be adhered to. Fire extinguishers will be available at storage areas for flammable substances, and a fire water system will be installed, servicing the plant and accommodation areas.

7.4 Impacts during the Decommissioning and Closure Phase

No detailed assessment of environmental impacts associated with decommissioning can be made at present. The plant has an expected lifespan of over 40 years and so only general principles can be established at the present time.

In broad terms, the process of decommissioning is likely to give rise to impacts similar to those experienced in the construction phase as a result of site clearing, earth moving and removal of project infrastructure, and rehabilitation of the site. The methods and techniques selected are expected to be in accordance with national and international standards prevailing at the time of decommissioning. A Closure Management Plan has been developed for the project by SRK Consulting and is included in Section 9.13), and will be updated and refined with the required project specific detail prior to commencement of closure activities.

Decommissioning and closure will involve the following activities:

- a) Removal of surface equipment and surface cover;
- b) Potential removal of hard standing and surface cover;
- c) Abandonment of sub-surface utilities or filling and abandonment as appropriate;

- d) Reinstatement of the site and all project areas to pre-construction and pre-development conditions or as close to these conditions as practically possible via ecological rehabilitation²⁰;
- e) Securing of remaining project infrastructure to manage safety risks to humans and animals post-closure.

For the cement plant, NYA will update the Closure Management Plan (Section 9.13) during the later stages of project design and maintain the plan throughout the life of the development. The plan should include arrangements for decommissioning the plant in a manner which avoids any pollution and return the site to an acceptable state. In addition, any decommissioning plan should take into account the social and economic impacts and include mitigation measures where necessary;

The opportunities the site provides for long term biodiversity conservation purposes should be investigated as part of the site closure plan. There are no identified sites of ecological significance outside the main development areas that should be affected by decommissioning activities, though consideration will need to be given as to the long term use of the access road to the quarry. This will depend on their future use. It may be necessary to remove the road and ‘re-instate’ the topsoil and vegetation, but maintaining vehicle or pedestrian access only are also possibilities;

The site closure plan and preceding rehabilitation plans will need to be reviewed and updated in the light of experience with implementing the ecological impact mitigation measures, especially with regard to habitat rehabilitation. These rehabilitation activities should be monitored, during the course of the project, so that lessons can be learned and applied prior to and at the time of final site closure.

Overall, decommissioning activities are transitory, and are likely to be similar in magnitude to construction impacts.

7.4.1 Ecology and biodiversity

A number of ecological impacts have been predicted to result during the decommissioning and closure phase of the project, including:

- Re-establishment of habitats and creation of new habitats via rehabilitation;
- Introduction and invasion of alien flora and fauna;
- Loss or disturbance of fauna species of special concern due to decommissioning/closure noise and collisions with vehicular traffic and powerlines; and
- Increased hunting/poaching of wildlife and clearing of habitats for crop production.

Each of these impacts are explained and assessed, and mitigation measures are recommended below.

Assumptions

The following assumptions apply:

- The ecological rehabilitation of components of the project site that lend themselves to such activities (e.g. quarry, plant sites, overburden site, haul roads) during the de-commissioning phase will result in habitats being re-established or new habitats created. Unless ecological restoration is undertaken, the condition (ecosystem structure, function, dynamics and species assemblages) of the re-vegetated area is not expected to be equivalent to that of the surrounding natural ecosystems in the short to medium-term, and likely even in the long term (> 15 years), if rehabilitation is undertaken.

²⁰ Ecological rehabilitation is defined as the improvement of ecosystem functions without necessarily achieving a return to ‘pre-disturbance’ conditions. Emphasis is generally on restoring ecosystem processes and functions (Clewett and Aronson, 2007).

Species richness of the rehabilitated areas will likely be lower than surrounding natural ecosystems and remain so for some time.

- If alternative, sustainable livelihoods for the project's labour force cannot be provided upon cessation of operations (excluding decommissioning and closure), a proportion of the labour force is likely to remain in the study area and rely upon hunting of wildlife or crop production for a living. The loss of natural habitats due to clearing for crop production and an increase in the hunting of wildlife (compared to current levels) will result under such conditions.
- The impacts of water abstraction on ecology or biodiversity were not assessed, as it was understood that they would be addressed under the Water Resources section.
- The impacts on Ecosystem Services were not assessed, as it was understood that they would be addressed under the Ecosystem Services section.

Limitations

The following limitations apply

- A botanical survey of aquatic and terrestrial habitats was conducted by the University of Lubumbashi in conjunction with SRK Consulting between 10 and 14 June 2013, which coincided with the early part of the dry season. Due to time constraints, a survey during the wet season was not possible. Transects were undertaken in each of the terrestrial habitats to record the species present and their respective abundance. It was estimated that a comprehensive survey during both the wet and dry seasons may yield approximately four times more plant species than were recorded during the short survey in June 2013. The species and habitats (ecosystems) identified during the short fieldwork survey should not be treated as comprehensive.
- A detailed fauna survey was not conducted due to a lack of available local experts and time. Bird, mammal, fish, amphibian, reptile and insect species were observed during the botanical surveys that were conducted from 10 to 14 June 2013 and are documented in this report. Information was gathered from local communities regarding both aquatic and terrestrial fauna present in the study area, but much of this data could not be verified in the available time-frames. No surveys of aquatic fauna were conducted. The species identified during the short fieldwork survey should not be treated as comprehensive.
- Additional IUCN Red List species may (and in fact are likely to) be identified via further fieldwork during both the wet and dry seasons.

The spatial distribution of habitats in the study areas was mapped in GIS at a 1: 5,000 scale as a desktop exercise. Limited verification of the desktop mapping was undertaken based on the results of the fieldwork, but detailed ground-truthing was not possible due to time constraints and the timing of availability of high resolution imagery for the study area. The accuracy of the spatial delineation and categorisation of the habitats in the study area therefore cannot be guaranteed, should be treated as preliminary, and requires refinement and verification during the development of the Biodiversity Action Plan.

Potential impacts

Impact EB15: Re-establishment of habitats or creation of new habitats via rehabilitation

The ecological rehabilitation²¹ of components of the project site that lend themselves to such activities (e.g. quarry, plant sites, overburden site, haul roads) during the de-commissioning phase will result in habitats being re-established or new habitats created.

Unless ecological restoration²² is undertaken, the condition (ecosystem structure, function, dynamics and species assemblages) of the re-vegetated area is not expected to be equivalent to that of the surrounding natural ecosystems in the short to medium-term, and likely even in the long term (> 15 years), if rehabilitation is undertaken. Species richness of the rehabilitated areas will likely be lower than surrounding natural ecosystems and remain so for some time²³.

Sequential removal and storage of topsoil and associated sequential rehabilitation of degraded areas is expected to improve the effectiveness of rehabilitation efforts and the ecological value of any re-established or new habitats. The trialing of various ecological rehabilitation methods, the institution of a rehabilitation monitoring program, and the implementation of an adaptive management approach to rehabilitation will present the greatest opportunity to re-establish ecosystems that resemble adjacent natural systems to the closest possible extent in terms of ecosystem structure and function, and to a lesser extent species assemblages (i.e. composition and richness).

Table 7-81: Impact significance rating and mitigation measures for Impact EB15

Impact EB15: Re-establishment of habitats or creation of new habitats via site rehabilitation								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	+	<i>Medium</i>
Management Measures: - Areas immediately adjacent to important habitats (e.g. lacustrine wetlands, swamps, Gallery and Swamp Forest) that have been degraded during the construction and operational phases must be restored to their natural, pre-construction condition; - All other cleared or degraded areas that are not identified in the closure plan for alternative commercial use (e.g. utilise the plant site for a new factory) must be rehabilitated to a stable ecological state. This condition should be as close to the pre-construction condition as practically possible via rehabilitation, but restoration of pre-construction ecosystems is not expected; - Site clearing to be conducted sequentially, not all at once; - Topsoil to be stockpiling separately from overburden for rehabilitation purposes, and protected against loss from run-off; - Sequential rehabilitation to be conducted as soon as quarrying of an area or disposal of overburden has been concluded; - A Rehabilitation Plan to be developed and implemented, with different objectives and rehabilitation approaches established for each habitat/ecosystem. Various rehabilitation methods must be trialed, a rehabilitation program implemented, and an adaptive management approach applied to rehabilitation. Development and implementation of the Rehabilitation Plan to be overseen by an appropriately qualified botanist/ecologist. The Rehabilitation Plan must be underpinned by a sound understanding of the ecological functioning of the various ecosystems in the study area.								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	+	<i>High</i>

²¹ Ecological rehabilitation is defined as the improvement of ecosystem functions without necessarily achieving a return to 'pre-disturbance' conditions. Emphasis is generally on restoring ecosystem processes and functions (Clewett and Aronson, 2007).

²² Ecological restoration is defined as the process of intentionally altering a site to establish a defined, indigenous ecosystem. The goal of this process is to emulate the historical structure, function, diversity and dynamics of the specified ecosystem (UNEP, 2003).

²³ During early stages of rehabilitation, certain ecosystems exhibit higher levels of biodiversity than surrounding natural areas due to the presence/emergence of both pioneer and successional plant species and limited competition between species. This higher level of diversity is typically a short-term occurrence that ceases shortly after secondary plant species become well established.

Impact EB16: Introduction of alien invasive flora and fauna

Invasive alien plants are present at very low levels in the study area, but a much higher prevalence thereof was noted along the N1 main road. Such invasions related primarily to bamboo present at road crossings over rivers and *Chromolaena odorata* at recently cleared areas. The movement of vehicle and earth-moving equipment (plant) to, from and through the project site during decommissioning and closure may result in the introduction of new alien invasive flora and fauna into the study area or into parts of the site where such species are currently not present. The introduction of new insect and mammal species (e.g. rodents) from outside of the DRC via the port of Matadi is likely to be the greatest alien invasive fauna risk.

Table 7-82: Impact significance rating and mitigation measures for Impact EB16

Impact EB16: Introduction of alien invasive flora and fauna								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: - An invasive alien species control programme to be developed and implemented as a component of the Biodiversity Action Plan, including adaptive management measures; - The initial Biodiversity Action Plan should be informed by baseline surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The Biodiversity Action Plan should be updated every five years, with particular emphasis to be place on the control of invasive alien flora and fauna; - All invasive alien species control measures specified in the Biodiversity Action Plan must be implemented.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>

Impact EB17: Loss or disturbance of fauna species of special concern due to collisions and noise disturbance

A number of the species identified by local communities as occurring in the study area are listed on the IUCN Red List, most notably *Psittacus erithacus* (*African grey parrot*) that is classified as Vulnerable and *Phataginus tricuspis* (*Tree pangolin*) that is classified as Near threatened. Detailed surveys during both the wet and dry seasons however may result in additional Red List species being recorded. During the surveys of the study area, no nesting birds were observed, but are they very likely to be present.

Disturbances to resident and visiting fauna are predicted due to vehicular traffic and noise from decommissioning and closure, with impacts on nesting birds likely to be most substantial. The fatal collision of birds with the new powerline is also anticipated, particularly due to the proximity of the new powerline to the Mbamba and Kabuendi wetland systems.

Table 7-83: Impact significance rating and mitigation measures for Impact EB17

Impact EB17: Loss or disturbance of fauna species of special concern due to collisions and noise disturbance								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>Medium</i>
Management Measures: - Bird collision minimisation technologies (e.g. bird flappers) to be installed on the new powerline from the grid station at Kimpese to the plant to minimise collisions. The most appropriate technology is to be determined by an experienced ornithologist; - A Biodiversity Action Plan to be developed to inform NYA protection and management of biodiversity in the entire concession. The initial Biodiversity Action Plan should be informed by comprehensive baseline								

Updated ESIA for NYA Cement Project – updated in response to lender requirements

surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The Action Plan must be updated at least every 5 years to facilitate adaptive management, or more frequently if required.								
After Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Definite	Medium	-	<i>High</i>

Impact EB18: Increased hunting/poaching of wildlife and loss of habitats for crop production

If alternative, sustainable livelihoods for the project's labour force cannot be provided upon cessation of operations (excluding decommissioning and closure), a proportion of the labour force is likely to remain in the study area and rely upon hunting of wildlife or crop production for a living. The loss of natural habitats due to clearing for crop production and an increase in the hunting of wildlife (compared to current levels) will result under such conditions.

Table 7-84: Impact significance rating and mitigation measures for Impact EB18

Impact EB18: Increased hunting/poaching of wildlife and loss of habitats for crop production								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Definite	Medium	-	<i>High</i>
Management Measures: • NYAs social and labour plan to address the provision of sustainable, alternative livelihoods upon cessation of operations, decommissioning and closure; and • An environmental education programme to be developed and implemented for all NYA employees, their families, and villages within the concession.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	Medium	Possible	Medium	-	<i>Medium</i>

7.4.2 Water resources**Potential impacts****Impact WR13: Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste**

Spills of fuel, oil, lubricants and other hazardous materials can have a potential adverse impact on surface water during dismantling and removal of project infrastructure. Inadequate waste management, especially of sewage and other hazardous waste, may result in contamination of surface water through runoff and seepage.

All contractors, technicians and laborers will be required to implement practices to minimize the potential for spills of fuels or chemicals during dismantling and removal of project infrastructure. In the unlikely event that spills do occur, they will have to be managed in accordance with the project's ESMP (Chapters 9 and 13).

To further minimize potential environmental impacts it is recommended that full-time environmental monitoring is conducted during construction, particularly during all refueling operations to minimize potential concern.

Table 7-85: Impact significance rating and mitigation measures for Impact WR13

Impact WR13: Chemical contamination of surface water resulting from accidental spills during transportation and handling								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Short Term</i>	<i>Regional</i>	Low	Possible	Low	-	<i>Medium</i>
Management Measures:								

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- Where contaminants are transported, emergency contaminant and mitigation measures must be developed to minimize impacts should accidental spillages occur along the transport routes - Equip all trucks and equipment carrying fuels or oil with spill response materials and train personnel in the use of such materials - Store all potential sources of contamination in secure facilities with appropriate Storm Water management systems in place to ensure that contaminants are not released to the water resource through Storm Water runoff								
After Management	<i>Minor</i>	<i>Short Term</i>	<i>Regional</i>	Low	Unlikely	Low	-	<i>High</i>

Impact WR14: Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads

Table 7-86: Impact significance rating and mitigation measures for Impact WR14

Impact WR14: Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Minor</i>	<i>Short Term</i>	<i>Regional</i>	Low	Possible	Low	-	<i>Medium</i>
Management Measures: - Minimise disturbance of soil and vegetation; - Implement rehabilitation and revegetation as soon as possible; - Refer to dust and erosion suppression measures listed in Impacts AQ6 and SL4								
After Management	<i>Minor</i>	<i>Short Term</i>	<i>Regional</i>	Low	Unlikely	Low	-	<i>High</i>

Impact WR15: Contamination of groundwater resulting from seepage from hazardous materials and waste

The removal of ablution facilities and other project infrastructure and equipment (and potential release of oils, lubricants and other hazardous liquids) may impact on groundwater quality through seepage if these systems are not appropriately managed. Waste (including hazardous waste) will also be generated and similarly may lead to groundwater contamination if it is not appropriately stored and disposed of. Although no current users of groundwater have been identified and the baseline quality of this resource has not been assessed, large volumes of groundwater are expected to exist in the area, and numerous wetland areas (where the groundwater table is at surface level) are present.

Table 7-87: Impact significance rating and mitigation measures for Impact WR15

Impact WR15: Contamination of groundwater resulting from seepage from hazardous materials and waste								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	<i>Minor</i>	<i>Short Term</i>	<i>Regional</i>	Low	Possible	Low	-	<i>Medium</i>
Management Measures: - Manage waste in accordance with the Waste Management Plan (Appendix 15) - Refer to mitigation measures for Impact WR13								
After Management	<i>Minor</i>	<i>Short Term</i>	<i>Site / local</i>	low	Unlikely	Low	-	<i>High</i>

7.4.3 Waste management

Large quantities of bulky waste will be generated during decommissioning and closure, and the detailed design process will need to take into consideration landfill and other disposal requirements at closure. The closure and rehabilitation plan to be developed in advance of closure will assess the

capacities of the existing landfill sites towards the end of project/ mine life in terms of which management measures for waste can be revised if required at that time. Measures might include co-disposal of wastes in the overburden stockpile.

Contaminated waste, including soils, could arise from the decommissioning of the plant, and may contaminate soils and water resources, affecting users. Impacts arising from this, as well as visual impacts are assessed under the relevant subsections and therefore are not rated separately here. Risk to the environment or human health will be assessed at that time based on the hazard profile of the wastes and their leachates, and appropriate disposal will be implemented. Hazardous waste may require stabilization and/or disposal in the on-site lined hazardous waste compartment.

7.4.4 Socio-economic Impacts

Various socio-economic impacts will result from the closure of the plant and cessation of operations. Associated with this will be retrenchment of staff, resulting in loss of both direct and indirect economic benefits to the area, and a reduction in government revenue gained from the project.

People quickly adapt their expectations in response to changes in their environment and tend to value continuous increase in economic opportunities. The significance of any impacts during the decommissioning phase will thus depend on the economic and social environment and opportunities present at the time of decommissioning and cannot be rated relative to the current baseline, as a return to the current situation might be perceived as a negative rather than a neutral impact.

Due to the considerable uncertainty relating to the further socio-economic conditions in the area, no impact ratings are provided for the impacts listed below, but recommended management measures are listed to minimize negative impacts.

NYA is likely to be one of the key employers in the project area for the foreseeable future however of the 40 year life of project this could change substantially if other industries and commercial activities are attracted to the area. In an environment where poverty is pervasive, unemployment is high, social services are low and infrastructure is largely outdated, poorly maintained and deteriorating, the project is likely to have many impacts of which some are expected to be positive on the economy and social infrastructure of the surrounding area. However, the reverse is expected in the event of unmanaged closure, and particularly unplanned or early closure.

Potential impacts

The socio-economic impacts at closure can be broadly classified into the following:

- Direct impacts on project employees and their families
- Loss of economic benefits to the project supply chain
- Loss of support to the local government and other government levels with respect to taxes and royalty incomes, increased pressure on maintenance of infrastructure and services
- Loss of community benefits in the form of project funded community development programmes

The various socio-economically impacts typically associated with closure of projects of this nature and broad recommendations for management / mitigation are summarised below.

Table 7-88: Summary of broad socio-economic impacts expected at closure

Aspect/Impact	Mitigation/Management
During the operation of the project, employees and their families will benefit from the following: • Direct income to employee • Career development and training • Employment benefits including medical facilities for employees and their families Jobs, secure incomes and employee benefits will end with closure leaving a void with respect to secure livelihoods, careers and health provision.	Typical mitigation and management strategies would include: • Communication with internal stakeholders, i.e. employees to discuss the implications of closure • Phased programme of retrenchments and retirements to ensure that the full impact of reduction in employment is spread over several years to ensure that the impact is absorbed as far as possible. • Consideration of various models of employment such as contracts, amendments to job descriptions and succession planning. • Early development of alternative livelihood strategies for employees • Career counselling and capacity building • Development of a skills register and dissemination of the register to alternative employers, government etc. • Phased programme to manage replacement of employee benefits
The project will generate some opportunities through its supply chain for direct contracts and secondary businesses in the local area and the surrounding region. The closure of the project will result in the loss of these economic opportunities. Currently there are no other industries in the area that could cushion the reduced supply chain opportunities and a resultant economic decline.	Typical mitigation and management strategies would include: • Early communication with stakeholders i.e. service providers including local service providers, bulk service providers and the business community to discuss the implications of closure • Liaison with other industries to discuss opportunities for service providers within their supply chain
Throughout the operational life of the project, taxes and royalties will be due to the government, mobilising resources which should ideally contribute towards the improvement and maintenance of social infrastructure and services in the project area. The closure of the project will result in: • Loss of mine provided services with respect to healthcare, road maintenance and so on; • Loss of income for local services • Loss of taxes resulting in reduced maintenance of services and facilities. • In the event that mine assets are transferred to local government, while these assets may be initially beneficial to the community, these assets may cause further strain on capacity to manage and maintain.	Typical mitigation and management strategies would include: • Timely engagement of local regional and national government to advise of closure and the implications this will have on the government revenue from taxes and royalties • On-going skills transfer and capacity development over the life of mine to ensure • Gradual transfer/return of responsibilities to local government with respect to service provision where the project has played an active role in service provision
Once project closure takes place, the loss of income and increased unemployment and poverty, might lead to elevated stress levels and the increase of social pathologies such as crime, alcoholism and gender issues. In addition, the adoption of non-traditional lifestyles by project-employed	Typical mitigation and management strategies would include: • Implementation of the management measures described above

Aspect/Impact	Mitigation/Management
households may result in renewed dependency as a result of the loss of traditional knowledge and skills that contribute towards traditional livelihoods such as agriculture.	• Timeous and phased-in life skills training • Timeous facilitation of alternative livelihood strategies
On closure of the mine, there could be infrastructure that will be treated in one or more of the following ways: • Returned to the local authority for their use; • Demolished if it has no useful value; • Made available to the community for their use. Examples include: roads, workshops, offices, clinics and housing. The transfer of these assets may provide opportunities for community members and businesses to develop new trades. However, with these opportunities come the responsibilities for maintenance and upkeep of the assets and there is the possibility that due to limited household and government revenues, these assets may deteriorate with lack of maintenance and may not be utilised in an optimal manner. With respect to roads and social infrastructure such as clinics that will have already been of benefit to the broader public, the deterioration of these facilities is expected to be of higher significance than infrastructure that may be transferred for private use, such as housing and workshops	Typical mitigation and management strategies would include: • Early engagement of stakeholders to discuss and scenario plan the transfer of usable assets to the community, local government and other stakeholders • Provision of information on the maintenance and management costs of assets and typical maintenance programmes • Capacity building for asset management

Impact EC5: Reduction in project revenue to government, resulting in local economic decline

Limited and short-term activity will take place during the decommissioning phase. However, production will have ceased and the workforce reduced significantly. Government revenue from the operation is thus expected to decline significantly in the decommissioning phase. The negative economic consequence of a reduction in revenue is likely to be more pronounced at the local level, where dependence on revenue from this project might be higher.

The impact of a reduction in cement supply due to the decommissioning of the plant will depend on the overall demand and supply situation at the time. The impact is more likely to be significant and negative if no provider steps in to make up for the reduction in cement supply despite sufficient demand. This may depress local economic activity if cement becomes unavailable or more expensive, which would also negatively affect government revenue.

Management measures

- To minimize impacts, opportunities should be explored with local and regional businesses to compensate for any loss in cement production.

Impact EC6: Loss of Employment and Income due to retrenchment

The workforce will be reduced during decommissioning of the project. Depending on the eventual size of the workforce, the number of other people who depend on the workers' income and other economic opportunities in the area, decommissioning could have a significant and negative effect on employment and income in the area. Depending on the social support network in place at the time, individual workers and their families could be highly vulnerable to the loss of employment and income at the end of the project, as they are likely to have shifted from a purely subsistence based to a mixed or exclusively cash based lifestyle.

Management measures:

To minimize impacts, opportunities should be explored with local and regional businesses to diversify the local and regional economic base and local skill level, thereby providing workers with opportunities for alternative employment. Initiatives in this regard should be undertaken throughout the project lifetime and include:

- Develop the NYA grievance procedure to capture and address grievances arising due to retrenchments and downscaling of Phase 1.
- Compliance with IFC's Performance Standard 2 "Labour and Working Conditions"
- Actively promoting the development of different economic sectors from an early stage, e.g. through incentivising other industries to locate in the area, contributing to adequate infrastructure and promoting an increase and diversity of skills in the local population; and
- Develop a decommissioning and closure plan which is updated every five years increasing in detail as closure approaches, and actively engaging with a range of stakeholders throughout the life-of-project to discuss potential consequences of decommissioning and possible mitigation.
- Monitor the use of violence by the mine security in instances of labour unrests (see impact HS 4)

7.4.5 Ecosystem Services

Similarly to socio-economic impacts, the significance of impacts on ecosystem services have not been rated due to the considerable uncertainty relating to the further socio-economic conditions in the area. Recommended management measures are listed to minimize negative impacts.

Potential impacts

Impact ES3: Reduced quality of natural resources and ecosystem services to local communities due to emissions to air, water or soil

Most project impacts on ecosystem services in the area are associated with the loss of land and modification of aquatic habitat on and near the project footprint during the construction and operation phases. However, as stated earlier, the overall impact of the project on ecosystem services is expected to be low due to the limited project footprint within a larger relatively intact area and the limited importance of the project area for the provision of ecosystem services used by the community.

The impact of the decommissioning phase on ecosystem services will largely depend on the management of wastes obtained from dismantling the facility at the time, as the incorrect disposal of wastes, including hazardous materials, can seriously compromise the functioning of the ecosystem and the services it provides.

Management measures

- To minimize impacts, the project must comply with GIIP for air emissions, water (stormwater and effluent) discharge quality and solid waste disposal.

7.4.6 Soils, land capacity and land use

Potential impacts

Impact SL7: Remediation of contaminated soils and demolition of project infrastructure, resulting in re-establishment of baseline soil characteristics and land capability

Both during operations and at closure, there is the opportunity to either undertake in situ soil remediation, particularly for hydrocarbon contamination. Where in situ rehabilitation cannot be undertaken, the contaminated soils should be excavated and disposed of at an appropriate facility, which may include a hazardous waste facility if one is developed regionally or onto the overburden

disposal facilities if the long-term impacts of disposal are not considered significant. It is recognized that no facilities for the handling of contaminated soils are available regionally or even nationally within the DRC. Therefore at closure, risk assessments will be conducted to determine the most appropriate method for the handling of contaminated soils. If contamination is removed, there is the potential that pre-mining land capability can be established and the land returned to its pre-mining land use. There is also the opportunity to demolish infrastructure and restore the footprints to conditions similar to that which existed prior to the commencement of mining. This can only be undertaken in areas where infrastructure is present, where demolition will permanently remove the infrastructure from the landscape.

Table 7-89: Impact significance rating and mitigation measures for Impact SL7

Impact SL7: Remediation of contaminated soils and demolition of project infrastructure, resulting in re-establishment of baseline soil characteristics and land capability								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Medium-term</i>	<i>Site/Local</i>	Low	Definite	Medium	-	<i>Medium</i>
Management Measures: Implement the Closure and Rehabilitation Plan as described in the report to support the proposed project.								
After Management	<i>Reestablishment of baseline</i>							<i>High</i>

7.4.7 Air quality

Potential impacts

Impact AQ7: Increase in PM₁₀ emissions resulting from land clearing, earthworks, and vehicular movement

Closure activities involving removal of project infrastructure and landscaping of the site may result in dust (PM₁₀) generation especially during dry windy conditions, which may impact on local communities in terms of nuisance and health impacts.

Table 7-90: Impact significance rating and mitigation measures for Impact AQ7

Impact AQ7: Increase in PM₁₀ emissions resulting from land clearing, earthworks, and vehicular movement								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Short Term</i>	<i>Local</i>	Low	Possible	Low	-	<i>Low</i>
Management Measures: - Apply dust suppressants to sections of roads used routinely by vehicles that pass through and close to villages; - Cover vehicles carrying dusty materials to prevent materials being blown from the vehicles; - Set speed limits to minimize the creation of fugitive dust within the project boundary; - Continue with the routine air quality monitoring program. - Minimize the disturbed footprint as far as practically possible. - Undertake stripping, stockpiling and stockpile management as per the Soil Management Plan (Section 9.9). - Revegetate and landscape disturbed areas as soon as possible.								
After Management	<i>Minor</i>	<i>Short Term</i>	<i>Local</i>	Low	Unlikely	Low	-	<i>Low</i>

7.4.8 Visual impacts

Potential impacts

Impact VI3: Dust generation and site disturbance due to earth moving and removal of project infrastructure, affecting the visual character for communities

Closure activities including site clearing, earth moving and removal of project infrastructure may result in dust plumes during dry windy conditions, which may be visible from great distances.

Table 7-91: Impact significance rating and mitigation measures for Impact VI3

Impact VI3: Dust generation and site disturbance due to earth moving and removal of project infrastructure, affecting the visual character for communities								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Minor</i>	<i>Short-term</i>	<i>Regional</i>	<i>Low</i>	<i>Possible</i>	Medium	-	<i>Medium</i>
Management Measures: - Minimize the disturbed footprint as far as practically possible. - Undertake stripping, stockpiling and stockpile management as per the Soil Management Plan (Section 9.9). - Revegetate and landscape disturbed areas as soon as possible, to reflect the surrounding topography and vegetation as much as possible. - Implement the waste management plan for the project (Appendix 15). - Refer to dust control measures under Impact AQ6.								
After Management	<i>Minor</i>	<i>Short-term</i>	<i>Regional</i>	<i>Low</i>	<i>Possible</i>	Low	-	<i>Medium</i>

7.5 Impacts during the Post-Closure Phase

7.5.1 Ecology and biodiversity

A single ecological impact has been predicted to result during the post-closure phase of the project, namely increased hunting/poaching of wildlife and clearing of habitats for crop production.

This is explained and assessed, and mitigation measures are recommended below.

Assumptions

The following assumptions apply:

- If alternative, sustainable livelihoods for the project's labour force cannot be provided upon conclusion of decommissioning and closure, a proportion of the labour force is likely to remain in the study area and rely upon hunting of wildlife or crop production for a living. The loss of natural habitats due to clearing for crop production and an increase in the hunting of wildlife (compared to current levels) will result under such conditions.
- The impacts of water abstraction on ecology or biodiversity were not assessed, as it was understood that they would be addressed under the Water Resources section.
- The impacts on Ecosystem Services were not assessed, as it was understood that they would be addressed under the Ecosystem Services section.

Limitations

The following limitations apply

- A botanical survey of aquatic and terrestrial habitats was conducted by the University of Lubumbashi in conjunction with SRK Consulting between 10 and 14 June 2013, which coincided with the early part of the dry season. Due to time constraints, a survey during the wet season was not possible. Transects were undertaken in each of the terrestrial habitats to record the species present and their

respective abundance. It was estimated that a comprehensive survey during both the wet and dry seasons may yield approximately four times more plant species than were recorded during the short survey in June 2013. The species and habitats (ecosystems) identified during the short fieldwork survey should not be treated as comprehensive.

- A detailed fauna survey was not conducted due to a lack of available local experts and time. Bird, mammal, fish, amphibian, reptile and insect species were observed during the botanical surveys that were conducted from 10 to 14 June 2013 and are documented in this report. Information was gathered from local communities regarding both aquatic and terrestrial fauna present in the study area, but much of this data could not be verified in the available time-frames. No surveys of aquatic fauna were conducted. The species identified during the short fieldwork survey should not be treated as comprehensive.
- Additional IUCN Red List species may (and in fact are likely to) be identified via further fieldwork during both the wet and dry seasons.
- The spatial distribution of habitats in the study areas was mapped in GIS at a 1: 5,000 scale as a desktop exercise. Limited verification of the desktop mapping was undertaken based on the results of the fieldwork, but detailed ground-truthing was not possible due to time constraints and the timing of availability of high resolution imagery for the study area. The accuracy of the spatial delineation and categorisation of the habitats in the study area therefore cannot be guaranteed, should be treated as preliminary, and requires refinement and verification during the development of the Biodiversity Action Plan.

Potential impacts

Impact EB19: Increased hunting/poaching of wildlife and loss of habitats for crop production

If alternative, sustainable livelihoods for the project's labour force cannot be provided upon conclusion of decommissioning and closure, a proportion of the labour force is likely to remain in the study area and rely upon hunting of wildlife or crop production for a living. The loss of natural habitats due to clearing for crop production and an increase in the hunting of wildlife (compared to current levels) will result under such conditions.

Table 7-92: Impact significance rating and mitigation measures for Impact EB19

Impact EB19: Increased hunting/poaching of wildlife and loss of habitats for crop production								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	<i>Moderate</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Definite</i>	<i>Medium</i>	-	<i>High</i>
Management Measures: • NYAs social and labour plan to address the provision of sustainable, alternative livelihoods upon cessation of operations, decommissioning and closure; and • An environmental education programme to be developed and implemented for all NYA employees, their families, and villages within the concession.								
After Management	<i>Minor</i>	<i>Long term</i>	<i>Site / local</i>	<i>Medium</i>	<i>Possible</i>	<i>Medium</i>	-	<i>Medium</i>

7.5.2 Water resources

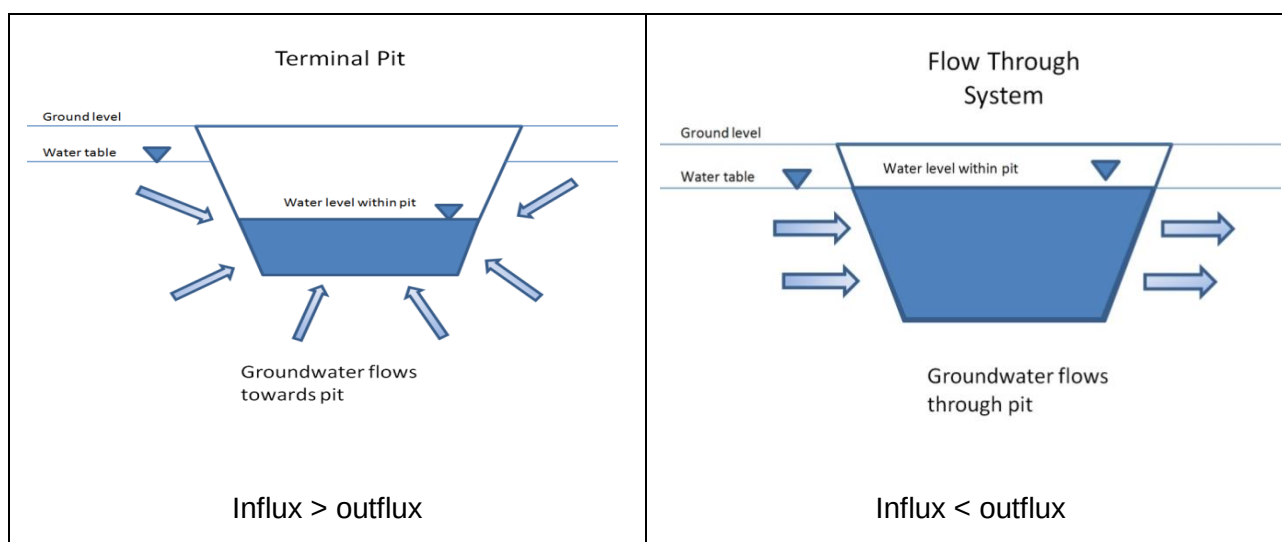
Potential impacts

Impact WR12: Pit lake formation due to inflow of ground and surface water, resulting in safety risks to animals and humans, and environmental contamination

When mining excavations are left open after mining, water ingress may cause a pit lake to form. The rate at which this forms (if applicable), is dependent on a number of factors namely: the rate of

groundwater seepage, rainfall, runoff, evaporation, pit geometry, volume within the pit and pit mineralogy of the high walls. Once the volume of water within the pit is known, the chemistry can be estimated by means of a salt balance which accounts for the presence of a specific element with regards to inflow concentrations and outflow concentrations from the system. It must be noted that in order to obtain a detailed chemical prediction of the pit water, an in-depth geochemical assessment is required which will take into account chemical reactions such as oxidation, reduction, precipitation etc. that may occur between the water and the associated rock formations, which is beyond the scope of this report.

The water balance establishes the water level within the pit over time. If the level in the pit remains below the natural groundwater level (20-25 mbgl), groundwater will be drawn towards the pit which acts as a sump and is called a 'terminal pit'. If the water level rises to the natural groundwater level, groundwater will rebound to the water table and could seep out; this is termed a 'flow through system'. The schematic figure below shows these two scenarios. Furthermore, the rate of groundwater inflow into a pit after mining will decrease as the hydraulic gradient towards the pit is reduced as the pit fills with water.



Considering the geology (dolomite), it is most unlikely that the water quality within a pit lake would be harmful to the environment (if it decants or if a "flow through" system develops), hence a low significance rating. Pit lake formation can be prevented by backfill of the open void (if enough discard material is available, which is not the case). In doing so the probability of pit lake formation is unlikely (higher confidence level).

Table 7-93: Impact significance rating and mitigation measures for Impact WR12

Impact WR12: Pit lake formation due to inflow of ground and surface water, resulting in safety risks to animals and humans, and environmental contamination								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	Minor	Long Term	Local	Medium	Possible	Low	-	Low
Management Measures: - Backfill of the remaining open void will prevent a pit lake from forming (if sufficient backfill material is available) - Restrict access (and ingestion of pit water) by animals and humans by fencing the pit.								
After Management	Minor	Long Term	Local	Medium	Unlikely	Low	-	Medium

By leaving a larger pit excavation in which a terminal pit is created, the risks of poor pit lake water seeping to the surrounding aquifer is minimized. Also by fencing in the pit, animals will be restricted from drinking the contaminated water.

7.5.3 Economic Impacts

As described in Section 7.4 for socio-economic impacts during decommissioning and closure, the significance of impacts listed in this section have not been rated due to the considerable uncertainty relating to the further socio-economic conditions in the area. Recommended management measures are listed to minimize negative impacts.

Potential impacts

Impact EC7: Cessation in project revenue to government, resulting in local economic decline

Economic activity is expected to have ceased entirely during closure, with a corresponding cessation of any government revenue from the operation. The negative economic consequence of a reduction in revenue is likely to be more pronounced at the local level, where dependence on revenue from this project might be higher, but small relative to the decommissioning phase where the impact is most significant.

The impact of a reduction in cement supply due to the closure of the plant will depend on the overall demand and supply situation at the time. The impact is more likely to be significant and negative if no provider steps in to make up for the reduction in cement supply despite sufficient demand. This may depress local economic activity if cement becomes unavailable or more expensive, which would also negatively affect government revenue.

Management measures

- To minimize impacts, opportunities should be explored with local and regional businesses to compensate for any loss in cement production.

Impact EC8: Loss of Employment and Income due to retrenchment

The workforce will be fully laid off during closure of the project. Depending on the eventual size of the workforce, the number of other people who depend on the workers' income and other economic opportunities in the area, closure could have a significant and negative effect on employment and income in the area. Depending on the social support network in place at the time, individual workers and their families could be highly vulnerable to the loss of employment and income at the end of the project, as they are likely to have shifted from a purely subsistence based to a mixed or exclusively cash based lifestyle. However, the main impact is expected to occur during the decommissioning phase, with little additional impact during the closure phase when the remaining layoffs are widely expected.

7.5.4 Ecosystem Services

As described above, the significance of impacts listed in this section have not been rated due to the considerable uncertainty relating to the further socio-economic conditions in the area. Recommended management measures are listed to minimize negative impacts.

Potential impacts

Impact ES4: Reduced quality of natural resources and ecosystem services to local communities due to contamination of water or soil

Similarly to potential impacts on ecosystem services arising during the decommissioning phase, the significance and nature of post-closure impacts on ecosystem services will largely depend on the management of wastes during the decommissioning phase, as the incorrect disposal of wastes,

including hazardous materials, can have long-term negative impacts on the functioning of the ecosystem and the services it provides.

Management measures:

- To minimize impacts, the project must comply with GIIP for air emissions, water (stormwater and effluent) discharge quality and solid waste disposal.

7.5.5 Soils, land capacity and land use

Potential impacts

Impact SL8: Demolition and restoration of project infrastructure, resulting in re-establishment of baseline soil characteristics and land capability

The post closure impacts for this infrastructure are dependent on the Closure and Rehabilitation Plan. If the infrastructure has a potential post mining benefit to the community, access roads for example, these areas can be handed to the community for post mining use. Should this occur, then the impacts as stated in Impact SL1 will remain as long as the community utilizes the infrastructure. However, it must be considered that the utilization of the roads would open access to areas not used for agriculture pre-mining. If no community benefit exists with the infrastructure, then it is expected to be decommissioned and the area rehabilitated by replacing soils and adding nutrients if necessary. By replacing the soils where infrastructure has been decommissioned and rehabilitated, the impact reverses from a Medium Negative impact at closure to a reestablishment of baseline.

Table 7-94: Impact significance rating and mitigation measures for Impact SL8

Impact SL8: Demolition and restoration of project infrastructure, resulting in re-establishment of baseline soil characteristics and land capability								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Medium-term</i>	<i>Site/Local</i>	Low	Definite	Medium	-	<i>Medium</i>
Management Measures: • Implement the Closure and Rehabilitation Plan as described in the report to support the proposed project.								
After Management	<i>Reestablishment of baseline</i>							<i>High</i>

As rehabilitation techniques following decommissioning are well established, there is a high confidence that with the demolition of infrastructure and the replacement of soils that the land capability can be returned to baseline conditions.

Visual impacts

Impact VI4: Re-establishment of baseline visual character due to rehabilitation of the site and removal of project infrastructure

With rehabilitation of the site post-closure, the aim will be to re-establish baseline (pre-construction) conditions as far as possible. While it will not be possible to remove all project infrastructure (notably the overburden site and quarry will remain as permanent features in the landscapes), landscaping and revegetation in accordance with the surrounding vegetation and topography will mitigate this impact to a large extent. As surrounding communities will have become accustomed to the presence of project infrastructure, thereby establishing a new baseline in terms of visual character, post-closure rehabilitation of the site is rated as a positive impact as it will improve on this baseline.

Table 7-95: Impact significance rating and mitigation measures for Impact VI4

Impact VI4: Re-establishment of baseline visual character due to rehabilitation of the site and removal of project infrastructure								
	Magnitude	Duration	Scale	Consequence	Probability	SIGNIFICANCE	+ / -	Confidence
Before Management	<i>Minor</i>	<i>Long-term</i>	<i>Site/local</i>	<i>Medium</i>	<i>Possible</i>	Medium	-	<i>Medium</i>
Management Measures: - Implement the Closure and Rehabilitation Plan as described in the report to support the proposed project. - Landscaping and revegetation in accordance with the surrounding vegetation and topography								
After Management	<i>Minor</i>	<i>Long-term</i>	<i>Site/local</i>	<i>Medium</i>	<i>Definite</i>	Medium	+	<i>Medium</i>

7.6 Environmental Impact of Coal Transportation

Sources of emissions from coal transport trucks are exhausts from diesel or gasoline engines, windage losses, and spillages.

Emission of pollutants are estimated for trucks on the basis of carrying 25 tonnes payload (return empty); return trip with one way distance of 110 kms; and diesel fuel consumption of 1.5 kms/liter loaded and 2.1 kms/liter, as shown below:

Table 7-96: Truck Emission Transporting Coal

Pollutant	Emissions – kg per Return Trip
Particulate	0.36
SO ₂	0.72
CO	5.88
NO _x	9.72

Wind losses and spillage will occur during transport unless the top of truck is covered. Normally covering with properly anchored tarpaulins will be acceptable for control wind losses and spillage.

Major sources of noise from trucks are from the engine, exhaust, and tires. The high compression engines produce more noise than the spark-ignited gasoline engines. Proper and regular tuning of engines will ensure noise limitations to the design conditions. Tuning will also contain air emissions.

Exhaust noise dominates other truck noise, producing about 100 dB(A). Exhaust noise can easily controlled through use of proper mufflers to level of 90 dB(A) measured at a distance of 15 meters.

Noise from tires ranges from 80 dB(A) to over 90 dB(A), and tires become the dominant noise-producing source at speeds above 80 km/hr. Regulating speeds and the condition of tires can control noise emissions from tires.

Accident during truck movements on highway and cities, carrying coal, could be a major environmental and fire hazard. Truck drivers will need regular training sessions for safe driving.

Operation of rail lines for transportation of coal can cause pollutant emissions, noise and potential fires. The atmospheric emissions are from the diesel fuel burned by the locomotives and fugitives emissions in transit. The diesel emissions are estimated on the basis of work output carrying a full train load. Table 7-97 shows the emissions by train when converted to truck equivalent of 25 tonnes carrying load.

Table 7-97: Train Emission Transporting Coal

Pollutant	Emissions – kg per Return Trip
Particulate	0.20
SO ₂	0.45
CO	0.54
NO _x	0.16

The emissions for railway have been calculated on basis on train with a payload on 500 tonnes and empty return journey travelling a distance 260 kms return. The full train will travel at an average speed of 40 kms/hr nonstop. Railway emissions can further reduced with electrification of railway network using hydel power.

Loss of particulates in transit varies with type of coal shipped, condition of cars, speed of train, and wind speed. Windblown coal that is lost to the environment will cause some adverse impact. Coal dust will cover the leaves of nearby vegetation and reduce its photosynthetic capabilities. Also the coal dust could possibly have toxic effects on wildlife that might browse on this vegetation. This condition will also apply windblown fugitive coal from road trucks movement.

An effective method of controlling wind losses is the use of removal tarpaulins on each car as is proposed for road trucks. Such of tarpaulins will also reduce coal spillage during bumping of rail cars/wagons.

Sources of noise in a moving diesel engine locomotive driven train are listed below:

- Diesel engine
- Diesel exhaust
- Wheel/rail interaction

Mufflers on exhaust system can greatly reduce the noise from diesel locomotive.

The railway system from Matadi Port to Minkelo Railway Station does not pass through congested areas as is the case with road trucks. Use of railway for transportation of coal will be less hazardous than road trucks.

7.7 Cumulative impacts

For the purposes of this assessment, the definition of cumulative impacts provided in the IFC's Glossary of Terms (IFC, 2006) has been used: *'the combination of multiple impacts from existing Projects, the proposed Project and/or anticipated future Projects that may result in significant adverse and/or beneficial impacts that would not be expected in case of a stand-alone Project.'* This section identified possible cumulative impacts and comments on their potential significance.

7.7.1 Cumulative impacts resulting from other projects

Other cement projects in the Bas-Congo region that have been identified are as follows:

- CIMALO (Cimenterie de Malange-Lombe) is a greenfields project located at Malange-Lombe, approximately 15 km south west of the project site, on the road to Matadi.
- CILU (Cimenterie de Lukala) is an existing facility situated at Lukala, approximately 37 km east of project site, on the road to Kinshasa; and
- PPC project. PPC's annual reports suggest that their investment into the region involves

winning a tender to operate the existing (but not operational) state cement plant outside Kimpese (CINAT - Cimenterie Nationale). This is located approximately 30 km east of project site, on the road to Kinshasa. If this does not materialise, then it appears as if PPC are investigating three other potential sites in the Bas-Congo region, the location of which is not reported. The 200 million USD investment suggests a similar scale of development to NYA's project.

A 400 kv powerline, running through the project area as indicated on Figure 4-5, is also in the process of being constructed (pylons have been installed).

Apart from these projects, the region is largely undeveloped with small scale agriculture being the predominant economic activity.

The potential cumulative impacts that have been identified relating to other proposed and existing projects in the region are discussed below.

Soils, Land Use and Land Capability

Detailed information on soil type and land capability in areas wider than the project site is currently not available, nor are the pressures on land use from factors external to the proposed NYA Project's activities understood. The expected drivers of the cumulative impact are:

- Population influx and therefore increased clearing of natural vegetation and cultivation of lands;
- Development of any other mining and or processing facilities.

Although soil resources are not unlimited in the region, it appears that the soils identified within the project area are ubiquitous to the region. These soils are considered moderate to marginal for agricultural purposes and the cumulative loss of land capability associated with mining could have an impact on communities if they are continually displaced by new developments in the longer term.

Population growth and/or migration of people to the area will result in more pressure for agricultural land and may include people who do not secure work from mining activities resorting to agriculture as a survival strategy.

In the absence of other infrastructure development, there may also be an associated increase in the need for charcoal, leading to the clearing of vegetation, deforestation, and exposing soils to erosion. This indirect loss of land capability as a result of mining, combined with impacts associated with an expanding community could potentially result in a cumulative impact on available agricultural resources. Given the extent of the area, and the potential mining activities therein, the contribution of mining in general, to this cumulative impact is considered to be minor.

Regional Economic Development

The development of multiple projects within the Bas-Congo region, and cement plants in particular, could trigger the development of supporting economic activity beyond what would occur as a result of this project on its own. The focal point of increased economic activity is likely to be Kimpese, given that there are two existing plants in close proximity to the town, and businesses that support quarrying and cement production would find the region attractive to invest in.

The cumulative effect of increased revenues to government could additionally enable larger scale infrastructure development projects which would improve services to the region. Upgrading of transport corridors (N-1 and rail between Matadi and Kinshasa), electricity infrastructure, and water supply and effluent treatment in towns such as Kimpese would offset the negative cumulative impacts on this infrastructure that would occur from increased population, traffic, and electricity consumption. Development of this infrastructure would further bolster economic development of the

region.

Cumulative economic benefits for the area are important considering the absence of existing large scale economic activities. Positive impacts on the regional economy can be enhanced through promotion of up- and downstream business and technological opportunities. These benefits will be further enhanced through improved power supply brought about by this and projects in the vicinity. Cumulative positive impacts can be further enhanced through effective communication and information provision, community liaison, as well as through labour and human resources management.

Transport

The contribution to traffic on the N-1 as a result of this project alone is considered in Section 0 and 7.3.10. The most noteworthy cumulative impact of more than one cement plant in the region is the potential to significantly increase congestion on the N-1 in the short and medium term. Traffic volumes on the N-1 would increase over time. On the other hand, the existing rail line is underutilised and in the longer term multiple projects and/or increased congestion could provide the economic stimulus for an improved freight rail service.

Production of cement in the DRC has the potential to reduce the extent of cement imports through the Port of Matadi, thereby reducing the contribution of this traffic on the N-1. Traffic modelling to predict the net effect of substituting imports with in country production, or substituting transportation by road with transportation by rail, has not been conducted. However, it is reasonable to assume that the net effect on transportation of cement by road over the longer term would reduce due to a shift to rail, which would be enhanced if there is demand for rail transport from multiple producers. The extent to which cement production in the region reduces the proportion of imported cement would depend on (amongst other factors) the rate of economic development within the DRC as a whole.

The cumulative impact on road transport is likely to be higher in the short to medium term and diminish over time.

Ecology and biodiversity

Ecological impacts as a result of this project alone are considered in Sections 7.2.7 and 7.3.4. Owing to the relatively undeveloped nature of the area and the wide distribution of habitats (ecosystems) in the area, the cumulative impacts of the project on ecology are unlikely to be significant.

Cumulative ecological impacts could occur if numerous additional mining and industrial developments were to take place in the surrounding area. The most likely cumulative impacts of additional mining and industrial developments would be the loss and fragmentation of habitats and ecological processes, as well as loss of species of special concern. In-migration to the area in response to major future mining and industrial investments will likely lead to the same ecological impacts due to an increase in clearing of natural areas for agricultural purposes. Such in-migration will likely also result in an increase in charcoal production, causing increased deforestation of Gallery and Swamp Forest in the area.

Water Resources

Other cement projects within the Bas-Congo Region fall outside of the catchment of the Sansikua River and consequently will not cause a cumulative impact on this water resource. The spatial extent of groundwater impacts is unlikely to extend beyond NYA's concession area. The potential for cumulative impacts is therefore limited to activities from the communities within the area that might impact on groundwater resources. Projects / activities that could contribute to a cumulative impact

on groundwater resources, or to the Sansikua River, have not been identified.

Air quality

The distance between this site and other cement projects within the Bas-Congo region is substantial and air quality is good in the area. Potential cumulative impacts could occur as a result of the use of fossil fuels at these facilities. Short term cumulative impacts during the dry season, as a result of the burning of fields, may also occur. A regional air quality survey has not been conducted, and baseline data on air quality is qualitative.

Cumulative impacts from particulate emissions are limited to short term impacts during the dry season (PM10 or smaller) and are likely to be localised to the concession area. The short term nature, and limited spatial extent, reduces the significance of cumulative impacts from particulate matter. The community at Mbamba village is the most susceptible to these cumulative impacts.

Dispersion of SOx and NOx emissions have the potential to combine with emissions from other cement production facilities and impact on air quality on a regional scale. However, given relatively low density of these projects, and the existing good air quality, the cumulative impact although negative, is unlikely to exceed health standards.

Greenhouse Gas Emissions

As mentioned in the impact analysis, it is anticipated that the DRC has or will move from a position of being a net sink to a net emitter. This in effect enhances the impact of any additional GHG emissions from sources, such as the cement plant, over the anticipated long life spans of such projects. With economic growth in the DRC being a strong priority of Government and the associated expected increase in infrastructure spend, it can be reasonably expected that cement production in the country will increase (even taking into account potential imports) and that GHGs associated with this sector will increase. This will further add to the DRC's contribution to climate change and indicates that there needs to be a focus on this issue at plant level.

Health impacts

The new 400 kV SNEL powerline runs directly over Yuku Village. Powerlines of this magnitude are thought to result in impacts on the health and / or well-being of residents in the direct vicinity, resulting from electromagnetic radiation. For this reason (and possible physical displacement due to the powerline), relocation of the village by SNEL is planned. In addition to the powerline, the NYA project's proposed haul road route runs directly through or very close to the village, resulting in potential physical displacement, as well as noise and dust impacts on Yuku residents if the village were to remain in that position.

Cultural heritage

- Increased human presence in the mine area may further expose or damage heritage resources, especially the looting of furnace areas for copper slag and artefacts;
- Informal or smaller infrastructure developments outside the areas covered by ESIA and EMPP may impact or expose further heritage resources not currently documented and recorded; and
- Due to the increase of mining activity and development in the larger area, depletion of the archaeological record is at risk and therefore increases the importance of managing the recorded heritage resources in a responsible manner.

7.7.2 Cumulative impacts resulting from the NYA project

The NYA project itself will result in numerous potential impacts on local villages, most of which relate to health and safety (and well-being), and physical and / or economic displacement. While the individual impacts on a community might not necessarily have a high negative significance rating, the combination of the various positive and negative impacts on a single community also needs to be considered. To a certain extent positive impacts (such as job creation and economic development) may partially ameliorate negative impacts as communities may be more accepting of developments that benefit them. Multiple negative impacts on a single village however, may cumulatively result in a negative impact of higher significance than any of the individual impacts and in the extreme case justify relocation of that community. Impacts on the various villages affected by the project are listed in Table 7-98. Due to the multiple impacts involved, and the subjective nature of the relevant importance of each impact, a single cumulative significance rating on each village has not been determined.

Table 7-98: Potential project-related sources of cumulative impacts on nearby communities resulting from the NYA project

Village name	Key potential impact
Yuku Camp Village	Negative impacts: - Noise from blasting at the quarry (if in the morning) - Noise from haul road and operations at the quarry - Dust from the haul road - Road safety risks from vehicles using the haul road - Physical displacement due to haul road - Economic displacement due to project infrastructure - Visual impacts (loss of sense of place) from project infrastructure - Decreased access to natural resources - Reduced surface water quality and availability - Destruction of or reduced access to cultural heritage resources such as village cemetery Positive impacts: - Employment - Increased investment in the area
Mbemba	Negative impacts: - Noise from blasting at the quarry (if in the morning) - Safety risks relating to flooding and road safety - Economic displacement due to project infrastructure - Visual impacts (loss of sense of place) from project infrastructure - Decreased access to natural resources - Reduced surface water quality and availability Positive impacts: - Employment - Increased investment in the area

Mbamba	Negative impacts: - Noise from the operation of the plant - Dust and emissions from the operation of the plant - Light pollution from the plant - Noise from blasting at the quarry (if in the morning) - Close proximity of the plant - Safety risks arising from villages crossing the plant and project roads - Reduced water quality at the lake - Economic displacement due to project infrastructure - Visual impacts (loss of sense of place) from project infrastructure - Decreased access to natural resources - Reduced surface water quality and availability Positive impacts: - Employment - Increased investment in the area
Nkonda	Negative impacts: - Road safety from increased vehicles using the N1 - Noise from increased vehicles using the N1 Positive impacts: - Employment - Increased investment in the area

7.8 No-go option

If the project does not proceed further, there will not be any change in the existing status of the environment or a status quo will be maintained with regard to all environmental, social and economic factors. The investment potential of US Dollar 200 million, as proposed by the Project Proponents, will not be utilised with “Do Nothing” option.

8 Proposed Environmental Management Measures

The ESMP documents the management commitments that NYA will implement to mitigate negative impacts and enhance positive impacts. The management commitments have been selected from management recommendations developed by the specialists and an assessment of the technical, environmental and financial implications of the various options. The overall objective of all the management commitments is to ensure compliance with the legal and governance requirements.

On the basis of SRK's cumulative experience a suite of conceptual management and action plans have been prepared to support the management of social and environmental issues on site including:

- Waste Management Plan (Appendix 15)
- Emergency Preparedness and Response Plan (Appendix 16)
- Community Health and Safety Plan (Appendix 13)
- Labour and Human Resources Plan (Appendix 11)

These management plans are considered as conceptual in many instances due to the limited baseline data and incomplete project description. These plans should be considered as dynamic and should be updated and made operational as new information becomes available.

An Action Plan outlining specific studies and tasks that are still required to complete the impact assessment and improve on the accuracy of impact prediction and management planning is provided at the end of the ESMP. The tasks included in this action plan are considered critical for the achievement of GIIP.

The mitigation measures presented below are to be carried out by the project contractors, design team and project management team, as per procedures and policies specified by NYA and supervised by the EHS Manager.

8.1 Mitigation measures proposed in the ECTECH ESIA

The mitigation measures listed below are extracted from the ECTECH 2013 ESIA for the project, and are therefore commitments already made by NYA.

8.1.1 Mitigation Measures during the Construction Phase

Table 8-1: Mitigation measures for construction phase impacts (as per ECTECH 2013 ESIA)

Environmental Impact	Proposed Mitigation
AIR QUALITY	
Dust emissions during construction and ground works.	Development of procedures for: • water spraying roads and dusty materials stockpiles • covering vehicles carrying dusty materials on leaving the site to prevent materials being blown from the vehicles • speed limits on unpaved surfaces on site to limit dust.
GROUND & WATER	
Importation of pollutants already present within the materials to be used for filling and site leveling operations	Ensure that pollutants are not present in materials imported onto the site by appropriate selection of source material by THE Contractors and chemical analysis by NYA if required.
Accidental release of fuels, oils, chemicals,	Appropriate procedures and protocols to be established

hazardous materials, etc., to the ground, especially in the construction lay-down area, <i>during delivery to the site.</i>	and monitored for materials delivery and handling to ensure there are no spills.
Accidental release of fuels, oils, chemicals, liquid waste, hazardous materials, etc., to the ground, especially in the construction lay-down area, <i>during storage.</i>	All storage areas will have appropriate environmental security measures to prevent accidental release to ground.
Accidental release of fuels, oils, chemicals, hazardous materials, etc., to the ground, especially in the construction lay-down area, <i>during transport to the area of use.</i>	Appropriate procedures and protocols to be established and monitored for materials transport and handling whilst on the site.
Accidental release of fuels, oils, chemicals, hazardous materials, etc., to the ground, especially in the construction lay-down area, <i>during transport to the area of use.</i>	Appropriate procedures and protocols to be established and monitored for materials transport and handling whilst on the site.
Accidental release of fuels, oils, chemicals, hazardous materials, etc., to the ground, <i>during use</i> , for example, re-fuelling, maintenance, etc.	Appropriate procedures and protocols to be established and monitored for materials handling and use. Where possible, re-fuelling and maintenance areas will include some form of secondary containment.
Accidental release of liquid wastes <i>during removal</i> from site.	Appropriate procedures and protocols to be established and monitored for waste materials removal.
Accidental discharge of sanitary wastewater to ground and groundwater from the workers camp.	Sanitary waste will not be discharged to the ground. Contractors will provide modern Sewage Treatment Facilities.
Contamination of local water ways from proposed effluent plant discharge.	Ensure that the plant complies with IFC standards and other international guidelines. Final effluent should have no significant negative impact on the receiving water. The plant will be designed for the full load during construction.
Discharge of pollutants in water used for plant, equipment and vehicle washing to ground.	Washing activities will take place on areas with appropriate containment and procedures and protocols will be established and monitored to ensure that the preventative measures are sufficient to meet the effluent standards.
Increase of sediment load in natural aquatic receptors resulting from direct run-off disposal.	Minimization of excavations face during Construction. Temporary drainage grooves and sedimentation ponds for surface run-off collection. The topography is nearly flat.
Natural aquatic receptors degradation due to direct disposal of domestic type wastewater.	Construction of appropriate sewage system and wastewater treatment facility by Contractor. Effluent if any will meet the standards.
Groundwater contamination from leakage of polluting substances.	Usage of non-hazardous construction materials for human health and environmental protection. Storage of potential polluting materials in appropriate areas, including secondary containment. Any contaminated land occurred during construction will be directly removed and disposed of in accordance with local regulations for waste disposal.
WASTE MANAGEMENT	
Waste generation.	Introduction of waste storage and control procedures. Segregation and recycling of waste by EPC Contractor into metal components, plastics, glass separately.
ECOLOGY	

Further land take over (habitat loss) for temporary Construction Camp.	Build temporary construction camp on land that in due course will be re-used for NYA for other activities. Contractors/NYA will also restore, wherever possible to green areas such as the planting of grass, shrubs & trees.
Destruction of fauna and habitat (mammals, birds, reptiles, amphibians, invertebrates).	Further ecological/fauna survey at appropriate seasons and translocations monitored by the NYA specialist.
Increase in exploitative pressures on habitats neighboring the sites.	Conduct and implement further "Habitat Survey and Management Study", in close consultation with local officials & communities.
On ecology of surrounding area by temporary workforce as a result of removal of vegetation and the displacement of wildlife.	Education, monitoring and enforcement program. Adequate waste management and sanitation facilities. No permits will be provided to Contractors for any burning.
VISUAL IMPACTS	
Damage to the landscape character and visual amenity due to Introduction of incongruous features and activities.	Sensitive planning of site works and worker's compound. Advanced structure planning. Minimize lighting and night time workings.
NOISE & VIBRATION	
[Incorporating Transport]	
Noise from construction of new plant/quarry and link roads.	Good site management; Appropriate choice of machinery; Methods of working; Hours of working; efficient material handling.
Noise from traffic relating to construction using existing roads through local residential areas & cities	Define access routes to the site with the smallest number of properties in proximity to it. Keep vehicle movements to a minimum. Once link roads are completed, all construction traffic to/from the site should only use the link roads.
SOCIAL	
Worker - industrial emergency	Prearranged quality curative treatment in Kimpese Hospital for all emergencies.
Non-local worker living conditions and quality of life. Utility and service provision impacts on local villages.	Contractors will provide detailed specification of camp layout, facilities, and utility provision (and disposal) in accordance with identified international standards. NYA to monitor health and safety and terms and conditions of employment.
Disturbance and conflict in camp	In-camp codes of conduct and enforcement of key behaviors and reasonable use of alcohol shall be required.
Disturbance and /or conflict with local population.	Camp code of conduct upheld by workers and enforced by camp. Provision of employment and opportunities to local population to minimize hostility.
Potential for increased incidence of sexually transferable disease (STD) in local populations and amongst workers.	Preventative health awareness campaigns for STDs provided to foreign workers and targeted at key local locations / groups. Contractors will provide health checks and immunizations before expatriation.

8.1.2 Mitigation Measures during the Operation Phase

Table 8-2: Mitigation measures for operation phase impacts (as per ECTECH 2013 ESIA)

Environmental Impact	Proposed Mitigation
AIR QUALITY	
Release of combustion gas emissions from the kiln stack	Equipment design and primary operational management control techniques
Release of particulate emissions from the kiln, the	Bag filters & ESP – dust abatement using very stringent

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clinker cooler, the coal mill and the cement mill.	20 to 30 mg/Nm ³ standard.
Release of dust emissions from the quarry operations.	Use of best practice management techniques during extraction and loading of raw materials.
Release of combustion emissions from transport associated with transport of materials to and from the site.	Use of new, efficient vehicles, driver training to minimize emissions (e.g. prevention of over revving, shut off engines when vehicles not in use), proper maintenance, rationalization of traffic management system to optimize transport efficiency.
SURFACE WATER	
Increase of sediment content in surface due to fugitive dust dispersion.	For cement plant: Storm water management through ditches and or gutters and settlement ponds. For quarries: Quarry face will be kept minimal. Gradual rehabilitation (through landscaping and planting) of locations where extraction works have been completed. Storm water management through peripheral ditches and settlement pond.
Degradation of surface waters quality due to process water direct disposal or leakage of polluting materials.	For cement plant: Process water circulation is closed circuit including settlement tank for treatment. Storage of fuels for cement production in enclosed storage area. Tidying the plant on regular basis with mechanical sweepers removing dust collected on the streets and gutters. Thorough washing of surfaces in case of polluting materials spillages and further processing of collected washings as special waste. For quarries special considerations for clay quarry. Preventative maintenance of quality equipment, protocols and procedures.
Pollution of surface water due to release of harmful/untreated sewage.	The sewage treatment system will be sized for peak demand during construction phase and therefore will cope with demands during operational phase. No hazardous liquids will be released on to the sewage treatment system. The provision of a large balancing tank before final release will act as a storage unit in the event of accidental release into the sewage system.
Soil Erosion.	For cement plant: EP Contractor to design proper drainage system consistent with seasonal winds. For quarries: Proper Drainage design by the Contractor as well as gradual rehabilitation of location where extraction works have been completed.
GROUNDWATER	
Ground and Groundwater contamination.	For cement plant and quarries: Secondary containment for potential polluting materials. Any contaminated land removal and disposal in accordance with local and general international requirements.
SOILS	
Accidental release of fuels, oils, chemicals, hazardous materials, etc., to the ground during delivery to the site.	Appropriate procedures and protocols to be established and monitored for materials delivery and handling. NYA will have, at all times, clean up kits available.
Accidental release of fuels, oils, chemicals, liquid waste, hazardous materials, etc., to the ground during storage.	All storage areas will have appropriate environmental security measures to prevent accidental release to ground. EP Contractor to design the plant for berms /detrimental retainer walls that are designed for 1.5 times the capacity of any such storage tank.
Accidental release of fuels, oils, chemicals, liquid	Appropriate procedures and protocols to be established

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waste, hazardous materials, etc., to the ground during transport to the area of use.	and monitored for materials transport and handling whilst on the site.
Accidental release of fuels, oils, chemicals, liquid waste, hazardous materials, etc., to the ground during use, for example, re-fueling, maintenance, etc.	Appropriate procedures and protocols to be established and monitored for materials handling and use. Where possible, re-fuelling and maintenance areas will include some form of secondary containment.
Accidental release of liquid wastes during removal from site.	Appropriate procedures and protocols to be established and monitored for liquid waste materials removal.
Accidental discharge of sanitary wastewater and wastewater to ground.	Sanitary wastewater will not be discharged to the ground. Wastewater sumps and pits will be properly designed. Pipe-work will be inspected periodically by NYA and recycle water wherever possible.
Discharge of pollutants in water used for plant, equipment and vehicle washing to ground.	Washing activities will take place on areas with proper drainage systems with containment and treatment. Effluent, if any, will meet the standards.
ENERGY AND GREENHOUSE GASES	
Use of solid fuels and direct and indirect greenhouse gas emissions.	Ensure that combustion and processing is as efficient and in full compliance with EU & IFC requirements for cement plant and maintenance and monitoring by NYA.
MATERIAL USE AND WASTEWATER MANAGEMENT	
Storage of solid and liquid wastes.	Inspection of all waste storage areas to ensure appropriate identification, segregation and containment.
Waste management	Arrangement of all solid waste management licenses and permits. Establishment of waste management disposal/recycling techniques and appropriate choice/negotiation of contractor by NYA. Establishment of filter dust handling procedures and choice of the contractors. Hazardous waste disposal techniques to be established. Review of waste minimization and recycling options for all waste will be exhaustive
ECOLOGY	
Dust deposition on leaves leading to loss of vegetation productivity and health.	The planting of tree lines by Contractors during the construction phase to provide local screening in accordance with ecology expert's recommendation as a mean to reduce dust emissions at the source. NYA will ensure that the trees are planted to aid in the prevention of dust accumulation on foliage outside the plant.
Productivity and quality of vegetation for herbivores reduced.	In-plant road will be paved. Quarry access roads will be clay and will be periodically wetted to minimize any impact.
Disturbance of wildlife by noise.	Reduced at source and less than 60 dB at the plant fence.
Disturbance of wildlife by human presence and activities.	Environmental educational program. On-site ecologist by NYA.
Wildlife "Road-Kills" along access roads.	Road Warning Signs. Driver briefings.
VISUAL IMPACTS	
Damage to the landscape character and visual amenity due to introduction of incongruous features and activities	Proper design of light sources by establishing and effective balance between safety/security and environmental sensitivity. Sensitive and uniform (paint specifications) coloration of cement plant and vehicles. Minimize the time between working and restoration phase of quarry
TRAFFIC	
Increased heavy vehicles traffic both locally and	Maximize the use of the rail network for bulk deliveries

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nationally.	and abnormal loads. Restricting delivery hours to reduce noise nuisance; avoid heavy truck movements in the night hours will be considered whether deliveries should be scheduled to avoid peak times to reduce congestion; heavy construction traffic will be subject to a traffic management plan, as necessary.
NOISE AND VIBRATION	
Noise from cement plant	None recommended unless the plant and various installation differ significantly from similar established cement plants used as a reference. EU directive for noise will be followed by FLS.
Noise from quarrying activities	Good site management; Appropriate choice of machinery; Methods of working; Hours of working; Efficient material handling.
SOCIAL IMPACTS	
Increased Employment. (Positive Change)	Measures to maximize local employment. Recommended: Local recruitment and training. Prioritization of employment of Project Affected People (PAP's) Identification of targets of local people to be employed by skill levels.
Increased National tax and budget (Positive Change).	Assistance to villagers to formulate projects and strengthen advocacy. Money from improved budget can be used to realize these objectives. NYA may offer skills training for improved planning & project formulation.
Electrical and other infrastructure improvements (neutral or positive if realized).	NYA will be self-sufficient from the National Grid so there is no mitigation.
Extended and improved road and implications for local economy (minor/moderate beneficial).	Regulations relating to roadside and commercial activities to be adhered to by business persons and enforced by Community. Monitoring of health, road safety issue. Curative and preventive action to be taken if issues identified by monitoring.
Loss of Land and property Yuku Camp Village household and compensation (minor benefit/minor adverse)	An appropriate compensation plan will be developed and agreed upon. Compensation Plan & Framework Documents will be prepared.
SAFETY RISKS	
Hazards associated with development of new roads from main Highway to the cement plant and from the quarry to the cement plant.	With regards to identified 'high' risks: Design measures to ensure landslips/falling rocks do not cause accidents Inclusions of pedestrian walkways and crossings Lighting, particularly at intersections. Planned access and parking. Risk of accident shall be reduced by implementation of education (road safety awareness) programs and liaison with the local communities as well as driver training programs and implementation of near-miss/accident reporting procedures. Communities to consider the need for additional safety bylaws.

8.1.3 Other Mitigation Measures

Occupational Safety and Health

The ECTECH ESIA listed the following mitigation measures:

Some the measures have already been discussed in Section-6, addition measures in this respect are discussed below:

Construction and operational activities could expose workers to health and safety risks. In particular, the following activities could have negative health impacts: noise and dust; working with heavy equipment (strains and accidents); working in confined spaces (fumes could mean respiratory impacts), heavy lifting, storage, handling and use of dangerous substances and waste (strains and accident risks), and working under noisy conditions (hearing and stress/psychological impacts). Excavations and transportation of materials may cause further health and safety negative impacts.

Occupational health and emergency health services for both the construction labour force and operations employees will be at risk of negative health impacts which cannot be quantified, until clear plans emerge. The need for an on-going, proactive workers health and safety plan applies for the full Life Cycle of the Project, particularly with regard to the operational phase for the employees.

Without an operational/fully functional Health and Safety plan and health training for workers the risks for worker health and safety are high.

Mitigation Measures:

The Company needs to demonstrate a GIIP occupational health scheme, and share plans for the health maintenance and emergency services for their employees so that local health infrastructure capacity is not put under greater strain. An important mitigation is the forming of partnerships of understanding and relationship building with local health care providers;

Company's contractors should adopt strict construction and operation practices with GIIP and health and safety training to ensure the safety of its workers.

Green House Gases

The ECTECH ESIA listed the following mitigation measures:

The CO₂ emissions from portland cement manufacturing are generated by two mechanisms. As with most high-temperature, energy-intensive industrial processes, combustion of fuels to generate process energy releases substantial quantities of CO₂. Substantial quantities of CO₂ also are generated through calcining of limestone or other calcareous material. This calcining process thermally decomposes CaCO₃ to CaO and CO₂. Typically, portland cement contains the equivalent of about 63.5 percent CaO.

Consequently about 1.135 units of CaCO₃ are required to produce 1 unit of cement, and the amount of CO₂ released in the calcining process is about 500 kilograms (kg) per tonne of portland cement produced. Total CO₂ emissions from the pyro-process depend on energy consumption and generally fall in the range of 0.85 to 1.35 tonnes of CO₂ per tonne of clinker.

IFC EHS Guidelines for Cement and Lime Manufacturing (April 30, 2007, Table-5 (see Figure 8-1 below) indicates the range of CO₂ output from cement plant

Table 5. Emission and waste generation.		
Outputs per unit of product	Unit	Industry benchmark
Waste	kg/t	0.25–0.6 ^a
Emissions		
Dust	g/t equivalent cement	20–50 ^a
NO _x	g/t equivalent cement	600–800 ^b
SO _x	kg/t	0.1–2.0 ^{a,h}
CO ₂		
From decarbonation ⁱ	kg/t	400–525 ^{a,e,f,h,k}
From fuel ^j	kg/t equivalent cement	150–350 ^{a,e,f,h}
^a Buzzi–Unicem (2004). ^b IPCC (2001). ^c Ernest Orlando Lawrence, Berkeley National Laboratory (2004). ^d NRCan (2001). ^e CIF (2003). ^f Italcementi Group (2005). ^g Environment Canada (2004). ^h Lafarge (2004). ⁱ Influenced by the variable quantities of fly ash and other additives used. ^j CO ₂ emissions from waste incineration (at least from the biodegradable fraction) are regarded as neutral in several countries. ^k World Business Council on Sustainable Development, Cement Sustainability Initiative, 2002.		

Figure 8-1: Emission and waste generation guidelines (source: IFC EHS Guidelines for Cement and Lime Manufacturing (2007))

The other sources of CO₂ emissions stemming from cement manufacturing operations include transportation equipment used in the mining and transport of raw and finished materials. The direct CO₂ emission intensity of fuels depends on the carbon content of the fuel which varies by type of fuel and further may vary within a given fuel type. The emission intensity of coals, for example, will vary depending on its geologic source.

In general, emissions of CO₂ from the cement manufacturing sector can be reduced by:

- Improving the energy efficiency of the process,
- Shifting to a more energy efficient process (e.g. from wet and long dry to preheater/precalciner process),
- Replacing high carbon fuels with low carbon fuels,
- Applying lower clinker/cement ratio (increasing the ratio additives/cement): blended cements, and/or
- The technology offered by FLS is efficient, for the plant capacity, using dry process and preheater/precalciner process. Coal will be used as fuel. Most of the Cement produced will be CEM-II which has lower clinker to cement ratio.

Forests are both a part of the global warming problem and part of the solution. Unlike other emission sectors, forests have the unique capacity to remove carbon dioxide (CO₂) from the atmosphere and store this gas as carbon for long periods of time in their biomass (e.g., trunks, branches, leaves, roots, etc.).

While forests are a natural CO₂ reservoir, or “sink”, they are also a source of CO₂ emissions. On a global level, forests are responsible for roughly 20 – 25% of overall CO₂ emissions, largely to due

conversion of forestland and the associated depletion of carbon stocks. When forests are disturbed through events such as conversion to development or agriculture, fire or harvest, the carbon that is stored in tree biomass is emitted to the atmosphere. When harvested for timber, a percentage of forest carbon is stored in wood products for periods of time. These wood products decay over time, releasing CO₂ at an average decay rate of 2% annually.

The Project can reduce greenhouse gas emission through activities that increase forest carbon stocks on the landscape in concession area.

The African Development Bank is supporting a project to the development of community agroforestry in the Bas Congo & the Bateke/Kinshasa Plateaus. This project is in line with the Growth and Poverty Reduction Strategy Paper (GPRSP) of the DRC.

The Ministry of Environment, Nature Conservation and Tourism (MECNT) of the Democratic Republic of Congo (DRC) plans to develop community agroforestry as a means of reducing poverty and mitigating the effects of climate change. Consequently, the overall objective of the Project to Support Agroforestry in the Democratic Republic of Congo is to reduce deforestation and forest degradation, and alleviate poverty in the communities of the two project areas namely: Bateke and Bas Congo plateaus.

Specifically, the project, which will provide support to the entire agroforestry subsector in the two project areas, entails: (i) the training of one thousand local stakeholders in the development of nurseries and agroforestry; (ii) the reforestation of 3500 ha of farm and forest crop lands; and (iii) support in terms of provision of infrastructure, equipment and training for the conservation, processing and marketing of agricultural products and fuel wood.

- In order to mitigation GHG generation, NYA can support similar project in concession area through the Regional / Territorial Forest Departments, by developing nurseries and provision of samplings. Oil palm, which can survive in savannah forests along water courses can be a good source of GHG reducers as well as income for local community.

Coal Transportation

The ECTECH ESIA listed the following mitigation measures:

Coal unloading at Matadi Port and transportation to cement plant site has the potential to generate fugitive dust. The fugitive dust can be reduced by:

- Importing coal without fines and larger sizes.
- Importing coal with moisture content ranging at 7% to 8%. This will also lessen fire hazard.
- Using tarpaulin covers during transportation.

8.2 Additional mitigation measures arising from SRK ESIA update

Over and above the mitigation measures listed in Section 8.1, the following mitigation measures are proposed to mitigate the impacts assessed in this ESIA update.

8.2.1 Mitigation Measures during Construction Phase

Table 8-3: Mitigation Measures during Construction Phase

Environmental Impact	Proposed Mitigation / enhancement measures
VISUAL IMPACTS	
Impact VI1: Loss of sense of place affecting local communities due to site clearing and construction activities	• Minimize the disturbed footprint as far as practically possible. • Undertake stripping, stockpiling and stockpile

Environmental Impact	Proposed Mitigation / enhancement measures
	management as per the Soil Management Plan (Section 9.5). • Revegetate and landscape disturbed areas as soon as possible, to reflect the surrounding topography and vegetation as much as possible. • Consider the use of screening tools such as dense vegetation where practical and appropriate to the surroundings. • Clear vegetation in phases so that only those areas required for immediate development are cleared. • Implement the waste management plan for the project (Appendix 15). • Refer to dust control measures under Impact AQ1 (Section 7.1.3).
SOIL, LAND CAPABILITY AND LAND USE	
Impact SL1: Placement of project infrastructure, resulting in a transient loss of soil resource, and change in soil characteristics, land capability and land use	• Minimize the disturbed footprint as far as practically possible. • Undertake stripping, stockpiling and stockpile management as per the Soil Management Plan (Section 9.5), for reuse on footprint. • Implement livelihood restoration and compensation measures in areas where livelihood are impacted by the loss of agricultural lands. • Implement the Closure Management Plan as described in Section 9.9 to support the proposed project
Impact SL2: Placement of permanent project infrastructure, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use	• Contain the disturbance to as small a footprint as practically required for the activity. • Preserve topsoil for rehabilitation, by stripping soil during construction as per Soil Management. • Assist community members where livelihood impacted with establishing new agricultural areas on land of equal or better land capability. • Implement the Closure and Rehabilitation Plan as described in the report to support the proposed project
Impact SL3: Spillage of chemicals and seepage from waste resulting in permanent loss of soil resource, and change in soil characteristics, land capability and land use	• The preparation of procedures to ensure that spillage during mobile equipment maintenance is minimized. • The provision of appropriate secondary containment in areas where hydrocarbons, solvents and other potentially hazardous materials are stored. • Implement emergency preparedness and response measures plan as described in Section 9.6.
Impact SL4: Site clearance resulting in a permanent loss of soil resource, and potential change in soil characteristics, land capability and land use as a result of increased erosion	• Minimize the area of disturbance. • Implement storm water control measures around infrastructure. • Appropriate topsoil stockpile management
AIR QUALITY	
Impact AQ1: Increase in PM ₁₀ emissions resulting from land clearing, earthworks, and vehicular movement	• Apply dust suppressants to sections of roads used routinely by vehicles that pass through and close to villages; • Design road alignments to minimize travel distances and eliminate unnecessary traffic;

Environmental Impact	Proposed Mitigation / enhancement measures
	• Locate stockpiles within site boundaries considering the location of potential sensitive receptors and the predominant wind direction; • Cover vehicles carrying dusty materials to prevent materials being blown from the vehicles; • Set speed limits to minimize the creation of fugitive dust within the project boundary; • Development of routine air quality monitoring program.
Impact AQ2: Increase in gas (SO ₂ , NO _x , CO and VOCs) emissions resulting from vehicle exhaust emission and biomass burning	• Limit vehicle idling and keep vehicles well maintained to minimize particulate and gaseous emissions; • Where possible, biomass burning should be considered and a schedule should be maintained to allow for pollutants to disperse into the atmosphere in a short amount of time; • Biomass burning should be conducted during the day and during the summer months; and • Development of routine air quality monitoring program
WATER RESOURCES	
Impact WR1: Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste	• Where contaminants are transported along construction roads, emergency contaminant and mitigation measures must be developed to minimize impacts should accidental spillages occur along the transport routes • Equip all trucks and equipment carrying fuels or oil with spill response materials and train personnel in the use of such materials • Store all potential sources of contamination in secure facilities with appropriate Storm Water management systems in place to ensure that contaminants are not released to the water resource through Storm Water runoff
Impact WR2: Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads	• Construct access roads and infrastructure in a way that sensitive ecosystems are avoided; • Ensure that proper designs are prepared and implemented to manage stormwater runoff in a manner that minimizes sediment transport to the receiving water resource and minimizes erosion along runoff channels.
Impact WR3: Contamination of groundwater resulting from seepage from sewage and other waste.	• Manage waste in accordance with the Waste Management Plan (Appendix 15) • Prioritise construction of a properly lined and designed waste landfill site and sewage treatment system as early as possible during construction
NOISE AND VIBRATION	
Impact NV 1: Continuous noise impact on Mbemba Village resulting from night-time construction at the quarry	• Restrict construction activities at the quarry to daytime hours 07:00 am to 07:00 pm.
Impact NV 2: Air-blast noise impact on Mbemba Village resulting from blasting at the quarry during construction	• Restrict construction phase blasting at the quarry to afternoon hours 14:00 to 17:00 pm.
ECOLOGY AND BIODIVERSITY	
Impact EB1: Loss of savannah habitat due to site clearing and earthmoving activities	• Site clearing to be conducted sequentially, not all at once; • Sequential rehabilitation to be conducted as

Environmental Impact	Proposed Mitigation / enhancement measures
	soon as quarrying of an area has been concluded; • All cleared or degraded areas of savannah that do not form part of NYA's operations must be rehabilitated to a stable ecological state, as close to the pre-construction condition as practically possible; • Topsoil to be stockpiling separately from overburden for rehabilitation purposes, and protected against loss from run-off; • A Rehabilitation Plan to be developed and implemented, with different objectives and rehabilitation approaches established for each habitat/ecosystem. Development and implementation of the Rehabilitation Plan to be overseen by an appropriately qualified botanist/ecologist; • A Biodiversity Action Plan to be developed to inform Nyumba ya Ikiba's protection and management of biodiversity in the entire concession, taking cognisance of ecosystem services currently utilised by the local communities. The initial Biodiversity Action Plan should be informed by comprehensive baseline surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The Action Plan must be updated at least every 5 years to facilitate adaptive management, or more frequently if required.
Impact EB2: Loss of forest habitat due to site clearing and earthmoving activities	• Gallery and Swamp forest to be avoided to the greatest practical extent possible; • A No-Go buffer of 50 m to be established around the Gallery forest present in the north of the proposed topsoil and overburden stockpile. No spoiling of material may be undertaken upgradient of this Gallery Forest. No spoiling of material to take place to the west of the existing (most western) road to the proposed spoil site, to avoid impacts to the extensive swamp and Swamp forest system west of the road; • The proposed haul road should be constructed via an upgrade of the existing road to the west of the current staff camp, as opposed to the development of a new road through/over the Yuku River to the east of the camp; • Roads and powerlines to be aligned to avoid Gallery and Swamp forest to greatest practical extent possible; • Re-shaping of slopes near Gallery and Swamp forest to be avoided to the greatest practical extent possible; • Site clearing to be conducted sequentially as required, not all at once; • Remaining Forest habitats that has been degraded during the construction phase must be restored to their natural, pre-construction condition; • Spoiling of material to be conducted sequentially

Environmental Impact	Proposed Mitigation / enhancement measures
	and concentrated in a single area at a time to the greatest practical extent possible; • A Biodiversity Action Plan to be developed to inform Nyumba ya Ikiba's protection and management of biodiversity in the entire concession, taking cognisance of ecosystem services currently utilised by the local communities.
Impact EB3: Loss of aquatic habitat due to site clearing and earthmoving activities	• Construction in or near to wetlands, swamps, streams and rivers must be avoided to the greatest practical extent possible, including the road and powerline alignments; • The plant, railway siding and haul road must not be moved any closer to the Kawenga wetland (immediately west of plant) and no construction or earthmoving activities may take place within 50m of the wetland and the swamp surrounding it. The plant site must be fenced and no slope/bank modifications may be conducted along the eastern boundary of the plant site; • The proposed haul road should be constructed via an upgrade of the existing road to the west of the current staff camp, as opposed to the development of a new road through/over the Yuku River to the east of the camp; • No spoiling of material to take place to the west of the existing (most western) road to the proposed spoil site, to avoid impacts to the extensive swamp and Swamp forest system west of the road; • A stormwater management plan must be developed for both the construction and operational phases of the project, with particular attention paid to minimising increased sedimentation of the wetlands and swamps; • The largest practically possible size of culvert/s to be installed at any stream/swamp crossings, particularly at the intersection of the proposed haul road and current railway line, to minimise impacts on the hydrological regime and habitat loss of the streams, wetlands and swamps present; • The alignment of the new powerline must avoid the southern catchment of the Mbamba wetland (immediately east of plant) to the greatest practical extent possible; • A No-Go buffer of 100 m should be established around all other wetlands, with the exception of the proposed roads, where site clearing and bank modification must be minimised the greatest practical extent possible; • Aquatic habitats and areas immediately adjacent to them that have been degraded during the construction phase must be restored to their natural, pre-construction condition; • All other cleared or degraded areas that do not form part of NYA's operations must be rehabilitated to a stable ecological state as close to the pre-construction condition as practically

Environmental Impact	Proposed Mitigation / enhancement measures
	possible; • A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession, taking cognisance of ecosystem services currently utilised by the local communities.
Impact EB4: Loss or disturbance of species of special concern due to site clearing and construction activities	• Sessile fauna present at construction sites to be relocated by relevant ecological experts prior to the commencement of site clearing and construction; • Site clearing to be conducted sequentially and from one corner of the site to the other, to enable highly mobile species to leave the construction area; • No fauna are to be hunted or destroyed by any project personnel; • An environmental education training programme to be developed and implemented, including regular refresher sessions; • Effective penalties (e.g. fines) must be imposed for the hunting or harm to fauna by any staff; • A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession.
Impact EB5: Loss or degradation of ecological processes due to site clearing and construction activities	• No diversions of any of the rivers, streams, wetland and swamps must take place; • The ecological water requirements of the aquatic ecosystems should be determined. Water abstraction from any of the rivers and from groundwater must not exceed levels that result in the ecological water requirements of the aquatic ecosystems being compromised. Abstraction from the wetlands and swamps must not be allowed; • Construction in or near to wetlands, swamps, streams, rivers, Gallery and Swamp forest must be avoided to the greatest practical extent possible, including the road and powerline alignments; • The plant, railway siding and haul road must not be moved any closer to the Kawenga wetland (immediately west of plant) and no construction or earthmoving activities may take place within 50m of the wetland and the swamp surrounding it. The plant site must be fenced and no slope/bank modifications may be conducted along the eastern boundary of the plant site; • The proposed haul road should be constructed via an upgrade of the existing road to the west of the current staff camp, as opposed to the development of a new road through/over the Yuku River to the east of the camp; • A stormwater management plan must be developed for both the construction and operational phases of the project, with particular attention paid to minimising increased sedimentation of the wetlands and swamps; • The largest practically possible size of culvert/s to be installed at the intersection of the proposed

Environmental Impact	Proposed Mitigation / enhancement measures
	access road and railway line, to minimise impacts on the hydrological regime and habitat loss of the wetlands and swamps present; • The alignment of the new powerline must avoid the southern catchment of the Mbamba wetland (immediately east of plant) to the greatest practical extent possible; • A No-Go buffer of 100 m should be established around all other wetlands, with the exception of the proposed roads, where site clearing and bank modification must be minimised to the greatest practical extent possible; • A Biodiversity Action Plan to be developed to inform Nyumba ya Ikiba's protection and management of biodiversity in the entire concession, taking cognisance of ecological processes. • Natural fire regimes in the study area to be allowed to continue, or active management must be instituted to mimic natural regimes as advised in the Biodiversity Action Plan.
Impact EB6: Fragmentation of habitats and ecological processes due to positioning of project infrastructure	• Wetlands, swamps, streams and rivers to be avoided to the greatest practical extent possible, including the road and powerline alignments; • The proposed haul road should be constructed via an upgrade of the existing road to the west of the current staff camp, as opposed to the development of a new road through/over the Yuku River to the east of the camp; • The largest practically possible culvert/s to be installed at the intersection of the proposed access road and railway line, and all other river/stream/wetland/swamp crossings, to minimise impacts on the aquatic ecosystems; • A No-Go buffer of 100 m to be established around all other wetlands, with the exception of the proposed roads, where site clearing and bank modification must be minimised to the greatest practical extent possible. The powerline alignment to avoid the southern catchment of the Mbamba wetland (immediately east of plant) to the greatest practical extent possible.
Impact EB7: Modification or degradation of aquatic habitats due to altered hydrological regimes and surface or groundwater quality	• No river diversions or bank modifications to be conducted on local Rivers; • Wetlands, swamps, streams and rivers to be avoided to the greatest practical extent possible, including the road and powerline alignments; • The largest practically possible culvert/s to be installed at the intersection of the proposed access road and railway line, to minimise impacts on the hydrological regime and habitat loss of the wetlands and swamps present; • The powerline alignment to avoid the southern catchment of the Mbamba wetland (immediately east of plant) to the greatest practical extent possible; • The plant, railway siding and haul road must not be moved any closer to the Kawenga wetland (immediately west of plant) and no construction

Environmental Impact	Proposed Mitigation / enhancement measures
	or earthmoving activities may take place within 50m of the wetland and the swamp surrounding it. The plant site must be fenced and no slope/bank modifications may be conducted along the eastern boundary of the plant site; • The proposed haul road should be constructed via an upgrade of the existing road to the west of the current staff camp, as opposed to the development of a new road through/over the Yuku River to the east of the camp; • A No-Go buffer of 100 m to be established around all other wetlands, with the exception of the proposed roads, where site clearing and bank modification to be minimised to the greatest practical extent possible; • A weir or gabion system must be constructed at the toe of the Kawenga and Mbamaba wetlands if increased run-off into these wetlands results in associated erosion immediately downstream of these systems. The weirs must be constructed to maintain the natural water levels of the wetlands and must not facilitate increased flow out of the wetlands; • A stormwater management plan to be developed for all project components to address stormwater run-off volumes, velocity, water quality to minimise impacts on natural areas; • Leak and spill management systems to be in place at all potential major sources of pollution such as fuel, lubricant and hazardous product storage facilities, vehicle servicing areas, and workshops; • All plant components and vehicles to be serviced within the designated workshop areas; • A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession.
Impact EB8: Introduction of alien invasive plants due to site clearing and disturbance of vegetation	• Minimise cleared or disturbed areas; • The specification for plant (machinery) contractors must include the washing of plant prior to it being dispatched to the study area; • A Biodiversity Action Plan to be developed to inform Nyumba ya Ikiba's protection and management of biodiversity in the entire concession; • A programme for the control of alien invasive plants in the concession to be developed and implemented as a component of the Biodiversity Action Plan.
Impact EB9: Impeded photosynthesis and transpiration rate of plants due to dust generation	• Dust suppression methods (e.g. watering) must be instituted at cleared areas, construction sites, and material and overburden/topsoil stockpiles on at least a daily basis when high dust generating conditions are prevalent.
TRAFFIC	
Impact T1: Impact of construction related traffic on utilisation capacity on the N-1	• Widening of the N-1 at the access road to allow for turning lanes would reduce the potential for accidents and congestion at this intersection. • Clear signage and traffic calming measures on

Environmental Impact	Proposed Mitigation / enhancement measures
	the N-1 warning motorists of the intersection would reduce potential traffic safety impacts at this intersection. • Truck staging area and/or rest area would enable trucks to exit the N-1 safely, and enable site staff to schedule deliveries in an orderly manner. • Provision of temporary on-site accommodation for construction personnel would limit the volumes of daily commuter traffic to the project site; • Provision of dedicated buses for construction personnel not accommodated on the site would reduce daily commuter traffic to the project site; • Schedule the delivery of materials outside peak traffic times.
Impact T2: Impact of construction related traffic on traffic flow in Matadi	• Schedule the delivery of materials and equipment outside peak traffic times. • NYA to specify maximum loads for shipping of equipment to site (size and weight).
Impact T3: Safety impacts to local communities and other road users due to increased road accident rates during construction	• Widening of the N-1 at the access road to allow for turning lanes would reduce the potential for accidents and congestion at this intersection. • Clear signage and traffic calming measures on the N-1 warning motorists of the intersection would reduce potential traffic safety impacts at this intersection. • A maintenance schedule for all vehicles directly under the control of NYA must be developed and implemented to ensure on-going roadworthiness of vehicles. Suppliers, contractors, and sub-contractors must be instructed to implement the same maintenance schedule. • Random inspections for roadworthiness of all vehicles entering or leaving the site must be implemented
POPULATION & DEMOGRAPHIC MOVEMENTS	
Impact PD1: Influx of potential job seekers into the area and associated risks	• Optimise the use of local labour as far as practically possible as outlined in the Labour and Human Resources Management Plan (Appendix 11). • Develop a code of conduct with which contractors and their employees must comply. The code should deal with the interaction with local communities and substance abuse among other things. • Implement the Stakeholder Engagement Plan (Appendix 17) which clarifies the principles of engagement with community and other stakeholders, sets in place appropriate liaison forums and describes the grievance management procedure to be adopted by NYA. • Implementation of a programme of HIV/AIDS screening, counselling and (where necessary) treatment. • Develop and communicate a clear and concise employment and recruitment policy to prevent opportunistic job seekers from settling in the area (Appendix 17)

Environmental Impact	Proposed Mitigation / enhancement measures
HEALTH & SAFETY	
Impact HS1: Increased chances of the spread of communicable diseases such as HIV/AIDS and STDs linked to influx of predominantly male job-seekers and workers	• Develop a comprehensive HIV/AIDS program to employees through employee wellness programmes which should include the following: ○ Awareness campaigns targeting project workers, senior management, contractors, sub-contractors and their spouses, communities near project facilities, risk groups (commercial sex workers, truck drivers) ○ Prevention, voluntary counselling for HIV testing, as well as anti-retroviral treatment for employees and surrounding communities. There are already HIV/AIDS programs developed by Kimpese Hospital, which NYA could potentially be involved in.
Impact HS2: Increased pressure on healthcare infrastructure due to project related influx	• Update an influx management plan as per management measures noted under Impact PD1. • Develop an MOU with the Local Healthcare Centres in Minkelo and Kimpese for service provision to the local workforce and their dependents. • Identify NGOs in the area that might support operations at the Minkelo Clinic and Kimpese Hospital, with special focus on refurbishment of key areas, equipment and building maintenance, as well as, improved healthcare management information systems. • Develop and implementation community development/sustainability plans to support infrastructure development in the area
Impact HS3: Increased risk of accidents and injuries to communities from improved roads and additional traffic	• Awareness campaigns in neighbouring communities, particularly at Nkonda village, with a focus on school children and mothers, about risks related to traffic • Enforcement of speed limits and sanctions for any personnel found in violation of speed limits, including senior staff and contractors' and sub-contractors' employees • Appropriate signalling of moving heavy machinery, and escort vehicles where needed • All construction drivers to be given safety education focussing on speed and conflicts between pedestrians and cyclists. • Advanced warning signs including sirens to be erected at locations of high pedestrian and cyclist activity
Impact HS4: The visible presence of DRC police within the project area, and their secondment as a subcontractor for the mine security	• Develop a code of conduct for police personnel, especially in relation to handling community violence • Proper screening of appointed security personnel to ensure they were not implicated in human rights abuses in the past
LAND AND NATURAL RESOURCES	
Impact LN1: Physical displacement of households residing at Yuku Village and the protection of vulnerable groups	• SRK Consulting has been contracted to develop a Resettlement Action Plan (RAP) to identify beneficiaries, (including vulnerable groups such as women and children headed households) compensation measures and assistance as well as livelihoods restoration measures. • Compliance with IFC's Performance Standard 5 "Land Acquisition and Involuntary Resettlement", which has the following objectives: ○ To avoid or at least minimize involuntary

Environmental Impact	Proposed Mitigation / enhancement measures
	resettlement wherever feasible by exploring alternative project designs; ○ To mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of land by i) providing compensation for loss of assets at replacement cost; and ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected; ○ To improve or at least restore the livelihoods and standards of living and displaced persons; ○ To improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.
CULTURAL HERITAGE RESOURCES	
Impact CH1: Indirect damage to Iron Age archaeological resources through land transformation activities	• Demarcate sites prior to construction, facilitating preservation of the site by avoidance. • The work activities can be monitored during this phase to successfully mitigate any chance finds. • A CHMP should be developed to manage and conserve the sites located on the periphery of the development footprint. This plan should include all sites recorded in the project area and make provision for communication channels to follow in the case of chance finds.
Impact CH2: Indirect damage to cemeteries through land transformation activities	• Demarcate Site 36 prior to construction, facilitating preservation or accidental impact of the site by avoidance. In the case of Site 16 this will have to be agreed with by family members. • If Site 16 is to be preserved in-situ the site will have to be fenced off with an access gate for family members. • A CHMP should be developed to manage and conserve the sites located on the periphery of the development footprint. This plan should include all sites recorded in the project area and make provision for communication channels to follow in the case of chance finds.
Impact CH3: Damage to all other identified archaeological and cultural resources through land transformation activities	• A CHMP will ensure that the sites are monitored and protected from any adverse development effects.
ECONOMIC IMPACTS	
Impact EC1: Local and regional benefits resulting from increased Revenue to Government	• None
Impact EC2: Stimulation of increased regional investment in the DRC Economy	• None
Impact EC3: Generation of direct, indirect and induced employment and income	• Stipulate in the Recruitment Plan mechanisms to employ local workers if applicants with the appropriate skills are available. • Procure goods and services locally, if available. • Work closely with the community before and during the project to identify and publicise skills and resources that the local community could provide. This should take place before

Environmental Impact	Proposed Mitigation / enhancement measures
	construction commences. Establish relevant mechanisms in the relevant social and labour plans.
ECOSYSTEM SERVICES	
Impact ES1: Reduced availability of natural resources and ecosystem services to local communities	• Comply with best practice standards for air emissions, water (stormwater and effluent) discharge quality and solid waste disposal to minimise impacts on ecosystem services. • Implement mitigation measures recommended in Section 7.1.9 to minimise impacts on ecological resources. • Implement mitigation measures recommended in Section 7.2.11 and the Resettlement Action Plan and Sustainable Development Plan (Appendix 19 and 20) to maximise community resilience and ensure fair compensation where resources are directly affected.

8.2.2 Mitigation Measures during Operation Phase

Proposed mitigation / enhancement measures to manage potential impacts during the operation phase of the project are presented in Table 8-4 below.

Table 8-4: Mitigation Measures during the Operation Phase

Environmental Impact	Proposed Mitigation / enhancement measures
AIR QUALITY	
Impact AQ3: PM ₁₀ emissions due to activities at the quarry and the vehicle entrainment of dust affecting air quality of nearby villages	• Apply dust suppressants to sections of roads used routinely by vehicles that pass through and close to villages; • Design road alignments to minimize travel distances and eliminate unnecessary traffic; • Locate stockpiles within site boundaries considering the location of potential sensitive receptors and the predominant wind direction; • Set speed limits to minimize the creation of fugitive dust within the project boundary; • Avoid constructing roads close to human settlements; • Vegetation and soil should be removed together (mixed) so that the plant matter helps to hold the soil. Alternatively, vegetation can be stripped and stockpiled and then spread over the newly made stockpiles of soil; • Where practical, rehabilitation of the quarry should be progressive – i.e. it should be implemented as soon as a section is worked out. (This is only possible if there is no water standing in the pit.); • Natural vegetation surrounding the quarry can play an important role in minimizing dust emissions. It will reduce surface wind speeds and also trap a lot of the dust. Therefore, vegetation should only be cleared where it is absolutely necessary for operation. As the quarry expands, clearing should not take place a long time in advance of quarrying. Planned planting of trees and vegetation outside the quarry limits will minimize spreading of dust to

Environmental Impact	Proposed Mitigation / enhancement measures
	surroundings; and • Development of routine air quality monitoring program.
Impact AQ4: Dust emission from activities at the cement plant affecting air quality for nearby communities	• Regular maintenance at the cement manufacturing plant will ensure that the abatement technology will continue to meet supplier specifications and EU air quality directives with regards to emissions; • The installation of spray bars, enclosure of transfer points or other means of control will be employed as necessary to ensure dust emissions from the crushing and conveying systems is properly managed to meet emission and ambient air quality targets; • Start-up conditions should be short as possible as this will reduce emissions during this process; and • Development of routine air quality monitoring program.
Impact AQ5: Gas (SO ₂ , NO _x and CO) emissions from activities at the cement plant affecting air quality for nearby communities	• Regular maintenance at the cement manufacturing plant will ensure that the abatement technology will continue to meet supplier specifications and EU air quality directives with regards to emissions; • Start-up conditions should be short as possible as this will reduce emissions during this process; and • Development of routine air quality monitoring program.
Impact AQ6: Gas (SO ₂ , NO _x and CO) and dust emissions from the cement plant affecting air quality for nearby communities during upset conditions	• An emergency response plan is developed for the village if it is not moved and this will include on-going training and drills with the villagers. Impacts are likely to occur when the prevailing winds are towards the village during an upset condition. • Start-up should be delayed when the prevailing winds are towards the village. • Before any decision is made to move the village I suggest that a proper dispersion model be run to more accurately quantify the extent and level of impacts associated with air emissions during normal and upset conditions.
GREENHOUSE GASES	
Impact GH1: Impacts associated with greenhouse gases emissions during the operational activities at the cement manufacturing plant	• Regular maintenance and with the plant operating efficiently will reduce greenhouse gas emissions at the cement manufacturing plant ; and • Development of routine air quality monitoring program.
Impact GH2: Contribution to climate change as a result of greenhouse gas emissions from the project	• Implementation of GHG Management Plan including the development of a GHG inventory and on-going programme of GHG emission reduction initiatives (they would include regular evaluation of new technology options for GHG reductions including: carbon capture and storage and co-processing opportunities). • Identification and implementation of offset opportunities e.g. reforestation, use of biofuels.
NOISE AND VIBRATION	

Environmental Impact	Proposed Mitigation / enhancement measures
Impact NV3: Continuous noise resulting from daytime operations of the quarry, cement plant and associated infrastructure	• Option 1 – Realignment of Haul Road ○ Change the alignment of the haul road to bypass Yuku Village • Option 2 – Relocation of community ○ Relocate Yuku Village •
Impact NV4: Continuous noise resulting from night-time operations of the cement plant and associated infrastructure	• Option 1 – Mitigation by Plant Design - Noise screening ○ Construct noise screens around Raw Mill. ○ Noise screen design by plant design engineers to be based on design input and specifications of acoustical engineer. ○ Because of complexity and weight of acoustic panels and structural considerations, noise screens may require a separate foundation and supporting framework detached from the mill main frame. This could also be achieved by locating the mill inside a steel clad building with acoustical treatment on the inside. ○ Screening of the mills can be expected to reduce the overall noise level and impact but it may be necessary to screen off additional equipment as well • Option 2 – Relocation of community ○ Relocate Mbamba Village •
Impact NV5: Air blast pressure and vibration resulting from blasting at the quarry	• Option 1 – Restrict blasting to afternoon hours ○ Restrict blasting to afternoon hours 14:00 to 17:00. No blasting to be allowed during the morning hours of the day. • Option 2 – Employ alternative mining techniques instead of blasting ○ Apply alternative mining techniques, such as ripping, which will eliminate the need for blasting at the quarry.
ECOLOGY AND BIODIVERSITY	
Impact EB10: Loss or disturbance of fauna species of special concern due to collisions and noise disturbance	• Bird collision minimisation technologies (e.g. bird flappers) to be installed on the new powerline from the grid station at Kimpese to the plant to minimise collisions. The most appropriate technology is to be determined by an experienced ornithologist; • A Biodiversity Action Plan to be developed to inform NYA's protection and management of biodiversity in the entire concession. The initial Biodiversity Action Plan should be informed by comprehensive baseline surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The Action Plan must be updated at least every 5 years to facilitate adaptive management, or more frequently if required.

Environmental Impact	Proposed Mitigation / enhancement measures
Impact EB11: Introduction of alien invasive flora and fauna	• An invasive alien species control programme to be developed and implemented as a component of the Biodiversity Action Plan, including adaptive management measures; • The initial Biodiversity Action Plan should be informed by baseline surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The Biodiversity Action Plan should be updated every five years, with particular emphasis to be place on the control of invasive alien flora and fauna; • All invasive alien species control measures specified in the Biodiversity Action Plan must be implemented. Appropriate topsoil stockpile management
Impact EB12: Increased hunting/poaching of wildlife	• A Biodiversity Action Plan to be developed to inform Nyumba ya Ikiba's protection and management of biodiversity in the entire concession; • An environmental education programme to be developed and implemented for all Nyumba ya Akiba employees, their families, and villages within the concession; • Effective penalties (e.g. severe fines) to be implemented for project staff that are found to be hunting or purchasing wildlife (e.g. bushmeat). Current villagers that are not employed by NYA should be allowed to continue hunting as a form of livelihood, but measures to ensure such hunting is undertaken within sustainable limits should be identified with the community as a component of the Biodiversity Action Plan.
Impact EB13: Modification or degradation of aquatic habitats due to pollution or nutrient loading	• A stormwater management plan to be developed for all project components to address stormwater run-off volumes, velocity, and water quality to minimise impacts on natural areas, and all relevant mitigation measures identified in the plan to be implemented prior to the commencement of operations; • A weir or gabion system must be constructed at the toe of the Kawenga and Mbamaba wetlands if increased run-off into these wetlands results in associated erosion immediately downstream of these systems. The weirs must be constructed to maintain the natural water levels of the wetlands and must not facilitate increased flow out of the wetlands; • Bunding and impermeable surfacing to be constructed around all potential major sources of pollution such as fuel, lubricant and hazardous product storage facilities, vehicle servicing areas, and workshops; • All plant components and vehicles to be serviced within the designated workshop areas or at appropriately designated off-site facilities; • The waste water treatment plant to be

Environmental Impact	Proposed Mitigation / enhancement measures
	constructed at least 100m from all wetlands. • No discharge of treated or untreated effluent to be permitted into any wetlands; • Any ponds for the secondary treatment of effluent to be located at least 200m from any wetlands and swamps; • A Biodiversity Action Plan to be developed to inform Nyumba ya Ikiba's protection and management of biodiversity in the entire concession.
Impact EB14: Impeded photosynthesis and transpiration rate of plants due to dust generation	• Dust suppression measures (e.g. watering) to be instituted at the quarry, plant site and on roads on at least a daily basis when high dust generating conditions are prevalent.
SOILS , LAND CAPABILITY AND LAND USE	
Impact SL5: Chemical spills and release of contact water resulting in permanent loss of soil, and change in soil characteristics, land capability and land use	• The preparation of procedures to ensure that spillage during mobile equipment maintenance is minimized. • The provision of appropriate secondary containment in areas where hydrocarbons, solvents and other potentially hazardous materials are stored. • Implement emergency preparedness and response measures plan as described elsewhere for the proposed project.
Impact SL6: Operational activities causing increased erosion, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use	• Minimize the area of disturbance. • Implement storm water control measures around infrastructure. • Appropriate topsoil stockpile management
WATER RESOURCES	
Impact WR4: Contaminated stormwater runoff from roads and other surfaces affecting surface and groundwater quality	• Implement a stormwater management plan which will separate dirty water from clean water and divert run off from dirty areas to a pollution control dam which should have a silt trap to settle any sediment • Re-use water from the pollution control dam as a first resort. Only discharge after treatment and compliance with discharge limits can be demonstrated • Store all potential sources of contamination (e.g. coal, hazardous materials, gypsum, cement product) in secure facilities with appropriate bunding and storm water management systems in place to ensure contaminants are not released to the water resources through storm water runoff • Construct concave run surfaces to ensure run-off is directed • Where contaminants are transported along roads, emergency spill management measures must be developed to minimize impacts should accidental spillages occur along the transport routes • Use oil & silt traps to remove these types of contaminants from stormwater
Impact WR5: Discharge of contaminated pit water to surface water resources, affecting downstream users	• Optimise water reuse and reclamation within the mining operations • Where practical, intercept clean ingress water as

Environmental Impact	Proposed Mitigation / enhancement measures
	close as possible to its source in order to prevent or minimize water quality deterioration and to allow this water to be pumped up to surface for appropriate use or discharge • Where appropriate, undertake dewatering operations ahead of the mine to keep the mine dry and prevent water quality deterioration. • Discharge pumped underground water into a dam for treatment and possible re-use as a first priority rather than discharging into the surface water resource
Impact WR6: Risk of flooding of project infrastructure due to placement within the 1:100 year floodline	• Undertake flood line study investigation to establish 1:100 year flood line • Locate plant, associated infrastructure and quarry outside the 1:100 year floodline • Construct cut-off trenches and storm water control measures to contain the 1:100 year flood event
Impact WR7: Dewatering of the quarry resulting in groundwater drawdown and reduced contribution to surface water baseflows and wetlands, affecting users	• Groundwater can be removed by pumping wells before it flows into the pit. The quality of the water will be of better quality for discharge purposes, compared to that within the pit. • Monitor groundwater levels to determine extent of dewatering impact • Ensure water supply for domestic and agricultural purposes to communities affected through dewatering activities • If necessary, treat removed groundwater to a quality that is suitable for discharge to streams and agricultural use • Monitor discharge water quality to ensure it is compliant with the necessary guidelines.
Impact WR8: Stormwater inflows into the pit, reducing surface water flows and availability to users	• Cut-off trenches should be installed around the pit perimeter to manage the extent of pit inflows (divert clean water away from the pit) • Inflows can be removed by pumping and discharging to the surface resource or distributing to other water users (community), provided the quality is not compromised. If quality is not fit for discharge treatment should be undertaken before discharge or distribution
Impact WR9: Raw water abstraction for the project reducing availability to other users	• Discharge treated effluent into streams to compensate for abstraction losses (provided it meets the quality criteria) • Implement the optimal reuse of pit water and purified waste water to limit raw water abstraction
Impact WR10: Seepage from waste affecting surface and groundwater quality	• Design the waste landfill in accordance with the requirements (e.g. lining and cover) for the type of waste handled • Cap waste landfill facility after closure to limit artificial recharge and seepage forming • Implement groundwater monitoring around waste disposal facility
Impact WR11: Wastewater effluent discharge to streams, affecting water quality for downstream users	• Discharge only treated wastewater to streams, to compensate for abstraction losses • Especially ensure the removal of nitrates from treated water as streams and rivers already contain elevated nitrate background

Environmental Impact	Proposed Mitigation / enhancement measures
	concentrations; - Water to be discharged need to comply with maximum concentrations of contaminants in waste water as prescribed by Article 66 of the Congolese Law. - Undertake monthly monitoring up-gradient and down gradient of the discharge point
Impact WR12: Sinkhole formation resulting from dewatering of subsurface cavities, resulting in safety and structural stability risks	There are no mitigation against sinkhole formation if mining takes place
VISUAL IMPACTS	
Impact VI2: Loss of sense of place affecting local communities due to project infrastructure and illumination	- Minimize the disturbed footprint as far as practically possible. - Undertake stripping, stockpiling and stockpile management as per the Soil Management Plan (Section 9.5). - Clear vegetation at the quarry in phases so that only those areas required for immediate development are cleared. - Implement the waste management plan for the project (Appendix 15). - Refer to dust control measures under Impact AQ3 and AQ4 (Section 7.2.1). - Use directional lighting in areas operating at night, if communities are affected by lighting.
TRAFFIC	
Impact T4: Impact on utilisation capacity on the N-1 during operation	- Widening of the N-1 at the access road to allow for turning lanes would reduce the potential for accidents and congestion at this intersection. - Clear signage and traffic calming measures on the N-1 warning motorists of the intersection would reduce potential traffic safety impacts at this intersection. - Truck staging area and/or rest area would enable trucks to exit the N-1 safely, and enable site staff to schedule deliveries in an orderly manner. - Provision of dedicated buses for construction personnel not accommodated on the site would reduce daily commuter traffic to the project site; - Schedule the delivery of materials and dispatch of cement avoid peak hour traffic. The dispatch of vehicles should be staggered throughout the day; and - NYA management to pursue the reviltisation of the rail network with the relevant authorities.
Impact T5: Impact on traffic in Matadi during operation	Not applicable
Impact T6: Increased road accident rates and road safety during operation	- Widening of the N-1 at the access road to allow for turning lanes would reduce the potential for accidents and congestion at this intersection. - Clear signage and traffic calming measures on the N-1 warning motorists of the intersection would reduce potential traffic safety impacts at this intersection. - Rest area for drivers should be implemented, and maximum driving hours per driver established and enforced. - A maintenance schedule for all vehicles directly

Environmental Impact	Proposed Mitigation / enhancement measures
	under the control of NYA must be developed and implemented to ensure on-going roadworthiness of vehicles. Suppliers, contractors, and sub-contractors must be instructed to implement the same maintenance schedule. • Random inspections for roadworthiness of all vehicles entering or leaving the site must be implemented.
POPULATION AND DEMOGRAPHIC MOVEMENTS	
Impact PD2: Influx of potential job seekers into the area and associated risks	• Optimise the use of local labour as far as practically possible. • Develop a code of conduct with which contractors and their employees must comply. The code should deal with the interaction with local communities and substance abuse among other things. • Implement the Stakeholder Engagement Plan (Appendix 17) which clarifies the principles of engagement with community and other stakeholders, sets in place appropriate liaison forums and describes the grievance management procedure to be adopted by NYA. • Implementation of a programme of HIV/AIDS screening, counselling and (where necessary) treatment. • Develop and communicate a clear and concise employment and recruitment policy to prevent opportunistic job seekers from settling in the area. See Recruitment strategy
HEALTH AND SAFETY	
Impact HS5: Increased chances of the spread of communicable diseases such as HIV/AIDS, STDs and malaria linked to the influx of jobseekers and workers	• Develop a comprehensive HIV/AIDS program to employees through employee wellness programmes which should include the following: ○ Awareness campaigns targeting project workers, senior management, contractors, sub-contractors and their spouses, communities near project facilities, risk groups (commercial sex workers, truck drivers) ○ Prevention, voluntary counselling for HIV testing, as well as anti-retroviral treatment for employees and surrounding communities. There are already HIV/AIDS programs developed by Kimpese Hospital, which NYA could potentially be involved in. • Collaborate with local health authorities and other relevant stakeholders to develop an integrated mosquito control strategy, which should include: ○ Awareness campaigns to inform employees of symptoms and treatment available for workers and community members ○ Elimination of potential breeding habitats for mosquito larvae such as pools of unusable standing water ○ Spraying residual insecticide to walls of living quarters

Environmental Impact	Proposed Mitigation / enhancement measures
	○ Provision of prophylactic drugs to non-immune workers ○ Promoting and supplying repellants, netting and clothing to employees
Impact HS6: Increased pressure on healthcare infrastructure due to project related influx	• Update an influx management plan as per management measures noted under Impact PD1. • Develop an MOU with the Local Healthcare Centres in Minkelo and Kimpese for service provision to the local workforce and their dependents. • Identify NGOs in the area that might support operations at the Minkelo Clinic and Kimpese Hospital, with special focus on refurbishment of key areas, equipment and building maintenance, as well as, improved healthcare management information systems. • Develop and implement community development/sustainability plans to support infrastructure development in the area
Impact HS7: Increased risk of accidents and injuries to communities from improved roads and additional traffic	• Awareness campaigns in neighbouring communities, particularly at Nkonda village, with a focus on school children and mothers, about risks related to traffic • Enforcement of speed limits and sanctions for any personnel found in violation of speed limits, including senior staff and contractors' and sub-contractors' employees • Appropriate signalling of moving heavy machinery, and escort vehicles where needed • All construction drivers to be given safety education focussing on speed and conflicts between pedestrians and cyclists. • Advanced warning signs including sirens to be erected at locations of high pedestrian and cyclist activity
Impact HS8: The visible presence of Congolese police within the project area, and their secondment as a subcontractor for the mine security	• Develop a code of conduct for police personnel, especially in relation to handling community violence • Proper screening of appointed security personnel to ensure they were not implicated in human rights abuses in the past
ECONOMIC IMPACTS	
Impact EC4: Local and regional benefits resulting from increased Revenue to Government	• None
Impact EC5: Generation of direct, indirect and induced employment and income	• Stipulate in the Recruitment Plan (or equivalent plan) mechanisms to employ local workers if applicants with the appropriate skills are available. • Provide on-the-job and other skills training for local workers. • Procure goods and services at a local level, if available. • Consider establishing a local procurement programme to increase local content over time. • Work closely with the community before and during the project to identify and publicise skills and resources that the local community could

Environmental Impact	Proposed Mitigation / enhancement measures
	provide. This should take place before construction commences. Establish relevant mechanisms in the relevant social and labour plans.
ECOSYSTEM SERVICES	
Impact ES2: Reduced availability of natural resources and ecosystem services to local communities due to use by the project and impacts on these resources	• Comply with best practice standards for air emissions, water (stormwater and effluent) discharge quality and solid waste disposal to minimise impacts on ecosystem services. • Implement mitigation measures recommended in Section 7.1.9 to minimise impacts on ecological resources. • Implement mitigation measures recommended in Section 7.2.11 and the Resettlement Action Plan and Sustainable Development Plan (Appendix 19 and 20) to maximise community resilience and ensure fair compensation where resources are directly affected.
SAFETY RISKS	
Impact SS1: Blasting, resulting in fly rock	• To reduce the risk of injury the Project will conduct blasting in accordance with international safety standards. • Open pit blasting will be conducted using standard mining industry practices and procedures for securing personnel and equipment. This includes the development and implementation of standard operating procedures, blasting rules and a safety management plan that: ○ Delineates the danger zone associated with each blast of at least 400m and clear workers from this zone before, during and after each blast; and ○ Provides an audible warning at least three minutes before a blast is fired.
Impact SS2: Community exposure to toxic or hazardous substances	• Design hazardous material containment structures taking into consideration natural hazards and the implications of these on structural integrity of the containment facilities. • Size containment areas to contain 110% of the contents of the largest tank within the facility or provide facilities to direct excess volume to an alternative spill containment facility. • Pave (with an impermeable surface such as concrete) fuel delivery and dispensing pump areas and designed these areas to drain into the adjacent storage tank containment areas. • Prohibit construction of hazardous material facilities (including temporary and permanent refuelling areas) within drainage lines or the 1 on 100 year flood lines of watercourses. • Treat (for example with an oil separator), evaporate or dispose of as a hazardous material any polluted water collected in hazardous material containment facilities. • Require vehicle maintenance to be undertaken in the designated workshops where appropriate pollution control measures are provided to

Environmental Impact	Proposed Mitigation / enhancement measures
	prevent leaks or spills of fuel or lubricants reaching the environment. Develop and implement a Spill Prevention Control and Countermeasure Plan for the site.
Impact SS3: Fire or explosions due to storage of explosives and use of combustible materials	- Standard international good practice will be followed with regard to storage and handling of these materials. - Occupational health and safety guidelines with regard to safe working conditions and the use of PPE will be adhered to. - Fire extinguishers will be available at storage areas for flammable substances, and a fire water system will be installed, servicing the plant and accommodation areas.

8.2.3 Mitigation Measures during Decommissioning and Closure

Proposed mitigation / enhancement measures to manage potential impacts during the decommissioning and closure phase of the project are presented in Table 8-5 below.

Table 8-5: Mitigation Measures during the Decommissioning and Closure Phase

Environmental Impact	Proposed Mitigation / enhancement measures
ECOLOGY AND BIODIVERSITY	
Impact EB15: Re-establishment of habitats or creation of new habitats via rehabilitation	- Areas immediately adjacent to important habitats (e.g. lacustrine wetlands, swamps, Gallery and Swamp Forest) that have been degraded during the construction and operational phases must be restored to their natural, pre-construction condition; - All other cleared or degraded areas that are not identified in the closure plan for alternative commercial use (e.g. utilise the plant site for a new factory) must be rehabilitated to a stable ecological state. This condition should be as close to the pre-construction condition as practically possible via rehabilitation, but restoration of pre-construction ecosystems is not expected; - Site clearing to be conducted sequentially, not all at once; - Topsoil to be stockpiling separately from overburden for rehabilitation purposes, and protected against loss from run-off; - Sequential rehabilitation to be conducted as soon as quarrying of an area or disposal of overburden has been concluded; - A Rehabilitation Plan to be developed and implemented, with different objectives and rehabilitation approaches established for each habitat/ecosystem. Various rehabilitation methods must be trialled, a rehabilitation program implemented, and an adaptive management approach applied to rehabilitation. Development and implementation of the Rehabilitation Plan to be overseen by an appropriately qualified botanist/ecologist. The Rehabilitation Plan must be underpinned by a sound understanding of the ecological

Environmental Impact	Proposed Mitigation / enhancement measures
	functioning of the various ecosystems in the study area.
Impact EB16: Introduction of alien invasive flora and fauna	• An invasive alien species control programme to be developed and implemented as a component of the Biodiversity Action Plan, including adaptive management measures; • The initial Biodiversity Action Plan should be informed by baseline surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The Biodiversity Action Plan should be updated every five years, with particular emphasis to be place on the control of invasive alien flora and fauna; • All invasive alien species control measures specified in the Biodiversity Action Plan must be implemented.
Impact EB17: Loss or disturbance of fauna species of special concern due to collisions and noise disturbance	• Bird collision minimisation technologies (e.g. bird flappers) to be installed on the new powerline from the grid station at Kimpese to the plant to minimise collisions. The most appropriate technology is to be determined by an experienced ornithologist; • A Biodiversity Action Plan to be developed to inform Nyumba ya Ikiba's protection and management of biodiversity in the entire concession. The initial Biodiversity Action Plan should be informed by comprehensive baseline surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The Action Plan must be updated at least every 5 years to facilitate adaptive management, or more frequently if required.
Impact EB18: Increased hunting/poaching of wildlife and loss of habitats for crop production	• NYAs social and labour plan to address the provision of sustainable, alternative livelihoods upon cessation of operations, decommissioning and closure; and • An environmental education programme to be developed and implemented for all NYA employees, their families, and villages within the concession.
WATER RESOURCES	
Impact WR13: Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste	• Where contaminants are transported, emergency contaminant and mitigation measures must be developed to minimize impacts should accidental spillages occur along the transport routes • Equip all trucks and equipment carrying fuels or oil with spill response materials and train personnel in the use of such materials • Store all potential sources of contamination in secure facilities with appropriate Storm Water management systems in place to ensure that contaminants are not released to the water resource through Storm Water runoff
Impact WR14: Sedimentation of surface water resulting from	• Minimise disturbance of soil and vegetation; • Implement rehabilitation and revegetation as

Environmental Impact	Proposed Mitigation / enhancement measures
erosion and runoff from exposed surfaces and roads	soon as possible; Refer to dust and erosion suppression measures listed in Impacts AQ6 and SL4
Impact WR15: Contamination of groundwater resulting from seepage from hazardous materials and waste	- Manage waste in accordance with the Waste Management Plan (Appendix 15) - Refer to mitigation measures for Impact WR13
ECONOMIC IMPACTS	
Impact EC5: Reduction in project revenue to government, resulting in local economic decline	To minimize impacts, opportunities should be explored with local and regional businesses to compensate for any loss in cement production.
Impact EC6: Loss of Employment and Income due to retrenchment	- To minimize impacts, opportunities should be explored with local and regional businesses to diversify the local and regional economic base and local skill level, thereby providing workers with opportunities for alternative employment. Initiatives in this regard should be undertaken throughout the project lifetime and include: - Develop the NYA grievance procedure to capture and address grievances arising due to retrenchments and downscaling of Phase 1. - Compliance with IFC's Performance Standard 2 "Labor and Working Conditions" - Actively promoting the development of different economic sectors from an early stage, e.g. through incentivizing other industries to locate in the area, contributing to adequate infrastructure and promoting an increase and diversity of skills in the local population; and - Develop a decommissioning and closure plan which is updated every five years increasing in detail as closure approaches, and actively engaging with a range of stakeholders throughout the life-of-project to discuss potential consequences of decommissioning and possible mitigation. - Monitor the use of violence by the mine security in instances of labour unrests (see impact HS 4)
ECOSYSTEM SERVICES	
Impact ES3: Reduced quality of natural resources and ecosystem services to local communities due to emissions to air, water or soil	To minimize impacts, the project must comply with GIIP for air emissions, water (stormwater and effluent) discharge quality and solid waste disposal
SOILS, LAND CAPACITY AND LAND USE	
Impact SL7: Remediation of contaminated soils and demolition of project infrastructure, resulting in re-establishment of baseline soil characteristics and land capability	Implement the Closure and Rehabilitation Plan as described in the report to support the proposed project.
AIR QUALITY	
Impact AQ7: Increase in PM10 emissions resulting from land clearing, earthworks, and vehicular movement	- Apply dust suppressants to sections of roads used routinely by vehicles that pass through and close to villages; - Cover vehicles carrying dusty materials to prevent materials being blown from the vehicles; - Set speed limits to minimize the creation of fugitive dust within the project boundary; - Continue with the routine air quality monitoring program.

Environmental Impact	Proposed Mitigation / enhancement measures
	- Minimize the disturbed footprint as far as practically possible. - Undertake stripping, stockpiling and stockpile management as per the Soil Management Plan (Section 9.5). - Revegetate and landscape disturbed areas as soon as possible.
VISUAL IMPACTS	
Impact VI3: Dust generation and site disturbance due to earth moving and removal of project infrastructure, affecting the visual character for communities	- Minimize the disturbed footprint as far as practically possible. - Undertake stripping, stockpiling and stockpile management as per the Soil Management Plan (Section 9.5). - Revegetate and landscape disturbed areas as soon as possible, to reflect the surrounding topography and vegetation as much as possible. - Implement the waste management plan for the project (Appendix 15). - Refer to dust control measures under Impact AQ6.

8.2.4 Mitigation Measures during Post- Closure

Proposed mitigation / enhancement measures to manage potential impacts during the post-closure phase of the project are presented in Table 8-6 below.

Table 8-6: Mitigation Measures during the Post-closure Phase

Environmental Impact	Proposed Mitigation / enhancement measures
ECOLOGY AND BIODIVERSITY	
Impact EB19: Increased hunting/poaching of wildlife and loss of habitats for crop production	- NYAs social and labour plan to address the provision of sustainable, alternative livelihoods upon cessation of operations, decommissioning and closure; and - An environmental education programme to be developed and implemented for all Nyumba ya Akiba employees, their families, and villages within the concession.
WATER RESOURCES	
Impact WR12: Pit lake formation due to inflow of ground and surface water, resulting in safety risks to animals and humans, and environmental contamination	- Backfill of the remaining open void will prevent a pit lake from forming (if sufficient backfill material is available) - Restrict access (and ingestion of pit water) by animals and humans by fencing the pit.
ECONOMIC IMPACTS	
Impact EC7: Cessation in project revenue to government, resulting in local economic decline	To minimize impacts, opportunities should be explored with local and regional businesses to compensate for any loss in cement production.
Impact EC8: Loss of Employment and Income due to retrenchment	None
ECOSYSTEM SERVICES	
Impact ES4: Reduced quality of natural resources and ecosystem services to local communities due to contamination of water or soil	To minimize impacts, the project must comply with GIIP for air emissions, water (stormwater and effluent) discharge quality and solid waste disposal.
SOIL, LAND CAPABILITY AND LAND USE	
Impact SL8: Demolition and restoration of project	Implement the Closure and Rehabilitation Plan

Environmental Impact	Proposed Mitigation / enhancement measures
infrastructure, resulting in re-establishment of baseline soil characteristics and land capability	as described in the report to support the proposed project.
VISUAL IMPACTS	
Impact VI4: Re-establishment of baseline visual character due to rehabilitation of the site and removal of project infrastructure	• Implement the Closure and Rehabilitation Plan as described in the report to support the proposed project. • Landscaping and revegetation in accordance with the surrounding vegetation and topography

8.2.5 Other Mitigation Measures

Green House Gases

Cement manufacturing processes are significant emitters of greenhouse gases. The recognition of this has led to several initiatives to assist the sector in reducing its footprint (for example, the WBCSD's Cement Sustainability Initiative, CSI - www.wbcsdcement.org). The technology proposed for the plant represents GIIP in terms of GHG emissions, as though there are expected to be technology developments in future, there are none that have been evaluated enough to be commercially and technically feasible at present. This applies for carbon capture and storage technologies that would potentially be suited to cement manufacture. However, there are always opportunities to reduce GHG emissions and energy use in such manufacturing operations, but the only way to get these to materialise is to have a systematic, procedurally based, on-going and rigorous process looking for and implementing these opportunities. Underpinning this will be the implementation of the GHG Management Plan described in Appendix 14. Possible mitigation options for inclusion in this plan are detailed in Appendix 6.2 – for example the use of co-processing, alternative fuels such as biomass and extenders to reduce clinker requirements.

There are however opportunities to offset the project's emissions through external focussed initiatives such as reforestation and avoided deforestation (which would also have climate change adaptation benefits). The original ECTECH ESIA report details a number of potential partnership opportunities in this regard which could be investigated further i.e.

- The African Development Bank is supporting a project to the development of community agroforestry in the Bas Congo and the Bateke/Kinshasa Plateaus. This project is in line with the Growth and Poverty Reduction Strategy Paper (GPRSP) of the DRC.
- The Ministry of Environment, Nature Conservation and Tourism (MECNT) of the Democratic Republic of Congo (DRC) plans to develop community agroforestry as a means of reducing poverty and mitigating the effects of climate change. Consequently, the overall objective of the Project to Support Agroforestry in the Democratic Republic of Congo is to reduce deforestation and forest degradation, and alleviate poverty in the communities of the two project areas namely: Bateke and Bas Congo plateaus. Specifically, the project, which will provide support to the entire agroforestry subsector in the two project areas, entails: (i) the training of one thousand local stakeholders in the development of nurseries and agroforestry; (ii) the reforestation of 3500 ha of farm and forest crop lands; and (iii) support in terms of provision of infrastructure, equipment and training for the conservation, processing and marketing of agricultural products and fuel wood.

These opportunities and the other greenhouse gas mitigation options identified require further baseline work (e.g. what amount of biomass would be available in the area for use in the project and what waste streams are available that could be used as alternative fuels). These could be done before the plant is commissioned so that their implementation, if found to be feasible, could be accelerated, thereby having as rapid an impact as possible on the plant's significant carbon footprint.

9 Environmental Management Plan

9.1 Introduction

SRK as part of the ESIA update has prepared the Environmental and Social Management system (ESMS) framework and is presented in the sustainable development structure in Section 9.2 and the Environmental Management Plan (EMP) in Sections 9.3. The ESMS further forms the framework for the Social Management Plan (SMP) in Section 13. Environmental and social monitoring is presented in Sections 9.12 and 13.8 respectively. This is in line with the policy of NYA which is provided in Appendix 10 covering their Sustainable Development, Human Resources, Health and Safety, as well as Human Rights Policies.

ECTECH in their 2013 ESIA provided the text within Section 9 below indicated by a blue line while the SRK text has no line. Reference is made by SRK within ECTECH sections to management plans which are appended to this SRK-updated ESIA.

Figure 9-1 below indicates how the social and environmental management plans interrelate in an overarching ESMS. The Environmental Management and Monitoring Plan are provided below within Chapter 9, while the Social Management and Monitoring Plans are provided in Section 13.

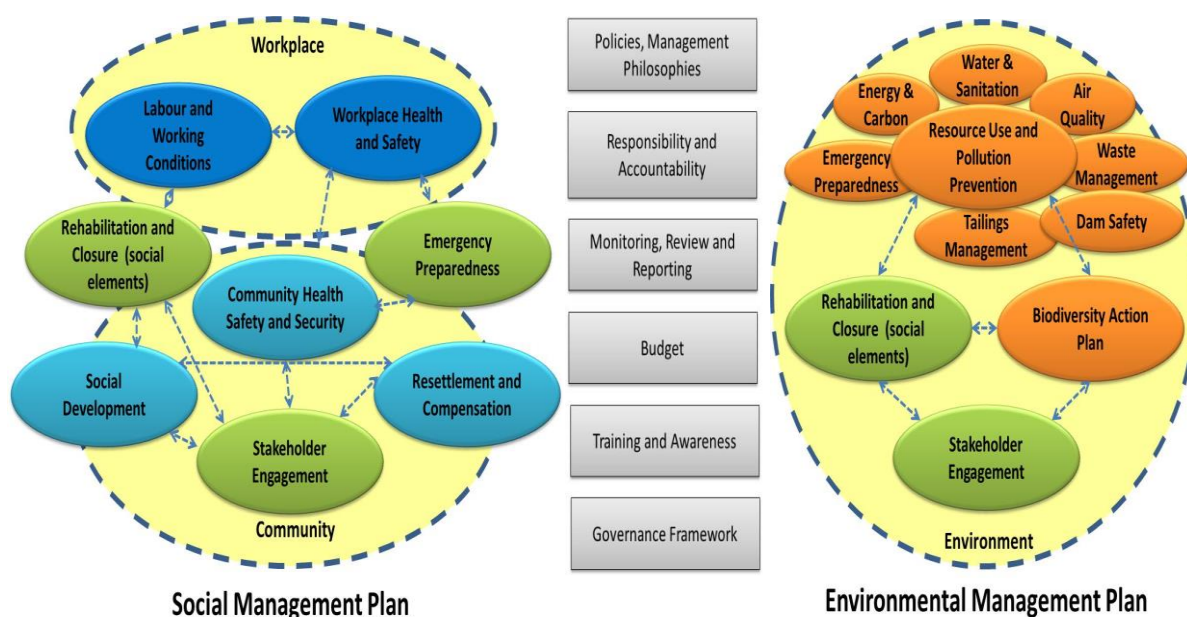


Figure 9-1: Diagrammatic representation of the interrelationship between the Social Management Plan and the Environmental Management Plan

9.2 NYA Sustainable Development Organisational Structure

SRK assisted NYA to expand on their organisational structure to implement and manage environmental and social impacts and ensure sustainable development. This section outlines this structure.

9.2.1 Responsibility and accountability

The following responsibilities and accountabilities rest with stakeholders in the implementation of the EMP/ SMP:

Responsibilities of stakeholders in EMP/ SMP

- NYA/borrower
 - Implement the ESMS including the EMP /SMPP in accordance with national legal requirements and international standards
 - Meet the requirements of lenders in covenant documentation
 - Report to stakeholders on performance on a regular basis
 - Undertake capacity building with local communities on environmental and social issues including rights and responsibilities
- Lenders
 - Monitor NYA performance in relation to its covenants
 - Sanction poor performance and non-compliance where appropriate
- Implementing agencies
- Communities
 - Monitor implementation of the ESMS by NYA
 - Actively participate in stakeholder forums including any development foundations
 - Make use of the NYA grievance mechanism to communicate issues with the company
- Government – specifically the DPEM and Ministry of Environment
 - Monitor legal compliance
 - Monitor the ESMP implementation and review performance reporting
 - Ensure transparent and efficient decision making on permit applications
 - Sanction poor performance and non-compliance where appropriate through directives, penalties and fines

9.2.2 NYA organisational structure

General management

Figure 9-2 shows the general organizational structure for management. The key positions involved in sustainability management (environment, health and safety, community, labour)²⁴ are outlined in black dashes. Direct and indirect reporting lines are shown as solid and dashed blue lines respectively. It is clear that numerous staff members will have defined responsibilities for managing sustainability issues; ultimately it is the Director General that is responsible for making it happen. The Board and specifically the Board Committees that are accountable to stakeholders for sustainability performance. The manager Sustainable Development is responsible for implementing the policy and strategy, and reports primarily to the Director General, and indirectly to the General Manager of the Plant, and the Board Committees specified in the organogram below.

9.2.3 Responsibilities and reporting lines of key staff members and governance bodies

Responsibility for sustainability management in particular the implementation of the management system falls under the responsibilities of numerous levels and functions in the organisation. Accountabilities, reporting lines and responsibilities of key staff members and governance bodies are indicated in Table 9-1. Regarding contractors, during the construction period they will be supervised by the consultant appointed by NYA. During the operational phase, they will report to the General Manager Plant.

Responsibilities and reporting line information provided below was compiled with reference to various guidelines and documents, including:

²⁴ Note that as 'sustainability' is a cross-functional issue that does not reside only with one person and that it should be integrated into the governance and decision making processes of the organization the position is referred to as "Sustainable Development" Manager. This encompasses the environment, communities and stakeholder engagement, health and safety, and the related provisions of labour (such as human rights, equal opportunity, child labour, skills development) etc. Refer to the table on responsibilities and accountabilities for further details on this.

- The NYA draft document on management systems
- International frameworks and standards including the
 - Institute of Directors' King Code on Corporate Governance for South Africa,
 - ISO 26000 guideline on Social Responsibility
 - Draft Framework for Integrated Reporting
 - Global Reporting Initiative's G4 Guidelines for Sustainability reporting
 - International Finance Corporation's Performance Standards on Environmental and Social Sustainability.

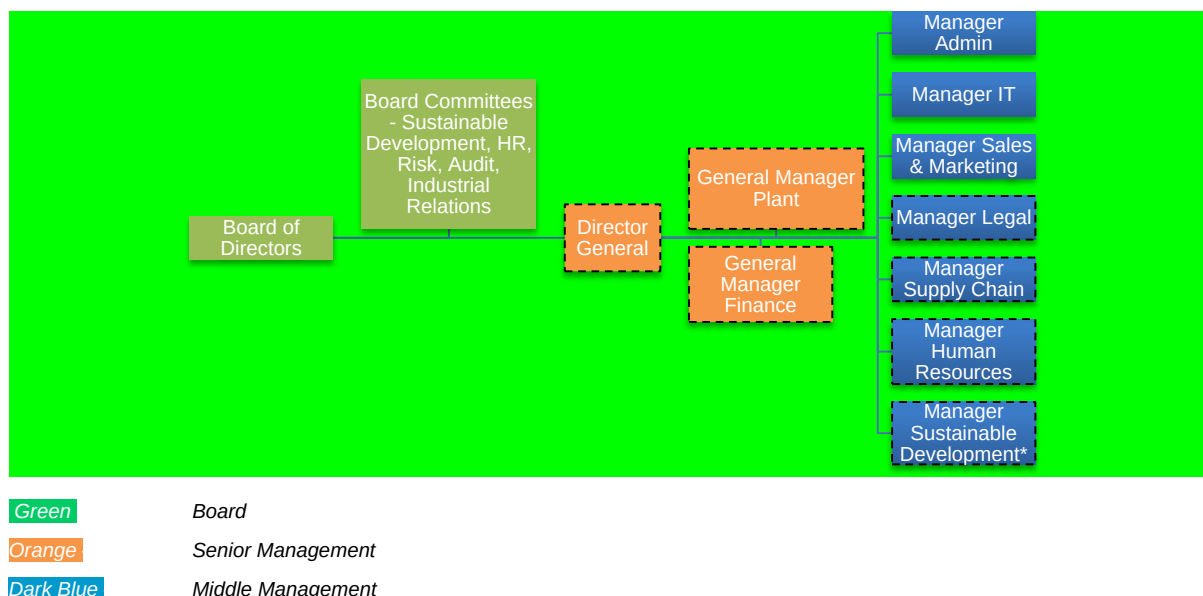


Figure 9-2: Organizational structure for NYA management

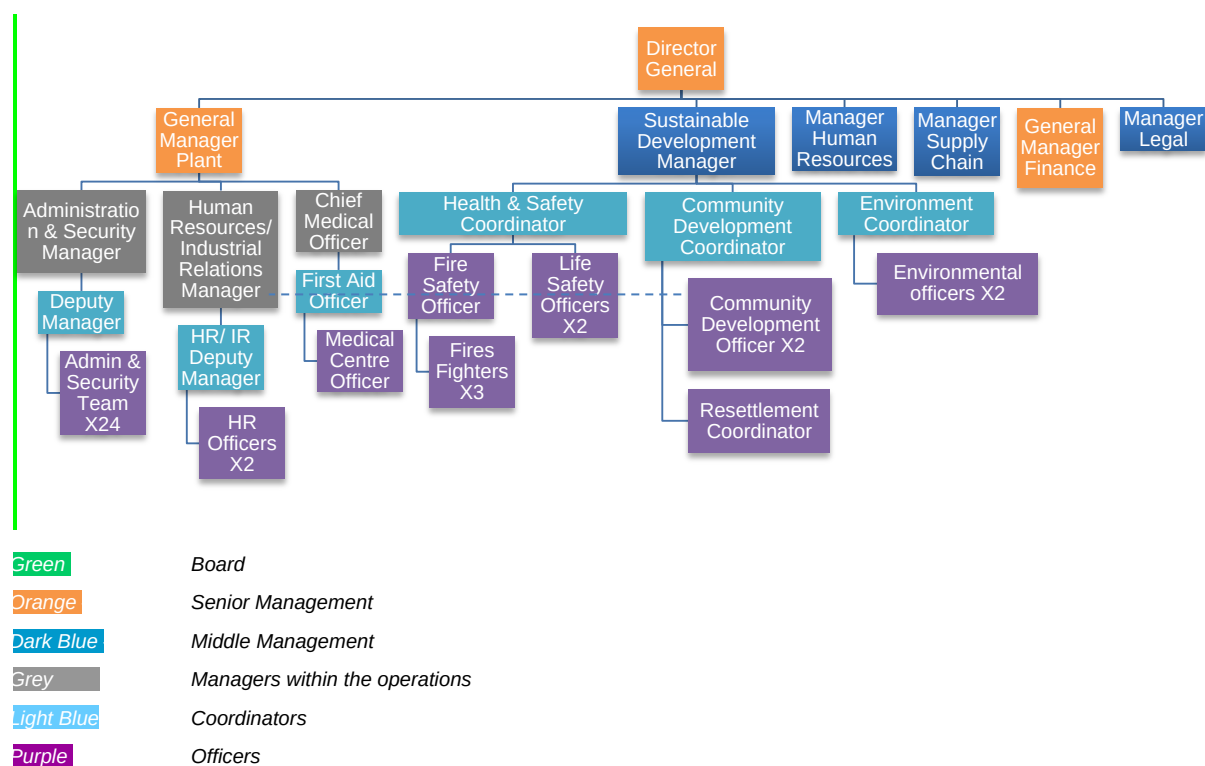


Figure 9-3: Organizational structure showing staff involved in sustainability management

Table 9-1: Responsibilities and reporting lines

Position/ Structure	Accountable to/ reporting line	Responsibilities
Board		
Chairman	Stakeholders	- Has ultimate accountability for sustainability performance at NYA - Ensures that sustainability is integrated into company strategy, governance and decision-making
Board Committee on Sustainable Development	Chairman Stakeholders	- Approve policy and strategy related to sustainability - Provides oversight of sustainability management - Ensure the company takes a stakeholder approach to governance and decision making - Oversee the production and disclosure of a public annual report on sustainability performance to stakeholders²⁵ - Ensure that the company's risk strategy, policy and management incorporates sustainability issues, both positive and negative
Board Committee on Audit	Chairman Stakeholders	- Oversee the company's risk strategy and management - Recommend an external assurance provider for the disclosure of performance on material sustainability issues - Review the public disclosure of sustainability issues in the annual/sustainability report and public disclosures to ensure that it is reliable and does not conflict with the financial information.
Senior Management		
Director General	Board of Directors	- Ensure sustainability is integrated into company management and decision-making processes such as management meetings and reporting, and risk management - Ensure sustainability is integrated into numerous operational functions such as operation of the plant and quarry, human resources, supply chain (including security), sustainable development, finance and legal. - Allocate adequate human and financial resources to enable effective functioning and continual improvement of the Sustainability Management System - Establish and maintain a governance system to monitor performance of the Sustainable Development team - Attend stakeholder forums such as community meetings, as appropriate, to demonstrate senior management support
General Manager Plant	Director General	- Implement the sustainability management system in the plant and quarry operations, which will include the environmental and social management plan and action plan, and other components. - Hold the managers and their teams in the plant and quarry responsible for sustainability performance, notably the Administration and Security Manager, the Human Resources and Industrial Relations Manager,

²⁵ Using international guidelines such as the Integrated Reporting Committee's Draft Framework on Integrated Reporting and Global Reporting Initiative's G4 guidelines on sustainability reporting.

Updated ESIA for NYA Cement Project – updated in response to lender requirements

Position/ Structure	Accountable to/ reporting line	Responsibilities
		and the Medical team. • Ensure sustainability is integrated into plant and quarry management and decision-making processes such as management meetings and reporting, and risk management • Attend stakeholder forums such as community meetings, as appropriate, to demonstrate senior management support
General Manager Finance	Director General	• Incorporate financial resources related to the implementation of the sustainability management system (e.g. salaries, skills development and training, equipment, liabilities including rehabilitation and closure, social development initiatives, independent audit/assurance etc.) into company financial systems
Management		
Sustainable Development Manager	Directly: Director General Indirectly: Board Committee on SD, General Manager Plant	• Develop and implement an Environmental and Social Management System that adheres to national and international standards. • Manage the support team of environmental, health and safety, and community coordinators to implement the ESMS. • Prepare monitoring reports for submission to the General Manager and to stakeholders and the DPEM. • Ensuring integration of environmental and social functions throughout the mine.
Legal Manager	Director General	• Ensure that assessment of compliance with National Law and International standards, frameworks and codes of practice takes place regularly
Supply Chain Manager	Director General	• Integrate ethical, social, environmental and gender equality criteria, and health and safety, in purchasing, distribution and contracting policies and practices. In particular assess human rights issues, including child and forced labour, in supplier selection and management. • Development and implementation of a supplier and contractor code of practice for sustainability management, in liaison with the Human Resources and Sustainable Development Managers. • Carry out appropriate due diligence and monitoring of suppliers to ensure compliance or movement towards compliance with company policies and plans. • Work with suppliers to improve sustainability performance through awareness raising and capacity building
Human Resources Manager	Director General	• Implement workplace policies, procedures, and management plans, notably recruitment, severance arrangements, skills development, training and awareness and retrenchment. • Ensure that policies and procedures incorporate the provisions of national labour law and international standards such as those of the International Labour Organisation, ISO26000, IFC Performance Standard 2 on Labour and Working Conditions, and the World Bank Group Environmental, Health and Safety Guidelines. • Implementation of the policies will cover direct, contracted and supply chain workers, and will include provisions covering human rights, non-discrimination, fair remuneration, equal opportunity, vulnerable people, skills development, grievance management, health and safety, forced and child labour, and the right to collective bargaining. • Implement a transparent and non-discriminatory grievance procedure to manage workplace concerns

Updated ESIA for NYA Cement Project – updated in response to lender requirements

Position/ Structure	Accountable to/ reporting line	Responsibilities
Sustainable Development Department/Team		
Environment Coordinator	Sustainable Development Manager	- Implement environmental policies, procedures, and management plans. - Review and analysis of monitoring results and preparation of reports to management and stakeholders. - Planning of and carrying out environmental training programs for employees and contractors. - Obtaining and maintaining all necessary environmental permits in liaison with the Manager Legal. - Management of the environmental related components of the grievance mechanism.
Environmental Officers	Environmental Coordinator	- Inspections/audits of environmental protection requirements by employees and sub-contractors. - Sampling and data capture in accordance with the environmental monitoring program and analysis of results. - Assistance with the preparation of environmental monitoring reporting and permit applications.
Health and Safety Coordinator	Sustainable Development Manager	- Implementation of health and safety policies, procedures, and management plans, notably the Occupational Health and Safety Plan (OHS). - Review and analysis of monitoring results and preparation of reports to management and stakeholders. - Planning of and carrying out safety training programs for employees and contractors. - Obtaining and maintaining all necessary safety permits. - Management of the safety related components of the grievance mechanism.
Safety Officers	Safety Coordinator	- Inspections/audits of safety requirements by employees and sub-contractors. - Sampling and data capture in accordance with Safety monitoring program and analysis of results. - Assistance with the preparation of reporting and permit applications.
Community Development Coordinator	Sustainable Development Manager	- Implementation of social policies, procedures, and management plans, notably the Stakeholder Engagement Plan, the social components of the ESMP and the Sustainable Development Plan. - Planning of and carrying out social and stakeholder engagement training programs for employees and contractors. - Developing and maintaining relationships with local community stakeholders, and in particular coordinate the Stakeholder and Community Forum in collaboration with stakeholders. - Establishment and overall management of the grievance mechanism in conjunction with the environmental, and health and safety coordinators, and in liaison with the Human Resources Manager.
Community Development Officer	Community Development Coordinator	- Assistance with stakeholder engagement and building relationships with local community stakeholders. - Act as the primary points of contact between communities and NYA. - Implementation of the social management system including social management plans.
Resettlement Coordinator	Community Development Coordinator and Sustainable Development Manager	Operational and daily responsibility for implementing the Resettlement Action Plan.

9.3 Environmental Management Sub-Plans

As part of the ESIA update, SRK has developed a series of environmental and social management 'sub-plans' and although this report is structured with separate chapters for environmental and social management, these are integrated here into one list since management measures for these aspects are inextricably interrelated.

The list of sub-plans already developed with assistance by SRK is as follows:

- Labour and Human Resources Plan (Appendix 11)
- Occupational Health and Safety Plan (Appendix 12)
- Community Health and Safety Plan (Appendix 13), to be updated prior to construction with hazardous material measures that need to be implemented to reduce community risks
- GHG Emission Assessment and Management Plan (Appendix 14)
- Waste Management Plan (Appendix 15), to be expanded upon once there is further information about the waste site location and specific waste streams
- Emergency Preparedness and Response Plan (Appendix 16)
- Stakeholder Engagement Plan (SEP), incorporating the stakeholder grievance mechanism (Appendix 17)
- Framework Resettlement Action Plan (FRAP) (Appendix 18) (requiring further development and finalisation to become a Resettlement Action Plan (RAP), as outlined in Appendix 18 and Table 14-1).
- Sustainable Development Plan (Appendix 19).

High-level sub-plans developed with assistance from SRK to be developed further by NYA prior to construction:

- Biodiversity Action Plan (Section 9.7)
- Soils, Land Use and Land Capability Management Plan (Section 9.9)
- Cultural Heritage Management Plan (Section 9.10), to be supplemented with a Cultural Heritage Monitoring Plan (CHMP) and a Chance Find Procedure

High-level sub-plans provided by SRK to be developed prior to closure:

- Rehabilitation and Restoration Plan (Section 9.8).

Comprehensive sub-plans need to be developed prior to construction for the following aspects:

- Construction Management Plan
- Influx Management Plan (IMP) to be developed with a high level of urgency
- Water Management Plan to include process wastewater management
- Traffic and Road Safety Management Plan
- Resource (with energy focus) Management Plan
- Security Management Plan to expand on measures and requirements already contained in the EPRP and CHSP
- Hazardous materials measures dealing with production, transportation, handling, storage, and use

- Communication Plan, as outlined further in Table 14-1 below, to ensure effective communication across cultural and language barriers during all project phases, to interface with the EPRP, the CHSP and the OHS.

The Environmental Management Plan (EMP) will be used to ensure that the proposed cement plant and quarry is operated with minimum environmental impact as permissible Environmental Quality Standards relating to quarries, mining and cement manufacturing are covered under the “OFFICIAL NEWSPAPER OF THE DEMOCRATIC REPUBLIC OF CONGO, Office of the president de la République, DECREE N°038 / 2003 OF CARRYING MARCH 26TH, 2003, MINING REGULATIONS” and the International Finance Corporation (IFC), EHS Guidelines and Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC - Statement by the European Parliament, the Council and the Commission **Official Journal L 102 , 11/04/2006 P. 0015 – 003**. In order to accomplish this objective, the environmental management systems described will comprise the following:

- Environmental Management Plan,
- Environmental Monitoring Plan (EMtP), and
- Resources Implementation and Training Program.

It is pertinent to note here that during the construction phase of the project the contractors and vendors and during the regular operation of the project, NYA will be required to follow all occupational health and safety guidelines as described under Section 2.0 of the General EHS Guidelines by the IFC. In addition, the following health and safety impacts of particular concern during the operation of the cement plant and quarry should also be taken care:

- Non-ionizing radiation
- Heat
- Noise
- Confined Spaces
- Electrical Hazards
- Fire and Explosion Hazards
- Chemical hazards
- Dust

It should be stated that monitoring will be required both during the construction phase and operations phase of the project as recommended in the EMP described here under. The EMP is required to be implemented by the vendors / contractors during the construction phase under the supervision of “Environment, Health and Safety” (EHS) Department of NYA, who will have the authority where necessary to “stop the job” if any activity is going on against the required standards of Environment, Health and Safety.

The Environmental Management Plan should include the protection, mitigation and environmental enhancement measures to be implemented to minimize the adverse impact on the environment. The adverse environmental impacts during the operational phase of the proposed project, under normal operating conditions are mainly from air emissions, wastewater generation, noise and solid waste generation.

ECTECH mitigation measures to address the environmental issues during construction of the project are discussed in Section-9.

Monitoring recommendations are presented under the EMP in this section for documenting compliance of the project to the DRC Mining Regulations standards and IFC, EHS Guidelines.

The contractors will be required to establish a team of Environmental and Social (E&S) professionals that will operate the Environmental Management System (EMS). This E and S team will be supervised by the EHS department of the NYA and will be subject to regular monitoring and auditing.

It may be worthwhile for the Company for initiate ISO 14001 certification. The following outline is based on the general requirements of an environmental management plan that would satisfy the requirement of the ISO 14001 standard.

1. Environmental policy
2. Planning
 - 2.1 Environmental aspects
 - 2.2 Legal and other requirements
 - 2.3 Objectives and targets
 - 2.4 Environmental management Programme(s)
3. Implementation and operation
 - 3.1 Structure and responsibility
 - 3.2 Training, awareness and competence
 - 3.3 Communication
 - 3.4 Environment management system documentation
 - 3.5 Document control
 - 3.6 Operational control
 - 3.7 Emergency preparedness and response
4. Checking and corrective action
 - 4.1 Monitoring and measurement
 - 4.2 Non-conformance, corrective and preventative action
 - 4.3 Records
 - 4.4 Environmental management system audit

In recent years for projects such as this, the aspect of delivery of project E&S commitments has come to the fore and good practice includes development of control plans in a transparent manner as part of the Environmental Action/Management Plan. Such plans are visible and auditable by any of the Project management stakeholders, including the Client and Lender representatives. Whilst at this stage they may be viewed as onerous, they should prove to be an effective tool for efficient delivery and compliant performance.

In simple terms they present the 'how' and 'when' of activities that have potential E and S implications and should be supported by a range of approaches to remedy any problems encountered. These approaches include for example 'Toolbox Talks', which is an industry-wide accepted mechanism for delivering on-going training during construction. It is expected that the contractors will develop a series of 'Toolbox Talks' on various technical issues, for example

approved traffic route adherence, cleaning up of oil and fuel spillages, following the chain of custody for all waste leaving work sites and so on.

An important mechanism for commencing work with due recognition of E&S standards complying with International Lender requirements is a Project Induction. It is expected that the Contractor will put all Project staff through an initial Project induction, covering health and safety standards and an overview of E&S Project values, requirements, standards and approaches.

9.4 Waste Management Plan (WMP)

This plan will cover, to the satisfaction of the project proponent, all aspects of waste and wastewater management and staffing during construction, including implementation of practice standards such as reduce, re-use and recycle. The WMP will include details of temporary waste storage, waste transfer and pre-treatment prior to final disposal or recycling. Licensed/approved facilities for solid and liquid waste disposal must be used and a duty of care and chain of custody for all waste leaving the site will be followed. As part of the plan, the contractors will be expected to produce waste handling forms for chain of custody, which will be used to control waste leaving site. Thus the waste controller will keep a copy of the form and the driver will always carry a copy and will ensure that the load is signed for at the final disposal site. All records will be kept by the contractors for audit purposes and to demonstrate that the Project is complying with good international industry practice and applicable legislation.

SRK as part of the ESIA update has prepared a WMP which is provided in Appendix 15.

9.5 Oil and Fuel Storage Management Plan (OFMP)

This plan will cover all storage, transportation and usage of HFO, diesel and lube-oils. All oils and fuels will be stored underground in storage containers designed to meet the SANS 10089-3:2010 requirements, which include recommendations for double skinned tank design, with anti corrosion fibreglassed outer shelter, and fuel leak detection wells.. Any spillages shall be cleaned up immediately. All categories of spillage will be reported in accordance with the Plan to be developed by the Company. 'Toolbox Talks' would be expected to be delivered on an on-going basis as 'continued training' and following any significant incident.

9.6 Construction Related Management Plan

This plan will set out the management of construction related effects, in particular covering dust and noise management to reduce disruption to local communities. The plan will provide details of the overall approach to noise and dust management and will link to the social management function, such that residents may contact the contractors with grievances for their redress.

This plan will, once drafted, be implemented by contractors and include management for the following issues during construction:

- Management of construction campsite
- Management of fuels and other hazardous materials
- Management of construction roads
- Emergency preparedness
- Fire prevention and management
- Management of dust and
- Dust and noise nuisance
- Controls for vegetation clearing, constructing in sensitive areas, stockpiling of topsoil, borrow pits and crossing of water courses

- Land occupier relations
- Complaints register
- Health management.

9.7 Biodiversity Action Plan

A Biodiversity Action Plan (BAP) must be developed to guide NYA in the execution of its biodiversity management obligations, including the provision of ecosystem services currently utilised by the local communities. The BAP should specify NYA's objectives for biodiversity management and include detailed management programmes (including annual operational plans with budgets) to address the various aspects of management (e.g. control of invasive alien plants, fire management, erosion control, sustainable natural resource use etc.). The initial BAP must be informed by comprehensive baseline surveys of mammals, birds, insects, amphibians, reptiles and fish (to complement the existing flora data) undertaken in both the wet and dry seasons. The BAP must be updated at least every five years, or more frequently if required, to facilitate incorporation of new information and facilitate adaptive management.

9.8 Rehabilitation and Restoration Plan

A Rehabilitation and Restoration Plan must be developed to guide NYA's rehabilitation and restoration efforts. Restoration (to their natural, pre-construction condition) is required in areas immediately adjacent to important habitats (e.g. lacustrine wetlands, swamps, Gallery and Swamp Forest) that have been degraded during the construction and operational phases. All other cleared or degraded areas that are not identified in the closure plan for alternative commercial use (e.g. utilise the plant site for a new factory) must be rehabilitated to a stable ecological state. This condition should be as close to the pre-construction condition as practically possible via rehabilitation, but restoration of pre-construction ecosystems is not expected.

The Plan must clearly specify the restoration and rehabilitation objectives for the various ecosystems and the proposed approaches to achieve the objectives. A Rehabilitation and Restoration Monitoring Plan must be developed as a sub-component of the Plan, including the determination of indicators and target values linked to realistic trajectories for ecological succession. The trajectories will enable measurement of rehabilitation/restoration success and flag the need for active management intervention. The monitoring plan must include a methodology for monitoring, including sampling protocols and plot sizes for monitoring and evaluation in reference sites, untreated controls, and rehabilitated/restored sites. Stakeholders should also be involved in the evaluation process, to facilitate social acceptance of the process.

9.9 Soils, Land Use and Land Capability

Prepared by SRK as part of the ESIA update, this section describes the action plan that is recommended to mitigate impacts on soils during the various phases of the proposed project. The proposed project activities that may potentially affect soils include:

- Loss of soil and land capability due to the construction of project infrastructure. This can be either permanent where infrastructure remains post closure (overburden disposal facility) or remain for the duration of mining where after infrastructure is demolished;
- Contamination of soil resources; and
- Increased erosion.

9.9.1 Objectives

The action plan for the construction and operation of the project includes various design features, mitigation measures and good management practices to achieve the following environmental objectives:

- Conserve soil as a resource where practical and possible;
- Prevent/reduce soil erosion;
- Maximize the potential to re-use soils; and
- Limit the adverse effects of mining on the post-mining land capability.

The objective of the soil monitoring program is to serve as an early warning system of undesirable impacts arising from the construction and operation activities of the proposed project, which may necessitate the modification of the action plan.

The key objectives of the soil monitoring program include:

- Providing information on impacts to soils as a result of construction and construction and operation activities; and
- Detecting changes to soil baselines that may be as a result of construction and operation activities.

9.9.2 Management measures

The following management measures are recommended during the construction phase to minimize impacts on soil quality and productivity. These measures should continue to be implemented during the remaining phase of the proposed project, where applicable.

Soil removal and disturbance

To minimize the area of disturbance during the construction and operation phases, mitigation measures should include progressive closure to take place, where possible, to minimize the mine footprint.

Loss of organic matter/loss of biochemical cycle

Soil productivity and the loss of the soil biochemical cycle should be considered during the construction, operation and closure phases. Mitigation measures include the following methods:

- The stripping, segregating and stockpiling of the soil by type. This can consist of combined soil horizons which include the mixed topsoil and subsoil horizons that have the potential to support agriculture and be utilized during rehabilitation programs;
- Rehabilitation with soils from the stripping program;
- Incorporation of organic matter into the upper horizons. This could include composting, or mulching depending on nutrient requirements; and
- Nutrients deficient to plant growth may be added to the soil, with fertilizer amendment.

Soil stockpiles

The following should be implemented to manage soils stored in stockpiles:

- Where space constraints are not limiting, topsoil stockpiles should be constructed as a low long facilities not higher than 2m, or where space constraints limit this, stockpiles should be constructed as terraced stockpiles with terraces limited to 5m high will slopes no steeper than 20°;
- Where necessary physical erosion control measures for soil stockpiles such as proper location on flatter areas with low erosion potential, interceptor ditches and berms, toe paddocks, mulches, could be used to control erosion. This would supplement the soil binding properties of the vegetation which is expected to naturally colonize the stockpiles; and
- Where practical, the different soils types should be stockpiled separately.

Soil erosion/sediment delivery

Soil erosion/sedimentation during the construction and operation phases can be mitigated using the following methods:

- Where needed, promptly re-vegetate exposed areas and topsoil stockpiles to control erosion;
- Construct roads and landscape features so that natural drainage patterns are not impeded;
- Construct on-site roads as far as possible along existing tracks;
- Establish a monitoring plan for identifying potential erosion problems early and implement mitigation measures where necessary; and
- Establish a sustainable self-sufficient vegetative community on the post-mine project landscape.

Soil contamination

Soil contamination may be an issue during the construction and operational phases. Soil contamination can be mitigated using the following methods:

- Develop a comprehensive spill response and clean-up plan;
- Designate fuel and chemical storage and refuelling areas; and
- Design project facilities with secondary containment systems that contain spills and minimize impacts.

Appendix 16 prepared by SRK contains the Emergency Preparedness and Response Plan which deals with spills at a high-level.

Progressive rehabilitation

Progressive rehabilitation should be conducted during the operational phase, particularly on the slopes of the overburden spoil piles and should run concurrently with the mining operations where possible.

9.10 Cultural Heritage Management

IFC Performance Standards require the development of an Environmental and Social Management System (ESMS) appropriate to the nature and scale of the project and its associated risks and impacts (IFC 2012). As part of the ESMS, specific mitigation measures should be identified for each significant aspect of the project. For archaeological and heritage sites, potential mitigation and management measures to be considered include;

- I. *Avoidance*: This option focuses on conservation of cultural heritage sites by avoiding disturbance of these locations where feasible. Depending on the importance of the resource and the economic viability of preservation, site conservation may be the only option available to the developer. A site CHMP may be developed to describe management plans and actions.
- II. *Mitigation and partial conservation*: This option focuses on a combined approach of mitigation and avoidance or conservation. Portions of a site that cannot be avoided may be managed through archaeological study including such actions as shovel test pits, test excavations, detailed documentation and mapping. In areas where avoidance is feasible, conservation efforts should especially consider parts that contain significant site features. A separate CHMP is also needed.
- III. *Site mitigation*: The entire site is mitigated through appropriate archaeological study and documentation before destruction.
- IV. *Site destruction*: If a site is of little or no archaeological or cultural heritage significance, it may be destroyed.

Two options can be considered in the mitigation and management of the sites in this report. Option I, which entails the conservation and protection of sites in their original location, is the preferred course. When this is not practically or economically viable for sites of significance, Option II, salvage excavations, is recommended. These measures will minimize the negative impacts of the development. To protect the conserved sites further, monitoring will be necessary.

9.10.1 Summary of chance find procedure

During construction, if any possible finds such as stone tool scatters, ceramics or bone and fossil remains are made, the following steps must be taken:

- Appropriate communication channels should be in place when chance finds are made. It will include line management from the construction worker on the ground to the direct supervisor who will report the find to the environmental officer who will have the contact details of a heritage specialist;
- A heritage specialist must be contacted immediately to assess the significance of the finds as soon as possible to prevent any delays to the project;
- Construction activities in this area should cease until the site is cleared by the heritage specialist; and

DRC legislation Law no. 007/2002 of 11 July 2002 relating to the Mining Code Section II: Protection of the Cultural Heritage states that the mining company must “inform the local administrative authority and the authority in charge of Culture, Arts and Museums of any archaeological discoveries revealed during mining activities.

9.11 Emergency Response Plan

The emergency procedures state the site contingency plans that cover all potential accidents and incidents during both construction and operation. Specific emergency procedures will be developed by the contractors (during construction) and the Company (during operation) which will define the control mechanisms, operational requirements and other controls during such events. These procedures will determine the response to incidents on the Company's Project sites and quarry such as spills, fires, vapour leaks or personnel injury or rescues.

Training programmes will be required for workers to ensure an appropriate response in case of accidental events. The Emergency Response Procedures should be developed by the contractors shortly after mobilization.

9.11.1 Definition of Emergency Response

A major emergency in a works is one, which has the potential to cause serious injury or loss of life. It may cause extensive damage to property and serious disruption both inside and outside the works. It would normally require the assistance of emergency services to handle it effectively. The overall objectives of the emergency plan will be:

- To localize the emergency and, eliminate it; and
- To minimize the effects of the accident on people and property.

Elimination will require prompt action by operations and works emergency staff using, for example, fire-fighting equipment, water sprays etc. Minimizing the effects may include rescue, first aid, evacuation, rehabilitation and giving information promptly to people living nearby.

9.11.2 Emergency Planning

Emergency Response or Disaster Management Plan for the cement plant and quarry is necessarily a combination of various actions which are to be taken in a very short time but in a present sequence

to deal effectively and efficiently with any disaster, emergency or major accident with an aim to keep the loss of men, material, plant/machinery etc. to the minimum.

The main functions of the Disaster Management Cell are to prepare a detailed Disaster Management Plan, which includes:

- Identification of various types of expected disaster depending upon the type of the cement plant and quarry.
- Identification of various groups, agencies, departments etc. necessary for dealing with a specific disaster effectively.
- Preparation – by intensive training of relevant teams/groups within the organization to deal with a specific disaster and keep them in readiness.
- Establishment of an early detection system for the disaster.
- Development of a reliable instant information/communication system.
- Organization and mobilization of all the concerned departments/ organizations /groups and agencies instantly when needed.
- A major disaster that can be expected in this proposed project be due to fire.

SRK as part of the ESIA update prepared an EPRP which is provided in Appendix 16.

9.12 Environmental Monitoring Plan

Table 9-2 prepared by Ectech presents the environmental monitoring plan for construction and operation phases of the project.

It will be worthwhile, once again, to note here that compliance with the environmental standards as prescribed by DRC Mining Regulations and the IFC, EHS Guidelines will be the criteria for all environmental parameters.

SRK in its ESIA update expanded on the monitoring activities for soils, land use and land capability. These are presented in Section 9.9.1. The detailed management plans that are contained in appendices 11 to 19 also contain requirements for monitoring.

Environment monitoring plans for the construction and operation phases of the project are provided in Table 9-2, and the more detailed management plans relating to soils, cultural heritage and air quality in Sections 9.12.1 to 0. Figure 9-4 shows the locations of the monitoring locations proposed for surface water quality and flow, and air quality monitoring, as described below. Detail of the monitoring requirements for the closure and post-closure phases are provided in the Closure Management Plan included in Section 9.13, and social monitoring requirements are included in Section 13.

It will be worthwhile, once again, to note here that compliance with the environmental standards as prescribed by DRC Mining Regulations and the IFC, EHS Guidelines will be the criteria for all environmental parameters.

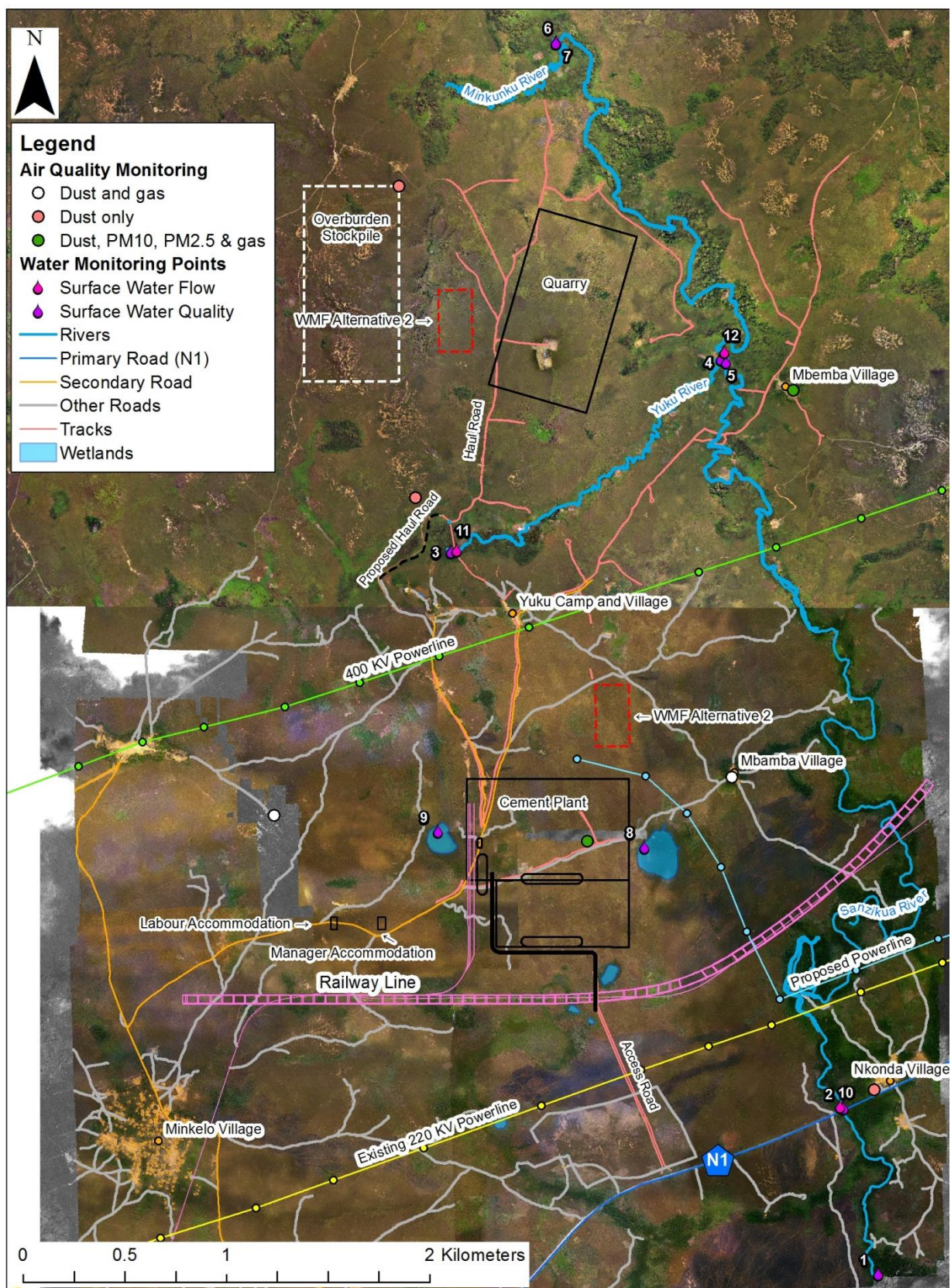


Figure 9-4: Monitoring points for air quality and surface water quality and flow

Table 9-2: Environmental monitoring plan for the construction and operation phases of the project

Environmental component	Monitoring parameters	Reference location/ ²⁶ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
CONSTRUCTION					
WATER: Drinking Water quality	Conductivity, pH, turbidity, calcium, magnesium, sodium nitrate and nitrite, potassium, zinc, fluoride, chloride, arsenic and total hardness, iron, manganese's, oil and grease, COD and BOD ₅ , Faecal Coliform, Total Coliform bacteria and free residual chlorine	Point of use (tap that is regularly used in site office)	- One sample on weekly basis, throughout the construction period. - Sample bottles must be sterilized for the coliform samples. - Free chlorine, pH and electrical conductivity must be measured on site - Calcium and Magnesium samples to be taken in borosilicate glass bottles	NYA	DRC Regional Mining Department
WATER: Surface Water Quality	Temperature, oil and grease, BOD ₅ , acute toxicity, pH, Suspended solids, arsenic, copper, total cyanide, iron, lead, mercury, nickel, zinc and total petroleum hydro carbons (Decree No 038/2003 of 26 March 2003, 2003) <u>Additionally:</u> Total chrome, nitrate and nitrite (measured as N) and total phosphate (PO ₄) measured as P) alkalinity ²⁷	1. Upstream of the Sanzikua River south of the N1 highway near Sanzikua Village 2. Sanzikua River at the bridge on the N1 3. Origin of the Yuku River 4. Confluence of Yuku and Sanzikua Rivers – in Sanzikua River 5. Confluence of Yuku and Sanzikua Rivers – in Yuku River 6. Confluence of Minikunku and Sanzikua Rivers - in Sanzikua River 7. Confluence of Minikunku and Sanzikua Rivers - in Minikunku River 8. Mbamaba Lake 9. Kawenga Lake	Monthly - pH and electrical conductivity must be measured on site - Calcium and Magnesium samples to be taken in borosilicate glass bottles - If not using a commercially purchased pre-acidified container for the dissolved metals in water, filtered metals- in-water samples should be preserved Holding times for acid preserved samples is six months except for mercury which is 28 days. - After collecting the sample and adding the preservative, the container must be placed back in a plastic bag for shipping.	NYA	DRC Regional Mining Department

²⁶ Refer to Figure 9-4 for monitoring locations for surface water quality and flow and air quality.

²⁷ The quality standards published as an annexure to the Decree No 038/2003 refers to surface water quality and not necessarily discharge standards (Development Bank of Southern Africa, 2012)

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Environmental component	Monitoring parameters	Reference location/ ²⁶ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
WATER: Surface Water Flow	Flow rate in m ³ /s	10. In Sanzikua river at the N-1 Road Bridge 11. In the Yuku River soon after its origin (Must be in flowing area and not where water is stagnant)	Daily (preferably with an in stream logger)	NYA	DRC Regional Mining Department
WATER: Treated sewage effluent quality	Temperature, oil and grease, BOD5, acute toxicity, pH, suspended solids, arsenic, copper, total cyanide, iron, lead, mercury, nickel, zinc and total petroleum hydro carbons (Decree No 038/2003 of 26 March 2003, 2003) Additionally: nitrate and nitrate measured as N, ammonium	1. Final outlet of the sewage treatment plant area after due treatment. 2. Sampling to inform operation of the treatment plant will also be required. Sampling points will depend on the type of treatment plant used and need to be confirmed with the manufacturers.	- One sample on monthly basis, throughout the construction period. - pH to be measured on site - If not using a commercially purchased pre-acidified container for the dissolved metals in water, filtered metals- in-water samples should be preserved - Holding times for acid preserved samples is six months except for mercury which is 28 days. - After collecting the sample and adding the preservative, the container is placed back in a plastic bag for shipping.	NYA	DRC Regional Mining Department
WATER: Groundwater Quality	Temperature, oil and grease, pH, arsenic, copper, iron, manganese lead, mercury, nickel, zinc and total petroleum. calcium, magnesium, sodium, potassium, aluminum, chromium, zinc, cadmium, cobalt, sulfate, phosphate, chloride, nitrate and fluoride Full analysis for first year there after one can reduce the number of metals depending on what the first year results is shown	Up- and down gradient of the quarry and plant area. Points to be confirmed after ground water flow modeling has been completed.	6-monthly - pH and electrical conductivity must be measured on site - Calcium and Magnesium samples to be taken in borosilicate glass bottles - If not using a commercially purchased pre-acidified container for the dissolved metals in water, filtered metals- in-water samples should be preserved - Holding times for acid preserved samples is six months except for mercury which is 28 days. - After collecting the sample and adding the preservative, the container is placed back in a plastic bag for shipping.	NYA	DRC Regional Mining Department

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Environmental component	Monitoring parameters	Reference location/ ²⁶ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
WATER: Ground water quantity	Flow rate in m ³ /s	Up- and down gradient of the quarry and plant area. Points to be confirmed after ground water flow modeling has been completed.	Boreholes to be equipped with flow meters	NYA	DRC Regional Mining Department
ECOLOGY: rehabilitation of disturbed habitats (including forest and aquatic habitats)	As per monitoring parameters to be determined in Rehabilitation and Restoration Plan (e.g. % vegetative cover, vertical structure of vegetation, plant health, richness and abundance of indicator species, type and extent of erosion, present and extent of invasive alien plants).	All borrow pits, degraded and temporarily disturbed land that is not occupied by permanent infrastructure.	Throughout construction period.	NYA	DRC Regional Mining Department
ECOLOGY: Rehabilitation of spoil areas	Rehabilitation of spoil and topsoil deposited sites or back fill sites.	All concerned areas.	Throughout construction period.	NYA	DRC Regional Mining Department
WASTE MANAGEMENT	- Ensure waste is disposed of according to the Internationally accepted good practices; - Keep records of all waste and materials.	All the points /sites of waste generation.	Throughout construction period.	NYA	DRC Regional Mining Department
AIR QUALITY (See section 9.12.2)	PM ₁₀ , CO, NO _x , SO ₂ , O ₃	All emission locations within the construction area.	- Continuous monitoring for PM₁₀ and PM_{2.5}, - Quarterly monitoring for other parameters	NYA	DRC Regional Mining Department
NOISE: ambient continuous noise	- L_{Aeq} (A-weighted equivalent continuous sound pressure level) - Monitor daytime and night-time levels, focusing on worst-case levels expected at night - Log noise in 10-minute averaging intervals (L_{Aeq}, 10 min)	Nearby villages (Mbemba and Mbamba Villages)	Monitoring survey covering at least one 24-hour period per month	NYA	DRC Regional Mining Department

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Environmental component	Monitoring parameters	Reference location/ ²⁶ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
NOISE: blast noise	L Pk (Linear peak sound pressure level) produced by air-blast	Mbemba Village - monitoring equipment to be set up at nearest receptor location. Review and as necessary, move monitoring location in accordance with blast locations.	As per blast frequency – capture all planned blast events	NYA	DRC Regional Mining Department
TRAFFIC	- Monitoring roadworthiness of all vehicles (NYA, contractors, and sub-contractors) entering or leaving the site. - Monitor speed limits on all mine related traffic.	- At site access control point. - Random points on haul and access roads	Daily (random inspections of a portion of vehicles). - Continuous	NYA	n/a
SOILS	See section 9.12.1 (Soils, land use and land capability monitoring plan)				
CULTURAL HERITAGE	See section 0 (Cultural Heritage monitoring plan)				
OPERATION					
WATER: Drinking Water Quality	Conductivity, pH, turbidity, , calcium, magnesium, sodium nitrate and nitrite, potassium, zinc, fluoride, chloride, arsenic and total hardness, Iron, manganese, oil and grease, COD and BOD ₅ , , Faecal Coliform, Total Coliform bacteria and Free residual chlorine	Point of use (tap that is regularly used in site office	Monthly after the water treatment plant has been commissioned. - Sample bottles must be sterilized for the coliform samples. - Free chlorine, pH and electrical conductivity must be measured on site - Calcium and Magnesium samples to be taken in borosilicate glass bottles	NYA	DRC Regional Mining Department

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Environmental component	Monitoring parameters	Reference location/ ²⁶ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
WATER: Surface Water Quality	Temperature, oil and grease, BOD5, Acute toxicity, pH, suspended solids, arsenic, copper, total cyanide, Iron, lead, mercury, nickel, zinc and total petroleum hydro carbons (Decree No 038/2003 of 26 March 2003, 2003) Additionally: Total chrome, nitrate and nitrite (measured as N) and total phosphate (PO ₄) measured as P) alkalinity ²⁸	- Upstream of the Sanzikua River south of the N1 highway near Sanzikua Village - Sanzikua River at the bridge on the N1 - Origin of the Yuku River - Confluence of Yuku and Sanzikua Rivers – in Sanzikua River - Confluence of Yuku and Sanzikua Rivers – in Yuku River - Confluence of Minikunku and Sanzikua Rivers - in Sanzikua River - Confluence of Minikunku and Sanzikua Rivers - in Minikunku River - Mbamaba Lake - Kawenga Lake	Monthly - If not using a commercially purchased pre-acidified container for the dissolved metals in water, filtered metals- in-water samples should be preserved - Holding times for acid preserved samples is six months except for mercury which is 28 days. - After collecting the sample and adding the preservative, the container is placed back in a plastic bag for shipping.	NYA	DRC Regional Mining Department
WATER: Surface Water Flow	Flow rate in m ³ /s	- In Sanzikua river at the N-1 Road Bridge - In the Yuku River soon after its origin (Must be in flowing area and not where water is stagnant)	Daily (preferably with an in stream logger)	NYA	DRC Regional Mining Department

²⁸ The quality standards published as an annexure to the Decree No 038/2003 refers to surface water quality and not necessarily discharge standards (Development Bank of Southern Africa, 2012)

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Environmental component	Monitoring parameters	Reference location/ ²⁶ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
WATER: Treated sewage effluent quality	Temperature, oil and Grease, BOD5, acute toxicity, pH, Suspended solids, arsenic, copper, total cyanide, iron, lead, mercury, nickel, zinc and total petroleum hydro carbons (Decree No 038/2003 of 26 March 2003, 2003) Additionally: nitrate and nitrate measured as N, ammonium	1. Final outlet of the sewage treatment plant area after due treatment. 2. Sampling to inform operation of the treatment plant will also be required. Sampling points will depend on the type of treatment plant used and need to be confirmed with the manufacturers.	One sample on monthly basis,	NYA	DRC Regional Mining Department
WATER: Groundwater Quality	Temperature, oil and grease, pH, arsenic, copper, iron, manganese lead, mercury, nickel, zinc and total petroleum. calcium, magnesium, sodium, potassium, aluminum, chromium, zinc, cadmium, cobalt, sulfate, phosphate, chloride, nitrate and fluoride <u>Full analysis</u> for first year there after one can reduce the number of metals depending on what the first year results is shown	Up- and down gradient of the quarry and plant area. Points to be confirmed after ground water flow modeling has been completed.	6-monthly - pH and electrical conductivity must be measured on site - Calcium and Magnesium samples to be taken in borosilicate glass bottles - If not using a commercially purchased pre-acidified container for the dissolved metals in water, filtered metals- in-water samples should be preserved - Holding times for acid preserved samples is six months except for mercury which is 28 days. - After collecting the sample and adding the preservative, the container is placed back in a plastic bag for shipping.	NYA	DRC Regional Mining Department
WATER: Ground water quantity	Flow rate in m ³ /s	Up- and down gradient of the quarry and plant area. Points to be confirmed after ground water flow modeling has been completed.	Boreholes to be equipped with flow meters	NYA	DRC Regional Mining Department
AIR QUALITY (See section 9.12.2)	Stacks Emissions of SO ₂ , NO _x , CO, CO ₂ , O ₃ , VOCs, PM, heavy metals subjected to their availability in the fuel.	All the kiln / Preheater stack and Vehicles	Ideally a continuous emissions monitor is installed; alternatively bi-annual stack monitoring	NYA	DRC Regional Mining Department

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Environmental component	Monitoring parameters	Reference location/ ²⁶ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
NOISE: ambient continuous noise	• L_{Aeq} (A-weighted equivalent continuous sound pressure level) • Monitor daytime and night-time levels, focusing on worst-case levels expected at night • Log noise in 10-minute averaging intervals ($L_{Aeq, 10 \text{ min}}$)	Nearby villages (Mbemba and Mbamba Villages)	• Monitoring survey covering at least one 24-hour period per month • Additional 24-hour surveys during all plant maintenance shut-downs to verify background levels in the absence of plant noise.	NYA	DRC Regional Mining Department
NOISE: blast noise	L Pk (Linear peak sound pressure level) produced by air-blast	Mbemba Village - Blast noise monitoring equipment should be set up at nearest receptor location.	• As per blast frequency to capture all blast events over a survey period of one month. • If levels recorded in one-month survey are below acceptable 120 dB limit, repeat survey (for a one-month duration) every 6 months. • If levels recorded in any one-month survey exceed acceptable 120 dB limit, continue survey to capture and monitor all blast events.	NYA	DRC Regional Mining Department
WASTE MANAGEMENT: solid waste disposal	Required DRC Mining Regulations	• Ensure that all waste is duly collected, segregated and disposed of according to legal requirements of the country • Keep records of the solid wastes disposed.	Regularly in connection with environmental and safety requirements	NYA	DRC Regional Mining Department
WASTE MANAGEMENT:	Implementation of the Globally Harmonized System (GHS) of Classification and Labelling of Chemicals	• All chemical storage areas	Visual inspection - continuous	NYA	n/a
SOILS	See section 9.12.1 (Soils, land use and land capability monitoring plan)				
ECOLOGY: Flora and Fauna	Monitoring of Illegal activities	Entire project area.	Continuous monitoring by regular full time guards	NYA	DRC Regional Mining Department

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Environmental component	Monitoring parameters	Reference location/ ²⁶ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
TRAFFIC	Monitoring roadworthiness of all vehicles (NYA, contractors, and sub-contractors) entering or leaving the site.	At site access control point.	Daily (random inspections of a portion of vehicles)	NYA	n/a
GREENHOUSE GASES	GHG Inventory once developed will detail monitoring requirements.	To be detailed in GHG Inventory.	Ongoing . Reporting should be monthly	NYA	n/a

9.12.1 Soils, land use and land capability monitoring plan

The monitoring program for soil should involve three main components as follows:

- Impacts on soils during construction;
- Impacts on soils during operation; and
- Indirect impacts on soil resources.

The following present details of the monitoring components listed above.

The impact of project activities on soil quality and productivity during construction and operations phases should be monitored as follows:

- Monthly
 - Inspect activities for the implementation of mitigation measures including soil salvage/management, storm water controls, etc. Keep record of inspections and areas visited; and
 - Inspect chemical and material storage area containment areas.
- Annual
 - Record total and new areas disturbed, volume of soil salvaged, and areas where reclamation is complete;
 - Site wide evaluation on the effectiveness of erosion control efforts including erosion control structures and measures implemented;
 - Evaluation on the effectiveness of the spill response plan, including a review of significant spill incidents and mitigation measures; and
 - Establishment of program for the monitoring of closure plots to determine the effectiveness of rehabilitation activities. Monitoring criteria should be established based on reference areas and the post-mining land use being re-established.

9.12.2 Air quality Monitoring Plan

Ambient air quality monitoring

These guidelines have been compiled for the use of monitoring of dust fallout, Particulate Matter (PM) (PM₁₀ and PM_{2.5}) and gas (CO, SO₂ and NO₂) at the cement plant and surrounding activities. The purpose of these guideline is to ensure reproducible sampling can be confidently used to assess the dust and gas levels in the receiving environment.

Proposed monitoring locations

The proposed dust and gas monitoring points and their respective co-ordinate locations are tabulated below and shown on Figure 9-4. Security at the sampling locations must be considered and, wherever possible, access to the general public must be restricted. The decision to locate the monitoring points at the selected location was with respect to mine infrastructure and receptors. However, these may change depending on site specific conditions and maybe better located if a dispersion model is run.

Table 9-3: Proposed monitoring locations for dust fallout and gas

Site	Co-ordinates	Pollutant
Mbemba Village	5°36'38.81" S 14°12'55.43" E	Dust, PM ₁₀ , PM _{2.5} and gas
At the quarr/overburden stockpile	5°36'06.04" S 14°11'52.43" E	Dust only
Yuku Camp Village	5°36'55.99" S 14°11'54.93" E	Dust only
Cement Plant North	5°37'51.00" S 14°12'22.37" E	Dust, PM ₁₀ , PM _{2.5} and gas
Cement Plant South	5°37'40.81" S 14°12'45.56" E	Dust and gas
Nkonda Village	5°38'30.87" S 14°13'08.30" E	Dust only
Waste Landfill	5°37'46.79" S 14°11'32.27" E	Dust and gas

Dust fallout monitoring methodology

Dust samples are generally collected at 30 day (+2) intervals. The following steps must be followed during sample collection:

- The sample buckets must be replaced on the 1st day or the first working day of every month;
- Record the date and identification number of the container installed and the container being replaced in the field notebook (e.g. NDM01 or NDM02 etc.);
- Unlock the padlock for the bucket holder and carefully remove the bucket taking care not to spill any of the contents;
- Inspect the contents of the bucket and note the condition of the bucket and the contents within the bucket (dust, foreign objects such as leaves, insects, etc.) in the field notebook;
- Reseal this container using a lid and place in a cooler box or any other container that will be used to transport the samples;
- The sealed buckets must be dispatched on a monthly basis to the laboratory for analysis;
- No additional sample preservation is required. Ensure that the buckets are sealed immediately on site after the buckets are removed from the stands and the sample has being inspected
- **Do not** discard any water present in the sample container when it is collected from the site. If sufficient rain has fallen at a site and the container is filled with water to the extent that it has overflowed, note this in the field notebook and seal the bucket as is for submission to the laboratory;
- Install the replacement bucket (ensuring that it contains sufficient water and disinfectant solution) and lock the bucket holder;
- During the dry (wet) season pour 3.5 L (2.5 L) bottled/distilled or deionised water and 90 ml (60 ml) bleach/sodium hypochlorite solution into each bucket; and
- During the dry season, water levels in the buckets should be monitored and replenished if the buckets are dry or water levels have dropped by more than 50%.

Gas (SO₂ and NO₂) sampling methodology

The following should be noted with respect to preparation of the passive diffuse badges:

- No preparation needed (badges can be assembled in the field).

The following sampling and frequencies must be followed:

- The gas cartridge must be returned to the original vial marked with the sample location on the side of the vial;
- Gas sampling should be done over a 15 day period every quarter. e.g. 1 July 2013 to 15 July 2013;
- The start and end time and date must be recorded on the field sampling log sheet; and
- No sample preservation is required other than keeping the samples cool (out of direct sunlight).

PM₁₀ and PM_{2.5} monitoring

Depending on the type of monitor procured, the sampling methodologies should be followed as per the instructions given in the operational manual for the sampler.

Carbon Monoxide (CO) - Single gas monitors or ambient air quality analysers

To monitor CO a gas analyser will have to be used. An ideal monitor for this area will be a hand held monitor as it is cost effective and easy to use. The monitor can be placed at each of the proposed locations and readings can be taken over a 24 hour period. Sampling can be undertaken every quarter.

Stack emissions monitoring

As per the EU recommendations for BAT monitoring at the cement plant, the following techniques should be used on a regular basis to monitor emissions from the processes at the plant. The

selection between continuous or periodic measurements mentioned is based on the emission source and the type of pollutant expected.

Table 9-4: Techniques for emission monitoring at the plant (Source BAT 5(f) EU, 2013)

Technique	Applicability
Continuous measurements of process parameters demonstrating the process stability, such as temperature, O ₂ content, pressure and flow rate	Generally applicable
Monitoring and stabilizing critical process parameters i.e. homogenous raw material mix and fuel feed, regular dosage and excess oxygen	Generally applicable
Continuous measurements of NH ₃ emissions when Selective Non-catalytic Reduction (SNCR) is applied	Generally applicable
Continuous measurements of dust, NO _x , SO _x and CO emissions	Applicable to kiln process
Periodic measurements of PCDD/F and metal emissions	
Continuous or periodic measurements of HCL, HF and TOC emissions	
Continuous or periodic measurements of dust	Applicable to non-kiln activities. For small sources (<10 000 Nm ³ /h) from dusty operations other than cooling and the main milling processes, the frequency of measurements or performance checks should be based on a maintenance management system.

9.12.3 Cultural heritage monitoring plan

Ideally, site monitoring should be conducted by an experienced archaeologist or heritage specialist. However, because of human resource limitations and budget constraints, this may not be practical. If heritage specialists are not available, it is recommended that Environmental Officers (EO) or other responsible persons should be trained along the following lines:

- *Induction training:* Responsible staff identified by the developer should attend a short course on heritage management and identification of heritage resources.
- *Site monitoring and watching brief:* As most heritage resources occur below surface, all earth-moving activities need to be routinely monitored in case of accidental discoveries. The greatest potential impacts are the initial soil removal and subsequent earthworks during construction. The EO should monitor all such activities in the field on a regular basis. In the event that any heritage resources are found, the relevant authorities must be informed and any artefacts uncovered must be protected and kept safe as per Articles 205 and 206. An archaeologist or heritage specialist should be contacted to assess the finds. In the event of human remains all work in the affected area should stop immediately, the local traditional leadership should also be informed. Furthermore, a qualified archaeologist or other specialist must document the finds.
- Finally, a heritage specialist should assess any material change to the conceptual layout plan.

Heritage resource management and monitoring measures are listed in Table 9-5.

Table 9-5: Heritage resource mitigation and management.

Site	Activity	Objectives	Mitigation/Management measure	Frequency of monitoring	Legal and International Standards Requirements	Recommended Action Plans	Timing	Responsible Person
Site 17-20 Iron Age Complex	Road infrastructure	To prevent accidental destruction	Site monitoring will be necessary if any earthworks take place nearby.	Once-off as required.	DRC legislation; IFC Unit Standard 8;	Site/area to be flagged on infrastructure development plans	Construction phase	Environmental officer to inform archaeologist of potential impact.
Site 16 and 36 (Cemeteries)	Village relocation (Site 16) Overburden Stockpile	To document and record site before destruction	Site monitoring will be necessary if any earthworks take place nearby.	Prior to any major alteration, restoration, demolition of site.	IFC Unit Standard 8; DRC legislation	Site 16: Based on community wishes determined by social team Site 36: Site/area to be demarcated and flagged on infrastructure development plans	Before construction starts	Developer and social team

9.13 Maintenance

The plant will be maintained to ensure that pollutants releases to the environment are minimized. Records will be kept to show what maintenance has been carried out. This would apply to a range of areas including combustion optimization, fuel handling and monitoring equipment

9.14 Closure Management Plan

9.14.1 Design Basis

The design of the Mine Closure Plan (MCP) considers a number of interrelated components. Among these are legal and other obligations, closure objectives, environmental and social considerations, technical design criteria, closure assumptions, and relinquishment conditions. The combination of these aspects provide the key considerations used in the development of the plan.

Local legislation

The main legislation is contained in Annexure IX of the Mining Regulations specifically in Articles 95 to 123 of Chapter VII: Mitigation and rehabilitation measures after closure of the site. These articles describe the mitigation required after closure of site not least which include revegetation, mitigation and rehabilitation of contaminated soils, surface buildings, infrastructure and equipment, road infrastructure, surface and underground machinery, open cuts excavations and ditches, water, waste dumps, sanitary facilities, stability, and so on. In addition the regulations address issues such as making the site safe including sealing of shafts, backfilling of pits and securing the site with fencing and warning signs.

EHS Guideline – Mining

In addition to the local legislation, international good practice guidelines that apply include the Equator Principles (III) and the IFC/World Bank Group's Policies and Performance Standards on Social and Environmental Sustainability.

A whole series of EHS guidelines has been developed for the different industrial sectors, with guidance given that is specific to that sector. However, the General EHS Guidelines contain information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors.

Closure requirements are specified in the Mining Sector guideline, and outline the requirements for the preparation of a Mine Reclamation and Closure Plan (MRCP) in draft form prior to the start of production. The EHS guidelines also recommend that both physical rehabilitation and socio-economic considerations should be an integral part of the project life cycle and should be designed so that:

- Future public health and safety are not compromised;
- The after-use of the site is beneficial and sustainable to the affected communities in the long term;
- Adverse socio-economic impacts are minimized and socioeconomic benefits are maximized.

9.14.2 Closure Objectives

The closure objectives for the operation are:

- Adhere to all statutory and other legal requirements
- Ensure safety & health of all stakeholders during closure and post closure and that communities using the site after closure are not exposed to unacceptable risks;

- Ensure that closure supports productive uses considering pre mining conditions and are in agreement with commitments to and requirements of stakeholders;
- Physically and chemically stabilise remaining structures to minimise residual risks;
- Promote bio-diversity and biological sustainability; and
- Utilize closure strategies that promote a self-sustaining condition with little or no need for on-going care and maintenance.

9.14.3 Post closure land use

Decisions regarding specific post closure land uses will need to be addressed in future detailed closure plans and in discussion with various internal and external stakeholders including local government, the municipality, the local communities and other stakeholders as identified.

A conservative approach has been adopted for decommissioning and closure. This is based on the assumption that the most stringent measures likely to be imposed on the development would be that the Project site would have to be returned to the pre-mining land capability. The implication of this is that the post mining land use would be that similar to the pre-mining land use, commensurate with the pre-mining land capability. This is within the context that it is unlikely that there is a post closure use for any of the infrastructure other than accommodation and access roads.

Cognisance must however be taken of the fact that the land use could be influenced by regional and socio-economic developments. It is however, expected that these changes, should they occur, will be addressed in subsequent reviews of the Closure Plan as the end of the Life of Operation is approached. It must also be noted that in some instances, it will not be practical to return the land to the pre-mining land use/capability as the benefits achieved, do not warrant the costs expended. This can be justified in that there is currently an abundance of landscape around the perimeter of the Project area, which has not been impacted by mining and processing activities. The areas where it will not be possible to return the land to its pre-mining land capability are:

- Overburden spoils pile;
- Quarry.

The rehabilitation activities in these areas will be undertaken to reduce residual health and safety risks to the local communities, mainly to limit the risks associated with inadvertent access, whereby injuries may occur.

9.14.4 Assumptions used to support closure costing

The liability assessment has been developed based on available information including environmental data in this document and design layouts. Some of the information currently available is preliminary therefore, a number of assumptions were made about general conditions and closure and rehabilitation of the facilities at the site in order to develop the proposed closure liability. As additional information is collected during operations, these assumptions will be reviewed and revised as appropriate.

The assumptions used to create this assessment are provided below:

- Limited third party use of infrastructure will be available at closure and all infrastructure, other than accommodation and access roads will require decommissioning;
- No closure requirements are considered for the Matadi Port from where the cement will be shipped;
- No provision is made or action developed for the closure of railway lines or powerlines as it is assumed that liability for this resides with a third party;
- Soil with the appropriate geochemical and geotechnical characteristics will be available to utilise as growth medium on the exposed footprint, following demolition;

- The materials balance will be such that backfilling of the quarry is not economically feasible and there is no significant risk mitigation achieved through backfilling. Therefore, it is assumed that all material placed in the overburden spoils pile, will remain in the overburden spoils pile. The only closure activities associated with the quarry will be the removal of all mobile equipment, the demolition of any civils structures and the construction of a perimeter bund to limit inadvertent access to the workings;
- In the absence of geochemical characterisation of the lithologies disposed of in the overburden spoils pile it is assumed that the geochemical characteristics of the leachate and runoff from this facility will comply with the discharge standards of the EHS Mining Guideline and with local legislation. Therefore, no low permeability covers to limit infiltration and leachate generation are required in the closure design of the overburden spoils pile;
- Although no low permeability cover materials are required on the overburden spoils pile, a growth medium is required for the establishment of vegetation to mitigate visual and erosion (both wind and water) risks post closure. It is further assumed that end tipping will be the depositional strategy during the majority of the life of the project, resulting in slopes constructed at the natural angle of repose. At closure the final slopes of the dump will require reshaping to form slopes that are no steeper than 24° to accommodate cover placement and vegetation establishment;
- All laydown areas utilised during the construction period will be rehabilitated and closed during the commissioning of the various infrastructure areas, with the costs of this covered by the construction contracts. Therefore, no closure provision is included for any of the laydown areas;
- All ash generated in the cement manufacturing process will be recycled back into the cement and no ash dumps will exist requiring closure;
- All coal stockpiled in the coal storage will be utilised and no coal will remain. However, it is likely that the basement of the coal storage yard will be contaminated and will require remediation to achieve the desired closure criteria;
- Although there is likely to be a significant salvage and scrap value to the equipment in the cement plant, a zero value has been assumed for the purposes of the liability assessment.

9.14.5 Closure actions

The closure strategy will be to undertake closure activities that will result in a stable landform, consistent with the post closure land use. The following closure actions are expected to achieve the final post closure land use plan of returning the land to a capability to support subsistence agricultural activities. Where a closure action addresses a specific requirement of Articles 95 to 123 of Chapter VII: the relevant article is indicated in parenthesis.

Soils (Article 97, 98 and 99)

The objective of any soil remediation program will be to ensure that contaminated soils are treated/disposed/ remediated in situ progressively through the life of mine, in consultation with the authorities, to meet the requirements of the final land use plan, without unduly negatively impacting on the health of surrounding communities or impacting on local ecology, thereby ensuring that the soils do not become a secondary source of contamination to other environmental media.

Specific activities that will be undertaken will include:

- NYA will undertake soil investigations after an accident or incident or at mine decommissioning to characterise the nature of possible contaminants and design a site specific soil remediation strategy. NYA will identify appropriate risk based guideline levels against which to assess contamination.
 - If contamination is primarily hydrocarbon, with soil concentrations exceeding an appropriate risk based guideline, the following will be undertaken:

- Volumes less than 100 m³ – On site bioremediation will be undertaken by collecting the affected soils and transporting them to a dedicated bioremediation facility.
- Volumes greater than 100 m³ – Alternative measures will be investigated which could include disposal at a waste site, micro-encapsulation etc.;
- If contamination is primarily inorganic, a risk based approach will be adopted in determining final soil remediation technology adopted. Options available at present include:
 - Isolation by installation of physical barrier or techniques such as micro-encapsulation;
 - Immobilisation by either pH or redox adjustment;
 - Extraction through enhancing solubility and then extracting contaminated solution;
 - Removal and disposal at a suitable alternative site,
- Where risk based assessment indicates that residual contamination is unlikely to present an unacceptable human or ecological risk, contaminated soils will be covered with sufficient soil to provide a suitable plant growth medium and vegetation will be established. These areas will be clearly demarcated as areas not for use by local communities.

Demolition of infrastructure (Article 96, 100, 101, 102, 104, 105, 107, 111 and 121)

Prior to closure a water management plan will be undertaken to identify which structures are required at closure and which can be decommissioned. Ditches decommissioned will be closed by backfilling the excavations with the material removed, and placed adjacent to the structures, during construction. Bunds not required will be flattened by redistributing the material across the footprint used to borrow the material for construction.

The following will be undertaken for infrastructure where written permission has not been obtained from the Minister to leave the buildings for the socioeconomic development of the region and where a suitable third party has not been identified for the transference of liability of the structure. This includes structures in the cement plant, coal stockyard, mining related infrastructure such as workshops, offices stores, accommodation and other buildings;

- Equipment with potential resale or scrap value will be removed.
- Remaining equipment will be drained of all lubricants, hydraulic oils, fuels and other process reagents and these disposed of as hazardous waste.
- Buildings to be demolished and rubble to be placed into the base of the quarry. Specific demolition requirements include:
 - All power and water services to be disconnected and certified as safe prior to commencement of any demolition works;
 - All fittings, fixtures and equipment within buildings will be dismantled and removed to designated temporary disposal yards;
 - All above ground electrical, water and other service infrastructure and equipment to be removed and placed in disposal pits or the designated temporary salvage yards;
 - All pond liners to be removed for disposal in designated landfills;
 - Electrical, water and other services that are more than 400mm below ground surface will remain;

- All pipes and structures deeper than 400mm need to be sealed to prevent possible ingress and ponding of water;
- All concrete below 400mm depth will remain underground with the invert of all structures broken/sealed to prevent possible ingress and ponding of water;
- All subsurface cavities such as reinforced concrete tunnels under stockpiles and septic tanks will be backfilled;
- All water tanks not required for closure activity will be demolished and rubble placed at the base of the quarry. Once water is no longer required on site, the remaining tanks will be demolished.

The yard areas (e.g. platforms created for buildings) will be closed and regraded to control storm water runoff and erosion. The natural topography of the site required the construction of terraces for the working areas using cut or cut-and-fill techniques. Once the structures and foundations are demolished, removed, or buried, the yard areas will be inspected for any areas of hydrocarbon contamination. Any hydrocarbon contaminated soils will be managed as described below. The yard areas will then be partially regraded to fill in any excavations remaining following the demolition activities utilising material in berms and highwalls of terraces. Compacted areas will be ripped to mitigate the effects of traffic. Growth medium will be imported and a 500mm layer placed, onto which vegetation can be established.

Roads (Article 100, 101 and 102)

Agreements will be reached with the local population and the authorities regarding which roads should remain. Any roads which will no longer be required, will be rehabilitated by NYA as described below:

- Bridges, culverts and ducts will be removed where they are no longer required;
- The natural water flow will be restored and any disturbed section of the watercourse will be stabilised and revegetated;
- The road surface will be ripped to break compaction using a tine of at least 500mm;
- The road surface, shoulders and embankments will be graded to a slope suitable to prevent erosion. Cuttings will be assessed and, where necessary, measures to improve safety and erosion stability will be implemented.
- Rehabilitated surfaces will be vegetated with a mixture of indigenous species.

Quarry (Article 108 and 109)

At closure, the quarry may fill up with water decanting from groundwater and rainfall and runoff into the cut. The cumulative effect of these inputs is likely to result in the quarry filling to a decant level. The quality of the mixed water in the quarry has not yet been determined and will be the subject of characterization work as the closure plan develops.

There is a risk that the quarry may be attractive as a water source. It is unlikely that it will be possible to prevent access to these users, however, the risks associated with inadvertent access will be managed through the construction of access control bunds.

Closure actions for the quarry will include:

- An engineered spillway will be constructed at an appropriate position to safely convey decant likely to occur as a result of the various water inputs, to the adjacent river.
- Inadvertent access to the quarry will be limited by the construction of abandonment bunds. The abandonment berm will be:
 - Constructed from overburden with a final crest height of 2m with a crest width of 1m;
 - Side slopes that don't exceed 1V:3H;

- Located outside of the quarry break back zone or a minimum of 15m from the crest, whichever is the greatest;
- Slope failure on the quarry walls is inevitable, particularly where the walls are excavated in weathered material. This potentially poses a risk to people and animals accessing the pits after closure. However, inadvertent access will be restricted by the construction of the abandonment bunds outside the zone of instability. Therefore, at closure no attempt will be made to reclaim the quarry walls excavated in overburden. This will be further investigated in subsequent iterations of the closure plan following completion of a geotechnical investigation and formal risk assessment.
- The ramps will remain post-closure; however, physical barricades will be constructed at strategic locations to limit inadvertent vehicular traffic into the pit.

Overburden spoil pile (Article 112 and 113)

Closure activities at the overburden spoils pile will result in a stable landform capable of supporting a vegetation community analogous with surrounding grasslands, where the generation of contact water is limited by the incorporation of appropriate covers in the closure design. Closure actions will include:

- Slopes steeper than 24°, will be reshaped to 24° on condition that the extended footprint remains within the permitted boundary. Where footprint constraints limit the potential to form the design slope, alternatives closure designs will be investigated;
- Growth medium likely consisting of recovered soils will be placed to form an average of 300mm of cover on the dumps;
- Vegetation will be established on the growth medium.

Sanitary facilities (Article 120)

At the commencement of closure activities all sanitary facilities will be decommissioned as follows:

- Septic tanks will be emptied and the sludge used as soil ameliorants where needed on reclaimed land;
- The tanks will be removed and disposed of;
- The excavation will be backfilled and the drainfield will remain in situ;
- Any sewage treatment facilities such as biodisks or package plants will be emptied of sludge, with the sludge used as a soil ameliorant. Civil infrastructure will then be decommissioned as described above.

Fuel storage and dispensing (Article 121)

Closure of these facilities will focus on physical closure and investigation of potential subsurface contamination from petroleum products. Closure of these facilities will include:

- Removing remaining fuel inventory;
- Decontaminating equipment including tanks, piping, and dispensing equipment, as needed;
- Removing equipment;
- Demolishing all storage tanks and buildings;
- Removing any appurtenances including piping and electrical;
- Breaking walls and foundations to grade;
- Hauling non-hazardous demolition debris to pit;
- Sampling soils beneath and surrounding the facility;
- Classifying and removing any contaminated soils identified and treating them on site to acceptable standards or to a licensed facility if hazardous; and
- Regrading the footprints in line with adjacent yard footprints.

A portion of the fuel inventory will be used during closure. Near the end of the closure period, after the primary earthwork is complete, the fuel storage and dispensing facilities will be decommissioned.

Waste management (Article 122 and 123)

- During closure hazardous and non-hazardous waste will be managed in accordance with the procedures established during operation for the management of these types of waste.
- Building rubble will be placed at the base of the quarry and covered by a minimum of 2m of overburden to limit access to the waste by the local communities. This overburden will then be rehabilitated as for the overburden spoils pile.

9.14.6 Relinquishment criteria

Following the implementation of the Action Plan, it is necessary to have measurable criteria against which to assess the effectiveness of the plan and its implementation. These criteria will assist NYA in identifying when the standard of closure achieved is sufficient to relinquish responsibility for a specific area. The site specific relinquishment criteria for the mine are documented in Table 9-6. These criteria relate mainly to the biophysical environment and do not at this stage include employee benefit criteria. Further relinquishment criteria will be developed once additional studies and consultations have been completed. Also included in the table are the indicators required to demonstrate achievement with the relinquishment criteria and the reporting requirements. The reporting requirements are those that are expected to fulfill the monitoring requirements set out by legislation.

These criteria related mainly to the biophysical environment and do not at this stage include alternative livelihood or employee benefit criteria. These criteria will be developed once additional studies and consultations have been completed. Also included in the table are the indicators required to demonstrate achievement with the criteria and the reporting requirements. The reporting requirements are those that are expected to fulfill the monitoring requirements set out by legislation.

Table 9-6 Relinquishment criteria

Category	Closure criteria	Indicators	Reporting requirements
Ground & Surface Water	Compliance with the in country or IFC EHS Mining Guideline	Downstream water quality monitoring	Monitoring report
Air	Compliance with the in country or WHO Air Quality guidelines as contained in IFC EHS General Guideline	Records of air quality measurements for PM10 and PM2.5	Monitoring report
Soil quality	Soil quality that does not present an unacceptable residual risk	Soil quality in areas where contamination identified	Results of soil quality and risk assessment
Land productivity	Land capability and productivity similar to that which existed prior to mining	Land capability and productivity	Comparison to analogue areas and pre-mining aerial photographs Socioeconomic survey
Erosion	Implementation or construction of erosion control measures	Engineered structures to control water flow Slope angle of 24o Establishment of vegetation	Evidence in rehabilitation report that required structures are in place and functioning See Vegetation below
Safety stability	The site is safe for use by humans and animals, including in the foreseeable future	Geotechnical and hydrological studies of existing structures - outer batter slopes of waste rock dumps & tailings storage facilities, pit stability	Evidence in rehabilitation report that appropriate risk assessment has been undertaken and control measures are in place
Vegetation	Establishment of self-sustaining vegetation population which stabilizes soils and is not invasive to the region.	Species cover and composition	Monitoring report

9.14.7 Data gaps

Several technical studies are required to improve the information available for closure planning, which ultimately reduces the residual risks associated with the operation. These include:

- Geochemical characterization of the overburden material to determine future quality associated with leachate;
- Pit lake investigation to determine the final quality of the lakes formed in the quarry;
- Detailed seepage analyses on the overburden soil stockpile;
- Stability modelling of quarry and overburden spoil stockpile;
- Long terms erosion modelling on the overburden spoil pile;
- Closure materials characterization, including the development of a materials balance;
- Vegetation Management Plan;
- Integration of the biophysical plan with the social closure requirements, which includes stakeholder engagement;
- Predictive closure water balance;

9.14.8 Post Closure Monitoring and Maintenance

The site monitoring plan will be revised in the first year of the closure period to reflect the post-closure monitoring requirements. A post-closure care and maintenance plan will also be prepared during the first year of the closure period.

The objective of the monitoring program will be to document the recovery of the site towards the closure land use goals, in accordance with the overall closure objectives and ultimately collect sufficient data to establish that the relinquishment criteria have been achieved.

The monitoring that will be required during the post-closure period is summarized below:

- *Air Quality*: The operational monitoring network will be rationalized to monitor potential post closure impacts with dust samples being collected routinely from strategic positions;
- *Surface water quality*: Strategic water sample position will be identified and samples collected on a monthly basis. Analyses to include both chemical as well as suspended load measurements;
- *Groundwater*: Groundwater levels in boreholes as well as in-pit will be recorded quarterly. Groundwater samples will be collected and analysed for a suite of chemical parameters; and
- *Vegetation*: Quarterly visual inspections to be undertaken in re-vegetated areas to assess vegetation establishment and provide early detection of erosion. Suitable plots within each area will be identified where quantitative ecological monitoring can be undertaken to determine

It is likely that more extensive monitoring in terms of both frequency and sampling location will be undertaken during the closure period. Once closure activities are completed, and the operation enters the post-closure phase, it is likely that the monitoring requirements will be revised to include only the key components where further data is required to establish that relinquishment objectives have been achieved.

Annual reports will be prepared to document the results of the monitoring during the closure and post-closure phases. These reports will provide important information required to manage the on-going closure activities, with the data and reports being used to:

- Provide recommendations for improving subsequent reclamation activities;
- Indicate where reclamation and closure activities have not been successful, requiring a potential change in design criteria;
- Provide information where care and maintenance is required during the post-closure period; and
- Indicate if relinquishment criteria have been achieved

The expected closure liability and estimate schedule of payments are provided in Table 9-6 and Table 9-87.

Table 9-7: Expected closure liability

Aspect	Closure Cost
Waste Rock Dump	\$1 086 489
Roads	\$49 677
Pit	\$36 263
Haul of debris to pit	\$601 113
Demolition	\$4 810 805
Process Ponds	\$281 490
Land fill	\$323 233
Yards	\$1 433 999
Monitoring & Maintenance	\$1 227 449
TOTAL	\$9 850 518

Table 9-8: Expected payment schedule

Period	Proportion	Payments
Year 4	0.008	\$78 804
Year 5	0.025	\$246 263
Year 6	0.041	\$403 871
Year 7	0.058	\$571 330
Year 8	0.074	\$728 938
Year 9	0.091	\$896 397
Year 10	0.107	\$1 054 005
Year 11	0.124	\$1 221 464
Year 12	0.141	\$1 388 923
Year 13	0.157	\$1 546 531
Year 14	0.174	\$1 713 990
Total	1	\$9 850 518

9.15 Assigning Responsibility for Implementation (by name or position)

The cement plant operational workforce will include the EHS Manager. This officer will be suitably trained and be responsible for the following:

- Ensuring that environmental protection procedures are followed;
- Coordinating environmental monitoring;
- Acting as a contact person for liaison with the public, local organizations and Government;
- Ensuring that data on all environmental aspects of plant operation is continuously updated, and available in a form suitable for immediate inspection by authorized personnel of the concerned including lending agency, Mining and Environment Ministries and internal authority of the plant;
- Monitoring especially hazardous substances on-site to ensure that the possibility of accidental release is minimized;
- Promoting on-site environmental awareness, and;

- In order to ensure implementation and effective operation of the EMP, it is of utmost importance that responsibilities be fixed to specific persons so that each one of them should be answerable in case of lapse or mishap. Accordingly, hereunder the same responsibilities have been described:

Table 9-9: Responsibilities (as per ECTECH 2013 ESIA)

Official Concerned	Responsibility
General Manger, Plant	i-Ultimate in-charge and responsible for all the operations of Environmental Management Plan (EMP) set up. ii- He will be responsible to ensure smooth functioning of the EMP system iii-Daily progress on the state of the environmental status will be reported to him in writing by the Shift Engineer/In -charge. iv-All other EMP matters, issues and problems will be reported to him (for rectification) by the Shift Engineer/In-Charge. v-He will work as bridge between the Government's concerned authorities and the senior most management of the project. vi-He will be answerable to the higher management in all matters relating to E.M.P. and report at least monthly about the state of the E.M.P. operations.
EHS Manager	i – Responsible for implementation of EMP. ii – Coordination with other departments/sections with respect to EMP. iii – Arranging, collection and reporting of environmental monitoring data and publishing of report.
3- Shift Engineer/ In charge	i-During his shift timings, he will be responsible to ensure smooth functioning of the entire EMP. ii-He will be responsible to rectify any problem regarding environmental matter. iii- He will directly report to the G.M. (Plant/Works) all matters relating to E.M.P. on daily basis.
4- Plant Operator	i- He will be responsible to operate effluent treatment plant and look after gaseous, PM and sound levels monitoring systems. ii-He will maintain all records of monitoring of the entire elements of the EMP. iii-He will report to the Shift Engineer/In-Charge about matters relating to EMP operations on daily basis and earlier if so required.
5- Laboratory Chemist	i- He will be responsible to carry out all laboratory testing of waste water at all levels. ii- He will perform all other lab. testing as may be required from time to time in the interest of effective operation of the EMP. iii- He will maintain records of the entire EMP operations. iv- He will report daily to the Shift Engineer/In-charge about the matters relating to the EMP operations.

9.16 Reporting and reviewing procedures

Environmental monitoring program, as described above, will be the guiding principle and reporting will be done regularly on monthly basis as per requirements of the Mining Regulations.

At the plant level all the monitored data will be reviewed and scrutinized at the level of Shift Engineer and on monthly basis at the General Manager, Plant level. The same review of the data will be done twice at the level of the Project Chief Executive. The data will be documented according to appropriate format at the project level. Discrepancies will be duly addressed to.

For presentation of the data to the concerned agencies, their format will be used and the pattern if to be provided by the lending agency (e.g. IFC) will also be adhered to.

9.17 Training Needs

In order to effectively operate the EMP all the staff to be engaged in this activity should be trained extensively.

All the environment management staff to be engaged for operating effluents treatment plant, monitoring and testing should be duly trained. Laboratory chemist should be trained in all operations of laboratory testing of the effluents and other relevant materials/samples. He should be trained in applying analytical methods/techniques of testing, data processing, interpretation and reporting. He should know the local laws, rules and regulations as applicable to the testing of effluents.

The designated EHS Manager will be charged with an on-going program of environmental training. This will include:

- General promotion of environmental awareness especially staff of the plant;
- Specific EHS training of staff working in sensitive areas;
- Updating of staff on changes to environmental standards; and
- Reporting to staff on the station's environmental performance.

The person to monitor gaseous emissions, PM and noise levels should be extensively trained to handle his job capably. Training program should include use of monitoring instruments, data generation, processing, interpretation, recording and presentation.

9.18 Auditing and Management Review

An auditing programme is a key component of many EMPs, including ISO 14001 and OHSAS 18001. The primary purposes of the audit programme are:

- To verify continued conformance with respect to all applicable laws and regulations and to the Company's internal policy and procedures;
- To confirm the continued existence and efficacy of management systems to ensure compliance and performance; and
- To assist in the identification of actual and/or potential risks.

The benefits of the audit programme are:

- Assistance to management in identifying and prioritizing activities and/or practices that have opportunities for improvement;
- Reduction in risk through identification of areas of concern and triggering of appropriate corrective action; and
- Assistance with benchmarking and measuring improvement in management system performance.

The benefits of the review process are detailed below:

- Assess whether company personnel have complied with policy and procedures using audit reports;

- Review targets, objectives and environmental performance indicators to establish their continued correctness in the light of changing environmental impacts and concerns, regulatory developments, concerns among interested parties, market pressures, internal changes/organizational activity changes and changes in the environment;
- Determine if targets and objectives are being met;
- Review regulatory compliance and whether EMP requirements have been achieved.
- Determine root causes of systemic non-conformances;
- Determine if the operational controls, procedures, corrective actions, preventative measures and continuous improvement efforts have resulted in enhanced environmental performance;
- Determine if energy efficiencies, accounting practices and information management systems are adequate;
- Determine areas of improvement in organizational structure, staff training, work instructions, processes, pollution prevention programmes, energy utilization and accounting practices, which may lead to environmental opportunities and increased profit margins;
- Formulate corrective actions and preventative measures as a result of the review of system non-conformance and verify corrective actions are effective and appropriate.

10 Public Consultations/Disclosure

10.1 Introduction

SRK's approach to the public consultation component of this ESIA update is to move and consolidate all socio-economic profile and context data, which was previously included in the public consultation section of the ECTECH report, into Section 6.6 (baseline socio-economic conditions) of this ESIA update report.

This section therefore focuses only on the previous public consultation and engagement undertaken by ECTECH, and is supplemented by:

- Further Information from the ECTECH public consultation process undertaken in 2012 which was not included in the previous report; and
- Information and stakeholder inputs obtained during the focus group meetings and key informant interviews with stakeholders undertaken by SRK in June 2013, in the process of updating the socio-economic baseline study.

Note: That while the writing style/ grammar of the ECTECH report has not been changed, some changes have been made to the structure of the previous report, but the overall structure has been largely retained. The changes include:

- Sub-sections moved elsewhere in the report (as mentioned above);
- Sub-headings added to provided additional information;
- Sub-headings deleted, but still retaining the information as part of other sub-sections.
- Presenting existing information in Tables.

10.2 Process followed for Public Consultations

10.2.1 Communication between Stakeholders and the Moderator:

It will be pertinent to note here that since Public Consultations (PCs) require more extensive interaction between the respondents, stakeholders and the moderator /professionals conducting the PCs, therefore, to ensure that complete understanding of the process and its importance was well brought home to the targeted participants by the moderator/professional i.e. expert from ECTECH; Mr. Guyghens Bongwele, Geologist from NYA sprl, well versed in English and Lingala (local language of the people of the project area) acted as mediator/translator to make the process a true success in letter and spirit. His services as translator remained at the disposal of the ECTECH team during their entire survey period of the project area and for the period of stay in DRC.

10.2.2 Moderator's guidelines

In order to get over all pictures of the villages subjected to Public Consultations, Moderator's Guidelines developed for the purpose were used. The specimen of the guidelines is enclosed as Appendix-9.1.

10.2.3 Information sharing

Information about the proposed Nyumba Ya Akiba (NYA) Cement Plant project was shared with stakeholders through verbal presentations in Lingala and Kikongo by members of the ECTECH public consultation team and the moderator from NYA.

10.2.4 Obtaining comments and inputs from stakeholders

Meetings with stakeholders during the ESIA (2012)

In every village, and during every meeting, the moderator with the help of the interpreter, first used to apprise the stakeholders/participants fully well of the true background of project including social, economic, educational, medical, moral, industrial, infrastructural development, civil water supply, environmental and other relevant impacts and implications of the installation of this Cement Plant in the project area both during construction and regular operation phases of the project. Thereafter, the participants used to put questions through the translator and thus there was a free and frank discussion between the stakeholders and the moderator till their questions were fully well answered by the moderator.

During the ESIA undertaken by ECTECH Environmental Consultants during 2012, various consultation meetings were held with key DRC government authorities and local communities. These meetings are listed in Table 10-1.

Table 10-1: Consultation meetings with authorities and local communities during ESIA in 2012

Date of meeting	Type of meeting	Stakeholder Group	Approx Number of Attendees
8 November 2012	Authority Consultation	Environment Minister	4
8 November 2012	Authority Consultation	GEEC and DPEM	8
10 November 2012	Community meeting	Tandi Kumbi and Nkonda Villages	24
11 November 2012	Community meeting	Nionga Village	12
12 November 2012	Community meeting	Nkondo Kiomba Village	32
13 November 2012	Community meeting	Minkelo and Mawete Village	52
14 November 2012	Community meeting	Mbemba and Yuku	17
15 November 2012	Community meeting	Kokolo Village	21
16 November 2012	Community meeting	Kinsua Village	9
17 November 2012	Authority Consultation	Songololo Territory Office	4
18 November 2012	Authority Consultation	District des Cataractes Office	3

The details of the stakeholders who attended these meetings have been included the stakeholder database - please refer to Section 10.2.5 below.

The comments, issues and inputs raised by stakeholders are included in Table 10-3 and Section 10.3.1.

Written comments

In addition to obtaining comments from meetings and interviews with stakeholders in the project area, stakeholders were encouraged to provide their comments, inputs and information in writing.

To get written views of the stakeholders, simple performatas, translated into French, were used for better understanding of the stakeholders before giving their written comments. The performatas are attached as Appendix – 9.2 and Appendix – 9.3.

At the end of each PC meeting a very simple performata translated into French was provided to them for their written replies for the purpose of record. These written replies were translated into English and became a permanent part of the ESIA report as Appendix – 9.4.

Meetings with stakeholders during the ESIA update (June 2013)

SRK held a series of focus group and key informant meetings in June 2013, during the process of updating the socio-economic baseline study. The opportunity was also used to inform stakeholders about progress with the project, and to invite them to raise further comments about the project.

Stakeholders were invited to meetings and notified in French via letters (see Appendix 9.5) distributed either electronically or delivered by hand to stakeholders by members of the SRK and NYA team.

In order to accommodate the number of meetings that had to be completed during the limited timeframe, the SRK team divided into three teams (comprising a facilitator and scribe) and ran parallel meetings (refer to Table 10-2 showing the list of meetings held by the SRK team, and approximate numbers of attendees).

Information regarding the proposed project, the reason for the meeting and ESIA update, as well as what inputs are required from stakeholders was presented verbally in French and Lingala (as appropriate) by the SRK facilitators. Stakeholders were encouraged to comment and provide input freely to the questionnaire (enclosed in Appendix 9.6) which was used to focus discussion, inputs and comments from the group.

Table 10-2: Focus group and key informant meetings during ESIA update in June 2013

Date	Type of meeting and Stakeholder Group	Approx number of attendees
11 June 2013	Information sharing & planning meeting with traditional and administrative authorities representing the Kimpese, Minkelo, Mbemba, Kondo Kiombia, Nyonga, Tandu, Kokolo, Mawete II, Yuku and Kinsua Communities.	29
15 June 2013	Focus group meeting with women in Mawete Village	13
	Focus group meeting with women in Minkielo Village	58
	Focus group meeting with men in Minkielo Village	28
	Focus group meeting with men in Mawete Village	24
	Focus group meeting with youth in Mawete Village	33
	Focus group meeting with youth in Minkielo Village	13
16 June 2013	Focus group meeting with women in Kondo Kiombia Village	12
	Focus group meeting with men in Kondo Kiombia Village	20
	Focus group meeting with youth in Kondo Kiombia Village	16
19 June 2013	Focus group meeting with women from Yuku, Mbemba, Kokolo, Kinsua Villages	31
	Focus group meeting with men in Yuku Village	5
	Focus group meeting with men from Kokolo, Mbemba and Kinsua Villages	17

10.2.5 Stakeholders consulted

Public Consultations (PCs) were conducted for NYA Cement Plant by ECTECH moderator/professionals. Among the stakeholders of the PCs included:

1. Residents of seven villages listed below.
2. Government functionaries of the project area.
3. Government Officials of the Ministry of Environment and mining.
4. Community leaders.
5. Tribal heads of the area.

Community Members

Residents of the following villages, located in and surrounding the NYA concession area, were involved in the PCs:

1. Kokolo,
2. Yuku,
3. Nkonda,
4. Minkelo,
5. Mbemba,
6. Kinsua, and
7. Mbamba.

Please refer to Section 6.6 for a map showing the location of these villages in the project area.

As part of the ESIA update, SRK identified additional villages and stakeholder groups whose views and information are important to include in the ESIA. These are:

- Mawete Village
- Kondo Kiombia Village
- Separate meetings with women, youth and men groups in the various communities as indicated in Table 10-2 above.

The stakeholder database, included in Appendix 9.7 comprises a list of the names and organisations/ villages of all stakeholders consulted in the ECTECH process, and during the focus group meetings and key informant interviews undertaken by SRK in June 2013. Stakeholders on the database represent a broad range of sectors of society including the various levels of government, NGOs, traditional authorities, and community members.

10.3 Stakeholder comments and perceptions

This section provides an overview of key comments and issues raised by stakeholders, and their perceptions about the project. These are reported separately for the ECTECH and SRK processes respectively, in the sections below. **Note that, with the exception of a few headings, no changes were made to the content or grammar of the information provided in the ECTECH report.**

10.3.1 Summary of stakeholder comments received during the ESIA in 2012

The comments, issues and overall perceptions expressed by stakeholders consulted in the ECTECH ESIA process conducted in 2012, are captured in Table 10-3 and summarised below. References to the sections in the ESIA Report where specific aspects related to the comments and issues, are addressed have also been included in Table 10-3.

- Summarily, the people have positive perception about project installation.
- All the people in the project area are aware of the project.
- They are of the views that the project will help to provide them job opportunities, reduce poverty, promote education, improve infrastructure, bring general awareness, promote health facilities etc.
- There is an expectation that there will be qualitative and quantitative improvements in all walks of life. Their future generations will have the chance to live a better life in all respects.
- Among the people consulted as a part of the Public Consultations, all of them welcome the project.
- The people have clear perception that the installation of the plant in the area is beneficial for the community especially and country on the whole.
- Study findings depict that the people of the study area perceive overall positive impacts as a result of installation of the plant. Therefore, their attitude towards the project installation is quite positive.
- As far as the Social Impact Assessment (SIA) is concerned, positive social impacts are dominant over hardly conceived any negative social impacts observed during the study.
- The people have high expectations and hope from the plant activity and its management.
- They correlate their positive attitude towards the plant with many socio-economic opportunities and benefits.
- The people believe that installation of the plant in the area will open up employment opportunities which in turn follow a chain of indirect socio-economic benefits.
- They also perceive accelerated economic activity due to the business opportunities likely to emerge in the area.
- Directly or indirectly, hundreds of the local people will get employment and business from the installation of the plant.
- People foresee many socio-cultural and psychological positive impacts on their lives and the community.
- They feel that the plant and its related activities will provide a strong base for social change.

Potential impacts perceived by stakeholders

According to the data gathered by the ECTECH experts, the impacts perceived by the inhabitants of the project area and the government officials can be divided into two categories below:

- The government officials responded in terms of National growth of DRC and positives impacts of this project on macro level including the domestic need of cement for DRC and for export after the domestic needs' satisfaction.
- The responses of the inhabitants of the project area were of micro level including development of the area, provision of roads, availability of medical facilities and up gradation of educational institutions.
- Positive impacts are perceived by all the respondents as almost all the respondents are very enthusiastic about the installation of the plant because it will surely raise the living standard of the people of this area along with more jobs and business opportunities.
- The inhabitants of this area do not feel any threat to their cultural values as their society is homogenous in nature and they look forward to this project as an opportunity to rebuild their future as well as the future of their upcoming generations.
- Most of the respondents including the Government Officials and local people of the area emphasized that this project will bring development to the area around the project site. This development is followed by certain indicators.

- Personnel from the Environment Ministry considered this project as “Real Need” as the installation of this Cement Plant will result in positive economic impacts for the local people and for DR Congo as well.
- Majority of the Government Officials were concerned about the installation of this Cement Plant regarding its compliance to the Mining Laws and Environmental protection but when they were told about the safety measures that will be taken for Environmental protection, they were satisfied and happy about this Project.
- Representatives of the government were of the opinion that by the installation of this plant, cement price will be more acceptable and within the approach of local people.
- This plant will serve as a mile stone for other investors to come in and invest in the area.
- People of the area are quite positive towards the economic change in their society.
- They want modernization and have an adaptive behaviour towards new changes.
- Head of Songololo Territory expressed her views in terms of increase in the revenue of the territory, development of the District and Province, as a result of the installation of this Cement Plant.
- All the respondents collectively expressed their views in terms of development of their lives, their villages, their territory, District, Province and ultimately the development of their country DR Congo.
- The respondents expressed their expectations regarding the job opportunities which will be available as a result of this plant installation.
- More the jobs better the chances of Social Mobility of the people so the installation of this Cement Plant will contribute to the welfare of the masses.
- The people expect this Cement plant to become a source of decreasing beggary as people will find new employment opportunities.
- The respondents also considered the installation of this Plant as a positive step towards industrialisation.
- The respondents also expect Electricity to be available.
- With the installation of the Cement Plant, the peoples expect roads development.

The **female's expression and expectation** regarding the installation of this Plant were also recorded.

- There is a lot of poverty in DRC and project area is also struck by poverty so the females want this project so that their upcoming generations will have enough to eat.
- They are also very concerned about the education of their children
- They also want their children to have better life than their elders.
- They better health facilities in their area as for the time being there are no proper medical facilities available.

Rawji Foundation has always been involved in social welfare activities and for these demands Nyumba Ya Akiba is also committed to provide educational and health facility to the people of this area.

- The respondents also expect more sophisticated economic activity in their area because with the installation of this Plant more people will come here so transportation facilities will be improved, hotels, shops and other necessities of life will be provided in this area and this will bring prosperity to the people.
- The only village that is going to be displaced is Yuku Camp Village and the response from the people of this village was as positive as the rest of the people of other villages. They were demanding house in return for the house.

Table 10-3: Stakeholder comments received during the ESIA conducted by ECTECH in 2012 and the references in the ESIA Report

Sr #.	Name	Sex	Age	Designation/Profession	Qualification	Address	Views about the Project	Reference in ESIA Report
1	Emene Elenga	Male	Adult	Chief Executive of GEEC		25 Urban Committee Avenue, Kinshasa	This project is welcomed in the manner that our country is on the development way, so it is a real need, To see the quantity of the cement from importation, I think that the local production is the best not only because it gets an economic impact but also the creation of job.	N/A
2	Matete Amani Polydor	Male	40	Geologist and Chief of Division in dept of protection of Mining Environment		239.Ex-SNEL Building Tower, Kinshasa	For the moment, it is very important to have a production project of cement in the province of Bas Congo and this project must respect the Mining Law and regulation of the DRC. At the environmental view, the project must care about the protection of the environment and the application at the site as durable or permanent development. The project must work in collaboration with the local authority, the local population (By giving jobs). The cement plant must manage and protect the environment affected by the project	Section 4.14 Section 7, 8, 9
3	Gabriel Twakwila	Male	Adult	Manager Environment	Pedagogue	Environmental Ministry	This project is welcome because it will lead other investors to come in our country and we are the time of modernization as said by the president of DRC	N/A
4	Eale Ekila Huguet	Female	Adult	National Pollster/Investigator	Graduate in Finance	Environmental Ministry	It is a good project because the cement plant will be established at good area where there is not a lot of population	Section 6.5
5	Mudosa Chirhabal Wa Pierre	Male	Adult	Chief of the board In Charge of Management of Classified Establishment	Graduate in Bio Chemistry	Environmental Ministry	At my opinion it is a good project to develop the DRC in general and especially the province of Bas Congo. It will be better if the project is also established in other provinces of the country like Sud-Kivu and Katanga where the environment I better for this kind of project	Section 3, 4
6	Beatrice Nlemvo Sukama	Female	Adult	Territory Incharge, Songololo		Songololo Residential	It is a good project because; It reduces the beggary, It helps raising the revenue of the territory, Improvement of the lifestyle of the local population by building new houses at Yuku, Schools, Hospitals, Roads, Bridges. Pure water and electricity. We wish the success of this project and advise them to respect the Environment Law and the local	Section 4.14 Section 13.7 Appendix 17 Appendix 19

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Sr #.	Name	Sex	Age	Designation/Profession	Qualification	Address	Views about the Project	Reference in ESIA Report
							community	
7	Antoine Mayifuila Ndosiba	Male	52	Supervisor of the Environment, Songololo	High School Diploma	Kimpese, 47 Dodoma Street	This is my point of view; the project is good because it will reduce beggary and reduce the price of cement bag in the market	Section 4.14
8	Vincent Depaul Ilunga Ndai Makela K.	Male	Adult	Technical Engineer in Cleaning up and Environment, Chief of Environmental Norms and Regulation Dept.		Environmental Ministry	On the basis of economical view, this project will help the country at the industrialization side. From the social view it will resolve cutting. People will find jobs.	Section 4.14 Section 6.5.2
9	Nayamuene	Male	34	Farmer		Kinsua	I am happy about this project and I am asking to Nyumba Ya Akiba to build houses for us and connect us to the power electricity	Section 4.10 Appendix 19
10	Utidi Selipa	Male	55	Instructor	5 Years	Kokolo	Yes I want this project to start	Section 4.16
11	Bilezi Mulumba George	Male	54	Trader	1st Level	Kinsua	We want bridges, roads and farming activities. It is a good project for the development of our country	Section 4.13 Appendix 19
12	Marie Lusinga	Female	59	Farmer		Kinsua	Built bridges, roads, houses and electricity and project will give job to our children	Section 4.10 Appendix 19
13	Kafutikinga	male	40	Nurse	A 2	Kinsua	It is a good project for the development of our province and village, Nyumba can build very good bridges, schools, that can also give job to us so e=we can help our family	Section 4.14 Section 4.13 Appendix 19
14	Pete Cessil	Female	27	Nurse	A 2	Kinsua	It is a good project for the development of our province and village, Nyumba can build very good bridges, schools, that can also give job to us so e=we can help our family	Section 4.14 Section 4.13 Appendix 19

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Sr #.	Name	Sex	Age	Designation/Profession	Qualification	Address	Views about the Project	Reference in ESIA Report
15	Mampuya Antoine	Male	35	Farmer		Kinsua	It is a good project because we want our country to develop. And the project will give job, You an also build bridge, Hospital and Schools	Section 4.14 Section 4.13 Section 6.5.2 Appendix 19
16	Mupupe Makuntuala Amen	Male	48	Mechanic	High School Diploma	Kinsua	Good for development of our village, engagement of entitled beneficiary. Building construction of market, school and hospital, cement plant contract with entitled beneficiary	Section 10 Section 11.6 Appendix 18
17	Nkongo Ndosimau	Male	29	Mechanic	Elementary	Kokolo	The Nyumba Ya Akiba project is good because it will help people. We are happy because you will help us, thank You	Section 4.14 Appendix 19
18	Lutalkueno	Male	37	Farmer		Kokolo	This project is very good for the development of our village. Built roads and schools	Section 4.13 Appendix 19
19	Matafuka Maluvuidi	Male	52	Farmer	High School Diploma	Kokolo	For the development of our villages, reduce the rate of beggary, built hospital, market and schools. Give job to our children	Section 4.14 Appendix 19
20	Thomas Nkunku	Male	Adult	Farmer	High School Diploma	Yuku	Nyumba got a good project because it is showing the best future of our province. This project will bring the development for the future generation of our community. This project will give job opportunity, and if they want us to shift from Yuku village; the project must build new houses at a new place. the project should not bring toxic products around us	Section 4.14 Appendix 18 Appendix 19 Sections 7.2, 7.3, 8.2, 9.4 Appendix 15
21	Patrice Adieyi	Male	41	Farmer		Yuku	Good project for the improvement of our lifestyle by giving us job, pure water, electricity, telephone... So the development of our land. I am just worried about our fauna and Flora because many people will be around and we will face health problems	Section 4.14 Section 4.10 Section 7.2.7 Appendix 19

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Sr #.	Name	Sex	Age	Designation/Profession	Qualification	Address	Views about the Project	Reference in ESIA Report
22	Shora Mbiyavanga	Male	30	Farmer		Yuku	This project is good for our village, now will be like Lukala and Kimpese. This project will change our daily lifestyle. Our poverty will be reduced and our children will be educated. We are lucky to have this project in our area and we will have free access to the information and medical care	Appendix 19
23	Joseph Kembela Lunzayiladio	male	64	Secretary	A 3	Minkelo	For me, this project is good for the development. Nyumba Ya Akiba must respect the environment and local community for a durable development	Section 7, 8, 9
24	Michel Mvukani Manson	Male	49	Chief of Under Post	Graduate in Bio Chemistry	Minkelo	It is a good Project because the project will reduce the beggary and raise the social life of the population	Section 4.14 Appendix 19
25	Nsumbu Antoine	Male	52	Junior Instructor	Deaf School	Mawete	Good project, start as soon as u can	Section 4.16
21	Katumua Mado	Female	50	Farmer	Primary School	Kokolo	Good for the development of our village	Section 6.5 Appendix 19
22	Nzuzi Maluzapangidi	Male	24	Driver		Kokolo	We just want development of our village	Section 6.5 Appendix 19
23	Kiese Mavomua	Male	20	Housewife	Primary School	Kokolo	We really want this project because it will bring development and reduce the begging of our population	Section 4.14 Appendix 19
24	Esai Mvene	Male	34			Kokolo	Job	Section 4.14
25	Nsimba Moyo	Female	27	Mechanic		Kokolo	It is good because many people will have jobs, Build also hospital and we hope we will receive many advantages	Appendix 19
26	Kisuka Nicole	Female	32	Farmer	Deaf and Dumb School	Kokolo	Start as soon as u can, it is a good project	Section 4.16
27	Moyo Makenga	Female	74	Farmer	Mechanical Diploma	Mbemba	Development of the roads, school, health, walk exercise, electricity, education, transport, communication	Section 4.10, 4.13 Appendix 19

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Sr #.	Name	Sex	Age	Designation/Profession	Qualification	Address	Views about the Project	Reference in ESIA Report
28	Mambote	male	34	Farmer	High School Diploma	Mbemba	It is a good project before all things we need job opportunity, hospital, schools and roads.	Appendix 19
29	Nsimba	Male	60	Farmer		Mbemba	It is good for the development of the province to give jobs, built schools, hospital, market and electricity supply	Appendix 19
30	Samuel Toko	Male	52	D.U.C	Primary School	Mbemba	We just need the development and change in our province	Section 6.5.2 Appendix 19
31	Ndongala Andre	Male	Adult	Farmer	Primary School	Mbemba	Good for the development of our province	Section 6.5.2
32	Lumbuenadio Jacky	Female	20	Farmer	Primary School	Minkelo	We want this project to start	Section 4.16
33	Lubuilu Promesse	Female	34			Mbemba	It is a good project but they have to give job to me also so I can send my children at school and after their study, they can help me out	Section 4.14 Section 6.5.3 Appendix 19
34	Tutonda Emmanuel	Male	34	Farmer	Community	Minkelo	Cleaning up of well(pit) and help to resolve some farming problems	Appendix 19
35	Luzieso Nkenge	Male	36		A 3	Minkelo	Good project, do what u can do	Appendix 19
36	Nzuzi Mambueni	Male	36	Nurse	A 2	Minkelo	It is good project because younger people will get jobs this will reduce poverty	Section 4.14 Appendix 11
37	Makiese	Male	42	Farmer		Minkelo	There is any job for me?	Section 4.14
38	Nzuzi Lusakueno	Male	23	Farmer	Primary School	Minkelo	This project must start	Section 4.16
39	Yeko Nsongo	Male	34	Nurse			We agree with the idea of building of new site in our area	N/A
40	Diangingindu Marcel	Male	25	Driver		Minkelo	Any kind of service give job for the local driver and also bakery	Section 4.14

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Sr #.	Name	Sex	Age	Designation/Profession	Qualification	Address	Views about the Project	Reference in ESIA Report
41	Nsilulu Metuzola	Male	Adult	Farmer	Chief on Nknonda Village	Nkonda	Yes, this project is very good for the development of the village and to give work to the population	Appendix 19
42	Muleba Wa Mulembo	Male	65	Farmer		Mawete	Yes, this project is very good for the development of the village and to give work to the population	Section 4.14 Appendix 19

Variables/parameters used for above Table.

- Development
- Real Need
- Positive Economic Impact
- Job Creation
- Compliance with Mining Laws
- Environmental Protection
- Collaboration with local authorities
- Industrialization
- Social Welfare
- Electricity
- Bridges
- Roads
- Secure Future of children
- Schools
- Hospital
- Market
- Reduced Beggary
- New investment
- Modernization
- Increased Revenue of Territory
- Cheaper price of cement
- Better future
- Telephone
- Security of Flora and Fauna
- Reduced poverty

10.3.2 Summary of stakeholder comments received during the ESIA update in 2013

The comments, issues and overall perceptions expressed by stakeholders consulted during the focus group meetings and key informant interviews undertaken by SRK in June 2013 for the ESIA update, are captured in Table 10-4.

Table 10-4: Stakeholder comments received during the ESIA update conducted by SRK in 2013 and the references in the ESIA Report

COMMENTS, ISSUES AND SUGGESTIONS RAISED BY STAKEHOLDERS	STAKEHOLDER NAME	ORGANISATION/ COMMUNITY (POSITION)	DATE	MEETING WHERE COMMENT RECEIVED	REFERENCE IN ESIA REPORT
The project is welcomed as the community believes it will boost local development. Note that the total population of Minkelo is estimated at 1080 inhabitants, and that an estimated 8000 people from 21 communities are dependent on the services and facilities at Minkelo Health Centre. The implementation of the cement project will attract more people to the area, and there is concern that the Minkelo Health Centre will not be able to cope with the increased demand for health care services and facilities. It is hoped that the NYA Cement Project will support Minkelo Health Centre with materials and equipment.	Nzuzi Mambueni	Minkelo Health Centre (Principal Nurse)	15 June 2013	Key Informant interview	Section 6.5 Sections 7.2.9, 7.3.11, 7.3.12 Section 7.7 Appendix 19
Only 60% of patients that receive treatment at Lamba/ Kimpese Hospital are able to pay consultation fees, or for the treatment. This is due to the high rate of unemployment in the area. The community has hope that this will change with the development of the NYA Cement Project in the area, and that it will also result in farmers being more profitable, and uplift the quality of life of local communities.	Leontine Kakiessse	Lamba/ Kimpese Hospital (Manager)	18 June 2013	Key informant interview at Lamba/ Kimpese	Section 4.14 Section 6.5 Sections 7.2.9, 7.3.11, 7.3.12 Appendix 19
This project will create opportunities and boost the local economy and provide jobs for the youth. In doing so, people in the rural areas will be less inclined to migrate	Kiala Kiamesso	Ecole Publique 3 Nzolo (Headmaster)	18 June 2013	Key informant interview at Nzolo Public School at Kimpese	Section 6.5 Sections 7.2.9, 7.3.11 Section 7.7

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COMMENTS, ISSUES AND SUGGESTIONS RAISED BY STAKEHOLDERS	STAKEHOLDER NAME	ORGANISATION/ COMMUNITY (POSITION)	DATE	MEETING WHERE COMMENT RECEIVED	REFERENCE IN ESIA REPORT
to urban areas in seek of job opportunities.					Appendix 19
Providing motorbike transport in Minkelo was once a profitable business, but this has declined with the migration of people out of the area, like the return of Angolan refugees to their country, and the increase in motorbike drivers in Minkelo. It is expected that the viability of the motorbike transport business will improve when the NYA project starts and more people move to the area.	Abdalah	Minkelo Community (Motorbike driver)	18 June 2013	Key informant interview at Minkelo weekly market	Section 4.13 Sections 7.2.9, 7.3.11 Section 7.7
My business which started in 1985, of buying Chicoangue from the communities adjacent to the NYA project area, and selling it in Matadi or Kinshasa, used to be profitable. But this has changed because the condition of the road from the farms to the market has deteriorated over the years, and the farmers, mainly women who produce the “Chicoangue” have great difficulty in getting their product to the market. This has a negative impact on me as the buyer and women as the sellers. It is hoped that that when the NYA project starts, that the condition of the roads from the farms to the market will be upgraded to improve access.	Nzuzi Tukiya	Matadi Resident (Local business man, attending Minkelo market weekly)	18 June 2013	Key informant interview at Minkelo weekly market	Section 4.13 Section 6.5.3 Appendix 19
There are expectations that the project will result in opportunity and benefits for the local communities. These expected benefits include job creations, boost to the local economy (small businesses such as	Manzambi Mabanza Geremi	Kimpese Community (Local business man)	18 June 2013	Key informant interview at Minkelo weekly market	Section 13 Appendix 19

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COMMENTS, ISSUES AND SUGGESTIONS RAISED BY STAKEHOLDERS	STAKEHOLDER NAME	ORGANISATION/ COMMUNITY (POSITION)	DATE	MEETING WHERE COMMENT RECEIVED	REFERENCE IN ESIA REPORT
selling dried fish, crops etc.) and upliftment of peoples' quality of life.					
It is pleasing that the NYA project already recruits people from local communities, and is contributing to the upliftment of people in the area. Being employed as a caretaker at NYA, I am happy to be a part of the project.	Toko Samuel	DUC (a DUC is administration representative at community level).	14 June 2013	Household survey in Mbemba Community	Section 4.14 Appendix 11 Appendix 19
The Mbemba Community looks forward to the development of the NYA project in the area, especially in terms of job opportunities for the youth. The community would also like NYA to assist with the upgrade of the roads especially the bridge across Sanzikwa river linking Mbemba Village to Yuku Village.	Katumua Madeleine	Mbemba Community (Farmer)	14 June 2013	Household survey in Mbemba Community	Section 4.14 Section 4.13 Appendix 11 Appendix 19
The youth welcome the NYA project and look forward to employment opportunities.	Bizuka Makanda	Mawete Community (Mechanic)	15 June 2013	Focus group meeting with youth in Mawete Community	Section 4.14 Appendix 11
Unemployment is a major concern in the area and the youth in local communities welcome the NYA project as it will create employment opportunities.	Nlandou Songo	Minkelo Community (Heavy duty vehicle driver)	15 June 2013	Focus group meeting with youth in Minkelo Community	Section 4.14 Appendix 11
The local community welcomes the NYA project as it will contribute to the upliftment of the quality of their lives, and associated benefits such as electricity.	Kabangu Loty	DUC (Administration representative at community level) Mawete II	15 June 2013	Focus group meeting with youth in Mawete Community	Section 4.10 Appendix 19
Local farmers would appreciate agricultural support from NYA in order to improve their livelihoods from farming.	Utidi Alice	Kokolo Community (Farmer)	19 June 2013	Focus group meeting with women of Kinsua, Mbemba and Kokolo Communities at Yuku camp	Appendix 19
	Cecile Pete	Kinsua Community (Farmer)	19 June 2013	Focus group meeting with men of Kinsua, Mbemba and	Appendix 19

Updated ESIA for NYA Cement Project – updated in response to lender requirements

COMMENTS, ISSUES AND SUGGESTIONS RAISED BY STAKEHOLDERS	STAKEHOLDER NAME	ORGANISATION/ COMMUNITY (POSITION)	DATE	MEETING WHERE COMMENT RECEIVED	REFERENCE IN ESIA REPORT
				Kokolo Communities at Yuku camp	
People hope that the project will bring benefits and development to the local communities, and that their farming activities will be more profitable as the number of people in the area increase.	Lumfimpdio Nkengue	Yuku Community (Farmer)	13 June 2013	Household survey at Yuku camp	Section 6.5 Appendix 19
If the Yuku Community is relocated, an area of similar or better agricultural potential must be selected.	Lumfimpdio Nkengue	Yuku Community (Farmer)	13 June 2013	Household survey at Yuku camp	Appendix 18
The NYA project is welcomed as it brings hope that schooling facilities in the area will be improved and supplies provided to create a more conducive environment for pupils.	Wayika Salanga Baudouin,	Nkonka Primary School (Teacher)	17 June 2013	Key informant interview at Nkonka Primary School	Appendix 19
	Luvedoso Vankatu	Minkelo Primary School (Teacher)	18 June 2013	Key informant interview at Minkelo Primary School	Appendix 19
The potential of the NYA project to create jobs and sustainable development is seen as a major opportunity for local development.	Misolukidi Muzita	Minkelo Primary School (Deputy Headmaster)	18 June 2013	Key informant interview at Minkelo Primary School	Appendix 19
Local business opportunities will improve because once people are employed at NYA, there will be more money available to boost the local economy.	Luyindula Kayembe Alain	Minkelo Community (Local business man)	18 June 2013	Key informant interview at Minkelo weekly market.	Section 4.14 Appendix 11 Appendix 19
Local communities look forward to the project starting as soon as possible, as they expect positive impacts on economic activities, reduction in unemployment, and a reduction in the price of cement.	Richard Muanda Mbungu	Kimpese Community (Local business man)	18 June 2013	Key informant interview at Kimpese market	Section 4.14 Section 7.2.9, 7.3.11 Appendix 19
	Nicolas Nyimbi	Kimpese Community (Local business man)	18 June 2013	Key informant interview at Kimpese market	
For several months before a cement factory in Kimpese closed down, its	Simon Ndombe;	Kimpese Community (Local business man)	18 June 2013	Key informant interview at Kimpese market	Section 3, 4

Updated ESIA for NYA Cement Project – updated in response to lender requirements

COMMENTS, ISSUES AND SUGGESTIONS RAISED BY STAKEHOLDERS	STAKEHOLDER NAME	ORGANISATION/ COMMUNITY (POSITION)	DATE	MEETING WHERE COMMENT RECEIVED	REFERENCE IN ESIA REPORT
employees did not receive their salaries. What guarantees are there that the NYA project will not face the same difficulties?					
How will the NYA project manage cope with the existing electricity shortage being experienced in the area?	Simon Ndombe;	Kimpese Community (Local business man)	18 June 2013	Key informant interview at Kimpese market	Section 4.10
People in the area are eagerly awaiting the start of the NYA project and its benefits in terms of job creation and boosting the local economy to make farming more profitable.	Nkumbu	Kimpese Community (Local business man)	18 June 2013	Key informant interview at Kimpese market	Section 4.14 Appendix 19
The community will appreciate if NYA project upgrades access roads between farms and the market, because the poor road conditions hamper farmers from transporting their crops to market.	Diankanumua Eugenie	Kokolo Community (Farmer)	19 June 2013	Focus group meeting with women of Kinsua, Mbemba and Kokolo Communities at Yuku camp	Section 4.13 Appendix 19
It would be ideal for the Yuku Community to be relocated to Mbemba Village because it is close to people's land.	Adieyi Luyilai	Yuku Community (Farmer)	19 June 2013	Focus group meeting with men in Yuku Community	Appendix 18
The NYA Project is eagerly awaited because of all the opportunities and benefits that it will bring towards improving the quality of life for communities in the area.	Adieyi Luyilai	Yuku Community (Farmer)	19 June 2013	Focus group meeting with men in Yuku Community	Appendix 18
As much as people look forward to the NYA project to provide employment opportunities for the youth and boost local development, there is also concern that people's farms will be destroyed.	Noa Michel	Yuku Community (Farmer)	19 June 2013	Focus group meeting with men in Yuku Community	Section 4.14 Appendix 18 Appendix 19
The youth of Mawete Village look forward to job opportunities at NYA.	Nkiwansisila Hakanda	Mawete Community (Mechanic)	15 June 2013	Focus group meeting with youth in Mawete Community	Section 4.14 Appendix 11
Due to unemployment in the area, there is an increase in the incidence of alcoholism	Massoluka Fabrice	Minkelo Community (Farmer and charcoal	15 June 2013	Focus group meeting with youth in Minkelo Community	Section 7.2.9, 7.3.11

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COMMENTS, ISSUES AND SUGGESTIONS RAISED BY STAKEHOLDERS	STAKEHOLDER NAME	ORGANISATION/ COMMUNITY (POSITION)	DATE	MEETING WHERE COMMENT RECEIVED	REFERENCE IN ESIA REPORT
amongst the youth in Minkelo Village.		maker)			
Most of the youth are currently involved in charcoal-making, which in time, will contribute to irreversible degradation of the environment.	Massoluka Fabrice	Minkelo Community (Farmer and charcoal maker)	15 June 2013	Focus group meeting with youth in Minkelo Community	Section 4.14 Section 6.5
Although parents have spent lots of money on schooling their children, there are no jobs available. The youth therefore look forward to the NYA project.	Ndemvokolo Nkebi	Minkelo Community (Farmer and Charcoal maker)	15 June 2013	Focus group meeting with youth in Minkelo Community	Section 4.14 Appendix 19
It would be appreciated if NYA provides agricultural support to local farmers, and purchases their products for its staff when the cement project starts.	Malungu Marcel	Kondo Kiombia Community (Farmer)	16 June 2013	Focus group meeting with youth in Nkondo Kiombia Community	Appendix 19
The community welcomes the NYA project, and would appreciate assistance to upgrade the road to enable easier access to sell their crops at Minkelo.	Tombo Tuzola	Kondo Kiombia Community (Farmer)	16 June 2013	Focus group meeting with youth in Nkondo Kiombia Community	Section 4.13 Appendix 19
The NYA project is welcome because it is expected to create many jobs opportunities for local communities.	Cecile Pete	Kinsua Community (Farmer)	19 June 2013	Focus group interview with women of Kinsua, Mbemba and Kokolo communities at Yuku camp	Section 4.14
CRAFOD kindly requests financial assistance from NYA as this will enable the organisation to successfully implement development projects in the area.	Gustave Muyamuna Kafenga	Centré Régional d'Appui et de Formation pour le Développement (CRAFOD) (Information and Documentation Manager)	19 June 2013	Key informant interview at Kimpese	Appendix 19
It is understood that collaboration between Lycee Lamba Ntumua and NYA is not appropriate at this stage because the	Emile Bavedila	Lycee Lamba Ntumua (Principal)	19 June 2013	Key informant interview at Kimpese	Appendix 19

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COMMENTS, ISSUES AND SUGGESTIONS RAISED BY STAKEHOLDERS	STAKEHOLDER NAME	ORGANISATION/ COMMUNITY (POSITION)	DATE	MEETING WHERE COMMENT RECEIVED	REFERENCE IN ESIA REPORT
project is still in the exploration phase. Lycee Lamba Ntumua however, looks forward to working with NYA on development projects in the future.					
We are grateful for the wooden boards recently donated by NYA, and would like to work with NYA on more development projects since ITP is a technical college.	Nlomba Daniel	Kiundu School (Principal)	19 June 2013	Key informant interview at ITP Technical College in Kimpese	Appendix 19
NYA and the Environmental Department of the Sector should work together to address the impacts caused by fishing, hunting and wood cutting, as these impacts are currently not monitored.	Joseph Kembela	Luima Sector (Head)	21 June 2013	Key informant interview at Luima Sector in Mawete	Section 6.3 Section 7.2.7, 7.3.4 Section 9.12
Minkelo Police Station kindly requests financial assistance from NYA as this will enable the police force to patrol the area more efficiently. Specific needs include, two motor bikes, electricity and, computers to record crime statistics electronically.	Mbambi Mvumbi Jacques	Minkelo Police Station (Deputy Principal Commissioner, Police Station commandant	21 June 2013	Key informant interview at Minkelo Police Station	Appendix 19

Summary of key comments from focus group meetings with women

Yuku Village:

- There is expectation that the NYA project will contribute to the improvement of the quality of life in Yuku Village for example:
 - improving access to potable water
 - upgrading roads for people to transport their crops to market
 - improving school and health care facilities.

Kinsua Village:

- There is hope that the NYA project will employ the husbands and youth from the village
- The village requires electricity supply
- NYA should consider community development projects to improve school and health care facilities in the area
- NYA should also promote adult literacy classes
- The project is welcome as it is the start of a process to address the unemployment in the area.

Kokolo Village:

- NYA is requested to prioritise recruitment of husbands and youth from Kokolo Village for employment opportunities at the cement plant.
- The community looks forward to the benefits and development opportunities that will result from the project, even though the community will lose its land.

Kondo Kiombia Village:

- The NYA project will assist to reduce unemployment in the area.
- There is an expectation that NYA's community development initiatives will improve school and health care facilities for the benefit of all the affected local communities
- The community looks forward to the development of the village
- The project will have a positive impact on the local economy of the area as more money will be in circulation as a result of people being employed.

Mawete Village:

- It is hoped that the NYA project will improve the quality of life in the community for example by improved access to basic facilities, and reducing unemployment.

Mbemba Village:

- It is hoped that the NYA project will improve the quality of life in the community for example by improved access to basic facilities in the area.
- NYA should consider facilitating access to adult literacy classes for women and young mothers.
- The only negative aspect of the project is that the community will lose its land.

Minkielo Village:

- The project is welcomed as it will create job opportunities for the husbands and youth in the village.
- The community would appreciate agricultural support to improve production for example, farming tools and fertilisers.
- Electricity supply to the community, if possible, will be greatly appreciated.

Summary of key comments from focus group meetings with youth**Kondo Kiombia:**

- The NYA cement project is an opportunity for the youth of the area to be employed.
- The project will benefit communities because the price of cement will be lower, and therefore more affordable for community members to build houses.
- People look forward to the project because they expect it to bring development to the area, and to improve the local economy for example, boosting the sales of their agricultural produce.

Minkielo Village

- The project is welcomed because it will provide employment opportunities for the youth of Minkielo Village, and boost local development.
- The community hopes that the project will make it possible for the village to access electricity.

Mawete Village:

- The NYA cement project is an opportunity for the youth of the area to be employed.
- The project is welcomed as it will bring development in the local area.

Summary of key comments from focus group meetings with men**Yuku, Mbemba, Kokolo and Kinsua Villages:**

- The community looks forward to the employment opportunities the project will bring to the youth of the area.
- Other expected benefits to local communities are that the roads will be upgraded for better access to markets, and that there will be more vehicles in the area to assist farmers to transport their produce to markets.
- Communities also look forward to NYA's community development projects and hope that they will meet some of the development needs and assist to uplift the quality of life for local people.
- NYA should consider providing internship and training opportunities to the youth in the area, particularly those without formal schooling.

Kondo Kiombia Village:

- The project is eagerly awaited and communities are proud to have the project in their area
- People look forward to the boost in the local economy, and other benefits such as upgrading of the access roads for farmers to transport their produce to market.

Minkielo Village:

- While there is great expectation that the project will boost the local economy, some people are still apprehensive about the effectiveness of the project.
- Minkielo Hill is a sacred prayer site for Christians and Kimbanguists. There is concern that the project will destroy this prayer site.
- Another cement factory started activities about three years, opposite Minkielo Village along the national road. No progress has been made and the project seems to have been abandoned.
- There is concern about air pollution, especially dust from the cement plant, as people expect this to be as at the factory in Lukala.
- There is however hope that the NYA project is realized and that its benefits will present many opportunities for employment and facilitate access to basic facilities in the village.

Mawete Village:

- The community welcomes the project, and count on it to boost local business and development.
- The community also looks forward to other benefits such as upgrading of the access roads for farmers to transport their produce to market.

10.4 Public disclosure of ESIA update

Following the various specialist studies and stakeholder engagement activities to update the ESIA, the key findings and management measures of the ESIA update was disclosed to the public in a Non-Technical Summary. The Non-Technical Summary (NTS) describes the project and provides a summary of the key findings and recommendations of the specialist studies.

Stakeholders were notified by letter, hand delivered by NYA project team members, that the NTS is available for comment from 16 - 31 July 2013, where to find the reports, and how to comment. The notification letter in English, French, Lingala and Kikongo is appended as Appendix 9.8.

Copies of the NTS together with comment forms (see Appendix 9.9) in English, French, Kikongo and Lingala, were made available from **Tuesday, 16 July to Wednesday, 31 July 2013** in the following locations, for easy access to community members and other stakeholders such as government officials, to view and comment on:

- Local Government Sector office in Mawete (on the N1 national road)
- Nyumba Ya Akiba (NYA) office, 7eme Etage Immeuble Forescom, 16, Avenue Lukusa, Kinshasa – Gombe
- Homes of the traditional Chiefs in the Kokolo, Yuku Camp, Nkonda, Minkelo, Mbemba, Kinsua, Mbamba, Mawete and Nkondo-Kiombia Villages
- On the SRK website, <http://www.srk.co.za/en/page/esia-nyumba-ya-akiba-project> (also in English)

Stakeholders had the opportunity to comment by:

- Completing the comment form available with the NTS, and placing it in the Comment Box provided at the Mawete Local Government Sector office, or at the NYA office in Kinshasa.
- Writing a letter or sending an email by 31 July 2013 to the following contact details.

- SRK Consulting:

Lubumbashi: Mr Philippe Katuta; Email: pkatuta@srk.co.za; Tel: +243 81 999 9775

South Africa: Mr Vuyo Matshikiza; Email: vmatshikiza@srk.co.za; Tel: +27 11 441 1021

- NYA

Kinshasa: Mr Patrick Vandewalle c/o Irene Kassongo; Email: ikassongo@nya-cement.com; Tel: +243 81 769 8491

Copies of the NTS together with the notification letter and comment form were also hand delivered to the relevant authorities in Kinshasa, the Territory Office in Songololo and Mawete Sector, as well as to traditional authorities and community leaders in the project area, for distribution to community members.

A total of approximately 430 comments forms and 65 NTS reports in the different languages were distributed to stakeholders during public disclosure of the ESIA update. Approximately 214 comment forms were received back from stakeholders during the public disclosure period that ended on 31 July 2013.

Note that due to the time constraints, the comment forms have been included as received from stakeholders and are enclosed in Appendix 9.10. The key comments and themes expressed by stakeholders are summarised as follows:

- Employment opportunities for local communities
- Eagerness for the project to start as soon as possible, and to bring development and improved infrastructure into the region
- Concern about the impact of dust generated by the project on air quality in the area.
- Concern about potential impacts of project related activities on water resources in the area, particularly because water is a precious resource.
- Hope that NYA will adhere to high standards and provide fair treatment and good salaries to employees.

NYA will address these comments during the implementation of the Stakeholder Engagement Plan.

10.4.1 Way forward

Following the public disclosure period, the ESIA Report will be updated with inputs from stakeholders received by 31 July 2013. The Non-Technical Summary will however still be available in the abovementioned locations for stakeholders to reference.

The Final ESIA will be submitted to NYA in early August 2013.

11 Project compliance with IFC-Performance Standards

11.1 General

The assessment of environmental risk and impacts has been undertaken in compliance with the IFC “Performance Standards 1 to 8, on Environmental and Social Sustainability – Effective January 1, 2012”.

11.2 Performance Standard 1- Assessment and Management of Environmental and Social Risks and Impacts

11.2.1 Social and Environmental Assessment

This ESIA Study Report complies with the International Finance corporation (IFC) requirement of “Performance Standards on Environmental and Social Sustainability” effective January 1, 2012, while taking into considerations also the IFC “**Environmental, Health, and Safety Guidelines, Cement and Lime Manufacturing** (April 30, 2007), IFC “**Environmental, Health, and Safety Guidelines, Mining** (December 10, 2007), and IFC “**Environmental, Health, and Safety Guidelines, General EHS Guidelines** (April 30, 2007).

11.2.2 Management Program

Based on the social and environmental risks impacts and mitigation measures requirement, NYA is committed to establish a management program. Various policies and procedures are in the process being developed for NYA, which will be incorporated for the Proposed Project. The NYA management is also developing policies and procedures. NYA also plans to implement an effective Environmental and Social Management System (ESMS).

The Company (NYA) is in the process of establishing policies defining the environmental and social objectives and principles that will guide the Company to achieve sound environmental and social performance. NYA plans to be obtain certification under ISO 9001:2008, ISO 14001 and OSHAS 18001 standards

In addition to developing an overall Environmental, Health and Safety Policy, the ESMS will consist of action plans addressing social and environmental risks and impacts. The action plans will identify issues and potential impacts, spell out practical mitigation measures and indicate what resources will be made available for implementing these measures within reasonable timeframes. The main components include: (i) occupational health and safety management, including workplace risk assessment; (ii) emergency response plan; (iii) traffic management plan; (iv) stakeholder engagement plan, including grievance mechanism; (v) storing and handling bulk (vi) monitoring and reporting; and (vii) organizational capacity and training.

Examples of issues to be included in the ESMS are: (i) domestic and hazardous waste management; (ii) water management; (iii) water discharge, including surface run-off; and (iv) dust control. The action plans will take into account technical and financial feasibility and are to be consistent with IFC’s Performance Standards and the EHS Guidelines.

According to the DRC Mining Code, the holders of the mining and or quarry rights must comply with the measures which are decreed by the Mines Administration with a view to preventing or removing the causes of the dangers which the work inflicts on the public safety and health, the preservation of the deposits, springs and public roads. In the event of an emergency or refusal by those involved to

comply with these measures, these will be taken and implemented by the administration without consultation at the expense of those involved.

The client has committed to appoint an Environment, Health and Safety (EHS) Manager, who will be responsible for overseeing construction and operations at the new plant site. The EHS manager will be responsible for establishing a chain and command, development of an ESMS, management and monitoring plans.

A Quality Assessment / Quality Control (QA/QC) department shall monitor performance of equipment, and a Safety Officer will be responsible for monitoring occupational health and safety. The Plant will also have a Safety Committee.

The Project Proponents, Rawji Groupe and Lucky Cement, have already implemented management programs at existing respective industrial operational facilities.

11.2.3 Organizational Capacity

NYA is committed to develop an adequate organizational structure required for implementation of ESMS and management program. The company is in the process of defining rules, responsibilities and the authority to implement the management program.

11.2.4 Training

The management is committed, that the employees and contractors training with respect to work skills; hazards; fire; environment; emergency; spills; accidents; first aid; etc.; shall be implemented.

11.2.5 Monitoring

Mandatory monitoring, according to the national codes and regulations need to be carried out during construction and operation stage of the Project. It is recommended that a third party monitoring should also be undertaken annually. NYA is also committed to follow the monitoring requirements specified in the World Bank “Pollution Prevention and Abatement Handbook (1998)”, IFC Environmental, Health, and Safety Guidelines, Cement and Lime Manufacturing April 30, 2007/ European Commission: Reference Document on Best Available Techniques (EU RDBAT) in the Cement, Lime and Magnesium Oxide Manufacturing Industries, May 2010 as the case may be.

11.2.6 External Communication and Grievance Mechanisms

Clients is committed to develop adequate procedures for external communications and grievance mechanism as per requirement of national grievance related regulations and IFC’s “Good Practices Note - Addressing Grievances from Project-Affected Communities (September 2009)”.

11.3 Performance Standard 2 – Labour and Working Conditions

11.3.1 Working Conditions and Management of Work Force

It is mandatory on the company to follow the DRC’s Labour Code, Mining Code, and Right to Social Security [June 29, 1961. - Organic Law of Social Security. (M.C., 1961, p. 319)] for setting up the working conditions and management of workers relationship. The company is committed to establish procedures/policies for non-discrimination, equal opportunity, retirement and grievance mechanism.

The regular workers union will be in place after the project has gone into operation, as per requirement of the DRC Labour Code.

NYA have prepared a draft policy pertaining to human resources (see Appendix 10) as well as a Labour and Human Resources Plan contained in Appendix 11. The information presented in this section by ECTECH should be read in conjunction with the relevant policy and plan

11.3.2 Protecting the Work Force

A strict policy, as per national laws shall have to be evolved and strictly implemented for non-employment of child and forced labour. The company is committed to enforce this policy under the DRC Constitution and laws (codes) requirement. This policy will also be enforced on contractors and contract labour.

Social Management System is in the process of being developed. The management has indicated that this will be implemented by Project's due date.

The management has also plans to address strictly the issue of child labour and forced labour with its supply chain and contractors.

NYA have prepared a draft policy pertaining to human resources (see Appendix 10) as well as a Labour and Human Resources Plan contained in Appendix 11. The information presented in this section by ECTECH should be read in conjunction with the relevant policy and plan.

11.3.3 Occupational Health and Safety

DRC Labour Code requires that “to ensure the worker and his family health care provided for in Title IX of the Labour Code, every employer must either organize itself a medical service to the company or establishment, or use a service common to several companies, or a foreign company or establishing training as a doctor after the opinion of the Ministry of Labour and Social Welfare. -Title IX of the old Code as title VIII of Act 015-2002 of 16 October 2002 on the Labour Code.”

Article -2 of Title IX states that “The employer with a workforce of 100 to 499 workers within a radius of 50 km around a place of business is required to arrange a medical service (the company with the assistance of a nurse or nurse engaged in a contract and work under the supervision of a doctor or medical training outside the company”.

The Company will have a well-equipped and adequately manned dispensary in the Plant premises. Adequate and well-equipped first aid kits will be placed in all control rooms of the factory as well as at other key locations. Ambulance will also be available round the clock. In addition, arrangement will made at nearby Kimpese medical facilities to cater for any emergencies.

Health and Safety Management System, Health and Safety Procedures and Health and Safety Training Procedures will be developed by the Company.

Adequate Personnel Protection Equipment (PPE) will be procured and compliance of its use shall be strictly enforced by the Company.

Routine medical check-up and record of all employees will be maintained. The medical policy will include protective measures against HIV/Aids.

NYA have prepared a draft policy pertaining to occupational health and safety (see Appendix 10).as well as an Occupational Health and Safety Plan contained in Appendix 12. The information presented in this section by ECTECH should be read in conjunction with the relevant policy and plan.

11.4 Performance Standard 3, Resource Efficiency and Pollution Prevention

11.4.1 General

The new cement plant, its offsites and quarry will correspond to the prevention of pollution and minimize emissions to be consistent with World Bank Standards, IFC's Environmental, health and Safety Guidelines, and good international industry practices.

11.4.2 Pollution Prevention, Resource Conservation and Energy Efficiency

The company is committed to maintain release of all type of pollutants in compliance with the IFC/World Bank standards/ EU RDBAT as the case may be. The company is also committed to examine and incorporate in its operations resource conservation and energy efficiency measures, consistent with the principles of cleaner production.

Liquid Effluents

All type of effluents will be treated to the level required by the national authorities and IFC/World Bank.

Gaseous Emissions

The emission levels of gases will correspond to the IFC/World Bank requirements.

Solid Waste

All solid waste will be disposed of according to environmentally sustainable fashion using internationally recognized practices.

Noise

Plant equipment and machine will be designed to operate within permissible noise levels of IFC/World Bank.

Wastes

The project management is committed to minimize, as far as practically possible, the generation of hazardous and non-hazardous wastes.

Hazardous Materials

The project management, during construction and operation stages, will endeavour to avoid use of hazardous materials. Wherever avoidance is not feasible, it will endeavour to minimize or control the release of hazardous materials resulting from their production, transportation, handling, storage and use for project activities.

The project management, in particular, commits that it will not use Ozone depleting substance like Freon's for refrigeration, PCBs and asbestos.

Emergency Preparedness and Response

The project management commits that it will quantify and monitor, on annual basis, the emissions of GHG in accordance with internationally recognized methodologies. In addition, the Company commits to evaluate technically and financially feasible and cost-effective options to reduce or offset project-related GHG emissions during the operation of the project.

Pesticide Use and Management

The project management is committed that during its project activities, it will manage the use of pesticides. It will avoid use of pesticides. When pesticides use becomes necessary, it will use pesticides with low human toxicity, known to be effective against the target species, and have minimal effects on non-target species and the environment.

The project management commits that it will not use products that fall in the World Health Organization Recommended Classification of Pesticides by Hazard Classes I(a) and I(b) or Class II.

Additional management quality, air quality and soils are presented in Section 9. A Waste Management Plan is contained in Appendix 15. The information presented in this section by ECTECH should be read in conjunction with additional information and the Waste Management Plan.

11.5 Performance Standard 4, Community Health, Safety and Security

11.5.1 General Requirements

- The project management is committed to conform to all the requirements of Community Health and Safety.
- All gaseous emissions, liquid effluents, noise levels and solid waste will be managed to conform to the World Bank “**Pollution Prevention and Abatement Handbook** (1998)” and IFC “**Environmental, Health, and Safety Guidelines, Cement and Lime Manufacturing** (April 30, 2007), IFC “**Environmental, Health, and Safety Guidelines, Mining** (December 10, 2007), and IFC “**Environmental, Health, and Safety Guidelines, General EHS Guidelines** (April 30, 2007).

11.5.2 Infrastructure and Equipment Safety

The project management commits that during design, engineering, construction and operation activities it will ensure that structural elements or components are in accordance with good international industry practice.

All structural elements will be designed and constructed by qualified and experienced professionals, and certified or approved by competent authorities or professionals.

The project management ensures that the equipment, specially safety shut-off instruments, controls and valves in hazard areas, shall meet the requirement of providing protection from hazards arising from combustibility and flammability of vapours, liquids, gases, dusts or fibres and shall have mechanical integrity to withstand designed process pressures, temperature and corrosion conditions.

11.5.3 Hazardous materials Safety

The project management commits, that it will prevent or minimize, the potential for community exposure to hazardous materials that may be released by the project. It also commits that where there is a potential for the community to be exposed to hazards, particularly those that may be life threatening, it will exercise special care to avoid or minimize their exposure by modifying, substituting or eliminating the condition or substance causing the hazards.

11.5.4 Environmental and Natural Resource Issues

The project management is committed to avoid or minimize adverse impacts due to project activities on soil, water and other natural resources in use by the affected communities.

11.5.5 Community Expose to Disease

The project management commits that its project activities do not have potential for and will also prevent or minimize the potential for community exposure to water-borne, water-based, water-related, vector-borne disease, and other communicable diseases.

11.5.6 Emergency Preparedness and Response

The project management is committed to develop an “Emergency Preparedness and Response Plan”.

11.5.7 Security Personnel Requirement

As per requirement of the DRC Mining Code, “the holder of mining or quarry rights must provide security in order to guarantee the compliance with the environmental obligations relating thereto during exploration and/or exploitation. In addition, the holder of a mining right is authorized to set up a provision for the site rehabilitation in accordance with the provisions of Article 258 of this Code”.

The Company is also committed to implement this article of the Mining Code

In addition, the management plans to hire security services on contract from registered and approved agencies. They are committed that in hiring security services it will ensure that it will be guided by the principles of proportionality, good international practices in terms of hiring, rules of conduct, training, equipping and monitoring of such security personnel, and applicable law.

NYA have prepared a draft corporate sustainability policy as well as a Sustainable Development Plan contained in Appendix 19. The information presented in this section by ECTECH should be read in conjunction with the relevant policy and plan.

11.6 Performance Standard 5 – Land Acquisition and Involuntary Resettlement

11.6.1 General Requirements

The Project will be established in the area of state owned land concession/lease granted by the Ministry of Mining.

Resident of one village, Yuku Camp Village, will need to be resettled and rehabilitated at mutually and negotiated location and as per requirement of local laws.

SRK in its ESIA update conducted a baseline socioeconomic investigation for Yuku Village in June 2013. This information is presented in section 6.5. Information pertaining to people that may be economically displaced by the project has also been collected. The Framework RAP contained in Appendix 18 presents this information.

11.7 Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources

11.7.1 Habitat

The project activities will not lead to any destruction of habitat and threat to the maintenance of biodiversity.

11.7.2 Modified Habitat

The project activities are not expected to affect habitat.

11.7.3 Natural Habitat

The management of the project commits to undertake measures through following actions:-

- Post-construction restoration of habitats, where practically, technically and financially feasible.
- Offset any losses that are caused by its operation, through creation of ecologically comparable area(s) that is managed for biodiversity.

11.7.4 Critical Habitat

The project area does not fall into critical habitat areas.

11.7.5 Legally Protected Areas

The project is not located within a legally protected area.

11.7.6 Invasive Alien Species

The project management is committed not to intentionally introduce any new alien species. Its activities also do not involve any introduction of alien species.

11.7.7 Management and Use of Renewable Natural Resources

The project management is committed to manage renewable natural resources in a sustainable manner. It has plans to grow trees and vegetation where technically and practically possible within its boundary.

11.8 Performance Standard 7 – Indigenous Peoples

The Social Impact Assessment indicates that none of the communities within the project's area of influence will be affected by the project's activities (after relocation of Yuku Camp Village). It is worth noting there are no Indigenous People in the project area according to definition. The management is committed that when any adverse impact occurs due to project activity, they will be minimized, mitigated and for any damage to occur to any segment of environment will be duly compensated.

11.8.1 Development Benefits

The management plans to hire labour on contract, to pass on the benefits of its activities to the peoples of the area, by passing on to them the activities like loading and unloading, horticultural services, janitorial services, canteen services etc.

11.8.2 Special Requirements

The establishment of the project at the selected location will not have any impact on traditional or customary land under use. Its activities are not expected to having any adverse impact on livelihoods, or cultural, ceremonial, or spiritual use that defines the identity and community of the Peoples.

11.8.3 Relocation of Indigenous People from Traditional or Customary Lands

The concession/lease of land by the Company has not involved any relocation of People from their traditional or customary lands, houses or else, except those from Yuku Camp Village.

11.9 Performance Standard 8 – Cultural Heritage

Although there is no cultural heritage according to its definition, yet the project management is committed to protect cultural heritage, if any.

12 Grievance Redress Mechanism

This chapter contains the original ECTECH 2013 ESIA text. For SRK's updated Grievance Mechanism, see Appendix 17 (Stakeholder Engagement Plan).

In order to hold states or other actors accountable, 'stake holders', need access to grievance mechanisms. These may take many forms.

A grievance mechanism is here understood as an institution or process through which stakeholders are able to raise concerns, grievances and legitimate complaints.

A grievance mechanism should be able to deal effectively with complaints from communities, or others filing a complaint on their behalf. To fulfill this purpose, a grievance mechanism should comply, among others, with the following criteria:

- Ability to respond quickly;
- Independence, transparency, fairness and impartiality;
- Easy accessibility and set-up to hear plaintiffs;
- Inclusion of independent (non-State) experts;
- Inclusion of experts from indigenous peoples and civil society;
- Authority to order restitution or compensation, and to stop ongoing or planned activities that would undermine human rights and safeguards.

Information about the existence of grievance mechanisms and their functions should be readily available to the public, including potential filers of complaints.

National grievance options would in general be easier to access for stake holders than international ones. Some grievance mechanisms are associated with the State's governance system, like local and national courts and dispute resolution mechanisms, ombudsman offices, and national human rights institutions.

The Aarhus Convention (UN/ECE Agreement on Access to Information Public Participation in Decision-making and Access to Justice in Environmental Matters) is also relevant. Individuals affected by project's activities supported by a State Party to the Aarhus Convention may present claims through the Convention's non-compliance mechanism.

A Compliance Committee safeguards the rights of stake holders, including the right to full and effective participation. NGOs that qualify as observers under the Aarhus Convention may nominate candidates to serve on the committee.

12.1 International Grievance Options

Complaint options also exist under international finance or credit institutions, like the World Bank Inspection Panel, and the International Finance Corporation. These become relevant when project is financed through these entities.

12.1.1 IFC - Good Practice Note Addressing Grievances from Project-Affected Communities

This Note does not discuss various internal grievance procedures intended for employees or commercial disputes involving contractors, suppliers, customers or consumers. The Note focuses on grievance management at the level of private sector projects and companies and is not intended to cover aspects of government, industry, or international-level grievance mechanisms. Such mechanisms together with the formal justice system and other independent dispute resolution and accountability bodies are part of a broader accountability framework for the private sector, and serve

as drivers for companies to engage more effectively with communities to preempt escalation of grievances and disputes. Thus, a company's accountability to its stakeholders encompasses more than a project-level grievance mechanism, which is only one of the tools that companies can use to respond to the need for greater accountability, without undermining or limiting communities' rights to use alternative avenues for recourse.

12.1.2 The Principles of a Good Grievance Mechanism

These principles are:

Principle 1: Proportionality

Principle 2: Cultural Appropriateness

Principle 3: Accessibility

Principle 4: Transparency and Accountability

Principle 5: Appropriate Protection

12.1.3 Process Steps for Grievance Management

Step 1: Publicizing Grievance Management Procedures

Step 2: Receiving and Keeping Track of Grievances

Step 3: Reviewing and Investigating Grievances

Step 4: Developing Resolution Options and Preparing a Response

Step 5: Monitoring, Reporting, and Evaluating a Grievance Mechanism

12.2 National Framework for Grievance

Both, the Mining and Labor Codes, provide compensation or grievance procedures for employees. Recourse to judicial system is option for redress of grievance. Policy or regulations on grievance related to environmental issues, caused by operation of an entity, are not clearly defined.

NYA will provide a grievance mechanism for employees to raise reasonable workplace concerns. NYA will inform the employees of the grievance mechanism at the time of hire, and make it easily accessible to them. The mechanism will involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides feedback to those concerned, without any retribution. The mechanism will not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

12.3 Formal Channel

The project is required to operate at least 95 % of its operational period in strict compliance with the required national emission standards as well as the guidelines laid down by the "Pollution Prevention and Abatement Hand Book, July 1998, the World Bank" and IFC EHS Guidelines. This ensures that the project proponent is bound to observe all requirements to avoid damaging the environment around the project.

The DRC Constitution and Mining Code cover aspects related to the protection, conservation, rehabilitation and improvement of the environment and the prevention, control of pollution and promotion of sustainable development.

The DRC Government is bound to protect the environment in accordance with its international commitments under various conventions and treaties it has signed or ratified. Non-compliance to these commitments may result in loss of credibility, popularity and even financial aid from the international forums.

12.4 Grievance Redress Mechanism- Informal

12.4.1 Compensation for Environmental Damages

Since the project is expected to follow the World Bank (WB)/ IFC emission standards, therefore, it is required to operate at least 95 % of its operational time in compliance with the required emission standards of the WB/IFC. This ensures that the project operation is legally bound to observe all legal requirements to avoid damaging the environment around the project.

The likely damages to be caused to any sector of the environment or property or else will need to be paid to the affected parties.

There is complete legal cover to address issues related to compensation for any environmental damage arising out of project activity. However, to address any such issues more expeditiously, the Project Administration will have a local committee as an Informal Mechanism.

This informal mechanism will provide convenient, quick and cost effective decisions for compensation against any environmental damages that occur from the project activity. This informal mechanism will also build confidence between the Project Administration and public and safeguard the interests of both the project and the public at large.

It is proposed to institute the following committee at the local level for amicable and speedy resolution of cases pertaining to any environmental damages that likely occur from the project activity. The decision of the committee will be executed in letter and spirit.

12.4.2 Constitution of the Committee:

- General Manager at Plant site of the Company or his nominee: Chairman of the committee
Head of the Songololo Territory Ex-Officio Member
- Head of the Local Sub-Sector Government Ex-officio Member
- A dignitary of the Project Area Member
(enjoying confidence of the people of the project area)
- Head EHS Department of the project Member
- Representative of the NGO from the project area. Member
- Representative of the aggrieved person Member

12.4.3 Time Schedule for Redressing the Grievance

- The committee will be under obligation to decide the grievance within three weeks of the complaint by the aggrieved party.
- Compensation as decided by the committee will be paid in full to the aggrieved party within two weeks from the date of decision of the committee.
- The decision of the committee will be binding on both parties, i.e. the project proponent as well as the aggrieved party.

13 Social Management Plan

13.1 Introduction

SRK as part of the ESIA update has prepared the Environmental and Social Management system (ESMS) Framework which is set out in Chapter 9 above and which also applies to the Social Management Plan (SMP). It should be noted that there has been substantial revision to the social impacts section, with these being provided in Chapter 7 of this updated ESIA and ESMP. The mitigation measures provided by SRK are contained in Chapter 8 of this updated report. Section 9-3 above provides the full list of sub-management plans covering both environmental and social aspects which have been developed, those requiring expansion, and those which still need to be developed.

ECTECH in the 2013 ESIA provided the text set out indicated by a blue line in the right hand margin. Updates provided by SRK do not have a blue line in the margin. Reference is made by SRK within ECTECH sections to management plans which are appended to this SRK-updated ESIA. Monitoring measures for social impacts have been added to this section by SRK and are provided in Table 13-2 below.

NYA is committed to design, develop, and operate the Proposed Project in a manner that will protect the quality of life for local residents, improve living conditions, provide needed community infrastructure to the extent possible, enhance skills and employment opportunities, encourage business development, and protect human health in the area. All programs will be developed in concert with stakeholders. In this regard, the primary impacts addressed in the Social Management Plan (SMP), both for construction and regular operation of the project, include:

- Resettlement and relocation of local communities, where essential;
- Local infrastructure pressures;
- Employment, training, and educational opportunities;
- Local economic opportunities and business development;
- Community health and safety; and
- On-going public consultation and disclosure.

13.2 Construction Phase

The project description has changed as provided in Chapter 4 and impacts have been revised as presented in Chapter 7, within mitigation measure in Chapter 8 of this updated ESIA and ESMP.

The construction of Project will involve the employment of approximately 600 workers over a 27-month period of construction. Provisions for housing and services as well as health and safety measures for workers within camps and on project sites will be addressed in the Construction Contractor's and sub-contractors' agreements in accordance with the Concession Agreement and DRC law. However, it is expected that there will be a number of migrants moving into the area as service providers that will impact communities and areas adjacent to or nearby project camps. There is a possibility among these service providers there will be a substantial number of influx population. It is expected that 500 - 600 times the worker population, largely male, will enter the area during the construction period, that is anywhere from 1000 to 1200 additional people, inclusive of construction workers. These assumptions are based on previous experience with similar large projects.

A plan is required to mitigate, reduce and/or offset any additional impacts such a population influx may cause communities in the project area. In particular, there is a need to manage this population, address health issues, prevent traffic accidents and discourage human trafficking.

In addition, there is a need to assist local Territory and Sector organizations in order to ensure that they have a good understanding of the challenges and ample resources to deal with these impacts and mitigate them effectively and in a gender-sensitive manner. The plan aims to fulfil the requirements of both the World Bank and IFC policies and EU Directives providing mitigation for indirect project impacts (population influx and “camp followers”) on communities in the vicinity of project camps and incorporating gender planning.

The main objective of the plan is to propose suitable mitigation measures for the impacts of construction workers and their service providers and related impacts on communities in the Project Area. The plan needs to create a balance between providing necessary mitigation in order to create temporary and reasonable living conditions for construction workers but at the same time to control the scale of impacts by discouraging population influx. The plan also must address the any concerns of permanent residents of impacted areas, especially women, about the influx creating security and health concerns. These points imply that provisions should be ‘adequate’ in terms of standards for construction workers and service providers and take into consideration the needs of surrounding communities.

Spontaneous service providers are part of the multiplier service (indirect component) that provides services to the direct construction workforce by setting up facilities in a random disorganized ribbon in the vicinity of work camps. Services offered can vary from food and retail products.

More specifically, the plan should ensure that the following conditions are met:

- The Contractors and sub-contractors carry out gender-sensitive local labour recruitment as a key measure to reducing potential population influx and optimizing benefits for local communities.
- Health conditions among service providers and residents adjacent to project sites and communities are of a reasonable standard with basic measures to ensure safe drinking water and sanitation and to reduce incidents of Sexually Transmitted Diseases, so that the general health of camp followers does not affect the health of workers or nearby communities.
- Local organizations involved in urban planning, enforcement, and monitoring of health and social impacts are ensured adequate training, personnel, technical assistance and support funds to plan, manage all potential social and health risks, and carry out prevention and control measures and enforcement.
- Illegal social and economic activities by workers and service providers, including trafficking in people and employment of minors, are quickly discouraged and heavily penalized, including the consequences of job loss and repatriation.

Construction Camp

The site or sites for the construction camps are yet to be defined but taking into account the baseline conditions, site allocated should be located physical environmental sensitivity. The key features of the camp site, as they relate to the construction activities, are summarized below:

- The site should in a relatively flat area and there should not be any drainage lines traversing the site.
- The site should be clear of any forest vegetation and broadleaved trees species. Notwithstanding, the extent of vegetation clearing should be minimized.
- There should not be any agricultural activities on land/area selected for the camp site. The area will be affected by the construction activities, but should ultimately be reinstated.
- During the dry season, there is a significant risk of air pollution from clay road dust. Control of dust need to be mitigated by water tankers during peak traffic times. There is also increased risk of traffic accidents, noise and amenity issues associated with an influx of high number of construction workers.

Direct Workforce Impacts

- Construction employment effects are normally short term with abrupt peaks and very rapid declines in the workforce. A construction workforce is generally highly transient and although

total numbers of the workforce may appear stable, this may result from equal numbers of incoming and outgoing workers. This highlights the need for flexible and well-managed accommodation arrangements. Due to the size of the proposed workforce and the relative geographical isolation, construction camps will be necessary in the locations discussed in the previous paragraphs.

- The various construction camps and essential on-site infrastructure will complete in stages and some workforces who may be accommodated off designated sites in what are described as “temporary camps”...
- The majority of unskilled and some semi-skilled labour categories will be drawn from outside the primary impact area.
- It is anticipated that the construction workforce, during most of the construction period, will adopt a daylight time work system, followed by break to return to the camp.

Most Probable Population Influx Scenario

- Half of the influx at camps is estimated to being local from within the Territory of Songololo, and from villages within or immediately adjacent to the project area.
- Majority of the remaining population will come from other parts of Bas Congo Province.

Population Influx Impacts and Mitigation

Without social management interventions, the risk of significant social impacts arising from the project, during construction phase, is considered high. The social impact of a workforce of this size will be significant with populations increasing many-fold that living near the vicinity of the plant. A high percentage of the affected people will be indigenous populations living in surrounding villages. A high percentage of the workforce will be men and a small percentage of the service providers may be women. Although the impact will be short term (about 2 years) it will also be intense.

An overview of Construction and Camp Impacts and Mitigation is presented in Table 13-1.

Table 13-1: Construction and Camp Impacts and Mitigations

Impact	Mitigation	Responsible Party
Potential for unregulated development of contractors or sub-contractors work camps	Contractors responsible for camp construction and monitoring of conditions	Contractors. NYA EHS Dept. to cover monitoring
Potential for a proliferation of random disorganised service providers developments with unhealthy and unsanitary living conditions	Social Management and Mitigation Plan (see following Section) Population Management and Security (PMS) Task Force and Territory Health Official.	NYA EHS Dept.
Increases in risks to worker and local resident health	NYA Health and Safety Plan to be finalised for worker safety and incorporated into the contractors agreement	Contractors with monitoring by NYA EHS Dept. and Territory Health Officials
A risk of violence and security problems due to the unusual, temporary population influx of workers and camp followers, and to the lack of local resources and human capacity.	Social Management and Mitigation Plan (see following Section) and Population Management and Security (PMS) Task Force	NYA Administration Dept.
Potential for discontent among local people if a significant percentage of workers are not given work	Direct workforce local labour recruitment plan	NYA HR Dept.
Potential for local discontent due to inappropriate social behaviour of workers (drinking, gambling, and harassing local women.)	Workers' Code for appropriate behaviour incorporated into contractors' agreements, with work dismissal as a consequence.	Monitoring by Contractors and NYA Security Force.
Lack of supply of potable water and water for domestic use for local	Provisions for improved water supply and sanitation as part of the Social	Contractors with monitoring by NYA

population and population influx	Management Plan and incorporated into the contractors' agreements.	
A significantly increased risk of traffic accidents with unregulated control of construction vehicles	1) Traffic safety programme (on site) 2) Traffic safety programme between sites and along main routes within the region Both to be incorporated into the contractors agreement, with stress on training and speed control	Contractors with monitoring by NYA Admin. Dept.
The generation of dust and noise by project vehicles on residents with houses in close proximity to the road	1) Dust and noise control measures for all project sites and adjacent populated areas 2) Monitoring of measures by contractors	Contractors with monitoring by NYA
The project has the potential to significantly increase jobs, employment and incomes of men and women in the local area which would help to mitigate the above negative impacts	Direct workforce local labour recruitment plans of NYA, including gender balanced targets (where appropriate) to guide local and external hiring.	NYA HR Department

13.2.1 Social Management and Mitigation Plan

It is clear that the existing social environment within the primary impact area has virtually no social carrying capacity to absorb and service the estimated workforce and service providers.

It is also clear that there is a risk of large number of service providers living in uncontrolled and unsanitary conditions. The risk of incoming human trafficking and to lesser degree outgoing human trafficking will be substantial. There are also a number of specific impacts arising from the interaction between the social and physical environment which requires immediate mitigation such as the risk of exposure to dust, the increased risk of traffic accidents and the increased risk to water supply. The opportunity to support the local community will be an additional project benefit.

In order to reduce these risks, social management and mitigation program should cover the following main components:

- Capacity Building for Local Agencies and Staff
- Infrastructure
- Health Issues
- Security and Population Management Issues
- Traffic Safety and Regulations

Water Supply

With an expected increase in population of at the peak of the construction phase and non-existent of in safe drinking water the area, there is a need for ensuring a regular supply of safe drinking water to designated camp and service provider's area. The following steps are needed:

- Draft a plan for the supply of water to camps, based on estimated population increase and scenarios for the construction period
- Plan should access needs, resources and need for examining all types of safe water sources.
- Management arrangements for water supply to be considered in Plan, including private water supplier for camps and service providers.
- Camp areas will be a key location for water quality and use monitoring due to the relative high population density and risk of contamination of water supplies by the different users.

Sanitation

Sanitation relates to the construction of toilets in camp and service providers areas. This will require the following activities:

- Draft a plan for the construction of toilet facilities for camps and service providers areas, based on estimated population increase and scenarios for the construction period;
- Construction to commence as soon as possible for health reasons;
- Management arrangements for maintaining toilet facilities to be outlined in the plan – responsible party to be identified and funds secured for maintenance.

SRK as part of the ESIA update has prepared a WMP which is provided in Appendix 15. This incorporates management measures related to the package sewage treatment plant in line with the updated project description contained in Chapter 4.

Waste Disposal

Given the expected population increase, there will be a need to organize an effective waste collection and disposal system. The following steps are required:

- Draft a plan for waste collection and disposal system for camps and service providers areas, based on estimated population increase and scenarios for the construction period;
- Contractor should be engaged to construct disposal areas as identified in the plan; and
- Work should commence as soon as possible for health reasons.

SRK as part of the ESIA update has prepared a WMP which is provided in Appendix 15.

Health Issues

In addition to safe water supply, sanitation and waste collection and disposal, there are a number of other outstanding health issues. The Territory Administration and Health Offices will be required to carry out a number of monitoring activities and possible interventions for camps and service providers and will require additional training and funding in order to do this.

- Price monitoring of essential goods since inflation is likely to occur with demand exceeding supply at various times during construction (socio-economic monitoring will cover these issues and service providers and hereby villages/towns will be key locations for monitoring).
- Monitoring of births, mortality, causes of mortality and illness by Village Heads or Territory health authorities to be reported on a monthly basis
- Support by NYA to Territory health staff for carrying out the above work in camps areas.
- The services of local police along with Territory health officials need to be extended to cover service provider areas. This will monitor infectious diseases, injuries, violence and other potential health problems.

SRK as part of the ESIA update has prepared an Occupational Health and Safety Plan (OHSP) which is provided in Appendix 12.

Population Management and Security Issues

Security and population management are important aspects for service providers, both from the point of view of internal security (ensuring safety and order) and potential negative impacts on nearby communities (crime or negative social influences). There are two main preventative issues:

- 1) supporting and improving security measures; and
- 2) demographic management and monitoring.

Security and population management of the contractor's camps will be the responsibility of the contractors.

Measures provided by SRK for the management of population influx and security issues are contained in Chapters 7 and 8. Relevant plans developed by SRK appended to this ESIA include the Community Health and Safety Plan (CHSP) in Appendix 13, the EPRP in Appendix 16 and the Sustainable Development Plan (SDP) in Appendix 19.

13.3 Operation Phase

13.3.1 Access to Clay Tracks

There is a regular inter-village movement of people (adults and children) surrounding the NYA Concession area. The villagers, though small in number, use existing clay tracks for their movement, mostly on foot, for agricultural activities, collection of water for drinking and other uses, fishing, cutting timber/bushes for fuel and animal (goats and pigs) feeding.

Some of these tracks will need to be re-routed as they fall within the plant site allocated area. Also tracks will be crossing project's paved and unpaved (to quarry) roads. NYA has to ensure the access of local population to these tracks as well as allow regular crossing of their developed roads.

Safety of local population, while crossing NYA developed roads, has to be ensured by NYA by limiting the speed of traffic on these roads access points and installation of adequate road signs supported by local population's awareness campaign.

Measures provided by SRK for the mitigation and management of road safety issues are contained in Chapter 8. Relevant plans developed by SRK appended to this ESIA include the CHSP in Appendix 13 and the EPRP in Appendix 16.

13.3.2 Traffic Management Plan

Traffic Management Plan will be developed for the safe use of vehicles on and off site; driving standards; safe access to construction sites as well as NYA developed roads, with minimum negative impact on the existing roads and in parallel for ensuring community safety and easy access to their properties (homes, land and gardens). Construction and operation Workforce transportation should be considered within this plan.

For traffic control and safety, the information about the project activities and driving standards will be announced through, discussion forums, the local radio and any other means of communication available. NYA will openly and transparently inform residents in the affected places and villages as a minimum on a quarterly basis regarding the planned activities and safety measures to be employed.

The traffic flow through the site and within the urban areas will be coordinated with the responsible traffic officers/authorities responsible in the municipalities.

13.3.3 Truck Parking and Rest Area

About 145 trucks will be daily moving in and out of the plant. Since most of the movement will be during daytime a parking, lodging and rest area for truckers will necessary. This area can be either close to the Highway or plant site.

Normally, such areas get developed in an unorganized fashion, creating environmental and social problems. If allowed to proceed un-mitigated the area can become a major environmental hazard.

Controlled and regulated service area provided by oil marketing companies, like: Engen DRC can guard against environmental degradation and reduce social problems. The area can be allocated by NYA in its Concession Area (with Mining Department permission) or arranged by oil marketing

company (OMC). The OMC as a part of its service provide: diesel/gasoline pump, service area, shopping, rest area/rooms, parking for trucks and sanitary facilities

13.4 Community Health and Safety

A Community Health and Safety Educational Programme will be developed to inform and build awareness and understanding of the local community and transport drivers on the hazards and potential adverse impacts during the construction and operation phases and how to minimize the potential for an accident and/or injury to occur. The Programme will be linked to the SEP and utilize various communication methods to address the needs of vulnerable groups such as children and illiterate residents.

Workers must receive training and guidance on how to avoid conflicts with the local community members and sign a code of conduct, in order not to create conflicts with the local environment. Any damage or grievance shall be managed by the Grievance Mechanism and any repair/compensation be made in a timely basis.

In order to avoid negative impacts on local residents, Worker transportation and modes for workforce movements during construction works and plant operation will be organized in a way that will minimize negative impacts on local residents.

Plan to be provided to ensure compliance with DRC National and EU safety requirements.

However, during and after construction traffic accidents will increase due to higher traffic volumes and speeds, and there is a risk of the spread of HIV/AIDS. Road safety and HIV/AIDS awareness campaigns have been proposed to mitigate these impacts.

As a part of its social management plan NYA will include special campaign against the spread of HIV/AIDS. Urban expansion and higher immigration rates along the project road will lead to greater demand on infrastructure services and natural resources; this will require regulation by the regional / district planning authorities.

The CHSP developed by SRK is provided in Appendix 13.

13.5 Recommendations and Mitigation Measures

Based on the initial benchmark study following recommendations are made:

- The management of the Project can capitalize on the positive attitude of the people of area towards proposed Project by offering them maximum employment opportunities at the construction stage and operational phase of the proposed plant.
- Insufficient and inadequate socio-economic structure of the community of the area also provides ample opportunities to Company management to win sympathies of local people in their favour, by introducing meaningful and manageable plan of community development.
- Aggressive and comprehensive plantation plan can also lessen fear of local people towards environmental issues.
- Plant management can explore direct or indirect chances of female employment opportunities. Such efforts can be fruitful to minimize negative social impacts.
- Sustainable development approach through conservation of natural resources would be the best strategy to compensate negative socio-environmental impacts.
- Plant management should offer technical training opportunities to the local youth, if possible, to remove relative sense of deprivation.
- Social responsible attitude and stewardship of company management towards local people and resources can make project people friendly.
- Prior to action of the Project installation a comprehensive awareness campaign may be launched at masses level to avoid any conflict.

- To avoid any political, ethnic and value conflict, the administration of the plant may win the building measures.

The SMP establishes the role and responsibilities of NYA, government, stakeholders and communities in mitigating and managing social impacts and opportunities during the construction and operational phases of the proposed project.

In general terms, the plan shall provide a program that will:

- avoid or reduce negative social impacts
- maximize positive social impacts
- monitor effectiveness of mitigation strategies.

The use of seven over-arching initiatives to reduce the negative social impacts of the Project and to uphold our NYA's Business Principles, include:

- monitoring social impacts and other social issues and co-developing management initiatives with government and the community
- ensuring Project employment, training and business benefits include a focus on local communities
- supporting enterprise development to foster a strong local economy
- sponsoring and giving to local community organizations sufficient development opportunities
- setting strong behaviour protocols for employees
- minimizing impacts on landholders where practicable
- being responsive to community concerns by gathering community feedback through engagement.

The plan includes potential timing of impacts, measures of any change to be experienced by the community, who may be affected by change, how changes will be measured and what actions will be taken, by whom and when in order to manage impacts.

13.6 Community Development

In the ECTECH ESIA NYA committed to support the communities in which it operates and to this end will implement a sustainable development plan, through engagement with local stakeholders and includes activities to:

- Address skills development needs.
- The providing of infrastructure.
- Eradicate poverty and projects to create jobs.
- Investigate and implement community investment opportunities.

NYA's Community Policy will express the organization's commitment to communities affected by its operations. To this end, communities are defined as those individuals or groups that may be directly affected by the company's activities. As a result, NYA operations are required to formalize their community engagement strategies by preparing a Community Engagement Plan. The plan defines a technically sound and culturally suitable approach to community engagement.

NYA, with guidance and support from Rawji Foundation is committed to undertake the following activities:

- Employment Opportunities
 - Locals shall be provided employment as per their skills set.
 - Security guards deputed at Project site belong to nearby villages.
- Education

- Construction of a new school
- Renovation of one of the schools in the area.
- Medical Facility
 - A setup of medical facility for the employees
 - Locals can also benefit from the same.
- Clean Drinking Water
 - Shall provide clean drinking water for local population.
- Vocational Training
 - To be provided by the NYA to locals for skill development.

NYA Commitment to Welfare of the People

The strong commitment of NYA to the welfare of the local villagers is well reflected in its agreement already finalized with them. The brief points of this contract are as follows and most of them will be executed after the project completion. According to this contract NYA is to:

- a) Construct one (1) modern school
- b) Renovate one (1) school at Konda
- c) Provide free medical check-up through company's clinic.
- d) Construct bridge over Sanzikua River.
- e) Construct roads as per company's requirements these may be used by villagers too.
- f) Provide job opportunities to the local villagers according to their skills with maximum quota of 10%.
- g) Provide 200 plastic chairs and 200 metal sheets per village. (Total 7 villages)
- h) Develop water sources at the place convenient for company.
- i) Provide X-max basket to the villagers only once.
- j) Sell cement on factory price with quota to be approved by company from time to time.

The above points are in addition to providing alternative accommodation for Yuku Camp Village settlers.

The SDP provided in Appendix 19 by SRK also carries forward the commitments made in the OEMS (2012), as well as the ECTECH (2013) reports. Please refer to this Appendix for relevant details on how NYA will be dealing with community development planning to fulfil the requirements of both the DRC, as well as those of lenders.

13.7 Social Monitoring Plan

Provided in Table 13-2 below is monitoring to be undertaken as part of the social component of project implementation in line with policies, plans and programmes provided in this updated ESIA and ESMP.

Table 13-2: Social monitoring to be undertaken during construction and operation for the NYA project, as identified in the SRK updated ESIA

Environmental component	Monitoring parameters	Reference location/ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
Grievances	Monitor community grievances and provide feedback	Grievance register (See Appendix 17 for the Grievance Mechanism)	As and when grievances are registered	NYA	DRC Regional Mining Department
Resettled Yuku village households	Monitor to confirm the RAP has been properly implemented	Resettlement Action Plan (See Appendix 18)	Grievance meetings: once a month Quarterly meetings with resettled households until 2 years after resettlement External review: annually after compensation until sustainability confirmed	NYA	DRC Regional Mining Department
Economic displacement due to development footprint	Finalisation and signing off of asset inventory	Resettlement Action Plan (See Appendix 18)	Regular negotiations and consultations Asset inventory an entitlement matrix: Once-off Grievance meetings: once a month External review: annually after compensation until sustainability confirmed	NYA	DRC Regional Mining Department
Resettled vulnerable groups	Monitor livelihoods of resettled community, particularly vulnerable households (women, elderly, children, disabled)	Resettlement Action Plan and Livelihoods Assessment and Income Restoration Plan (See Appendix 18)	Monthly for the first year, followed by quarterly for the second year and as and when required after that. To be done together with the grievance register	NYA	DRC Regional Mining Department

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Environmental component	Monitoring parameters	Reference location/ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
Sustainable Development Plan	Agreed development initiatives Allocation of funds and capacity for identified development projects Progress in implementation Outcomes of projects and programs	Sustainable Development Plan (See Appendix 19)	Monitoring of inputs (funds, human resources) and the effectiveness of their deployment Monitoring of participation (extent and effectiveness) Monitoring of outputs (products of SDP projects or programs) Evaluation of impacts (the outcomes of SDP projects and programs) Inputs: Annually Participation, outputs and impacts: Bi-annually	NYA	DRC Regional Mining Department
Community and Health and Safety	Formal and regular communication to affected communities Record number of grievances received from communities Determine baselines for selected individuals and monitor community health to assess if it is deteriorating with time or not. Include screening and examination for potential health impacts arising from dust	A sample of community members Community Health and Safety Plan (See Appendix 13) Sustainable Development Plan (See Appendix 19)	For community members- before construction and annually afterwards	NYA	
Occupational Health and Safety	Monitor employee health to assess if it is deteriorating with time or not. Include monitoring (Screening and Examination) for potential health impacts arising from dust	All employees Occupational Health and Safety Plan (See Appendix 12)	For all employees – during induction and annually afterwards Feedback to NYA Sustainable Development Manager as well as NYA OHS committees Record of formally lodged employee complaints, and actions taken to correct these Record of OHS health and safety	NYA	DRC Regional Mining Department

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Environmental component	Monitoring parameters	Reference location/ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
Consultation and disclosure	Formal and regular communication to interested and affected communities and various stakeholders	Stakeholder Engagement Plan (See Appendix 17)	Monthly for life of operation	NYA	DRC Regional Mining Department
Contractor management	Register complaints from project impacted communities regarding contractor activities Progress reports from contractors following community complaints regarding contractor activities	Commit contractors to meeting the relevant responsibilities by means of a Code of Practice (to be developed) Occupational Health and Safety Plan (See Appendix 12)	Contractors meetings: Weekly Progress reports: Monthly Community feedback structure Record of formally lodged community complaints and actions taken Contractor meetings to discuss environmental, health, safety and community performance	NYA	DRC Regional Mining Department
Employment	Regular and accessible dissemination of the human resources and employment policy to interested and affected communities Complaints of inequality and discrimination in job selection	Labour and Human Resources Plan (See Appendix 11) Sustainable Development Plan (See Appendix 19)	Monthly feedback to community structures	NYA	DRC Regional Mining Department
Labour and skills development	Adherence to ILO Conventions Planning for structured skills development and counselling prior to closure Engagement with the workforce to determine the skills deficit Open communication channel between NYA and its workforce Contractors incorporating the ideals of skilling and counselling prior to closure, into their labour work plans	Labour and Human Resources Plan (See Appendix 11) Sustainable Development Plan (See Appendix 19)	6-monthly Feedback to community development forum	NYA	DRC Regional Mining Department

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Environmental component	Monitoring parameters	Reference location/ monitoring point	Monitoring frequency and method	Implementing Body	Regulatory Body
Consultation with authorities	Two-way (NYA with authorities) communication and feedback channel Engagement of community issues at meetings Constructive input into the SDP	Sustainable Development Plan (See Appendix 19)	Quarterly Meetings with key authorities dealing with health, local infrastructure and mining	NYA	DRC Regional Mining Department

14 Summary and Conclusions

14.1 Summary of environmental and social impact ratings, management and monitoring

A summary of the impact ratings (before and after implementation of the recommended management measures) for all of the impacts discussed and assessed in Section 7 is provided in Table 14-2. With effective implementation of appropriate mitigation, the significance ratings of almost all negative impacts are predicted to be reduced to low or medium significance.

Table 14-3 provides a summary of the applicable management plans for both environmental and social impacts for all project phases. Mitigation measures related to both environmental and social impacts can be found in Chapter 8, while environmental monitoring measures can be found in Chapters 9 and social monitoring measures in Chapter 13.

14.2 Recommended further actions

Table 14-1 provides a summary of the key information gaps and actions that are recommended to address gaps in knowledge. Addressing these gaps is critical to:

- improving the confidence and quality of impact assessment predictions and bringing it in line with GIIP;
- ensuring that the nature and scale of management commitments are appropriate to the impacts identified.

Table 14-1: Summary of information gaps and recommended actions to address them

Information gap	Actions	Timing	Responsibility
Project description			
Infrastructure footprints: SRK has provided high level recommendations for the location of the overburden spoil pile and other facilities on the basis of a preliminary environmental and social sensitivity analysis. The impact assessment has been undertaken on the basis of these recommended locations. NYA has not however confirmed these footprint areas.	Once the footprint locations have been finalised by NYA, elements of the impact assessment will need to be revised to ensure that impacts are relevant to the actual footprint that will be affected by land take. This will in turn affect the following management plans which will need to be updated: • FRAP/RAP • Sustainable development plan	Prior to construction	NYA
Project activities/processes: SRK has been unable to quantify the water related impacts for two reasons – NYA has not been in a position to advise on waste water discharges and water use within the process and NYA has not provided design detail on process waste water management facilities – location and sizing. At the same time no hydrogeological or hydrological studies had been undertaken ahead of SRK's update and insufficient time was available in	In the detailed design phase, NYA will need to design its water management facilities. These designs should be informed by and in turn inform the following studies: • Water balance – wet and dry season • Sources of water supply • Floodlines • A hydrogeological model including pit water model The conceptual water management plan should then be updated and detailed into a	Prior to construction	NYA

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Information gap	Actions	Timing	Responsibility
this update to address these gaps	comprehensive Integrated Water Management Plan. The location of water management facilities will need to be considered in updates to the RAP/FRAP with regards land take.		

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Information gap	Actions	Timing	Responsibility
Air quality modeling has not been undertaken by SRK for this ESIA. Of greatest concern are the air quality impacts associated with upset conditions. It is anticipated that NYA will experience power outages from the national grid (SNEL). The typical frequency of power outages is uncertain, but the environmental and technological implications of frequent shut-downs may require further investigation so as to inform impacts and management around unplanned shutdowns.	Detailed baseline monitoring over a full 12 months needs to be undertaken to inform baseline air quality and assist in predicting routine and upset impacts that require management. Start-up conditions for the plant should also be modelled, as it will give an indication on the magnitude of the difference in ambient pollutant concentrations between start-up and normal operations. Emissions are usually higher during start-up conditions. A weather station as well as monitoring at the various villages needs to be implemented as soon as possible to inform this exercise and modeling for routine and upset conditions should be undertaken. The results of this assessment should inform: • The Community Health and Safety Plan • The FRAP/RAP • Occupational Health and Safety Plan.	To be completed prior to the end of construction	NYA
Outside the scope of the current study, it is anticipated that once the NYA cement plant is operational, co-processing (in the cement plant kiln) of suitable categories of waste from the NYA site could be undertaken. This would most likely require a separate feasibility study. Should this proceed, co-processing will be undertaken in line with best available technology (BAT) and Good International Industry Practice (GIIP) including implementation of the waste hierarchy. It is further expected to reduce greenhouse gas (GHG) emissions from the project, and will be in accordance with multilateral agreements including the Basel Convention. This would not completely replace the requirement for a WMF however, but could considerably reduce the amount of waste going to landfill, as well as the coal fuel requirement of the kiln.	The results of this study, if it is undertaken should inform the Waste Management Plan.	During operations	NYA
Currently the haul road is planned to cross the Yuku River and traverse the Yuku Camp Village with resultant impacts associated with water quality, biodiversity and health and safety. SRK has assumed that Yuku Village will be resettled, however this does not address the water and biodiversity impacts associated with the haul road and an alignment upstream of the Yuku River, sufficiently far from the source of the river should be identified and considered.	NYA to decide on the haul road routing. Once a decision has been taken on the routing, the relevant management plans should be updated accordingly. In rerouting the haul road, the health and safety of other communities and stakeholders should still be considered and the FRAP/RAP updated accordingly.	Prior to construction	NYA
Baseline Data			

Information gap	Actions	Timing	Responsibility
In terms of GIIP, baseline data collection should be undertaken to cover full seasonal variations. Full seasonal baseline data collection has not been collected for air or water with the resultant inability to accurately predict impacts or develop appropriate management measures. Principle level management is included in the management plans however detailed management measures can only be developed once baseline data and quantified predictions have been undertaken.	Management plans to be updated on the basis of the full seasonal monitoring data and impact predictions. Specifically the following studies will be undertaken • A long term monitoring programme need to be undertaken (approximately a year) to monitor flow and chemistry from both the Yuku and Sanzikua Rivers to get a better understanding of the baseline conditions • In addition to the existing monitoring stations which were sampled once, the following is proposed: ○ A monitoring point after the confluence of the Yuku and Sazikwa stream, as flow might be impacted on by mining (baseflow reduction); ○ Monitoring points up-gradient within the Sazikwa stream to measure flow and baseline chemistry as the plant may impact on the stream (dirty water run-off) ○ Implement constant monitoring within the pond close to the plant area. • It is assumed the hydrogeological study that is currently underway by CREN-K will include run-off estimations and baseline contributions (these components will be impacted on by the open pit mining. - reduced run-off and baseflow contributions to these streams). • Analysis of a full spectrum of cations and anions needs to be undertaken for water samples from all monitoring points in streams and hydro-census sampling points. There is a preliminary indication that chrome concentrations (Cr6+) are highly elevated rendering the water not fit human consumption. • Gravimetric geophysics investigation will be undertaken within the mining footprint area to investigate the occurrence of cavities, extent, depth etc. • Drill testing holes to intersect such cavities to undertake pumping tests to acquire aquifer parameters (conductivity and storativity values), which can give an indication of underlying aquifer conditions;	Commence immediately	NYA

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Information gap	Actions	Timing	Responsibility
	- To measure water levels and take water samples for analysis from these boreholes to establish baseline conditions; - The interpolation of water levels from the boreholes drilled and possible water level data to be obtained from villages (hydro-census investigation) will give an indication of groundwater flow directions and potential receptors that could be impacted by proposed mining activities; - That a numerical groundwater model be developed which will be used to better quantify groundwater inflows into the open pit (the volume mentioned is not substantiated)		
ECTECH reported that based on the geology of the soil of the area it appears likely that the water will not pose a significant impact to the environment or human health.	This should be verified ahead of construction or through monitoring and mitigation.	Prior to construction	NYA
A Biodiversity Action Plan should be compiled for the area, and should be informed by comprehensive baseline surveys of fauna (to complement the existing flora data)	Comprehensive baseline surveys of mammals, birds, insects, amphibians, reptiles and fish should be undertaken in both the wet and dry seasons. Should species of special concern be identified during these surveys, additional mitigation measures may be recommended.	Prior to construction	NYA
Policy and management structures			
NYA has a suite of draft environmental and social policies that need to be reviewed, finalised, disclosed, adopted and implemented. The draft plans that have been prepared for NYA assume that organisational structures will be in place to implement those plans.	In order to operationalize the policies NYA will need to: - Translate the policies into operational procedures within an environmental and social management system - Populate the organisational structure that is outlined in the updated ESMP (Chapter 9) - NYA must ensure that, once adopted, the ESMS, policies, procedures and plans are all aligned and all are updated as and when changes to the project and/or legislation and GIIP are made.	Prior to construction	NYA
A large portion of the project will be contracted out to contractors.	NYA must ensure that the principles and obligations within the ESMP are translated into codes of practice for contractors to adhere to and that these are incorporated as contractual requirements.	Prior to any contracts going out to tender	NYA
Stakeholder engagement and disclosure is a key requirement of GIIP.	The grievance mechanism and the SEP need to be adopted and implemented as soon as possible to ensure appropriate engagement processes and continuity in engagement.	Immediately	NYA
Management plans			

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Information gap	Actions	Timing	Responsibility
RAP/FRAP: In the absence of a finalised detailed project layout, which has affected impact prediction to some extent, it is not possible to develop a resettlement action plan (RAP) that is of sufficient detail for implementation. Further work will be required at the detailed design stage to finalise and quantify physical and economic displacement and only at that stage can the framework RAP be developed into a RAP for implementation	NYA to fix a final project layout at detailed design stage. Verification of the exact fields that are affected will need to be done in consultation with affected households and representatives structures at the detailed design phase once infrastructure footprints have been pegged on site. RAP to be developed on the basis of confirmed project description and assets inventory.	Detailed design stage	NYA
Outside of the scope of SRK's work, was the development of a detailed construction management plan. This remains a commitment of the ESIA and should be developed ahead of contractors being appointed for the construction phase.	A detailed construction management plan needs to be developed ahead of the confirmation of contractors so that this can be incorporated into contractual requirements. This plan should be based on the ESMP and other relevant management plans.	Prior to construction and ahead of contracts going out to tender	NYA
This updated ESIA has not assessed traffic impacts in any relevant detail. The introduction of construction vehicles and the transport of cement out and diesel and coal into the project area as well as haul vehicles will introduce substantial new traffic to the area. Communities in the area do not have much experience of the nature and scale of traffic that will be introduced to the local roads and road safety issues are of concern.	NYA should commission a specialist traffic and road safety specialist study to quantify the impact and develop a detailed traffic road safety management plan that addresses engineering, education and enforcement. This plan should be incorporated into the emergency preparedness and response plan, the community health and safety plan and the sustainable development plan. All personnel and contractors should be contractually required to meet the obligations of this plan.	Prior to construction	NYA
A range of management plans has been developed with assistance by SRK	NYA to sign off on the management plans developed with assistance by SRK	Prior to construction	NYA
Immigration Management Plan (IMP)	NYA to develop IMP as urgently as possible to management stakeholder expectations of employment		NYA
Energy Management Plan	NYA to develop Energy Management Plan		NYA
Hazardous materials production, transportation, handling, storage, and use for project activities	Measures to be developed and documented once relevant information is available		NYA
Communication Plan	It is proposed that a Communication Plan accompanied by a glossary of key technical, emergency and operational terms each with a standardized symbol should be developed (to include phonetic spellings). Emergency and other signage should use the standardized symbols e.g. English, Arabic, French, Chinese and Lingala. Obligatory training should be provided with requirement that key symbols are learned. Basic language courses should also be undertaken for relevant staff. Translators will need to attend key induction/training and feedback meetings.	Prior to construction	NYA
Action Plan			
Action Plan from NYA to take forward the requirements identified by SRK, lenders and reviewers	NYA to develop an action plan aligned with the high level ESMS developed with SRK, and take forward the development and implementation of the ESMS	Prior to construction	NYA

Table 14-2 Summary of impact significance ratings before and after implementation of recommended management measures

Impact groups	Identified impacts	Initial impact rating (pre-management)			Residual/enhanced impact rating (post-management)		
		Probability of impact occurring	Significance	Confidence rating	Probability of impact occurring	Significance	Confidence rating
CONSTRUCTION PHASE							
Biophysical impacts							
Visual Impacts	Impact VI1: Loss of sense of place affecting local communities due to site clearing and construction activities	Definite	Medium (-ve)	Medium	Possible	Low (-ve)	Medium
Soils, land capability & land use	Impact SL1: Placement of project infrastructure, resulting in a transient loss of soil resource, and change in soil characteristics, land capability and land use	Definite	Medium (-ve)	Medium	Definite	Medium (-ve)	Medium
	Impact SL 2: Placement of permanent project infrastructure, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use	Definite	Medium (-ve)	Medium	Definite	Medium (-ve)	Medium
	Impact SL 3: Spillage of chemicals and seepage from waste resulting in permanent loss of soil resource, and change in soil characteristics, land capability and land use	Definite	Medium (-ve)	High	Possible	Low (-ve)	High
	Impact SL4: Site clearance resulting in a permanent loss of soil resource, and potential change in soil characteristics, land capability and land use as a result of increased erosion	Definite	Medium (-ve)	Medium	Possible	Low (-ve)	Medium
Air quality	Impact AQ1: Increase in PM ₁₀ emissions resulting from land clearing, earthworks, and vehicular movement	Possible	Low (-ve)	Low	Unlikely	Low (-ve)	Low
	Impact AQ2: Increase in gas (SO ₂ , NO _x , CO and VOCs) emissions resulting from vehicle exhaust emission and biomass burning	Possible	Low (-ve)	Low	Unlikely	Low (-ve)	Low
Water resources	Impact WR1: Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste	Possible	Low (-ve)	Medium	Unlikely	Low (-ve)	High
	Impact WR2: Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads	Possible	Low (-ve)	Medium	Unlikely	Low (-ve)	High
	Impact WR3: Contamination of groundwater resulting from seepage from sewage and other waste	Possible	Low (-ve)	Medium	Unlikely	Low (-ve)	High
Noise and Vibration	Impact NV 1: Continuous noise impact on Mbemba Village resulting from night-time construction at the quarry	Possible	Low (-ve)	Medium	Unlikely	Low (-ve)	Medium

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Impact groups	Identified impacts	Initial impact rating (pre-management)			Residual/enhanced impact rating (post-management)		
		Probability of impact occurring	Significance	Confidence rating	Probability of impact occurring	Significance	Confidence rating
	Impact NV 2: Air-blast noise impact on Mbemba Village resulting from blasting at the quarry during construction	Possible	Low (-ve)	Medium	Unlikely	Low (-ve)	Medium
Ecology & Biodiversity	Impact EB1: Loss of savanna habitat due to site clearing and earthmoving activities	Definite	Medium (-ve)	High	Possible	Low (-ve)	High
	Impact EB2: Loss of forest habitat due to site clearing and earthmoving activities	Definite	Medium (-ve)	High	Unlikely	Low (-ve)	High
	Impact EB3: Loss of aquatic habitat due to site clearing and earthmoving activities	Definite	Medium (-ve)	High	Unlikely	Low (-ve)	Low
	Impact EB4: Loss or disturbance of species of special concern due to site clearing and construction activities	Definite	Medium (-ve)	Medium	Possible	Low (-ve)	Medium
	Impact EB5: Loss or degradation of ecological processes due to site clearing and construction activities	Possible	Medium (-ve)	Medium	Unlikely	Low (-ve)	Low
	Impact EB6: Fragmentation of habitats and ecological processes due to positioning of project infrastructure	Possible	Medium (-ve)	Medium	Unlikely	Low (-ve)	Low
	Impact EB7: Modification or degradation of aquatic habitats due to altered hydrological regimes and surface or groundwater quality	Possible	Medium (-ve)	Medium	Possible	Medium (-ve)	Low
	Impact EB8: Introduction of alien invasive plants due to site clearing and disturbance of vegetation	Definite	Medium (-ve)	Medium	Unlikely	Low (-ve)	Low
	Impact EB9: Impeded photosynthesis and transpiration rate of plants due to dust generation	Possible	Low (-ve)	Medium	Unlikely	Low (-ve)	Medium
Traffic	Impact T1: Impact of construction related traffic on utilisation capacity on the N-1	Possible	Medium (-ve)	Medium	Possible	Low (-ve)	Medium
	Impact T2: Impact of construction related traffic on traffic flow in Matadi	Definite	Medium (-ve)	Low	Possible	Low (-ve)	Low
	Impact T3: Safety impacts on local communities and other road users due to increased road accident rates during construction	Definite	Medium (-ve)	Medium	Definite	Medium (-ve)	Medium
Socio-economic impacts							
Population & Demographic movement	Impact PD1: Influx of potential job seekers into the area and associated risks	Definite	Medium (-ve)	Medium	Possible	Low (-ve)	Medium
Health & Safety	Impact HS1: Increased chances of the spread of communicable diseases such as HIV/AIDS and STDs linked to influx of predominantly male job-seekers and workers	Possible	Low (-ve)	Medium	Possible	Low (-ve)	Medium

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Impact groups	Identified impacts	Initial impact rating (pre-management)			Residual/enhanced impact rating (post-management)		
		Probability of impact occurring	Significance	Confidence rating	Probability of impact occurring	Significance	Confidence rating
	Impact HS2: Increased pressure on healthcare infrastructure due to project related influx	Definite	Medium (-ve)	Medium	Possible	Low (-ve)	Medium
	Impact HS3: Increased risk of accidents and injuries to communities from improved roads and additional traffic	Possible	Low (-ve)	Medium	Unlikely	Low (-ve)	Medium
	HS4: The visible presence of DRC police within the project area, and their secondment as a subcontractor for the mine security	Possible	Low (-ve)	Medium	Possible	Low (-ve)	Medium
Land & Natural Resources	Impact LN1: Physical displacement of households residing at Yuku Village and the protection of vulnerable groups	Definite	High(-ve)	High	Definite	Medium(-ve)	Medium
Economic Impacts	Impact EC1: Local and regional benefits resulting from increased Revenue to Government	Possible	Low (+ve)	Low	n/a	n/a	n/a
	Impact EC2: Stimulation of increased regional investment in the DRC Economy	Possible	Low (+ve)	Low	n/a	n/a	n/a
	Impact EC3: Generation of direct, indirect and induced employment and income	Possible	Medium (+ve)	Medium	Possible	Medium (+ve)	Medium
Cultural Heritage Resources	Impact CH1: Indirect damage to Iron Age archaeological resources through land transformation activities	Possible	Medium(-ve)	Medium	Possible	Low(-ve)	Medium
	Impact CH2: Indirect damage to cemeteries through land transformation activities	Possible	Medium(-ve)	Medium	Unlikely	Low (-ve)	Medium
Ecosystem Services	Impact ES1: Reduced availability of natural resources and ecosystem services to local communities	Possible	Medium (-ve)	Low	Possible	Low (-ve)	Low
OPERATIONAL PHASE							
Biophysical impacts							
Air quality	Impact AQ3: PM ₁₀ emissions due to activities at the quarry and the vehicle entrainment of dust affecting air quality of nearby villages	Possible	Medium (-ve)	Low	Unlikely	Low (-ve)	Low
	Impact AQ4: Dust emission from activities at the cement plant affecting air quality for nearby communities	Possible	Medium (-ve)	Medium	Unlikely	Low (-ve)	High
	Impact AQ5: Gas (SO ₂ , NO _x and CO) emissions from activities at the cement plant affecting air quality for nearby communities	Possible	Medium (-ve)	Low	Unlikely	Low (-ve)	High
Greenhouse Gases	Impact GH1: Increase in greenhouse gas emissions in the area resulting from the cement plant	Possible	Medium (-ve)	Low	Unlikely	Low (-ve)	High

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Impact groups	Identified impacts	Initial impact rating (pre-management)			Residual/enhanced impact rating (post-management)		
		Probability of impact occurring	Significance	Confidence rating	Probability of impact occurring	Significance	Confidence rating
Noise and Vibration	Impact NV3: Continuous noise resulting from daytime operations of the quarry, cement plant and associated infrastructure	Definite	High (-ve)	High	Option 1 – Realignment of Haul Road		
					Unlikely	Low (-ve)	Medium
					Option 2 – Relocation of Yuku community		
					Unlikely	Low (-ve)	High
	Impact NV4: Continuous noise resulting from night-time operations of the cement plant and associated infrastructure	Possible	Medium (-ve)	Medium	Option 1: Mitigation by Plant Design		
					Possible	Medium (-ve)	Medium
					Option 2: Relocation of Mbamba Community		
					Unlikely	Low (-ve)	High
	Impact NV5: Air blast pressure and vibration resulting from blasting at the quarry	Possible	High (-ve)	Medium	Option 1: Restricting blasting to afternoon hours		
					Possible	Medium (-ve)	Medium
					Option 2: Employ alternative mining techniques instead of blasting		
					Unlikely	Low (-ve)	High
Ecology & Biodiversity	Impact EB10: Loss or disturbance of fauna species of special concern due to collisions and noise disturbance	Definite	Medium (-ve)	Medium	Possible	Medium (-ve)	High
	Impact EB11: Introduction of alien invasive flora and fauna	Possible	Medium (-ve)	Medium	Unlikely	Low (-ve)	Medium
	Impact EB12: Increased hunting/poaching of wildlife	Definite	Medium (-ve)	High	Unlikely	Low (-ve)	Medium
	Impact EB13: Modification or degradation of aquatic habitats due to pollution or nutrient loading	Possible	High (-ve)	High	Possible	Medium (-ve)	Low
	Impact EB14: Impeded photosynthesis and transpiration rate of plants due to dust generation	Possible	Medium (-ve)	Low	Possible	Low (-ve)	Medium
Soils, land capability &	Impact SL5: Chemical spills and release of contact water resulting in permanent loss of soil, and change in soil characteristics, land capability and land use	Definite	Medium (-ve)	Low	Possible	Low (-ve)	Low

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Impact groups	Identified impacts	Initial impact rating (pre-management)			Residual/enhanced impact rating (post-management)		
		Probability of impact occurring	Significance	Confidence rating	Probability of impact occurring	Significance	Confidence rating
land use	Impact SL6: Operational activities causing increased erosion, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use	Definite	Medium (-ve)	Medium	Possible	Low (-ve)	Medium
Water Resources	Impact WR4: Contaminated stormwater runoff from roads and other surfaces affecting surface and groundwater quality	Possible	High (-ve)	Medium	Unlikely	Low (-ve)	Medium
	Impact WR5: Discharge of contaminated pit water to surface water resources, affecting downstream users	Definite	High (-ve)	Medium	Unlikely	Low (-ve)	Low
	Impact WR6: Risk of flooding of project infrastructure due to placement within the 1:100 year floodline	Possible	Medium (-ve)	Low	Unlikely	Low (-ve)	Low
	Impact WR7: Dewatering of the quarry resulting in groundwater drawdown and reduced contribution to surface water baseflows and wetlands, affecting users	Possible	High (-ve)	Low	Unlikely	Medium (-ve)	Medium
	Impact WR8: Stormwater inflows into the pit, reducing surface water flows and availability to users	Definite	High (-ve)	Medium	Possible	Medium (-ve)	High
	Impact WR9: Raw water abstraction for the project reducing availability to other users	Definite	Medium (-ve)	Low	Unlikely	Low (-ve)	Medium
	Impact WR10: Seepage from waste affecting surface and groundwater quality	Definite	Medium (-ve)	Medium	Possible	Medium (-ve)	Low
	Impact WR11: Wastewater effluent discharge to streams, affecting water quality for downstream users	Definite	High (-ve)	High	Possible	Medium (+ve)	Medium
	Impact WR12: Sinkhole formation resulting from dewatering of subsurface cavities, resulting in safety and structural stability risks	Possible	High (-ve)	Medium	n/a	n/a	n/a
Visual Impacts	Impact VI2: Loss of sense of place affecting local communities due to project infrastructure and illumination	Definite	Medium (-ve)	Medium	Possible	Low (-ve)	Medium
Traffic	Impact T4: Impact on utilisation capacity on the N-1 affecting other road users	Definite	Medium (-ve)	Medium	Possible	Medium (-ve)	Low
	Impact T5: Impact on traffic in Matadi affecting other road users	Possible	Medium (+ve)	Low	n/a	n/a	n/a
	Impact T6: Increased road accident rates and road safety of other road users	Possible	High (-ve)	Medium	Possible	Medium (-ve)	Medium
Socio-economic impacts							
Economic Impacts	Impact EC4: Local and regional benefits resulting from increased Revenue to Government	Possible	Medium (+ve)	Low	n/a	n/a	n/a

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Impact groups	Identified impacts	Initial impact rating (pre-management)			Residual/enhanced impact rating (post-management)		
		Probability of impact occurring	Significance	Confidence rating	Probability of impact occurring	Significance	Confidence rating
	Impact EC5: Generation of direct, indirect and induced employment and income	Possible	High (+ve)	Medium	Possible	High (+ve)	Medium
Ecosystem Services	Impact ES2: Reduced availability of natural resources and ecosystem services to local communities due to use by the project and impacts on these resources	Possible	Low (-ve)	Low	Possible	Low (-ve)	Low
Population & Demographic Movement	Impact PD2: Influx of potential job seekers into the area and associated risks	Definite	Medium(-ve)	Medium	Possible	Low(-ve)	Medium
Health & Safety	Impact HS5: Increased chances of the spread of communicable diseases such as HIV/AIDS, STDs and malaria linked to influx of job-seekers and workers	Possible	Low(-ve)	Medium	Possible	Low(-ve)	Medium
	Impact HS6: Increased pressure on healthcare infrastructure due to project related influx	Definite	Medium(-ve)	Medium	Possible	Low(-ve)	Medium
	Impact HS7: Increased risk of accidents and injuries to communities from improved roads and additional traffic	Possible	Low(-ve)	Medium	Unlikely	Low(-ve)	Medium
	Impact HS8: The visible presence of Congolese police within the project area, and their secondment as a subcontractor for the mine security	Possible	Low(-ve)	Medium	Possible	Low(-ve)	Medium
DECOMMISSIONING AND CLOSURE PHASE							
Ecology & Biodiversity	Impact EB15: Re-establishment of habitats or creation of new habitats via rehabilitation	Possible	Medium (+ve)	Medium	Definite	Medium (+ve)	High
	Impact EB16: Introduction of alien invasive flora and fauna	Possible	Medium (-ve)	Medium	Unlikely	Low(-ve)	Medium
	Impact EB17: Loss or disturbance of fauna species of special concern due to collisions and noise disturbance	Definite	Medium (-ve)	Medium	Unlikely	Low (-ve)	High
	Impact EB18: Increased hunting/poaching of wildlife and loss of habitats for crop production	Definite	Medium (-ve)	High	Possible	Medium (-ve)	Medium
Water Resources	Impact WR13: Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste	Possible	Low (-ve)	Medium	Unlikely	Low (-ve)	High
	Impact WR14: Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads	Possible	Low(-ve)	Medium	Unlikely	Low(-ve)	High

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Impact groups	Identified impacts	Initial impact rating (pre-management)			Residual/enhanced impact rating (post-management)		
		Probability of impact occurring	Significance	Confidence rating	Probability of impact occurring	Significance	Confidence rating
	Impact WR15: Contamination of groundwater resulting from seepage from hazardous materials and waste	Possible	Low(-ve)	Medium	Unlikely	Low(-ve)	High
Soils, land capacity & land use	Impact SL7: Remediation of contaminated soils and demolition of project infrastructure, resulting in re-establishment of baseline soil characteristics and land capability	Definite	Medium (-ve)	Medium	Re-establishment of baseline		High
Air Quality	Impact AQ6: Increase in PM ₁₀ emissions resulting from land clearing, earthworks, and vehicular movement	Possible	Low(-ve)	Low	Unlikely	Low(-ve)	Low
Visual Impacts	Impact VI3: Dust generation and site disturbance due to earth moving and removal of project infrastructure, affecting the visual character for communities	Possible	Medium(-ve)	Medium	Possible	Low(-ve)	Medium
POST-CLOSURE PHASE							
Ecology & Biodiversity	Impact EB19: Increased hunting/poaching of wildlife and loss of habitats for crop production	Definite	Medium (-ve)	High	Possible	Medium (-ve)	Medium
Water Resources	Impact WR12: Pit lake formation due to inflow of ground and surface water, resulting in safety risks to animals and humans, and environmental contamination	Possible	Low (-ve)	Low	Unlikely	Low (-ve)	Medium
Soils, land capacity & land use	Impact SL8: Demolition and restoration of project infrastructure, resulting in re-establishment of baseline soil characteristics and land capability	Definite	Medium (-ve)	Medium	Re-establishment of baseline		High
Visual Impacts	Impact VI4: Re-establishment of baseline visual character due to rehabilitation of the site and removal of project infrastructure	Possible	Medium(-ve)	Medium	Definite	Medium(+ve)	Medium

Table 14-3: Mitigation and management measures for environmental and social impacts caused by project activities during all project phases²⁹

Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
Visual	VI1: Loss of sense of place affecting local communities due to site clearing and construction activities	X				Construction Management Plan (still to be developed) Stakeholder Engagement Plan in Appendix 17	Contractor in charge of Construction to report to the General Manager Plant Community Development Coordinator
	VI2: Loss of sense of place affecting local communities due to project infrastructure and illumination		X			Project final design by NYA Construction Management Plan (still to be developed) Stakeholder Engagement Plan in Appendix 17	Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Community Development Coordinator
	VL3: Dust generation due to earth moving and removal of project infrastructure, affecting the visual character for communities			X		Construction Management Plan (still to be developed) Air Quality Control Plan in Chapter 9 Stakeholder Engagement Plan in Appendix 17	Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Community Development Coordinator
	VI4: Re-establishment of baseline visual character due to rehabilitation of the site and removal of project infrastructure				X	Construction Management Plan (still to be developed) Stakeholder Engagement Plan in Appendix 17	Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Community Development Coordinator
Soils, land capability and land use	SL1: Placement of project infrastructure, resulting in a transient loss of soil resource, and change in soil characteristics	X				Soil Management Plan contained in Chapter 9 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Community Development Coordinator

²⁹ Note – this table has been developed by SRK Consulting to provide an overview of all impacts for the project. Mitigation measures can be found in Chapter 8, environmental monitoring measures in Chapter 9, and social monitoring measures in Chapter 13.

³⁰ Key to project phases: C – Construction; O – Operation; DC – Decommissioning and closure; PC – Post-closure

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	SL2: Placement of permanent project infrastructure, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use and capability and land use	X				Soil Management Plan contained in Chapter 9 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Community Development Coordinator
	SL3: Spillage of chemicals and seepage from waste resulting in permanent loss of soil resource, and change in soil characteristics, land capability and land use	X				Soil Management Plan contained in Chapter 9 Waste Management Plan contained in Appendix 15 Emergency Preparedness and Response Plan contained in Appendix 16 Sustainable Development Plan in Appendix 19	Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Health and Safety Coordinator Community Development Coordinator
	SL4: Site clearance resulting in a permanent loss of soil resource, and potential change in soil characteristics, land capability and land use as a result of increased erosion	X				Stormwater Management Plan contained in Chapter 9 Soil Management Plan contained in Chapter 9 Comprehensive Water Management Plan (still to be developed) Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Community Development Coordinator
	SL5: Chemical spills and release of contact water resulting in permanent loss of soil, and change in soil characteristics, land capability and land use		X			Soil Management Plan contained in Chapter 9 Waste Management Plan contained in Appendix 15 Emergency Preparedness and Response Plan contained in Appendix 16 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Health and Safety Coordinator Community Development Coordinator
	SL6: Operational activities causing increased erosion, resulting in a permanent loss of soil resource, and change in soil characteristics, land capability and land use		X			Stormwater Management Plan contained in Chapter 9 Soil Management Plan contained in Chapter 9 Comprehensive Water Management Plan (still to be developed) Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Community Development Coordinator

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	SL7: Remediation of contaminated soils and demolition of project infrastructure, resulting in re-establishment of baseline soil characteristics and land capability			X		Stormwater Management Plan contained in Chapter 9 Soil Management Plan contained in Chapter 9 Waste Management Plan contained in Appendix 15 Closure Plan contained in Chapter 9 Comprehensive Water Management Plan (still to be developed) Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Community Development Coordinator
	SL8: Demolition and restoration of project infrastructure, resulting in re-establishment of baseline soil characteristics and land capability				X	Stormwater Management Plan contained in Chapter 9 Soil Management Plan contained in Chapter 9 Waste Management Plan contained in Appendix 15 Closure Plan contained in Chapter 9 Comprehensive Water Management Plan (still to be developed)	Sustainable Development Manager Community Development Coordinator
Air Quality	AQ1: Increase in PM ₁₀ emissions resulting from land clearing, earthworks, and vehicular movement	X		X		<u>Construction</u> : Construction Management Plan (still to be developed) Soil Management Plan contained in Chapter 9 Occupational Health and Safety Plan in Appendix 12 <u>Closure</u> : Closure Plan contained in Chapter 9	<u>Construction</u> : Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Health and Safety Coordinator <u>Decommissioning/Closure</u> : Sustainable Development Manager Health and Safety Coordinator
	AQ2: Increase in gas (SO ₂ , NO _x , CO and VOCs) emissions resulting from vehicle exhaust emission and biomass burning	X				Construction Management Plan (still to be developed) Air Quality Management Plan contained in Chapter 9 GHG Emission Plan contained in Appendix 14 Waste Management Plan contained in Appendix 15	Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager
	AQ3: PM ₁₀ emissions due to activities at the quarry and the vehicle entrainment of dust affecting air quality of nearby		X			Community Health and Safety Plan contained in Appendix 13	Sustainable Development Manager Health and Safety Coordinator

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	villages					Air Quality Control Plan contained in Section 9 Framework Resettlement Action Plan in Appendix 18 Stakeholder Engagement Plan in Appendix 17	Community Development Coordinator
	AQ4: Dust emission from activities at the cement plant affecting air quality for nearby communities		X				
	AQ5: Gas (SO ₂ , NO _x and CO) emissions from activities at the cement plant affecting air quality for nearby communities		X				
	AQ6 : Increase in PM10 emissions resulting from land clearing, earthworks, and vehicular movement			X		Community Health and Safety Plan contained in Appendix 13 Soil Management Plan contained in Chapter 9 Closure Plan contained in Chapter 9 Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Health and Safety Coordinator Community Development Coordinator
Greenhouse Gases	GH1: Increase in greenhouse gas emissions in the area resulting from the cement plant		X			GHG Emission Plan contained in Appendix 14 Waste Management Plan contained in Appendix 15	Sustainable Development Manager
	GH2: Contribution to climate change as a result of greenhouse gas emissions from the project		X			GHG Emission Plan contained in Appendix 14 Waste Management Plan contained in Appendix 15	Sustainable Development Manager
Surface Water	WR1: Chemical contamination of surface water resulting from accidental spills during transportation and handling, and seepage from waste	X		X		Waste Management Plan contained in Appendix 15 Emergency Preparedness and Response Plan contained in Appendix 16 Community Health and Safety Plan contained in Appendix 13 Stakeholder Engagement Plan in Appendix 17	<u>Construction</u> : Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Community Development Coordinator <u>Decommissioning/Closure</u> : Sustainable Development Manager Health and Safety Coordinator Community Development Coordinator

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	WR2: Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads	X		X		Stormwater Management Plan contained in Chapter 9 Soil Management Plan contained in Chapter 9 Comprehensive Water Management Plan (still to be developed) Sustainable Development Plan Stakeholder Engagement Plan in Appendix 17	<u>Construction</u> : Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Community Development Coordinator <u>Decommissioning/Closure</u> : Sustainable Development Manager
	WR3: Contamination of groundwater resulting from seepage from sewage and other waste	X	X			Stormwater Management Plan contained in Chapter 9 Waste Management Plan contained in Appendix 15 Comprehensive Water Management Plan (still to be developed) Community Health and Safety Plan contained in Appendix 13 Stakeholder Engagement Plan contained in Appendix 17	<u>Construction</u> : Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager <u>Operation</u> : Sustainable Development Manager Chief Medical Officer Community Development Coordinator
	WR4: Contaminated stormwater runoff from cement plant, roads and other surfaces affecting surface and groundwater quality		X			Stormwater Management Plan contained in Chapter 9 Waste Management Plan contained in Appendix 15 Comprehensive Water Management Plan (still to be developed) Sustainable Development Plan contained in Appendix 19 Stakeholder Engagement Plan contained in Appendix 17	Sustainable Development Manager Community Development Coordinator
	WR5: Discharge of contaminated pit water to surface water resources, affecting downstream users		X			Stormwater Management Plan contained in Chapter 9 Comprehensive Water Management Plan (still to be developed) Emergency Preparedness and Response Plan contained in Appendix 16 Sustainable Development Plan contained in Appendix 19	Sustainable Development Manager Community Development Coordinator

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	WR6: Risk of flooding of project infrastructure due to placement within the 1:100 year floodline		X			Project final design by NYA Stormwater Management Plan contained in Chapter 9 Waste Management Plan contained in Appendix 15 Comprehensive Water Management Plan (still to be developed) Emergency Preparedness and Response Plan in Appendix 16	Board Committee - Risk Sustainable Development Manager Community Development Coordinator
	WR7: Dewatering of the quarry resulting in groundwater drawdown and reduced contribution to surface water baseflows and wetlands, affecting users		X			Comprehensive Water Management Plan (still to be developed) Community Health and Safety Plan in Appendix 13 Sustainable Development Plan contained in Appendix 19 Stakeholder Engagement Plan contained in Appendix 17	Board Committee - Risk Director General Sustainable Development Manager Community Development Coordinator
	WR8: Stormwater inflows into the pit, reducing surface water flows and availability to users		X				General Manager Plant Sustainable Development Manager Community Development Coordinator
	WR9: Raw water abstraction for the project reducing availability to other users		X				
	WR10: Seepage from waste affecting surface and groundwater quality		X				
	WR11: Wastewater effluent discharge to streams, affecting water quality for downstream users		X				
	WR12: Sinkhole formation resulting from dewatering of subsurface cavities, resulting in safety and structural stability risks		X			Project final design by NYA Comprehensive Water Management Plan (still to be developed) Emergency Preparedness and Response Plan in Appendix 16	Board Committee - Risk Director General Health and Safety Coordinator
	WR13: Chemical contamination of surface water resulting from accidental			X		Waste Management Plan contained in Appendix 15 Emergency Preparedness and Response Plan	Board Committee - Risk Director General

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	spills during transportation and handling, and seepage from waste					contained in Appendix 16 Community Health and Safety Plan contained in Appendix 13 Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Health and Safety Coordinator Community Development Coordinator
	WR14: Sedimentation of surface water resulting from erosion and runoff from exposed surfaces and roads			X		Stormwater Management Plan contained in Chapter 9 Soil Management Plan contained in Chapter 9 Comprehensive Water Management Plan (still to be developed) Sustainable Development Plan Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Community Development Coordinator
	WR15: Contamination of groundwater resulting from seepage from hazardous materials and waste			X		Soil Management Plan contained in Chapter 9 Waste Management Plan contained in Appendix 15 Emergency Preparedness and Response Plan contained in Appendix 16 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Board Committee - Risk Director General Health and Safety Coordinator Community Development Coordinator
	WR16: Pit lake formation due to inflow of ground and surface water, resulting in safety risks to animals and humans, and environmental contamination				X	Emergency Preparedness and Response Plan contained in Appendix 16 Community Health and Safety Plan in Appendix 13 Occupational Health and Safety Plan in Appendix 12	General Manager Plant Administration and Security Manager
Noise and vibration	NV1: Continuous noise impact on Mbemba Village resulting from night-time construction at the quarry	X				Community Health and Safety Plan in Appendix 13 Occupational Health and Safety Plan in Appendix 12 Stakeholder Engagement Plan in Appendix 17 Resettlement Action Plan	Contractor in charge of Construction to report to the General Manager Plant Health and Safety Coordinator Community Development Coordinator
	NV2: Air-blast noise impact on Mbemba Village resulting from blasting at the quarry during construction	X				Community Health and Safety Plan in Appendix 13 Occupational Health and Safety Plan in Appendix 12 Stakeholder Engagement Plan in Appendix 17	Contractor in charge of Construction to report to the General Manager Plant Health and Safety Coordinator Community Development Coordinator

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	NV3: Continuous noise resulting from daytime operations of the quarry, cement plant, haul road and associated infrastructure		X				General Manager Plant Sustainable Development Manager Health and Safety Coordinator Community Development Coordinator
	NV4: Continuous noise resulting from night-time operations of the cement plant and associated infrastructure		X				
	NV5: Air blast pressure and vibration resulting from blasting at the quarry		X				
Ecology and Biodiversity	EB1: Loss of savannah habitat due to site clearing and earthmoving activities	X				Soil Management Plan contained in Chapter 9 Stormwater Management Plan in Chapter 9 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17 Biodiversity Action Plan (Still to be developed)	Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Community Development Coordinator
	EB2: Loss of forest habitat due to site clearing and earthmoving activities	X					
	EB3: Loss of aquatic habitat due to site clearing and earthmoving activities	X					
	EB4: Loss or disturbance of species of special concern due to site clearing and construction activities	X				Construction Management Plan (still to be developed) Stakeholder Engagement Plan in Appendix 17 Biodiversity Action Plan (Still to be developed)	Contractor in charge of Construction to report to the General Manager Plant Sustainable Development Manager Community Development Coordinator
	EB5: Loss or degradation of ecological processes due to site clearing and construction activities	X					
	EB6: Fragmentation of habitats and ecological processes due to positioning of project infrastructure	X				Project final design by NYA Construction Management Plan (still to be developed) Biodiversity Action Plan (Still to be developed)	Sustainable Development Manager Contractor in charge of Construction to report to the General Manager Plant
	EB7: Modification or degradation of aquatic habitats due to altered hydrological regimes and surface or groundwater quality	X				Construction Management Plan (still to be developed) Soil Management Plan contained in Chapter 9 Stormwater Management Plan in Chapter 9	Sustainable Development Manager Contractor in charge of Construction to report to the General Manager Plant

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
						Stakeholder Engagement Plan in Appendix 17	Community Development Coordinator
	EB8: Introduction of alien invasive plants due to site clearing and disturbance of vegetation	X				Construction Management Plan (still to be developed)	Sustainable Development Manager Contractor in charge of Construction to report to the General Manager Plant Community Development Coordinator
	EB9: Impeded photosynthesis and transpiration rate of plants due to dust generation	X				Construction Management Plan (still to be developed) Soil Management Plan contained in Chapter 9 Traffic Management Plan (still to be developed) Air quality Control Plan in Section 9	Sustainable Development Manager Contractor in charge of Construction to report to the General Manager Plant
	EB10: Loss or disturbance of fauna species of special concern due to collisions and noise disturbance		X			Traffic Management Plan (still to be developed)	Sustainable Development Manager
	EB11: Introduction of alien invasive flora and fauna		X			Measures in Section 9	Sustainable Development Manager
	EB12: Increased hunting/poaching of wildlife		X			Measures in Section 9	Sustainable Development Manager
	EB13: Modification or degradation of aquatic habitats due to pollution or nutrient loading		X			Measures in Section 9 Comprehensive Water Management Plan (still to be developed)	Sustainable Development Manager
	EB14: Impeded photosynthesis and transpiration rate of plants due to dust generation		X			Soil Management Plan contained in Chapter 9 Traffic Management Plan (still to be developed) Air quality Control Plan in Section 9	Sustainable Development Manager
	EB15: Re-establishment of habitats or creation of new habitats via rehabilitation			X		Closure Plan in Chapter 9	Sustainable Development Manager
	EB16: Introduction of alien invasive flora and fauna			X		Measures in Section 9	Sustainable Development Manager

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	EB17: Loss or disturbance of fauna species of special concern due to collisions and noise disturbance			X		Traffic Management Plan (still to be developed)	Sustainable Development Manager
	EB18: Increased hunting/poaching of wildlife and loss of habitats for crop production			X		Measures in Section 9	Sustainable Development Manager
	EB19: Increased hunting/poaching of wildlife and loss of habitats for crop production				X	Measures in Section 9	Sustainable Development Manager
Traffic	T1: Impact of construction related traffic on utilisation capacity on the N-1	X				Traffic Management Plan (still to be developed)	Sustainable Development Manager Contractor in charge of Construction to report to the General Manager Plant
	T2: Impact of construction related traffic on traffic flow in Matadi	X					
	T3: Safety impacts to local communities and other road users due to increased road accident rates during construction	X				Traffic Management Plan (still to be developed) Community Health and Safety Plan in Appendix 13 Emergency Preparedness and Response Plan Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Contractor in charge of Construction to report to the General Manager Plant Health and Safety Coordinator Community Development Coordinator
	T4: Impact on utilisation capacity on the N-1, affecting other road users		X			Traffic Management Plan (still to be developed)	General Manager Plant Sustainable Development Manager
	T5: Impact on traffic in Matadi, affecting other road users		X				
	T6: Increased road accident rates, affecting road safety of other users		X			Traffic Management Plan (still to be developed) Community Health and Safety Plan in Appendix 13 Emergency Preparedness and Response Plan in Appendix 16 Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Health and Safety Coordinator Community Development Coordinator

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
Socio-economic: Population and Demographic movements	PD1: Influx of potential job seekers into the area and associated risks	X	X			Sustainable Development Plan in Appendix 19 Community Health and Safety Plan in Appendix 13 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Administration and Security Manager Health and Safety Coordinator Community Development Coordinator
Health and Safety	HS1: Increased chances of the spread of communicable diseases such as HIV/AIDS and STDs linked to influx of predominantly male job-seekers and workers	X				Community Health and Safety Plan in Appendix 13 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Chief Medical Officer Health and Safety Coordinator Community Development Coordinator
	HS2: Increased pressure on healthcare infrastructure due to project related influx	X					
	HS3: Increased risk of accidents and injuries to communities from improved roads and additional traffic	X				Traffic Management Plan (still to be developed) Community Health and Safety Plan in Appendix 13 Emergency Preparedness and Response Plan in Appendix 16 Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Chief Medical Officer Health and Safety Coordinator Community Development Coordinator
	HS4: The visible presence of DRC police within the project area, and their secondment as a subcontractor for the mine security	X				Labour and Human Resources Plan in Appendix 11 Community Health and Safety Plan in Appendix 13 Stakeholder Engagement Plan in Appendix 17	Administration and Security Manager Human Resources/ Industrial Relations Manager
	HS5: Increased chances of the spread of communicable diseases such as HIV/AIDS and STDs linked to the influx of predominantly male jobseekers		X			Community Health and Safety Plan in Appendix 13 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Chief Medical Officer Health and Safety Coordinator Community Development Coordinator

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	HS6: Increased pressure on healthcare infrastructure due to project related influx		X			Community Health and Safety Plan in Appendix 13 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Chief Medical Officer Health and Safety Coordinator Community Development Coordinator
	HS7: Increased risk of accidents and injuries to communities from improved roads and additional traffic		X			Traffic Management Plan (still to be developed) Community Health and Safety Plan in Appendix 13 Emergency Preparedness and Response Plan in Appendix 16 Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Chief Medical Officer Health and Safety Coordinator Community Development Coordinator
	HS8: The visible presence of Congolese police within the project area, and their secondment as a subcontractor for the mine security		X			Labour and Human Resources Plan in Appendix 11 Community Health and Safety Plan in Appendix 13 Stakeholder Engagement Plan in Appendix 17	Administration and Security Manager Human Resources/ Industrial Relations Manager
Land and natural resources	LN1: Physical displacement of households residing at Yuku Camp Village	X				Resettlement Action Plan in Appendix 18 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Community Development Coordinator
Economic	EC1: Local and regional benefits resulting from increased Revenue to Government	X	X			Labour and Human Resources Plan in Appendix 11 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Human Resources/ Industrial Relations Manager Community Development Coordinator
	EC2: Stimulation of increased regional investment in the DRC Economy	X				Sustainable Development Plan in Appendix 19	Community Development Coordinator
	EC3: Generation of direct, indirect and induced employment and income	X				Labour and Human Resources Plan in Appendix 11 Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Human Resources/ Industrial Relations Manager Community Development Coordinator
	EC4: Local and regional benefits resulting from increased Revenue to Government		X				
	EC5: Generation of direct, indirect and induced employment and income		X				

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	EC6: Reduction in project revenue to government, resulting in local economic decline			X			
	EC7: Loss of Employment and Income due to retrenchment			X	X		
	EC8: Cessation in project revenue to government, resulting in local economic decline				X		
Cultural Heritage Resources	CH1: Indirect damage to Iron Age archaeological resources through land transformation activities	X				Construction Management Plan (still to be developed) Cultural heritage measures provided in Section 9	Sustainable Development Manager
	CH2: Indirect damage to cemeteries through land transformation activities	X				Construction Management Plan (still to be developed) Cultural heritage measures provided in Chapter 9	Sustainable Development Manager
	CH3: Damage to all other identified archaeological and cultural resources through land transformation activities	X				Construction Management Plan (still to be developed) Cultural heritage measures provided in Section 9	Sustainable Development Manager
Ecosystem Services	ES1: Reduced availability of natural resources and ecosystem services to local communities	X		X	X	Construction Management Plan (still to be developed) Soil Management Plan in Chapter 9	Community Development Coordinator
	ES2: Reduced availability of natural resources and ecosystem services to local communities due to use by the project and impacts on these resources		X			Resettlement Action Plan in Appendix 18 (including livelihoods restoration) Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Community Development Coordinator
	ES3: Reduced quality of natural resources and ecosystem services to local communities due to emissions to air, water or soil			X		Resettlement Action Plan in Appendix 18 (including livelihoods restoration) Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Community Development Coordinator

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Impact category	Impact	Project phase ³⁰				Management plans	Responsible party
		C	O	DC	PC		
	ES4: Reduced quality of natural resources and ecosystem services to local communities due to contamination of water or soil				X	Resettlement Action Plan in Appendix 18 (including livelihoods restoration) Sustainable Development Plan in Appendix 19 Stakeholder Engagement Plan in Appendix 17	Community Development Coordinator
Health and Safety Risks	SS1: Blasting, resulting in fly rock		X			Community Health and Safety Plan in Appendix 13 Emergency Preparedness and Response Plan in Appendix 16 Stakeholder Engagement Plan in Appendix 17	Sustainable Development Manager Chief Medical Officer Health and Safety Coordinator Community Development Coordinator
	SS2: Community exposure to toxic or hazardous substances		X				
	SS3: Fire or explosions due to storage of explosives and use of combustible materials		X				

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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- Fundamental Conventions:
 - C029 - Forced Labour Convention, 1930 (No. 29)
 - C087 - Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87)
 - C098 - Right to Organize and Collective Bargaining Convention, 1949 (No. 98)
 - C100 - Equal Remuneration Convention, 1951 (No. 100)
 - C105 - Abolition of Forced Labour Convention, 1957 (No. 105)
 - C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
 - C138 - Minimum Age Convention, 1973 (No. 138) Minimum age specified: 14 years
 - C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)
- Technical Conventions
 - C014 - Weekly Rest (Industry) Convention, 1921 (No. 14)
 - C017 - Workmen's Compensation (Accidents) Convention, 1925 (No. 17)
 - C018 - Workmen's Compensation (Occupational Diseases) Convention, 1925 (No. 18)
 - C019 - Equality of Treatment (Accident Compensation) Convention, 1925 (No. 19)
 - C026 - Minimum Wage-Fixing Machinery Convention, 1928 (No. 26)
 - C042 - Workmen's Compensation (Occupational Diseases) Convention (Revised), 1934 (No. 42)
 - C050 - Recruiting of Indigenous Workers Convention, 1936 (No. 50)
 - C062 - Safety Provisions (Building) Convention, 1937 (No. 62)
 - C064 - Contracts of Employment (Indigenous Workers) Convention, 1939 (No. 64)
 - C088 - Employment Service Convention, 1948 (No. 88)
 - C089 - Night Work (Women) Convention (Revised), 1948 (No. 89)
 - C094 - Labour Clauses (Public Contracts) Convention, 1949 (No. 94)
 - C095 - Protection of Wages Convention, 1949 (No. 95)
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 - C116 - Final Articles Revision Convention, 1961 (No. 116)
 - C117 - Social Policy (Basic Aims and Standards) Convention, 1962 (No. 117)
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 - C119 - Guarding of Machinery Convention, 1963 (No. 119)
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Appendices

Appendix 1.1: Project Sponsors Profile

(From original ECTECH ESIA)

Appendix 1.2: Brief Introduction of the Experts

(From original ECTECH ESIA)

Appendix 3.1: Mining Ministry's Letters

(From original ECTECH ESIA)

Appendix 3.2: Analysis of Soil Core Samples

(From original ECTECH ESIA)

Appendix 3.3: Process Flow Diagrams

(From original ECTECH ESIA)

Appendix 3.4: FLS Noise Engineering Methods

(From original ECTECH ESIA)

Appendix 3.5: Mass Flow Diagrams

(From original ECTECH ESIA)

Appendix 3.6: MoU with SNEL

(From original ECTECH ESIA)

Appendix 3.7: Cement Plant Layout

(SRK update)

Appendix 6.1: Air dispersion Modelling

(From original ECTECH ESIA)

Appendix 6.2: Greenhouse Gases

(SRK update)

Appendix 7.1: Habitat Map

(SRK update)

Appendix 7.2: List of Species

(SRK update)

Appendix 7.3: Water sampling points

(SRK update)

Appendix 8.1: Social survey attendance register

(SRK update)

Appendix 8.2: Social survey Questionnaire

(SRK update)

Appendix 8.3: Social survey Questionnaire coding

(SRK update)

Appendix 8.4: Social survey Schedules

(SRK update)

Appendix 8.5: Social survey Map

(SRK update)

Appendix 9.1: Moderator's Guidelines

(From original ECTECH ESIA)

Appendix 9.2: Performa for written views of stakeholders

(From original ECTECH ESIA)

Appendix 9.3: Filled Performa Translated in French

(From original ECTECH ESIA)

Appendix 9.4: Filled Performa Translated into English

(From original ECTECH ESIA)

Appendix 10: NYA Policies

(SRK update)

Appendix 11: Labour and Human Resources Plan

(SRK update)

Appendix 12: Occupational Health and Safety Plan

(SRK update)

Appendix 13: Community Health and Safety Plan

(SRK update)

Appendix 14: GHG Emission Assessment and Management Plan

(SRK update)

Appendix 15: Waste Management Plan

(SRK update)

Appendix 16: Emergency Preparedness and Response Plan

(SRK update)

Appendix 17: Stakeholder Engagement Plan

(SRK update)

Appendix 18: Resettlement Action Plan

(SRK update)

Appendix 19: Sustainable Development Plan

(SRK update)

Appendix 20: MOU between NYA and local communities

(From original ECTECH ESIA)

SRK Report Distribution Record

Report Name and No.

Nyumba Ya Akiba Cement Plant : 463574

Copy No.

Name/Title	Company/ Organization	Email Address	Copy	Date
F Rodrigues	AfDB	f.rodrigues@afdb.org	Electronic - Email	02/08/2013
A Haidara	AfDB	a.haidara@afdb.org	Electronic - Email	02/08/2013
H Mansaray	AfDB	h.mansaray@afdb.org	Electronic - Email	02/08/2013
M Niang	AfDB	m.niang@afdb.org	Electronic - Email	02/08/2013
M Kinane	AfDB	m.kinane@afdb.org	Electronic - Email	02/08/2013
Dr. J de Wolff	DEG	Jessica.de-Wolff@deginvest.de	Electronic - Email	02/08/2013
R Riedel	DEG	Ralf.Riedel@deginvest.de	Electronic - Email	02/08/2013
J Barragan	EIB	j.barragan@eib.org	Electronic - Email	02/08/2013
E Gschwindt	EIB	e.gschwindt@eib.org	Electronic - Email	02/08/2013
M R Alvarado	EIB	m.ruizalvarado@eib.org	Electronic - Email	02/08/2013
H.Gornall-Thode	EIB	h.gornall-thode@eib.org	Electronic - Email	02/08/2013
S Juhl	EKF	sju@EKF.DK	Electronic - Email	02/08/2013
K Christiansen	EKF	klc@EKF.DK	Electronic - Email	02/08/2013
	EKF	jkr@EKF.DK	Electronic - Email	02/08/2013
G Nialt	ERM	Gwenaelle.Nialt@erm.com	Electronic - Email	02/08/2013
B Vanwelde	ERM	Benoit.Vanwelde@erm.com	Electronic - Email	02/08/2013
U Hameed	HBL	usman.hameed@hbl.com	Electronic - Email	02/08/2013
M A Jalil	HBL	Ali.jalil@hbl.com	Electronic - Email	02/08/2013
A Y Mahmood	HBL	yousuf.mahmood@hbl.com	Electronic - Email	02/08/2013
S Feroze	NYA	sferoze@nya-cement.com	Electronic – Email Hardcopy 1 DVD 1	02/08/2013
P Van de Walle	NYA	pvandewalle@nya-cement.com	Electronic – Email Hardcopy 2 DVD 2	02/08/2013
C Ngoy	NYA	cngoy@nya-cement.com	Electronic – Email Hardcopy 3 DVD 3	02/08/2013
SRK	SRK EnviroDepartment	N/A	DVD 4	02/08/2013
SRK	SRK Library	N/A	DVD 5	02/08/2013

Approval Signature:



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